A QUANTITATIVE ANALYSIS OF TRADE POLICY RESPONSES TO HIGHER WORLD AGRICULTURAL COMMODITY PRICES

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From 2007 through mid-2008, world prices of major agricultural commodities, such as cereals, oilseeds, and their by-products, experienced unprecedented surges since World War II (Baffes and Haniotis 2010).¹ The world food price indexes produced by the Food and Agricultural Organization (FAO) of the United Nations increased by 56 percent between 2006 and 2008, while cereals and vegetable oils price indexes doubled during the same period (FAO 2010). Although price pressure for these commodities was temporarily relieved in late 2008 and 2009, the world price indexes for food, grains, and vegetable oils have rebounded in 2011 to their former high levels again (Figure 11.1). The sudden price spikes of agricultural and food commodities in 2007–2008 quickly caught worldwide attention because cereal grains such as rice and wheat are staples in many developing economies, while corn is an important feedstock for the growing livestock sector in both developed and developing countries. For some food-deficit developing economies that rely heavily on imports for food consumption, drastic increases in the prices of these crops threatened the nutritional needs and social stability of these economies. Moreover, in major Asian rice-producing and rice-consuming countries, rice availability and affordability is a focus of national food security and policies (Wailes 2005).

In order to insulate domestic food prices from global price increases, a number of key grain exporting countries, primarily developing economies, adopted policies that included export bans or at least partial export restrictions in an attempt to provide enough domestic production for local consumption. Meanwhile, some major grain importing nations reacted by tendering larger-than-anticipated import bids, reduced preexisting import restrictions such as tariffs, and relaxed tariff-rate quotas. Export restrictions, as well as lowering import tariffs, can reduce domestic prices in the short-term, but these trade policy adjustments are generally considered as inadequate responses

¹ This chapter was originally published as an article in *Food Policy* (Yu et al. 2011).

FIGURE 11.1 Annual world food price indexes, 1990–2010

Source: FAO (2010).

Note: 2002–2004 = 100

to high commodity prices (Trostle 2008; Von Braun 2008; Rapsomanikis 2009). Export bans will eventually discourage producers in exporting countries from expanding production, while lowering import tariffs will stimulate the consumers' demand in importing countries. The combination of these two policies will ultimately push the world commodity prices even higher, transferring more price pressure to consumers in the poorest food-deficit countries. However, these two policies are usually the most commonly used means to control domestic prices by large trading countries since the desired short-term effect of lowering domestic prices is hard to resist. As of May 2008, there were 66 countries that adopted various trade and consumption policies to mitigate domestic price pressures, of which 18 economies (27 percent) chose to reduce import tariffs and 17 countries (26 percent) increased export restrictions (FAO 2008).

To date, few studies have attempted to explore the impacts of policy interventions on mitigating the recent price spike in agricultural and food commodities. Rapsomanikis (2009) made a qualitative analysis of the consequences of various consumption and trade policy responses in eastern and southern Africa to the 2007–2008 price surges. The author observed that both import tariff reductions and export bans exercised by a number of countries in that region had limited success in stabilizing domestic food prices. Moreover, the study argued that adopting policy interventions without caution may negatively affect private traders and investors in agribusiness. Sugden (2009) analyzed the factors driving the food commodity price boom in 2007–2008 and discussed the policy responses adopted by Asian Pacific governments at the global, regional, and national levels, respectively. This study concluded that coordinated elimination of trade restrictions such as export bans is considered as the most sensible action to control surging commodity prices at the regional level. Nogue and Wodon (2008) studied the upward pattern in Mali's rice price starting from 2004 and simulated the impact of reducing the import tariff and increasing productivity on the rice market using a dynamic general equilibrium model. Results showed that a reduction in the tariff would have only a limited effect on mitigating price pressures and on reducing the poverty rate in Mali. Coady, Dorosh, and Minten (2009) examined the soaring rice price issue in Madagascar and applied a partial equilibrium model to evaluate the net household and social welfare impacts of lowering the rice tariff and introducing targeted transfers for the rice sector. Their analysis suggested that tariff reductions allocated more gains to the better-off households and reduced the welfare of poor rice sellers. Bouët and Laborde (2010) used a Computable General Equilibrium (CGE) model to illustrate the impacts of export taxes and import duties on world wheat prices and national real incomes (their measure of welfare). They ran scenarios where there is a demand shock that increases the world wheat price by 10 percent, and countries change export taxes and/or import duties to maintain the constant real domestic price of wheat. They found that the world wheat price increased by 20.6 percent to 41.0 percent under the scenarios of changes in export taxes and import duties. These studies undoubtedly improve our knowledge on the impacts of trade policy responses on commodity markets. However, they focus typically on a single commodity market in one particular country or region. Thus the inter-market and intercountry links are usually ignored in these analyses.

This chapter aims to investigate the potential effects of trade policy responses on the prices and trade of major crops in the world and in different countries. In contrast to previous studies, this chapter generates a more

comprehensive analysis of the trade policy impacts on various commodity markets over a wider coverage of countries and regions. The consequences of reactive trade policies on the welfare of producers and consumers in these countries are also analyzed. The relevant export and import policy changes in major exporting and importing countries that affected various crops in 2007–2008 are used for the policy impact analysis.

The remainder of the chapter is organized as follows: “Method of Analysis” describes the analytical tool and the policy scenario analyzed in this chapter. A discussion of the simulated price and trade impacts of policy interventions is presented in “Simulated Impacts of Trade Policy Responses on World Grains and Oilseeds Markets,” while the section “Distributions of Welfare Gains and Losses from Trade Policy Responses” provides the associated welfare changes for producers and consumers. The final section offers conclusions and a discussion of policy implications.

Method of Analysis

In order to capture the inclusive impact of trade policy modifications on agricultural commodity markets, a broad modeling system of the world agricultural sector is used. The models are a set of multimarket, partial-equilibrium, and nonspatial models of agricultural crops. The models cover major crops, such as wheat, corn, barley, sorghum, rice, soybeans, rapeseed, and sunflower for all major country producers and consumers and are calibrated on the most recently available data. Each model is a homogenous product model such that the same product produced in different countries is viewed indifferently by the buyers. The structure of this modeling system—including the exogenous drivers, historical agricultural data, endogenous variables, commodities, and major trade countries/regions—is summarized in [Table 11.1](#). Macroeconomic variables, such as GDP, population, and exchange rates, are exogenous variables that drive the projections of the model. The country/region coverage varies by commodity group, and we present the country coverage for all crops in [Table 11.1](#).

Extensive market links exist in these models (rice, grains, and oilseed sector) with the symmetric cross-price elasticities, reflecting competition for land in production and consumer substitution possibilities for close substitutes such as oilseed meals and vegetable oils. The model structure and the elasticities used in the model are based on analysis of historical data, current academic research, and a reliance on accepted economic and agronomic relationships in the agricultural markets. The price elasticities of supply and demand and income elasticities in the grain sector are summarized in [Table 11.A1](#) (in the

TABLE 11.1 Structure of the multicommodity and multicountry model

Exogenous drivers	Historical agricultural data	Endogenous variables (by commodity and country)	Commodities
Population	Area harvested	World prices	Grains: Rice, corn,
GDP	Yield	Domestic prices	wheat, sorghum,
GDP deflator	Production	Production (area harvested, yield)	barley
Exchange rate	Consumption	Consumption by use (food, feed, biofuel, crush)	
Population	Exports	Net trade	Oilseeds (seeds and beans, meal, and oil): Soybeans, rapeseed, sunflower, palm, peanuts
Policy variables	Imports	Beginning stocks	
	Ending stocks	Ending stocks	Biofuels: Ethanol, Biodiesel
	Domestic prices		
	World prices		

Major countries or regions: Algeria; Argentina; Australia; Bangladesh; Brazil; Canada; China; Commonwealth of Independent States (CIS); Côte d'Ivoire; Egypt; EU27; India; Indonesia; Iran; Iraq; Israel; Japan; Malaysia; Mexico; Myanmar; Morocco; Nigeria; other Africa; other Asia; other CIS; other eastern Europe; other Latin America; other Middle East; Pakistan; Paraguay; Philippines; rest of the world; the Russian Federation; Saudi Arabia; South Africa; South Korea (Republic of Korea); Taiwan, China; Thailand; Tunisia; Turkey; Ukraine; United States; Uruguay; Viet Nam.

Source: Authors.

Note: Country coverage varies by commodity. EU27 = European Union—27 countries.

appendix), while the elasticities of supply, crush demand, food demand, and income for the oilseed sector are provided in [Table 11.A2](#) (in the appendix).² In general, for each commodity sector, the economic relationship that supply equals demand is maintained by determining a market-clearing price for the commodity. The models include behavioral equations for area harvested and yield on the supply side, and feed use, per capita consumption, stocks, and net exports on the demand side. Specifically, the supply, demand, and stock equations of each commodity in a country/region are functions of market prices, while the net exports equation is the difference between supply and utilization by commodity in each country. The models solve for representative world crop prices by equating excess supply and excess demand across countries. To generate domestic prices of crops for each country, price transmission equations are used that link the representative world price to domestic prices by using

2 More information regarding the set of models used in this study is provided at www.fapri.iastate.edu/models.

TABLE 11.2 List of policy scenarios

Export policies in selected countries by commodity	Units	Baseline	Scenario
Rice			
China: Export tax	%	0	5
China: Export tax rebate	%	13	0
Egypt: Export tax	EGP/metric ton	200	300
Egypt: Export restriction (estimate)	%	0	30
India: Export restriction	%	0	14
India: Export tax (basmati rice)	US\$/metric ton	0	200
India: Minimum export price (basmati rice)	US\$/metric ton	0	1,000
Pakistan: Minimum export price (super basmati)	US\$/metric ton	0	1,500
Pakistan: Minimum export price (medium grade basmati)	US\$/metric ton	0	1,300
Pakistan: Minimum export price (IRRI-6)	US\$/metric ton	0	750
Pakistan: Export restriction (estimate)	%	0	10
Viet Nam: Export tax	US\$/metric ton	0	176
Viet Nam: Export restriction (estimate)	%	0	10
Wheat			
Argentina: Export tax	%	20	28
China: Export tax	%	0	20
Russian Federation: Export tax	%	0	40
Corn			
Argentina: Export tax	%	20	25
China: Export tax	%	0	5
Barley			
China: Export tax	%	0	20
Russian Federation: Export tax	%	0	30
Soybeans			
Argentina: Export tax	%	27.5	35
Soy meal			
Argentina: Export tax	%	24	32
Soy oil			
Argentina: Export tax	%	24	32
Sunflower seed			
Argentina: Export tax	%	23.5	32
Sun meal			
Argentina: Export tax	%	20	30
Sun oil			
Argentina: Export tax	%	20	30

Export policies in selected countries by commodity	Units	Baseline	Scenario
Palm oil			
Indonesia: Export tax	%	1.5	15
Import policies in selected countries by commodity	Units	Baseline	Scenario
Rice			
Indonesia: Import tariff	Rp/kg	550	450
Japan: Import makeup	Yen/metric ton	154,023	152,004
Japan: Special safeguard duty	Yen/metric ton	374,162	351,486
Japan: Specific import tariff	Yen/metric ton	281,325	264,275
Nigeria: Import tariff	%	100	2.7
Philippines: (Milled rice) In-quota tariff	%	50	7
Turkey: Import tariff	%	35	25
Wheat			
India: Import tariff	%	50	0
Republic of Korea: Import tariff	%	2	0
Corn			
India: In-quota import tariff	%	15	0
India: Out-of-quota import tariff	%	50	0
Republic of Korea: Import tariff	%	428.7	0
Barley			
Republic of Korea: Import tariff	%	406.4	0
Soybeans			
China: Import tariff	%	3	1
Soy meal			
China: Import tariff	%	5	2
Soy oil			
India: Import tariff	%	45	0
Sunflower oil			
CIS: Import tariff	%	15	5
Palm oil			
India: Import tariff	%	80	46.5
Rapeseed oil			
CIS: Import tariff	%	15	5
India: Import tariff	%	75	0
Peanut oil			
India: Import tariff	%	100	92.7

Source: Authors.

exchange rates and other price policy wedges. The models incorporate major agricultural and trade policies in each country since they affect the supply and demand decisions of the producers and the consumers.

In this chapter, the analysis is based on a 2008 baseline (FAPRI 2008) modified by specifying the 2007 export and import policy regimes that existed before the commodity price inflation. The baseline projections include supply, utilization, and prices for grains, rice, and oilseeds, including applicable by-products. In the scenario the modified export restrictions and import policies that were adopted by major trading countries in response to the price inflation in the 2007–2008 marketing year are incorporated for three years (2008–2009 through 2010–2011). Since the other parameters remain unchanged between the baseline and scenario models, the difference (in absolute quantity and percent) between the baseline and scenario captures the impact of the trade policy changes. Changes in export and import policy restrictions in the major grain and oilseed exporting and importing countries used for the scenario are summarized in [Table 11.2](#).

Simulated Impacts of Trade Policy Responses on World Grains and Oilseeds Markets

[Figure 11.2](#) presents the world price and net trade changes for the trade policy scenario relative to the baseline for 10 selected agricultural commodities. Results are presented as the three-year average of the annual percentage changes between the marketing years of 2008–2009 and 2010–2011.³ It is clear that the world prices for selected grains and oilseed products all increased due to higher export restrictions and lower import restrictions in the global market. The world rice price increased the most since rice is a thinly traded commodity in the global market, where less than 7 percent of the production enters international markets. Also, trade is highly concentrated with only six countries accounting for 90 percent of the global rice exports. Increases in grain prices were generally higher than the increase in prices of oilseeds and oilseed-derived products, as more policy adjustments were executed in the grain markets.

3 We also simulate the impact of trade policy interventions on the total price rise between 2007 and 2008 by imposing the policy shocks in the 2007–2008 marketing year alone. The output, presented in [Table 11.A3](#), suggests that trade policy interventions accounted for about 26 percent of the rice price increase between 2007 and 2008. Trade policy changes also increased the price of other coarse grains by 15 percent to 23 percent and moved the oilseed sector prices up by 5 percent.

FIGURE 11.2 Impact of trade policy changes on world prices and net trade of agricultural commodities

Source: Authors' calculations.

Changes in aggregate world net trade varied by commodity: trade of wheat, corn, soybeans, minor oilseeds (sunflower and rapeseed), and minor oil expanded; while rice, barley, soybean meal and oil, and minor meal markets experienced a trade reduction. The difference depended mostly on which policy was primarily used in each market. For instance, export tax and restrictions were heavily utilized in primary rice exporting countries, which consequently reduced the trade in the international rice market.

Following is a detailed discussion associated with the impact of trade policy by major commodity markets. We focus on the major food and feed commodities in the detailed discussion. To better understand the variations in the trade policy impacts among commodities and countries, a summary of the results by commodity and by country group (that is, developed and developing) is presented in [Table 11.3](#). The developing-country group is further categorized based on whether the country implemented trade policy responses or not, both for the net exporters and net importers subgroups. The average price change in each group is an aggregate average price change weighted by consumption quantities in the baseline.⁴

⁴ The details of the average impact of the scenario on trade, production, and consumption by individual country are not included here due to limited space but are available from the authors upon request.

TABLE 11.3 Impacts of trade policy responses on price, production, consumption, and net trade, by commodity

	Price/metric ton US\$ (%)	Production	Consumption	Net trade
		1,000 metric ton (%)		
Rice				
Developed-country net exporters	+94 (+20.10)	+993 (+15.71)	−104 (−2.54)	+1111 (+50.49)
Developed-country net importers	+30 (+3.83)	+288 (+1.90)	−321 (−1.67)	−163 (−4.01)
Developing-country net exporters	+94 (+15.03)	+4800 (+1.64)	−1229 (−0.46)	−2249 (−8.73)
Implemented trade policy	+32 (+10.72)	+4684 (+1.80)	−1187 (−0.48)	−2264 (−15.77)
Did not implement trade policy	+828 (+18.33)	+116 (+0.36)	−43 (−0.20)	+15 (+0.13)
Developing-country net importers	+38 (+7.94)	+938 (+1.03)	+468 (+0.45)	−352 (−2.68)
Implemented trade policy	−13 (−2.05)	+148 (+0.31)	+873 (+1.61)	+866 (+15.40)
Did not implement trade policy	+93 (+23.19)	+790 (+1.84)	−405 (−0.81)	−1218 (−16.24)
World	+88 (+24.02)	+7340 (+1.70)	−2689 (−0.62)	−1561 (−5.01)
Wheat				
Developed-country net exporters	+13 (+5.11)	+3050 (+1.26)	−3067 (−2.06)	+7636 (+12.41)
Developed-country net importers	+35 (+13.61)	+13 (+1.45)	−1397 (−13.28)	−1476 (−15.08)
Developing-country net exporters	−21 (−8.80)	−1362 (−1.21)	+1059 (+1.29)	−2554 (−8.69)
Implemented trade policy	−69 (−29.59)	−1728 (−2.60)	+1488 (+3.45)	−3421 (−15.04)
Did not implement trade policy	+33 (+13.86)	+366 (+0.80)	−429 (−1.11)	+866 (+13.00)
Developing-country net importers	−3 (−0.87)	−5262 (−1.80)	+1517 (+0.41)	+6557 (+8.16)
Implemented trade policy	−50 (−16.24)	−7013 (−3.91)	+6254 (+3.49)	+13726 (+2679.40)
Did not implement trade policy	+11 (+3.76)	−1079 (−0.99)	−3830 (−2.01)	−3138 (−3.93)
World	+35 (+14.29)	−3561 (−0.55)	−2488 (−0.39)	+5320 (+5.80)
Corn				
Developed-country net exporters	+9 (+3.43)	+3410 (+1.01)	−2080 (−0.74)	+6471 (+11.32)
Developed-country net importers	−67 (−17.69)	+178 (+0.26)	+5160 (+4.76)	+5435 (+14.05)
Developing-country net exporters	+3 (+1.52)	−211 (−0.18)	+384 (+0.44)	−509 (−1.16)
Implemented trade policy	−15 (−8.10)	−289 (−0.44)	+509 (+2.22)	−816 (−4.23)
Did not implement trade policy	+9 (+4.63)	+78 (+0.15)	−124 (−0.19)	+247 (+2.31)
Developing-country net importers	+5 (+2.23)	−232 (−0.08)	+325 (+0.10)	+509 (+1.16)
Implemented trade policy	−1 (−0.46)	−409 (−0.26)	+180 (+0.12)	+620 (+138.16)
Did not implement trade policy	+6 (+2.45)	+177 (+0.14)	+145 (+0.08)	−111 (−0.26)
World	+9 (+4.71)	+3189 (+0.41)	+3795 (+0.47)	+5953 (+6.75)
Barley				
Developed-country net exporters	+6 (+2.59)	+163 (+0.19)	−178 (−0.24)	+440 (+4.07)
Developed-country net importers	+13 (+9.15)	+1 (+0.52)	−91 (−0.72)	+120 (+1.41)
Developing-country net exporters	−16 (−9.88)	−254 (−0.77)	+344 (+1.31)	−659 (−11.90)
Implemented trade policy	−35 (−23.58)	−302 (−1.76)	+416 (+2.63)	−795 (−66.12)

	Price/metric ton US\$ (%)	Production	Consumption	Net trade
		1,000 metric ton (%)		
Did not implement trade policy	+12 (+7.32)	+48 (+0.31)	-72 (-0.69)	+136 (+3.13)
Developing-country net importers	+13 (+7.95)	+88 (+0.01)	+21 (+0.02)	-1041 (-2.43)
Implemented trade policy	-18 (-12.37)	-66 (-2.02)	+143 (+2.75)	-213 (+10.85)
Did not implement trade policy	+14 (+8.67)	+154 (+0.02)	-122 (-0.14)	-828 (-1.85)
World	+13 (+9.16)	-2 (0.00)	+96 (+0.07)	-219 (-1.34)
Soybeans				
Developed-country net exporters	+15 (+4.42)	-617 (-0.73)	-313 (-0.53)	-270 (-1.08)
Developed-country net importers	+17 (+3.36)	+11 (+0.91)	-69 (-0.29)	-91 (-0.40)
Developing-country net exporters	+1 (+0.85)	-2 (0.00)	-540 (-0.58)	+506 (+1.05)
Implemented trade policy	-0.07 (-0.09)	-495 (-0.94)	-696 (-1.59)	+127 (+1.49)
Did not implement trade policy	+0.04 (+0.02)	+493 (+0.55)	+156 (+0.31)	+378 (+0.95)
Developing-country net importers	+5 (+1.88)	+20 (+0.09)	+354 (+0.48)	+327 (+1.39)
Implemented trade policy	+0.02 (+0.01)	+60 (+0.40)	+390 (+0.76)	+326 (+0.89)
Did not implement trade policy	+0.04 (+0.02)	-39 (-0.50)	-36 (-0.17)	+1 (+0.01)
World	+19 (+3.81)	-587 (-0.23)	-562 (-1.66)	+236 (+0.32)
Soybean Meal				
Developed-country net exporters	+15 (+3.88)	-168 (-0.40)	+89 (+0.27)	-255 (-2.94)
Developed-country net importers	+8 (+2.33)	-30 (-0.18)	-193 (-0.41)	-174 (-0.58)
Developing-country net exporters	+6 (+3.56)	-63 (-0.06)	-301 (-0.61)	+235 (0.47)
Implemented trade policy	+6 (+3.98)	-224 (-0.34)	-187 (-0.56)	-48 (-0.15)
Did not implement trade policy	+4 (+2.53)	+162 (+0.48)	-114 (-0.72)	+283 (1.56)
Developing-country net importers	+5 (+3.24)	+8 (+0.06)	+168 (+0.42)	+153 (+0.57)
Implemented trade policy	n.a.	n.a.	n.a.	n.a.
Did not implement trade policy	+5 (+3.24)	+8 (+0.06)	+168 (+0.42)	+153 (+0.57)
World	+9 (+2.59)	-252 (-0.15)	-237 (-0.14)	-188 (-0.32)
Soybean Oil				
Developed-country net exporters	+43 (+3.90)	-40 (-0.40)	-81 (-0.86)	+56 (+7.39)
Developed-country net importers	+42 (+3.83)	-7 (-0.18)	+3263 (+64.43)	+710 (+58.03)
Developing-country net exporters	+14 (2.78)	-133 (-0.91)	-31 (-0.54)	-106 (-1.19)
Implemented trade policy	-22 (-7.11)	-136 (-1.69)	+17 (+1.26)	-159 (-2.36)
Did not implement trade policy	+24 (+2.08)	+3 (+0.05)	-48 (-1.08)	+53 (+2.51)
Developing-country net importers	+6 (+0.77)	+112 (+0.93)	+99 (+0.49)	-1 (-0.01)
Implemented trade policy	-155 (-15.90)	+34 (+2.09)	+152 (+5.28)	+136 (+10.84)
Did not implement trade policy	+33 (+1.15)	+78 (+0.75)	-54 (-0.31)	-138 (-1.99)
World	+50 (+3.82)	-68 (-0.17)	-68 (-0.17)	-50 (-0.52)

Source: Authors' calculations.

Note: n.a. = not available.

Rice

The scenario results for rice contribute to our understanding of why international rice prices increased dramatically in the 2007–2008 marketing year. Major exporting countries that adjusted export policies included China, Egypt, India, Pakistan, and Viet Nam. The combination of export restrictions by these nations exerted significant pressure on the rice supply in the global market. Importing countries that grew anxious with the price inflation responded by lowering import tariffs or with larger than normal import tenders. Particularly important were the Philippines and Nigeria, which implemented significant cuts in import tariffs. The aggregate global changes show that the international reference price increased by US\$88 per metric ton (24.0 percent), production increased by 7.3 million metric tons (1.7 percent), consumption declined by 2.7 million metric tons (0.62 percent), and net trade declined by 1.6 million metric tons (5.0 percent). The net exports were reduced, particularly in the key exporting countries of Egypt, India, Pakistan, and Viet Nam.

The impact of policy changes by country subgroups show on average that *developed-country net exporters* (represented solely by the United States) experienced a weighted price increase of 20.1 percent, a gain in production of 993,000 metric tons (15.7 percent), an increase in trade of 1.1 million metric tons (50.5 percent), and a decline in domestic consumption of 104,000 metric tons (2.5 percent). In contrast, the weighted average price in the *developed-country net importers* increased by 3.8 percent, with production gaining 288,000 metric tons (1.9 percent), and both domestic consumption and net imports declining by 321,000 metric tons (1.7 percent) and 163,000 metric tons (4.0 percent), respectively.

In developing countries, the net exporters group exhibited a relatively weaker weighted average price increase of 15.0 percent, with production increasing by 4.8 million metric tons (1.6 percent), and consumption and net trade declining by 1.2 million metric tons (0.5 percent) and 2.2 million metric tons (8.7 percent), respectively. However, decomposing the impact shows that there is a higher price shock for countries that did not implement a policy that insulated their domestic prices from the international price, at 18.3 percent, compared to those that implemented the trade-insulating policies, at only 10.7 percent. Rice prices in the subgroup of countries that imposed export constraints still increased because the impact of the higher world price outweighed the effect of the policy interventions on domestic price in some countries—for example, China, where the aggregate rice production then increased, while consumption declined. Net exports in this group declined, primarily as

a result of significant cuts in India's exports because of its export ban, higher export taxes, and higher minimum export prices.

The *developing-country net importers* group also experienced a weighted average price increase of 7.9 percent, and an increase in average production and consumption of 938,000 metric tons (1.0 percent) and 468,000 metric tons (0.5 percent), respectively. Net imports declined by 352,000 metric tons (2.7 percent). As in the case of the net exporters' group, the subgroup impacts show that the price increase for those countries that did not implement the policy, at 23.2 percent, is much higher than for those countries that implemented the trade-insulating policies (for example, Philippines, Nigeria, and Turkey) at 2.1 percent.

The model results demonstrate that much of the export supply response over a three-year period comes from Western Hemisphere net exporters including Argentina, the United States, and Uruguay. Inelastic supply and demand throughout much of Asia, where rice is the dominant food staple, thus explains why the trade policy adjustments in the politically sensitive rice sector can induce a large price movement.

Wheat

Exporters such as Argentina, China, and the Russian Federation implemented export-restrictive policies and decreased their export supply to the world market. Moreover, China switched to being a net importer of wheat due to these policy changes. Significant decreases in the import tariffs in India led to a higher domestic demand. Countries that did not adjust their import policy regimes in this environment decreased their imports of wheat due to higher prices in the world market. The increases in Indian and Chinese wheat net imports were more than enough to offset the declines in wheat imports of other countries. The overall changes in the world show that the international reference price of wheat increased by US\$35 (14.29 percent), production decreased by 3.56 million metric tons (0.55 percent), consumption declined by 2.48 million metric tons (0.39 percent), and net trade increased by 5.80 percent.

Taking a closer look at the market changes by country groupings, we see that *developed-country net exporters* experienced a weighted price increase of 5.11 percent, a gain in production of 3.05 million metric tons (1.26 percent), an increase in trade of 7.6 million metric tons (12.41 percent), and a decline in consumption of 3.07 million metric tons (2.06 percent). In contrast, the weighted average price in the *developed-country net importers group* increased by 13.61 percent, with production gaining 13 thousand metric

tons (1.45 percent). As a result, consumption and net imports declined by 1.39 million metric tons (13.28 percent) and 1.47 million metric tons (15.08 percent), respectively.

For the *developing-country net exporters*, the weighted average price decreased by 8.80 percent, as production decreased by 1.36 million metric tons (1.21 percent), and net trade declined by 2.55 million metric tons (8.69 percent). Consumption increased by 1.06 million metric tons (1.29 percent) for this group. However, the price impacts were different between developing-country net exporters that implemented the policy responses and those that did not. Those countries that implemented trade policy responses successfully lowered their price by 29.59 percent; however, countries that did not adjust their trade policy experienced an average price increase of 13.86 percent.

The *developing-country net importers* group experienced a weighted average price decline of 0.87 percent, with weighted average production decreasing by 5.26 million metric tons (1.80 percent) and consumption increasing by 1.51 million metric tons (0.41 percent). Net imports dropped by 6.55 million metric tons (8.16 percent). Similarly, decomposing the impact showed that those countries that did not implement the policy interventions encountered an increase in wheat price of 3.76 percent, while those that implemented policies saw a price decline of 16.24 percent.

Coarse Grains

In the corn market, Argentinean net exports decreased because of the higher export tax for corn. China implemented export-restrictive policies for corn, resulting in a decline in corn production and higher corn net imports. India eliminated its import tariffs for corn, which increased domestic consumption and imports. Higher world corn prices led some major exporters to increase their exports to meet the growing demand, including Brazil, the United States, and South Africa. In response to higher world corn prices, many countries and regions decreased their net imports since they did not implement any changes in their tariff policies. The overall changes in the world show that the international reference price for corn increased by US\$9 per metric ton (4.71 percent), production increased by 3.19 million metric tons (0.41 percent), consumption by 3.79 million metric tons (0.47 percent), and net trade by 5.95 million metric tons (6.75 percent).

On average, *developed-country net exporters* experienced a weighted price increase of 3.43 percent, a gain in production of 3.41 million metric tons (1.01 percent), an increase in trade of 6.47 million metric tons (11.32 percent),

and a decline in consumption of 2.08 million metric tons (0.74 percent). In contrast, the weighted average price in the *developed-country net importers* decreased by 17.69 percent due to the removal of import tariffs in South Korea (Republic of Korea), with production gaining 0.26 percent. Consumption and net imports consequently increased by 5.16 million metric tons (4.76 percent) and 5.4 million metric tons (14.05 percent), respectively.

The *developing-country net exporters* as a group exhibited a weighted average price increase of 1.52 percent, with production decreasing by 211 thousand metric tons (TMT) (0.18 percent), and net trade declining by 0.5 million metric tons (1.16 percent). Consumption increased by 0.38 million metric tons (0.44 percent) for this group. However, the price impacts were different for *developing-country net exporters* that implemented the policy shocks and those that did not. Local corn prices decreased 4.63 percent for *developing-country net exporters* that adopted trade policy responses. Countries that did not exercise trade policy responses experienced higher domestic prices.

The *developing-country net importers* experienced a weighted average price increase of 2.23 percent. Production decreased by 232 thousand metric tons (0.08 percent) and consumption increased by 325 thousand metric tons (0.10 percent). As a group, net imports increased by 509 thousand metric tons (1.16 percent). Those countries adopting trade policy responses experienced a lower local corn price and more imports while the countries that did not implement policy interventions had a price increase of 2.45 percent.

In the barley market, the changes are partially due to modifications in trade policies and partially in response to movements in the wheat and corn markets. The Russian Federation introduced an export tax for barley, which led to lower domestic production and a consequent decline in its net exports. Other barley exporters, such as the EU and Canada, responded to the increase in world barley prices by increasing their net exports. A Chinese barley export tax reduced barley production, thus increasing its net imports. Other barley importers decreased their net imports due to higher prices in the world market. Overall changes in the international reference price of barley showed an increase of US\$13 per metric ton (9.16 percent).

Average results of the policy changes in the barley market show that *developed-country net exporters* experienced a weighted price increase of 2.59 percent. Also, the weighted average price in the *developed-country net importers* group increased by 9.15 percent. The *developing-country net exporters* group exhibited a decrease of 9.88 percent in world average price. However, decomposing the average impact shows that the price impact was different for each group: price increased 7.32 percent for the countries that did not

implement the policy shocks, and declined 23.58 percent for the ones that implemented policy responses. The *developing-country net importers* experienced a weighted average price increase of 7.95 percent. Again, price increased 8.67 percent in those countries that did not adopt policy shocks while those using policy tools pushed local prices down by 12.37 percent.

Soybean Sector

Changes in the world trade and price of soybeans and derived products were relatively smaller than those in the trade and price of grains, as policy modifications were less intensive in this sector. Argentina increased the export tax for soybeans and derived products (soybean meal and oil), while China lowered the import tariffs for soybeans and meal. India also reduced the tariffs for soybean oil. The other two major soybean exporters, Brazil and the United States, reacted to the policy shocks differently. Brazil's net exports for soybeans, meal, and oil rose, while the US soybean exports decreased as soybean area shifted to other commodities with stronger prices, such as wheat. The overall change in the three-year average soybean world price increased by US\$19 per metric ton (3.8 percent), partially driven by the changes in trade policies and partially by the response to area competition from corn and wheat. World production decreased modestly while consumption declined by 562 thousand metric tons (1.7 percent). The aggregate trade remained stagnant, although the trade flows changed among countries.

On average, *developed-country net exporters* (represented by the United States and Canada) encountered a higher weighted soybean price of US\$15 per metric ton (4.42 percent) and consequently a reduction in consumption of 313 thousand metric tons (0.53 percent). Although the price increased, production declined by 617 thousand metric tons (0.73 percent) because the soybean areas in the United States shifted to other more profitable crops. As a result, net trade declined by 1.08 percent. The group of *developed-country net importers* encountered a price increase of US\$17 per metric ton (3.36 percent) and reduced net imports by 91 thousand metric tons (0.40 percent).

Soybean prices in the *developing countries net exporters* slightly increased by 0.85 percent and the net exports also gained by 506 thousand metric tons (1.05 percent). However, decomposing the impact shows that countries without trade policy interventions experienced a price increase of 0.02 percent, while the group of countries that manipulated trade policies (solely represented by Argentina) lowered the local price by 0.09 percent. The consumption in these countries decreased due to a lower crush margin after the policies imposed on both soybeans and derived products.

The *developing-country net importers* of soybeans also experienced a higher weighted average price by 1.88 percent, driven by rising net imports of 327 thousand metric tons (1.39 percent). Similar to other commodities, the increase of net imports in this group was primarily contributed by those countries that lowered their import tariffs. The increasing demand offset the impacts of lower tariffs and increased the local price only slightly in those countries that adopted policy changes (0.01 percent). Net importing countries without policy distortions had a slightly higher price increase of 0.02 percent.

In the soybean meal market, the overall policy changes show that the international reference price increased by US\$9 per metric ton (2.59 percent) and net trade declined by 188 thousand metric tons (0.32 percent). The average results of the policy impacts show that *developed-country net exporters* encountered an increase in weighted price of US\$15 (3.88 percent), while the weighted average price in *developed-country net importers* increased by 2.33 percent. The weighted average prices also rose by US\$6 (3.56 percent) and US\$5 (3.24 percent) for *developing-country net exporters* and *developing-country net importers*, respectively. A similar pattern was observed in the soybean oil market, where a US\$50 (3.82 percent) gain in the international reference price and a reduction in net trade of 50 thousand metric tons (0.52 percent) occurred. The weighted average soybean oil prices increased in all groups, up to 3.9 percent, except for developing countries that implemented trade policy interventions.

Distributions of Welfare Gains and Losses from Trade Policy Responses

Estimates of the welfare distribution among trading countries in the world due to trade policy interventions imposed by major countries can provide a more comprehensive understanding of the effects of those policies. Timmer (2010) considered the aggregate global welfare in the rice market and believed that trade policy interventions employed by larger trading countries (that is, India and Indonesia) may be an effective way to mitigate a domestic food crisis even if the consequent pecuniary externality of higher global price volatility will exacerbate poverty in those small countries that rely on food imports. In contrast, the main focus of this study is to illustrate the consequences of trade policy interventions adopted by some major exporting and importing countries on the welfare changes in individual countries, including those food-deficit countries that have little power in manipulating their trade policies.

To explore the impacts of increasing export constraints and lowering import tariffs in individual countries, a welfare analysis consisting of the

FIGURE 11.3 Welfare effects of an import tariff decline for a net importer

Source: Authors.

changes in the producer surplus (PS), consumer surplus (CS), and tariff and tax revenues (TR) was conducted for the evaluated countries. The three-year average production, consumption and real price (in 2000 US dollars) of commodities were used to calculate the changes in PS, CS, and TR for each country in the model. The changes in trade policies by various countries affect consumers and producers as well as the revenue for the government. The net impact of a trade policy depends on various factors, such as whether the country is a net exporter or a net importer. The final change in the price of a commodity determines whether consumers and producers will lose or gain.

To illustrate the computation of welfare measures in our study, we include two examples: one for an import tariff decline and one for an export tax increase. [Figure 11.3](#) depicts the change in welfare in a country that is a net importer of a commodity where the trade policy change is an import tariff decline. The domestic price of the commodity is $P^D_{Baseline}$ in the baseline and $P^D_{Scenario}$ after the shock. The change in consumer surplus in this country for this particular commodity is represented by sum of the areas (1, 2, 3, 4, and 5). The change in producer surplus is represented by sum of the areas (1 and 2). The change in government revenue due to tariff decline is represented by area 4. In contrast, [Figure 11.4](#) shows the change in welfare in a country that is a net exporter of a commodity where the trade policy change is an export tax increase. In [Figure 11.4](#), $P^D_{Baseline}$ is the domestic price of the commodity in the baseline, while $P^D_{Scenario}$ represents the price after trade policy interventions. The change in consumer surplus in this country for this particular commodity is represented by sum of the areas (1 and 2). The change in producer surplus is

FIGURE 11.4 Welfare effects of an export tax increase for a net exporter

Source: Authors.

represented by sum of the areas (1, 2, 3, 4, and 5). The change in government revenue due to export tax increase is represented by area 4.

The change in the domestic price of a commodity in a country reflects not only the change in the representative world price of that commodity but also the trade policy changes implemented in that country. Since policy changes were implemented for multiple commodities in many countries, the final change in the domestic price for a given crop in one country is affected not only by the trade policy changes in this country, but also by the dynamics of world agricultural markets. To demonstrate the welfare changes in different country groups, [Table 11.4](#) presents welfare changes for producers, consumers, and government for developing countries and regions included in the model, while [Table 11.5](#) summarizes the distribution of welfare gains and losses in developed countries. Comparison of net welfare changes among countries is made difficult by the difference in commodity coverage in each country.

As seen in [Table 11.4](#), developing countries that imposed higher export restrictions (tax or quota) experienced significant gains in consumers' surplus and government tax revenues but had adverse effects on the producers' welfare. These countries include Argentina (corn, wheat, soybeans and products, and sunflower and products), Egypt (rice), Pakistan (rice), the Russian Federation (wheat and barley), and Viet Nam (rice). Also, some developing countries in [Table 11.4](#) only reduced import tariffs.⁵ These countries include Commonwealth of Independent States (CIS) (sunflower oil and rapeseed oil),

(text continues on page 393)

5 Pakistan raised the minimum export price for rice instead of imposing tax or quota, so the government did not receive any direct tax revenue from the policy response.

TABLE 11.4 Welfare effects of trade policy scenario on major crops in evaluated developing countries and regions

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Countries with trade policy responses				
Argentina				
Rice	15,499	–6,019	n.a.	9,480
Wheat	15,680	–4,277	295,928	307,331
Corn	–60,183	4,705	170,974	115,496
Barley	9,606	–4,733	n.a.	4,873
Sorghum	14,172	–824	n.a.	13,348
Soybeans, meal, and oil	–341,351	1,035	1,669,843	1,329,527
Sunflowers, meal, and oil	–65,296	8,982	213,994	157,680
Peanuts, meal, and oil	–2,684	–518	n.a.	–3,202
Total 14 commodities	–414,558	–1,649	2,350,739	1,934,533
China				
Rice	8,803,477	–8,530,384	60,354	333,447
Wheat	–1,748,017	1,641,231	38,042	–68,744
Corn	–111,344	32,511	5,694	–73,139
Barley	–48,043	60,668	259	12,884
Soybeans, meal, and oil	316,722	–309,675	–286,400	–279,353
Rapeseeds, meal, and oil	163,269	–303,008	n.a.	–139,739
Sunflowers, meal, and oil	22,802	–16,465	n.a.	6,337
Palm oil	0	–51,762	n.a.	–51,762
Peanuts, meal, and oil	–56,541	18,346	n.a.	–38,195
Total 17 commodities	7,342,325	–7,458,538	–182,051	–298,264
CIS				
Corn	22,511	–3,169	n.a.	19,342
Barley	62,885	–10,798	n.a.	52,087
Soybeans, meal, and oil	–949	–68,834	n.a.	–69,783
Rapeseeds, meal, and oil	9,624	–2,153	n.a.	7,471
Sunflowers, meal, and oil	–77,095	44,078	n.a.	–33,017
Total 11 commodities	16,976	–40,876	0	–23,900
Egypt				
Rice	195,782	–152,586	4,612	47,808
Wheat	250,048	–482,679	n.a.	–232,631

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Corn	45,784	–15,817	n.a.	29,967
Total 3 commodities	491,614	–651,082	4,612	–154,856
India				
Rice	–2,191,983	2,094,043	1,201,667	1,103,727
Wheat	–5,394,185	5,757,943	–126,939	236,819
Corn	–267,543	139,601	0	–127,943
Sorghum	52,634	–43,806	n.a.	8,828
Soybeans, meal, and oil	–160,437	24,672	–604,200	–739,965
Rapeseeds, meal, and oil	114,186	–95,156	–15	19,015
Palm oil	–3,808	326,925	–1,195,119	–872,002
Peanuts, meal, and oil	–176,585	–89,094	95,590	–170,089
Total 14 commodities	–8,027,721	8,115,128	–629,017	–541,610
Indonesia				
Rice	1,030,853	–1,081,115	–394	–50,656
Corn	98,329	–53,001	n.a.	45,328
Palm oil	–77,807	0	1,861,095	1,783,288
Total 3 commodities	1,051,375	–1,134,116	1,860,701	1,777,960
Nigeria				
Rice	–696,146	1,120,933	–497,552	–72,765
Sorghum	141,977	–139,637	n.a.	2,340
Total 2 commodities	–554,169	981,296	–497,552	–70,425
Pakistan				
Rice	–93,550	42,995	n.a.	–50,555
Wheat	742,219	–712,931	n.a.	29,287
Corn	10,730	–5,984	n.a.	4,746
Barley	3,000	–3,000	n.a.	0
Sorghum	1,575	–1,119	n.a.	456
Total 5 commodities	663,974	–680,040	0	–16,066

*(continued)***Source:** Authors' calculations.

Note: n.a. = not applicable; ^aFor oilseeds, change in producer surplus is computed for seed and bean producers and for crushers; ^bFor oilseeds, change in consumer surplus is computed for oil consumers and for consumers where there is food consumption of seeds; ^cChange in tax revenue refers to the change in tax revenue of countries that applied an export tax change or to the change in tariff revenue of countries that applied an import tariff change.

TABLE 11.4 (Continued)

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Philippines				
Rice	-511,151	617,153	-219,571	-113,569
Corn	61,188	-16,543	n.a.	44,646
Total 2 commodities	-449,963	600,610	-219,571	-68,923
Russian Federation				
Corn	29,158	-4,667	n.a.	24,491
Wheat	-3,018,480	1,460,809	625,015	-932,656
Barley	-474,444	132,733	15,810	-325,901
Total 3 commodities	-3,463,766	1,588,875	640,825	-1,234,066
Turkey				
Rice	17,460	-28,282	-1,798	-12,620
Total 1 commodity	17,460	-28,282	-1,798	-12,620
Viet Nam				
Rice	-220,660	178,679	1,556,442	1,514,461
Corn	35,016	-7,988	n.a.	27,027
Total 2 commodities	-185,644	170,691	1,556,442	1,541,489
Group Welfare Changes	-3,512,097	1,462,017	4,883,330	2,833,252
Countries without trade policy responses				
Algeria				
Wheat	79,788	-226,908	n.a.	-147,119
Corn	7	0	n.a.	7
Barley	7,418	-1,727	n.a.	5,691
Total 3 commodities	87,213	-228,634	0	-141,422
Bangladesh				
Rice	2,566,741	-2,639,077	n.a.	-72,336
Total 1 commodity	2,566,741	-2,639,077	0	-72,336
Brazil				
Rice	580,763	-642,970	n.a.	-62,208
Wheat	98,304	-300,021	n.a.	-201,718
Corn	382,943	-47,757	n.a.	335,186
Barley	3,872	-7,639	n.a.	-3,766
Soybeans, meal, and oil	406,577	-56,171	n.a.	350,406
Total 7 commodities	1,472,459	-1,054,558	0	417,901

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Côte d'Ivoire				
Rice	60,591	–99,687	n.a.	–39,095
Total 1 commodity	60,591	–99,687	0	–39,095
Iran				
Rice	106,133	–143,001	n.a.	–36,868
Wheat	729,136	–729,312	n.a.	–176
Total 2 commodities	835,269	–872,313	0	–37,044
Iraq				
Rice	65,549	–348,931	n.a.	–283,381
Total 1 commodity	65,549	–348,931	0	–283,381
Malaysia				
Rice	131,276	–207,958	n.a.	–76,682
Corn	654	–1,166	n.a.	–513
Palm oil	136,384	–6,153	n.a.	130,231
Total 3 commodities	268,313	–215,276	0	53,037
Mexico				
Rice	15,852	–67,243	n.a.	–51,391
Wheat	111,578	–183,217	n.a.	–71,639
Corn	171,133	–119,195	n.a.	51,938
Barley	10,029	–951	n.a.	9,078
Sorghum	40,109	–707	n.a.	39,402
Soybeans, meal, and oil	17,607	–18,734	n.a.	–1,127
Peanuts	–1,536	4,253	n.a.	2,717
Total 9 commodities	364,771	–385,793	0	–21,022
Morocco				
Wheat	169,427	–326,983	n.a.	–157,555
Total 1 commodity	169,427	–326,983	0	–157,555
Myanmar				
Rice	13,394,692	–13,394,405	n.a.	287
Total 1 commodity	13,394,692	–13,394,405	0	287

*(continued)***Source:** Authors' calculations.

Note: n.a. = not applicable; ^aFor oilseeds, change in producer surplus is computed for seed and bean producers and for crushers; ^bFor oilseeds, change in consumer surplus is computed for oil consumers and for consumers where there is food consumption of seeds; ^cChange in tax revenue refers to the change in tax revenue of countries that applied an export tax change or to the change in tariff revenue of countries that applied an import tariff change.

TABLE 11.4 (Continued)

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Paraguay				
Soybeans, meal, and oil	36,158	–555	n.a.	35,603
Total 3 commodities	36,158	–555	0	35,603
Saudi Arabia				
Rice	0	–26,008	n.a.	–26,008
Barley	0	–103	n.a.	–103
Total 2 commodities	0	–26,111	0	–26,111
South Africa				
Rice	0	–44,174	n.a.	–44,174
Corn	75,902	–31,947	n.a.	43,955
Barley	2,202	–1,629	n.a.	573
Sorghum	1,439	–1,193	n.a.	246
Total 4 commodities	79,543	–78,943	0	600
Tunisia				
Wheat	73,588	–123,614	n.a.	–50,026
Total 1 commodity	73,588	–123,614	0	–50,026
Ukraine				
Corn	56,775	–4,192	n.a.	52,583
Wheat	246,471	–146,748	n.a.	99,723
Barley	76,657	–14,234	n.a.	62,423
Total 3 commodities	379,903	–165,174	0	214,730
Uruguay				
Rice	–26,018	–4,738	n.a.	–30,755
Total 1 commodity	–26,018	–4,738	0	–30,755
Other African countries				
Corn	250,500	–232,129	n.a.	18,371
Wheat	1,097,378	–1,676,675	n.a.	–579,297
Barley	48,753	–37,913	n.a.	10,840
Total 3 commodities	1,396,631	–1,946,718	0	–550,087
Other Asian countries				
Wheat	226,001	–702,291	n.a.	–476,290
Corn	38,256	–29,344	n.a.	8,912
Barley	23,568	–24,398	n.a.	–831
Total 3 commodities	287,825	–756,033	0	–468,208

Country/Commodity	Average 2008–2010 (2000 US\$ [1,000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Other CIS countries				
Wheat	951,828	–669,559	n.a.	282,269
Total 1 commodity	951,828	–669,559	0	282,269
Other Eastern European countries				
Wheat	53,299	–72,329	n.a.	–19,030
Corn	26,656	–3,841	n.a.	22,815
Barley	5,843	–2,456	n.a.	3,387
Total 3 commodities	85,798	–78,626	0	7,172
Other Latin American Countries				
Wheat	168,634	–595,349	n.a.	–426,715
Corn	220,932	–104,639	n.a.	116,292
Barley	16,230	–21,790	n.a.	–5,560
Total 3 commodities	405,796	–721,778	0	–315,983
Other Middle Eastern countries				
Corn	42,721	–16,209	n.a.	26,512
Barley	125,761	–23,658	n.a.	102,104
Total 2 commodities	168,483	–39,867	0	128,616
Rest of the world				
Wheat	122,798	–152,001	n.a.	–29,203
Corn	83,493	–31,708	n.a.	51,785
Barley	19,599	–4,586	n.a.	15,013
Sorghum	166,235	–134,969	n.a.	31,266
Soybeans, meal, and oil	51,019	–202,172	n.a.	–151,153
Rapeseeds, meal, and oil	30,118	–79,721	n.a.	–49,603
Sunflowers, meal, and oil	94,359	–154,096	n.a.	–59,737
Palm oil	–74,474	–224,888	n.a.	–299,362
Peanuts, meal, and oil	–451,313	328,758	n.a.	–122,555
Total 17 commodities	41,835	–655,385	0	–613,550
Group welfare changes	23,253,979	–24,854,020	0	–1,600,038

Source: Authors' calculations.

Note: n.a. = not applicable; ^aFor oilseeds, change in producer surplus is computed for seed and bean producers and for crushers; ^bFor oilseeds, change in consumer surplus is computed for oil consumers and for consumers where there is food consumption of seeds; ^cChange in tax revenue refers to the change in tax revenue of countries that applied an export tax change or to the change in tariff revenue of countries that applied an import tariff change.

TABLE 11.5 Welfare effects of trade policy scenario on major crops in evaluated developed countries and regions

Country/Commodity	Average 2008–2010 (2000 US\$ [1000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Countries with Trade Policy Responses				
Japan				
Rice	–339,345	346,242	91,019	97,917
Wheat	27,713	–173,344	n.a.	–145,630
Corn	7	–35,561	n.a.	–35,554
Barley	2,086	–3,197	n.a.	–1,111
Soybeans, meal, and oil	–5,606	–46,466	n.a.	–52,072
Rapeseeds, meal, and oil	92	–59,621	n.a.	–59,529
Total 10 commodities	–315,052	28,054	91,019	–195,979
Republic of Korea				
Rice	348,145	–363,561	n.a.	–15,416
Wheat	123	–50,967	–13,234	–64,078
Corn	–40,941	1,679,754	–6,281,674	–4,642,861
Soybeans, meal, and oil	630	–18,052	n.a.	–17,422
Total 6 commodities	307,957	1,247,173	–6,294,908	–4,739,777
Group Welfare Changes	–7,095	1,275,227	–6,203,889	–4,935,756
Countries without Trade Policy Responses				
Australia				
Rice	14,626	–29,822	n.a.	–15,196
Wheat	476,755	–54,789	n.a.	421,966
Corn	3,113	–1,028	n.a.	2,086
Barley	77,342	–9,880	n.a.	67,462
Sorghum	15,873	–36	n.a.	15,838
Rapeseeds, meal, and oil	11,847	–7,693	n.a.	4,154
Total 8 commodities	599,557	–103,247	0	496,310
Canada				
Rice	0	–18,749	n.a.	–18,749
Wheat	575,451	–129,237	n.a.	446,214

Country/Commodity	Average 2008–2010 (2000 US\$ [1000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Corn	72,930	–29,302	n.a.	43,628
Barley	126,564	–14,598	n.a.	111,966
Soybeans, meal, and oil	27,754	–8,903	n.a.	18,851
Rapeseeds, meal, and oil	136,014	–15,564	n.a.	120,450
Peanuts	0	6,061	n.a.	6,061
Total 11 commodities	938,713	–210,293	0	728,420
European Union				
Rice	160,133	–269,391	n.a.	–109,257
Wheat	522,658	–254,656	n.a.	268,003
Corn	186,021	–48,729	n.a.	137,292
Barley	153,261	–40,563	n.a.	112,699
Soybeans, meal, and oil	16,551	–182	n.a.	16,369
Rapeseeds, meal, and oil	436,797	–169,255	n.a.	267,541
Sunflowers, meal, and oil	156,566	–153,989	n.a.	2,577
Palm oil	0	–40,699	n.a.	–40,699
Peanuts, meal, and oil	3,284	38,459	n.a.	41,743
Total 17 commodities	1,635,272	–939,005	0	696,267
Hong Kong				
Rice	0	–3,245	n.a.	–3,245
Total 1 commodity	0	–3,245	0	–3,245
Israel				
Corn	0	3	n.a.	3
Barley	0	–115	n.a.	–115
Sorghum	0	–33	n.a.	–33
Total 3 commodities	0	–145	0	–145

*(continued)***Source:** Authors' calculations.

Note: n.a. = not applicable; ^aFor oilseeds, change in producer surplus is computed for seed and bean producers and for crushers; ^bFor oilseeds, change in consumer surplus is computed for oil consumers and for consumers where there is food consumption of seeds; ^cChange in tax revenue refers to the change in tax revenue of countries that applied an export tax change or to the change in tariff revenue of countries that applied an import tariff change.

TABLE 11.5 (Continued)

Country/Commodity	Average 2008–2010 (2000 US\$ [1000])			
	Change in producer surplus ^a	Change in consumer surplus ^b	Change in tax revenue ^c	Net welfare change
Taiwan, China				
Rice	76,585	–86,718	n.a.	–10,133
Wheat	0	–32,396	n.a.	–32,396
Corn	600	–2,804	n.a.	–2,204
Barley	0	–322	n.a.	–322
Soybeans, meal, and oil	–323	–20,627	n.a.	–20,950
Total 7 commodities	76,862	–142,868	0	–66,006
United States				
Rice	519,745	–308,124	n.a.	211,621
Wheat	1,698,892	–808,809	n.a.	890,082
Corn	2,472,644	–261,715	n.a.	2,210,930
Barley	55,301	–34,755	n.a.	20,546
Sorghum	66,644	–5,629	n.a.	61,015
Soybeans, meal, and oil	922,653	–322,910	n.a.	599,743
Rapeseeds, meal, and oil	1,440	–32,979	n.a.	–31,539
Sunflowers, meal, and oil	19,098	–15,737	n.a.	3,361
Peanuts, meal, and oil	12,722	–14,524	n.a.	–1,802
Total 17 commodities	5,769,139	–1,805,182	0	3,963,956
Group Welfare Changes	9,019,543	–3,203,985	0	5,815,557

Source: Authors' calculations.

Note: n.a. = not applicable; ^aFor oilseeds, change in producer surplus is computed for seed and bean producers and for crushers; ^bFor oilseeds, change in consumer surplus is computed for oil consumers and for consumers where there is food consumption of seeds; ^cChange in tax revenue refers to the change in tax revenue of countries that applied an export tax change or to the change in tariff revenue of countries that applied an import tariff change.

Nigeria (rice), Philippines (rice), and Turkey (rice).⁶ Consumers' welfare in those countries typically gained from price reduction, while producers' welfare and government revenues dropped. Moreover, a number of countries took a mixed strategy of export restrictions and import tariff reductions for different commodities to alleviate the price pressure in their domestic markets, such as China, India, and Indonesia. Those mixed policy distortions created various impacts on each of those countries. In general, producers in the developing countries implementing trade policy responses endured the largest loss in welfare, while most revenues switched to governments through tax collections. The welfare changes in this group totaled US\$2.8 million, including a loss of US\$3.5 million in PS, a gain of US\$1.5 million in CS, and an increase of TR of US\$4.9 million.

For other developing countries and regions that made no adjustments in trade policies, consumers typically suffered from the higher food and agricultural commodity prices, while producers gained in terms of their welfare (see [Table 11.4](#)). Except for some countries that are major exporters of agricultural and food commodities (such as Brazil, Malaysia, Paraguay, and Uruguay), the high commodity prices caused by the trade restrictions in other countries resulted in a significant net adverse effect on net importing countries. This situation is particularly significant in many developing countries in Africa, the Middle East, and Latin America that have less opportunity of being self-sufficient in agricultural production and rely heavily on imports for domestic food demand. Most of the countries/regions (75 percent) in this group experienced net welfare losses. The aggregate gains of US\$23.2 million in PS were offset by the reduction in CS (US\$24.8 million), resulting in a net welfare loss of US\$1.6 million.

Most developed countries did not adopt any trade policy adjustments during this period, except Japan (rice) and Republic of Korea (wheat and corn). In [Table 11.5](#), Japan's aggregate loss in PS outweighed the total gain in CS and TR, and caused a net welfare loss of US\$0.2 million. In the Republic of Korea, loss in tax revenue dominated the gain in both PS and CS of six selected commodities, resulting in nearly a US\$5 billion loss in net welfare. Hence those two countries together endured about a US\$4.9 billion loss in welfare, primarily shared by the Republic of Korea's government. For developed countries that did not impose modifications in trade policy, the distribution of welfare between producers and consumers is consistent: PS increases while CS decreases

6 Since CIS is a net exporting region of sunflower and rapeseed oils, changes in the government revenue of import tariffs were not considered in this study. This suggests the estimate of the loss in total net welfare in CIS is conservative.

(see [Table 11.5](#)). Net welfare in dominant exporting countries (for example, Australia, Canada, the European Union, and the United States) increases since the significant gain in PS surpassed the loss in CS. As expected, developed countries relying on imports of grains and oilseeds (for example, Taiwan [China] and Israel) experienced a loss in net welfare as loss in CS dominated a slight gain in PS. In this group the total PS gain, US\$9.0 million, outweighed the reduction in CS, US\$3.2 million, creating a net welfare gain of US\$5.8 million.

Conclusions

It is generally believed that inefficient trade policies, such as export restrictions or import tariffs, can create a short-term impact of mitigating the upward pressure on domestic commodity prices, but ultimately will tend to have an adverse impact on domestic prices. Moreover, trade policies implemented by those major trading countries will usually create more price pressure on the poorer food-deficit countries/regions that are less capable of manipulating their trade policies. Unfortunately, most policy makers focus on the short-term impacts and adopt these policies as a way to combat price inflation. We use a set of multimarket, partial-equilibrium, and nonspatial models of agricultural commodities to investigate the impacts adopting these trade policies will have on the world agricultural commodity prices and trade. The policy scenario is based on the relevant policy parameters utilized by the major exporting and importing countries by July 2008 in a period when these countries attempted to slow down the price hikes in their domestic markets.

The scenario results suggest a consistent world price behavior, but a heterogeneous trade pattern impact, among agricultural commodities. The international reference prices of the major agricultural commodities increased, ranging between 0.1 percent and 25.0 percent, due to the trade policy responses by various countries. Rice price experienced the largest increase, at 24.0 percent, as major exporting countries imposed export bans and restrictions, negatively impacting supplies on the global rice market. Considerable increases in the world prices of wheat (14.3 percent) and barley (9.2 percent) were also observed due to the additional export taxes and lower import tariffs. Similar to the rice market, world net trade of barley fell. However, wheat and corn world net trade expanded as higher demand was encouraged by the lower import tariffs. Oilseed prices reacted moderately to the policy modifications, as fewer trade policies had been exercised in these markets. However, vegetable oil price responses were larger as India eliminated or cut the typical high import tariffs.

Decomposing the price and trade impact of policy interventions by country type, the results show that the group of developing countries implementing trade policy responses lowered their domestic price and consequently reduced their net exports (the exporting countries) or increased their net imports (the importing countries). However, the group of developing countries with less power in manipulating their trade policies faced higher prices from the world market and had to lower their imports of agricultural and food commodities.

Welfare analyses of these trade policies show that the negative net welfare is observed particularly in many developing countries in Africa and Latin America that rely on imports for their domestic consumption and have little power to introduce any trade policy changes. This group experienced a total US\$1.6 million net welfare loss as estimated in this study. For these countries the higher world commodity prices brought about by trade policy modifications generate more challenges in attaining food security. This suggests that the “costs” of major trading countries imposing trade restrictions on small countries relying on food imports are important and should not be neglected. In contrast, developing countries that increased export taxes or lowered/eliminated import tariffs enjoyed total net welfare gains. However, the welfare gain primarily goes to the government in the form of higher revenue; and the producers’ losses in these countries actually outweighed the gains in consumers’ welfare. The distribution of the additional tax revenue is beyond the scope of our analysis, but the efficiency of compensating producers and consumers with those extra tax revenues is crucial in this group.

The findings of this study are consistent with literature. FAO (2009) discusses the various trade policy responses adopted by countries in response to higher food prices and argues that by maintaining prices at artificially low levels, these countries may experience lower production. It also warns that export restrictions will lower supplies in world markets, leading to even higher prices. Von Braun et al. (2008) raise similar concerns and note that “policy responses such as export bans or high export tariffs may reduce risks of food shortages in the short term for the relevant country, but they are likely to backfire by making the international market smaller and more volatile. At the country level, price controls can also backfire by reducing farmers’ incentives to produce more food and diverting resources away from those who need them most.” Results of our study show the adverse effects of export bans/restrictions on the production of agricultural commodities in countries that implement them.

In terms of the price and welfare impact of trade policy adjustments, von Braun et al. (2008) conclude that the elimination of export bans would reduce

price levels by as much as 30 percent. Bouët and Laborde (2010) also suggest that the world wheat price increases by 20.6 percent to 41.0 percent in the scenarios of raising export taxes. The welfare analysis in Bouët and Laborde finds that under policy interventions wheat net exporters' welfare increases while the net importers' welfare decreases. Those findings are in line with the direction of price and welfare impacts estimated in this study. The price impacts of trade policy adjustments in those studies are relatively higher than the commodity price changes in this study (2.6 percent to 25.0 percent among different commodities), which could be due to scenario definition and modeling differences. Although it is difficult to make a direct comparison of the magnitude of price impacts, the directions of price changes in those studies are similar to the percentage price changes in this study.

This chapter provides an illustration of the adverse impacts of exercising inefficient trade policies to mitigate the price pressure in domestic commodity markets. In order to stabilize the price of agricultural and food commodities, governments can rely on minimizing the policy distortions in markets and focusing on investment in infrastructure, information diffusion, and research in the agricultural sector (Cummings et al. 2006). As suggested by von Braun (2009) and illustrated by Nogue and Wodon (2008), policies that encourage productivity improvements that boost the supply would be much more beneficial and provide a long-term solution for the higher price problem of today's agricultural markets.

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Appendix

TABLE 11.A1 International grains model supply and demand elasticities

Commodity/Country	Supply elasticity	Price elasticity of demand	Income elasticity of demand
Rice			
Australia	0.19	-0.44	2.31
Bangladesh	0.16	-0.00	0.41
India	0.09	-0.04	-0.16
Indonesia	0.10	-0.13	-0.09
Malaysia	0.15	-0.30	0.09
Myanmar	0.15	-0.10	0.13
Philippines	0.04	-0.25	0.15
Thailand	0.15	-0.05	-0.16
Viet Nam	0.01	-0.20	-0.23
China	0.22	-0.10	-0.14
Hong Kong	n.a.	-0.16	-0.19
Japan	0.29	-0.11	-0.26
South Korea (Republic of Korea)	0.24	-0.66	-0.32
Taiwan, China	0.17	-0.02	-0.29
Argentina	0.24	-0.07	0.11
Brazil	0.08	-0.10	-0.05
Canada	n.a.	-0.21	0.47
Mexico	0.10	-0.05	0.46
Uruguay	0.21	-0.17	0.50
Iran	0.00	-0.35	0.20
Iraq	2.18	-0.04	0.53
Pakistan	0.29	-0.18	0.10
Saudi Arabia	n.a.	-0.25	0.10
Egypt	0.161	-0.15	0.30
South Africa	n.a.	-0.20	0.47
Côte d'Ivoire	0.57	-0.55	0.14
Nigeria	0.10	-0.15	0.25
European Union	0.10	-0.08	1.63
Turkey	0.05	-0.01	1.41
United States	(0.39,0.81) ^a	-0.12	0.37

Commodity/Country	Supply elasticity	Price elasticity of demand	Income elasticity of demand
Wheat			
India	0.27	-0.26	n.a.
China	0.33	-0.08	-0.06
Argentina	0.31	-0.28	-0.11
Brazil	0.32	-0.25	0.04
Canada	0.35	-0.24	0.01
European Union	0.02	-0.22	-0.03
United States	(0.13,0.44) ^a	-0.08	n.a.
Australia	0.27	-0.26	-0.21
Corn			
India	0.34	-0.21	0.00
China	0.27	-0.15	0.05
Argentina	0.60	-0.42	n.a.
Brazil	0.33	-0.14	0.01
Canada	0.31	-0.31	0.07
European Union	0.03	-0.24	-0.03
United States	(0.17,0.52) ^a	-0.07	n.a.
Australia	0.20	-0.25	0.05
Barley			
China	0.43	-0.30	0.05
Argentina	0.31	-0.36	-0.08
Brazil	0.16	-0.36	0.11
Canada	0.33	-0.35	0.01
European Union	0.05	-0.31	-0.06
United States	(0.19,0.59) ^a	-0.09	n.a.
Australia	0.28	-0.33	0.01
Sorghum			
India	0.22	0.25	0.01
Australia	0.22	-0.35	0.02
Argentina	0.39	-0.28	-0.35
United States	(0.16,0.28) ^a	-0.49	n.a.

Source: Authors.

Note: n.a. = not applicable.

^aThe ranges of the elasticities for the 9 subregions in the US crops model are presented. The regions include the Corn Belt, the Central Plains, the Delta States, the Far West, the Lake States, the Northeast, the Northern Plains, the Southeast, and the Southern Plains.

TABLE 11.A2 International oilseeds model supply and demand elasticities

Commodity/Country	Supply elasticity	Revenue elasticity of crush demand	Price elasticity of food demand	Income elasticity of food demand
Soybeans				
India	0.33	0.15	-0.30	0.85
China	0.30	0.21	-0.20	0.60
Japan	0.34	0.25	-0.34	0.45
Taiwan, China	n.a.	0.04	-0.30	0.43
Argentina	0.26	0.20	n.a.	n.a.
Brazil	0.33	0.10	n.a.	n.a.
Paraguay	0.18	0.08	n.a.	n.a.
Mexico	0.22	0.23	n.a.	n.a.
Canada	0.31	0.25	n.a.	n.a.
European Union	0.30	0.20	-0.25	0.40
United States	(0.16, 0.33) ^a	0.08	n.a.	n.a.
Rapeseed				
India	0.34	0.25	n.a.	n.a.
China	0.22	0.24	n.a.	n.a.
Canada	0.25	0.20	n.a.	n.a.
CIS	0.34	0.25	n.a.	n.a.
Japan	0.24	0.17	n.a.	n.a.
European Union	0.24	0.26	n.a.	n.a.
United States				
Australia	0.25	0.10	n.a.	n.a.
Sunflower				
China	0.33	0.20	-0.17	0.01
Argentina	0.19	0.23	n.a.	n.a.
European Union	0.25	0.20	n.a.	n.a.
CIS	0.32	0.20	n.a.	n.a.
United States	(0.47, 0.48) ^a	0.34	-0.17	n.a.
Peanuts				
India	0.36	0.25	-0.20	0.20
China	0.20	0.30	-0.03	0.50
Argentina	0.25	0.20	-0.20	0.20
Canada	n.a.	n.a.	-0.40	0.20
United States	(0.28, 0.60) ^a	0.48	-0.19	n.a.
Palm				
Indonesia	0.01	0.20	n.a.	n.a.
Malaysia	0.01	0.22	n.a.	n.a.

Source: Authors.**Note:** n.a. = not applicable.

^aThe ranges of the elasticities for the 9 subregions in the US crops model are presented. The regions include the Corn Belt, the Central Plains, the Delta States, the Far West, the Lake States, the Northeast, the Northern Plains, the Southeast, and the Southern Plains.

TABLE 11.A3 Simulated price impacts of policy shocks in 2007–2008

Commodity	Simulated price impact of trade policy shocks in 2007/2008 (%)	Actual price growth between 2006/2007 and 2007/2008 (%)	Share of policy shocks on the total price change (%)
Rice	19	72	26
Wheat	13	70	19
Corn	6	40	15
Barley	9	37	23
Soybeans	3	64	5
Soymeal	3	70	5
Soyoil	1	72	1
Minor oilseeds	0	79	1
Minor oil meals	3	65	4
Minor oils	1	80	1

Source: Authors' calculations.

Note: The second column represents the price impacts of trade policy shocks imposed in the 2007/2008 marketing year. It is computed as the percentage change in commodity prices in scenario and baseline. The third column is the actual growth rate of commodity prices between 2006/2007 and 2007/2008 marketing years. Therefore the impact of trade policy responses on the actual price increase from 2006/2007 to 2007/2008 is the ratio of the simulated price growth rate over the actual price growth rate, which is presented in the fourth column.