Welfare and Price Impacts of Price-Insulating Policies

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Abstract

The impacts on welfare and poverty of policies that insulate domestic food prices from international prices are considered in this paper. Varying protection rates in order to insulate domestic prices from movements in international prices is a very common approach to attempting to stabilize domestic prices. When prices rise, this involves exporters introducing or raising export barriers. For importers, reductions in import duties are common, with gains in economic efficiency, but potential terms-of-trade losses. When all countries follow this type of policy, the stabilizing impact on domestic prices is, on average, eliminated, although countries that insulate more than others may experience reductions in price volatility, while those who insulate less may experience increases in price volatility. This paper provides estimates of the impacts of changes in price distortions in major economies for domestic prices and for national economic welfare, taking into account the impacts of changes in countries' own policies and those of their trading partners during key periods of price instability in world commodity markets. Our methodology uses the GTAP model and the set of detailed estimates of distortions to agricultural incentives from the global agricultural distortions project. By aggregating these individual impacts, we are able to evaluate whether domestic prices in each country or region were stabilized or destabilized by price insulating policies, and to assess the impacts on economic welfare of these policies.

[1] The authors are affiliated with the World Bank but the views in this paper are those of the authors alone and not necessarily those of the World Bank

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Introduction

The recent global food crises have had serious consequences, particularly for the poorest people, who spend very large shares of their income on staple foods. As shown in Figure 1, the volatility of world food prices has increased substantially over the last few years following decades of relatively low and stable food prices. The recent price spikes of 2008 and 2010 have raised concern as the poor are especially vulnerable because they spend the largest portions of their income on food. For example, in Nigeria, about 70 percent of the income of the lowest decile is spent on food, 75 percent in Vietnam, and 50 percent in Indonesia compared with 12 percent in the United States. An estimated 100 million people were thrown back into the ranks of the poor because of the price rise between 2005 and 2008 (Ivanic and Martin, 2008) and 44 million by the more recent price rise of 2010 (Ivanic, Martin and Zaman, 2011).

Unfortunately, pressure on food supplies, and associated high food prices, may be a medium- to long-term reality because of the durable nature of some of the driving factors—high fuel prices, biofuel policies that encourage or mandate use of food for fuel and do not allow efficient sourcing of that biofuel feedstock, rising prosperity in the developing world which creates more demand for food, slowing agricultural productivity, and climate—change induced pressure on agricultural supplies. This means that policy responses need to take into account the longer-term consequences of their actions as well as the short-term implications.

Some of the trade policy responses of governments to the high prices have increased the upward pressure on world prices in attempts to reduce domestic prices. Many exporting countries have imposed export restrictions, while others have reduced their import barriers. Out of 58 countries surveyed by the Bank, 40 had liberalized import barriers while 28 had imposed some form of export restrictions in response to the food price increases of 2008 (Zaman et al 2008) Clearly, many countries try to offset the variability in international prices.

There are several concerns with these trade policy responses. First, by lowering domestic prices, they reduce the incentives to increase production and for those who can—in particular the relatively well-off members of the community—to reduce their consumption; the lower prices penalize farmers, reducing the incentives for investments that can increase long-term supply. Second, if large countries—or small countries collectively accounting for a large amount of production--impose restrictions, they raise world prices and hurt importing countries. These measures are an example of a "beggar-thy-neighbor" policy if a large share of exports is covered. They may also be much less effective in stabilizing domestic prices than they appear. If they raise world prices sufficiently, they will be ineffective in stabilizing domestic prices, with the reduction in the domestic price relative to the world price offset by the increase in the world price. Even if they are ineffective in stabilizing domestic prices, they may destabilize incomes by reinforcing the initial terms-of-trade shock and setting off a second-round redistribution to the exporters.

This paper builds on the Martin and Anderson (2011) study of the effects of price insulation on world prices. It uses a structural modeling approach to allow investigation of the impacts of insulation on price variability, on economic welfare. We set out the theoretical framework for analyzing the impact of trade actions, especially export restrictions. Then, we describe the data and the policy analysis that we have undertaken and describe our main results. After we discuss the relevant WTO rules and policy discussions, we offer some policy implications and conclusions that flow from our analysis.

The impact of trade restrictions on efficiency, equity and volatility

To understand the qualitative impacts of export and import trade policy changes, it is useful to work through some examples of their implementation by exporting and importing countries. In this section, we consider these impacts as a prelude to a quantitative assessment. We first consider the use of restrictions in an exporting country, and then factor in use of import barrier reductions in importing countries. Our focus is on the short term in which countries respond to higher food prices.

For an individual small exporting country, a key effect of introducing or intensifying the use of export barriers is to reduce the domestic price relative to the world price. If the exporter is large, or if a number of exporting countries that are collectively large in the market impose export restrictions, the effect of the export restriction is to increase the world price of the good, and this change may offset the impact of the reduction in the domestic price.

Consider the situation depicted in Figure 2. The export supply of the country or group is indicated by the ES curve prior to the imposition of the export tax or restriction. This curve shows the volume of exports offered as increasing with the world price; this reflects the fact that higher prices are likely to increase domestic supply and to reduce domestic consumption. If an export tax is applied, then the world price needed to obtain any given level of exports is higher, since part of the export price is paid to the exporting government, and this situation is reflected by the higher curve, ES'. If quantitative export restrictions are imposed, the rights to export become valuable, and shift the ES curve upwards in a similar way, with the holders of the export rights or quotas receiving the benefits that would have accrued to the government if an export tax had been used. Note that the effect of the restriction is to raise the world price from p_0 to p_w and to lower the domestic price from p_0 to p_d.

In the situation depicted in Figure 2, the exporting countries gain from the improvement in their export prices, while losing from the induced changes in domestic production and consumption. Even though export prices are higher, production incentives are reduced and consumers have an incentive to increase the quantity they demand. The social costs associated with these incentives are given by the triangle abc. Whether the exporting country gains or losses from restricting exports depends upon whether these social costs are outweighed by the gain from improvements in the terms of trade. For small export tax rates, it is likely that the benefits will exceed the costs. However, the social costs rise with the square of the export tax equivalent (p_w - p_d), while the terms-of-trade gain is likely to rise linearly with the rate. This implies that the benefits to the exporter will become negative if the export tax rate becomes sufficiently large. By contrast with the exporter, the importing country unambiguously loses from the export restrictions. While it has not imposed any efficiency costs upon itself, the world price of its import has risen, transferring income to the exporter.

If policy makers in importing countries were concerned primarily about the level of world prices and their terms-of-trade, they might respond to the increase in world prices by raising tariffs on their imports. However, during the current episode of rapidly-increasing world prices, the response has frequently been the opposite. In a large number of countries, tariffs on food imports have been reduced in an attempt to avoid adverse impacts on consumers. This response reduces the cost imposed on the importing country by its own protectionist barriers. If it is adopted by importers with a large share of world markets, however, it will compound the increases in world prices resulting from the initial price shock and the restrictions imposed by exporters. From the point of view of the exporter this compounds the terms-of-trade benefits resulting from the initial upward price shock and from the imposition of export restrictions.

The effects of the attempts by exporters and importers to offset the impacts of a price increase on them may be partly or completely offsetting. A case where they are completely offsetting is shown in Figure 3, where exporters and importers both attempt to offset the impact of the initial shock. Exporters do this by imposing an export barrier equal to the initial price shock-shifting the ES curve upwards to ES'. Importers do it by reducing protection-or paying import subsidies—targeted to reduce domestic prices by an amount equal to the initial price shock. These importer responses shift the import demand curve up to ED'. As is evident from the Figure, the combined effect of these policy changes is to leave the domestic price unchanged at its post-shock level p_0. In this situation, the attempts of both the importers and the exporters to offset the original increase in price are completely ineffective.

Even when they are ineffective in insulating the domestic economy from price increases, these policy responses may destabilize welfare. In the case of an initial positive shock to prices followed by responses that further increase world prices, the exporter is doubly advantaged and the importer doubly disadvantaged. The exporter benefits from the initial increase in world prices and from the second-round increase in prices resulting from the policy response. If policy makers seek to insulate their economies from reductions in world prices, the exporter is likely to be doubly disadvantaged and the importer to be doubly advantaged. An initial decline in world prices worsens exporters' terms of trade, while the induced, insulating change in protection rates (reductions in export taxes or increases in export subsidies and/or increases in tariffs) further depresses world prices and hence the exporters' terms of trade.

Despite the possible impotence and certain inefficiency of trade restrictions, their use is sometimes justified as a means to achieve two objectives: price stabilization and poverty reduction. Where only some countries attempt to insulate their domestic markets from world price shocks, attempts to use price insulation to reduce domestic market price instability might have some effect, in contrast with the situation in Figure 2. However, the fundamental problem identified in Figure 2 remains. The use of trade measures to insulate economies from shocks to world prices can, at best, transfer the risks associated with commodity production and trade. If all countries seek to transfer price risk to others, the outcome is likely to be ineffective, as we have seen using Figure 2. This is in sharp contrast with the move from autarchy towards free trade, which is able to reduce total price risk through diversification as long as the shocks in individual markets are not perfectly correlated.

The extent to which countries can reduce the instability they face by transferring it to other countries will depend on which countries seek to insulate and the response of other countries to these insulating policies. Tyers and Anderson (1992) made an ambitious attempt to assess the extent to which the policies adopted by major participants in the world market for grains and other agricultural staples affect the volatility of world market prices, and of domestic market prices. They concluded (p227–8) that the coefficient of variation of world prices for food would fall from 34 to 10 if all countries agreed to eliminate their price insulating policies. In most of the 16 developing economies they considered, the coefficient of variation for domestic prices would fall substantially if all countries refrained from using the type of price insulating prices they have used in the past. In a number of these cases, such as Bangladesh, Thailand and South Africa, the reductions in domestic price instability were estimated to be dramatic with the coefficient of variation in Bangladesh, for instance, falling from 26 to 8. In the few cases where the coefficient of variation of domestic prices was estimated to rise, the increases were much smaller.

The traditional GATT/WTO approach of binding and lowering import tariffs helps to reduce the extent to which individual countries insulate their domestic prices from shocks to world prices. Safeguard policies such as those permitted under Article XIX; those provided under the current Special Agricultural Safeguard or the proposed Special Safeguard Mechanism are specifically designed to permit insulation of domestic prices from world market prices. If these measures are widely used, the problems of world market price destabilization; destabilization of the welfare impacts of price shocks; and potential ineffectiveness in stabilizing domestic prices need to be taken into account.

Protection to biofuels can create distortions with potentially serious impacts on both the level and stability of prices. The recent increase in world energy prices greatly stimulated demand for food for use in biofuels, introducing a potentially large—and previously absent—source of shocks to world food prices. This source of instability appears to be compounded by trade barriers, such as the duty on imports of ethanol into the United States. Instead of ethanol being sourced in a way that is environmentally and economically efficient—perhaps from a mix of corn and sugar—the stimulus to demand has been concentrated on a subset of food products, and particularly on maize in the United States. Unfortunately, an effect of this has been to stimulate demand for a staple food grain that is a close substitute for wheat and rice, instead of spreading the increase in demand across sugar (which plays a less significant role in the food consumption of the poor) as well as grains.

Even where unilateral trade policy measures are effective in reducing increases in prices, whether they will have the desired effects on poverty and income distribution is open to question. In many cases, interventions that lower the prices of staple foods in poor countries will lower poverty, because the poorest people spend a very large share of their incomes on staple foods, and because poor farmers producing staple foods tend to self-consume a large share of their output. Ivanic and Martin (2008) found that increases in the prices of staple foods would raise poverty in seven of the nine low-income countries they considered. However, they also identified a possibility that higher prices of some staple foods can reduce poverty, particularly in exporting countries where many small, poor farmers are net sellers of these goods.

Clearly, the examples considered above highlight the potential for gains from collective action. If policies by individual countries are so much less effective than they appear—or have completely unintended consequences—there may be scope for improvements in the rules governing international trade to achieve substantial welfare gains. However, the discussion in this section also highlights a need for empirical evidence on the extent and effects of policy intervention in response to changes in world prices. Key questions include: which countries have intervened, and to what extent; and what are the effects of these interventions on the level and stability of world prices; domestic prices; producer revenues; and consumer costs. Only with knowledge of these impacts can any assessment be made of the potential benefits from international rules against certain types of intervention. To understand the role of policy, it is important to understand the relevant rules governing international trade.

WTO Rules and Proposals on Export and Import Barriers

Since its inception as the GATT in 1947, the multilateral trading system has focused on import barriers, with the twin objectives of reducing these barriers and making them less variable. If countries can be persuaded to lower their import barriers on a reciprocal basis, then it may be possible to make all of them better off. The GATT/WTO approach tries to lower protection and to make it less volatile by introducing comprehensive limits (bindings) on import barriers. On the export side, however, its export disciplines are much less comprehensive.

The GATT/WTO is usually seen as identifying and implementing cooperative solutions to trade-related problems which reduce the adverse impacts on other participants in the trading system of unilaterally chosen policies. The key problem with unilateral policies is the costs they impose on trading partners through deterioration in their terms-of-trade (Bagwell and Staiger 2002). Limits on both import protection and export taxation/restrictions would be needed to avoid the imposition of such adverse terms of trade shock on trading partners.

The incompleteness of the GATT contract on the export side may reflect the fact that part of the political support for the GATT comes from mercantilist thinking. From a mercantilist perspective, a competing supplier introducing export barriers becomes a less effective competitor, creating greater opportunities for me to export. If other members are also motivated by mercantilist goals, they will also be loath to introduce export barriers, which have a direct, adverse impact on export success. Perhaps as a result, there are essentially few restrictions on the use of export taxes in the GATT and the disciplines on export restrictions are very incomplete.

The recent upsurge in the use of export barriers suggests that the general mercantilist reluctance to restrict can no longer be taken for granted when world prices of food rise. In this situation, many governments may place a higher weight on the welfare of (at least urban) consumers than on producer interests when deciding whether to use export restrictions or taxes.

Article XI of the GATT does prohibit quantitative restrictions on exports, although its paragraph 2(a) permits temporary restrictions in order to prevent critical shortages of food or other goods. This exception appears to have been interpreted relatively broadly in justifying the application or threat of export barriers, in cases such as the US proposal for an export ban on soybeans in 1973. Article 12 of the Agreement on Agriculture (WTO 1995, p51) requires that developed members and net-exporting developing-country members introducing export restrictions under this provision take into account the implications for importing members' food security, and to notify the Committee on agriculture, preferably in advance. However, it appears that this has rarely been done-it appears that the most recent notification is from Hungary in 1997 (Gamberoni and Newfarmer, 2008).

Not all WTO members are happy with the absence of disciplines on export barriers in GATT rules. An important concern in countries depending heavily on the world market for food is that they might be vulnerable to export controls or taxes imposed by their suppliers. Not surprisingly, WTO members that depend heavily on world markets for food have pushed for disciplines on export controls and taxes (Congo 2001, Japan 2000, Jordan 2001, Korea 2001 and Switzerland 2000). Some of these proposals would have been far reaching with, for example, the Jordan proposal involving a ban on export restrictions and the binding of all export taxes at zero. The proposal by Japan involved disciplines similar to those on the import side, with export restrictions to be replaced by taxes and export taxes to be bound.

Another group of countries with concerns about export barriers has been major exporters of agricultural products. Recognizing that importers' concerns about the reliability of supply might inhibit liberalization, some exporting countries have advocated multilateral restrictions on the right to use export restrictions. In the preliminary negotiations on agriculture held between 1999 and 2001 under Article 20 of the Uruguay Round Agreement on agriculture, the Cairns Group (2000) and the United States (2000) put forward proposals for disciplines on export barriers and/or taxes.

These proposals languished for a long time in the Doha negotiations on agriculture. The Doha Ministerial declaration (WTO 2001) that provided the framework for subsequent negotiations did not discuss the issue of disciplines on export taxes or restrictions. Similarly, the Framework Agreement (WTO 2004) mentioned the issue only in very general terms. The draft Modalities of May 2008 (WTO 2008b) include some quite specific but limited disciplines on the use of export prohibitions and restrictions under Article XI.2(a). In particular, existing restrictions would be eliminated by the end of the first year of the implementation period, and members would be required to notify and provide reasons for any new measures within 90 days of their invocation. In April 2008, Japan and Switzerland (2008) proposed incorporating stronger disciplines on the use of export restrictions in the WTO and the EU Trade Commissioner expressed concern about the need for such disciplines.

Policies to stimulate the use of biofuels generally take the form of domestic subsidies; tax credits or mandates for the use of particular types of biofuels. These policies are generally consistent with GATT rules. Protection measures designed to encourage the use of domestically produced biofuels are subject to WTO rules on binding of tariffs and other duties and charges, and would normally be expected to be subject to reductions in protection under the Doha Agenda negotiations on reductions in agricultural (ethanol) or non-agricultural (biodiesel) tariffs. One surprising feature of the current negotiations is that the important protection of ethanol-which diverts the sourcing of ethanol from lowest-cost international sourcing-to reliance on domestically-produced maize-would not be subject to tariff reduction because almost all of this protection is provided by a measure classified as an Other Duty and Charge.

Policy Implications

The current crisis illustrates how the world has ended up with the worst of all possible worlds in terms of trade policy actions. Under normal agricultural conditions, we have huge distortions in terms of costly taxpayer support to reduce imports and encourage production and exports. Under abnormal conditions, such as those in 2006–8 and 2010–11, we see the opposite where exporters restrict exports while importers stimulate them through cuts in protection. To a large degree, these attempts at insulating domestic prices from world price shocks are offset by the increases in world prices they create.

What seems to be needed is a system where both imports and exports remain free to flow in good times and bad. This is especially important if trade is to remain a reliable avenue for food security. If in bad times, importing countries are subject to the export-restricting actions of producing countries, they will consider trade an unreliable way of maintaining food security and will reconsider how to manage their agriculture; there will be a greater temptation to move toward more self-reliance as insurance against the bad times. And if in good times, exporting countries cannot have access to markets because of import barriers and other subsidies, they will be reluctant to give up the right to restrict exports during bad times.

In the Uruguay Round, there was a strong focus on reducing the problem of price insulation. The agreement banned one of the most egregious forms of price insulation—the Variable Import Levy. It also subjected another form of price insulation—the provision of domestic support linked to an administered price support—to double disciplines. Such support was constrained through inclusion of the gap between this price and a world price measure as part of the Aggregate Measure of Support, and through the disciplines on border protection needed to support such an administered price.

Unfortunately, the ongoing Doha Round of trade negotiations as currently configured does not focus as strongly on addressing price insulation. This Round has been focusseded primarily on the level of agricultural protection-trade barriers in the importing countries and on export subsidies in advanced exporting countries. While lowering bound tariffs will help reduce the destabilizing effects of insulating trade barriers, proposals to expand the use of safeguard measures, and particularly the proposed price-based special safeguard with 85 percent insulation of changes in external prices--could increase the variability of world prices (Hertel, Martin and Leister 2010). Measures to reduce barriers to trade in environmental goods such as ethanol could also be important, although the fact that ethanol tariffs are currently excluded from the negotiations on agricultural and non-agricultural tariffs means that protection on this product would need to be explicitly included if progress is to be made in reducing this distortion.

Even in the event of a successful Doha Agenda outcome, much more will remain to be done to manage the problems of instability identified in this study. Further attention will need to be given to enhancement of WTO disciplines. And, at the country level, an enormous amount needs to be done to address the problems for the poorest created by instability in prices and particularly the problems for the poor created by high prices for staple foods.

Scenario outline

To illustrate the benefit of international trade in lowering domestic price volatility and the damage of price insulation in raising global price volatility with additional implications for global poverty, we execute a series of computable simulations to illustrate each of these points. In our first set of simulations, we compare the levels of domestic price volatility of four major crops with the current level of trade and when international trade in these commodities is abolished. In the second set of simulations, we compare the levels of international price volatility for the same four crops when countries respond to the changes in international prices by the current level of insulation and when they accept the changes in world prices without changing their import duties or export taxes. In the third set of simulations, we illustrate the role of the international trade in mitigating and governments' insulation in exacerbating the global prices and poverty impacts of the 2008 food crisis by calculating a set of counterfactual changes in global prices and poverty if international trade had been suspended or countries had abstained from price insulating policies.

Methodology

In pursuit of our research questions, we employ three distinct methodologies. First, we measure econometrically the extent of national price insulation using the recent database on distortions to agricultural trade (Anderson, Kurzweil, Martin, Sandri, Valenzuela 2008). Our second methodology involves the use of the GTAP model with its stochastic extension to analyze the consequences of these policy changes for world and domestic price volatility. Finally, we use the methodology of Ivanic and Martin (2008) to calculate poverty changes in our illustration scenario. We describe each of these methodologies in further detail below.

Measuring national price insulation

We assume that political-economy factors of the type discussed in Anderson (2010) cause policy makers, under normal market conditions, to protect some sectors and to tax others. specify the level of national price insulation by regressing observed changes in domestic protection, τ, measured as the ratio of the domestic to the world price, on the change in the log of the real border price p and the distance from a target level of the tariff, τ^* determined by political-economy factors:

$$\tau_t - \tau_{t-1} = \alpha(\tau_{t-1} - \tau^*) + \beta(p_t - p_{t-1}), \quad (1)$$

We can rearrange the model as:

$$\hat{\tau}_t = \alpha\tau_{t-1} + \beta\hat{p}_t - \alpha\tau^*, \quad (2)$$

Simplifying by specifying the politically-economy tariff as a linear function of time, we estimate:

$$\hat{\tau}_t = \alpha\tau_{t-1} + \beta\hat{p}_t + \gamma t + \delta. \quad (3)$$

We expect α to be negative, reflecting the fact that countries adjust their tariffs towards their political-economy target levels. We also expect α not to fall below negative one, meaning that countries make corrections which do not overshoot their target tariffs. Similarly, we expect β to be bound between negative one and zero for those commodities where countries attempt to insulate their domestic prices. The sign of γ is ambiguous because countries may pursue different trade policies over time. Finally, the sign of δ is expected to be positive for those countries where the optimal protection is an import tariff or an export tax, and negative for those countries that seek to raise their domestic prices.

Measuring global and domestic price volatility

We use the standard GTAP model with its stochastic extension to calculate the covariance of global and domestic prices as a result of the exogenous covariance matrix of regional yields for maize, rice, soybeans and wheat. The covariance matrix is constructed using the FAO data on national yields which have been de-trended and weighted by production over the period 1993–

2008. The top ten observed variances and covariances in Table 4 suggest that the greatest level of variability is observed in wheat yields in Oceania, followed by the variability of soybean yields in Oceania. Besides significant variance in the yields of individual commodities, we observe significant covariation in yields of different commodities in the same region (soybeans and wheat in Oceania) and, occasionally, between different commodities in different regions (soybeans in South Asia and wheat in Oceania).

Measuring poverty

We apply the methodology developed by Ivanic and Martin (2008) to express the changes in domestic prices as changes in global poverty. We estimate the global poverty impacts of the changes in the prices of rice and wheat for a sample of twenty-eight developing countries. For each country in the sample, we calculate the changes in individual households' welfare resulting from the changes in the cost of expenditure and the changes in agricultural profits for farming households. Assuming that the price changes we consider in this exercise are transient, we use the short-run version of the model where we consider substitution effects on the consumption of households, but we do not assume any change in production. We assess the change in poverty headcount by counting the households which fall below the poverty line as a result of the price shock.

In its principle, this model is an extension of the earlier model of Angus Deaton used to analyze the welfare impacts of higher rice prices in Thailand (Deaton, 1989) to which a full set of agricultural commodities and consumption and production substitution effects have been added. This type of a model has been used extensively to analyze poverty impacts in a number of applications (e.g. Ravallion, 1989; Seshan and Umali-Deininger, 2007; Byerlee, Myers, and Jayne, 2006; Ivanic and Martin 2008). By analyzing individual households, this model stands in contrast to the efforts to analyze poverty indirectly from the perspective of macroeconomic impacts on broad socio-economic groups without looking at individual households (i.e. work of Ataman Aksoy and Aylin Isik-Dikmelik (2010). Because models relying on interpreting macroeconomic changes operate with severely limited amount of information, their projections are necessarily less precise and often unable to project changes in poverty conclusively.

Data

GTAP Data

We use the latest GTAP database (version 8) which reflects the state of the world in 2007. To facilitate the complex calculations, we aggregate the regions in to ten major groups (Table 1) and commodities into seven (maize, rice, soybeans, wheat, other food, manufactures and services). Since the GTAP database does not contain maize and soybeans as a separate groups, we separated maize from “Other grains” and soybeans from “Oil seeds” using the available FAO data on trade and production.

FAO Data on yields and production

To replicate the volatility of world prices, we need information on the variability of yields in each region and the covariances of yields across regions. From FAO's FAOSTAT database, we retrieved data on national yields and production for the period 1993–2008. We aggregated the national-level data into the regions defined in (Table 1) using the quantity of production as weights.

Protection data

We used the recent database on distortions to agricultural trade available from the World Bank website to measure the level of domestic protection. We calculate the level of protection as the ratio of the producer farm-gate price and the undistorted farm domestic price (also referred to as border price). We used the national-level estimates for the period reported in the database (1956–2007) in the econometric analysis.

Results

National price insulation

The estimated parameters $(\alpha, \beta, \gamma, \delta)$ for 70 countries and the four commodities (maize, rice, soybeans and wheat) are presented in Table 2. This table shows that the coefficient determining countries' desire to return to the optimal tariff (α) is generally found to be significant (85 percent of the cases), and in each case when it is estimated with significance greater than 90 percent, it is also found to be negative. This finding is in line with our expectations that when the tariff in the previous period was away from the political-economy target, countries change move it towards its target level.

The price insulation coefficient (β) is also found in most cases (77 percent) significantly different from zero, which means that most countries tend to adjust to their protection to global prices. The estimated coefficients range between -1.30–-0.03 is roughly within the expected range, meaning that countries generally do not insulate beyond the actual global price change. While the lowest estimate for wheat in Pakistan, -1.30, falls below the expected range, its standard error of 0.15 makes it possible that the true insulation parameter is no lower than negative one.

We observe significant changes in protection over time (γ) only in a small number of cases (14 percent). The greatest reduction is observed in the case of Russian maize (-0.05), while the greatest increase was observed for rice in Nicaragua (0.05). Similarly, we obtain a significant sign in the intercept (δ) only in a small number of cases (14 percent), meaning that generally countries are often ambivalent about having a target tariff rate different from zero and/or about converging to their target rate.

To use these sparsely estimated insulation coefficients in our model with highly aggregated regions, we calculate and use trade-weighted regional estimates of significant national estimates. In several cases, where no estimates in the region were available, we used global trade-weighted averages. Because in this exercise we were only interested in the annual price volatility, we only used the short-run insulation estimates. Table 3 reports the regional insulation estimates used in the following simulations. A quick look at the table shows that the level of insulation varies among regions and commodities: the lowest regional level of insulation is observed in the case of cereals in Oceania and North America, while the highest insulation levels have been predicted for wheat and soybeans in the region of Sub-Saharan Africa.

Price volatility

In our first set of simulations, we implement the observed yield volatility covariance matrix for maize, rice, soybeans and wheat for the ten regions identified in our model. The stochastic simulations of the model were run using the Gaussian Quadrature approach. We first calculate the resulting volatility in domestic prices when trade is restricted[2] and then when trade is allowed under the existing conditions, with no price insulation or other policy changes. The resulting price volatility is shown in Figure 4 and it shows that international trade—with very few exceptions—lowers domestic price volatility, in many cases very significantly: consider for example the case of rice and soybeans in East Asia, where the standard deviation of prices drops from nearly 30 percentage points to less than five percentage points or the price of soybeans in the EU where the standard deviation of the price drops from nearly 20 percentage points to less than 10.

Clearly, the introduction of trade with no policy interventions helps greatly lower domestic price volatility by allowing the output from the regions with better harvest to supply output to those regions with worse harvest. This insulating capacity of international trade is, of course, only possible because crop yields are only very weakly correlated across regions, which means that simultaneous global crop failure is extremely unlikely.

Because our econometric analysis of the relationship between domestic price insulation and global prices suggests a great level of price insulation, in our second set of simulations, we compare the level of global price volatility when governments refrain from any policy responses to the changes in global prices and when the observed level of insulation is maintained. As shown in Table 5, the introduction of price insulating policies greatly increases the global price volatility. This result is not unexpected—as countries respond collectively to a higher global price by restricting their exports and encouraging imports, they inadvertently raise the price higher; by doing the opposite when prices are low, they make global prices during the low-price periods even lower.

However, we find that the introduction of insulating policies does not generally lower domestic price volatility (Figure 4), even if it may shift some volatility away from the regions that insulate less or different commodities that are not insulated. For example, in the case of wheat, the introduction of insulating policies lowers wheat price volatility in all regions except North America where wheat price volatility increases as a result. Similarly, the consumer price of maize in MENA becomes more volatile as a result of every region to insulate itself.

[2] To model restricted trade, we first run a simulation to remove 80 percent of the value of existing trade and use the resulting global database in the simulation.

Welfare and poverty impacts of the 2008 food price shock

To illustrate the role of the insulating policies in the recent 2008 food price shock, we use our model to calculate the welfare and poverty impacts of the observed protection changes observed for wheat and rice during the food crisis of 2007–2008. To make our experiment as realistic as possible, we use the available data on the changes in protection for rice and wheat between 2007 and 2008, which are available in the supplement to the distortions database. The aggregates of the observed changes in the protection policies (i.e. import tariffs and export taxes) are presented the first set of columns of Table 6.

The observed change in protection of rice and wheat during the food crisis of 2007–2008 revealed significant difference among regions in their desire to insulate against the rising prices. This was mainly obvious in the case of rice whose price rose most out of all cereals (87 percent): the most vigorous price insulation was observed in the MENA region, a rice importer, where the level of protection declined by 64 percent, which means that the policy change lowered the domestic price relative to the global price by 64 percent. The smallest level of insulation was observed in the case of Sub-Saharan Africa, where the ratio between domestic and global price declined by 24.4 percent. In case of wheat, the price insulation was generally lower, reflecting the fact that he price of wheat rose only mildly in 2008 (7 percent) after a much stronger price increase in 2007 (43 percent). We apply the estimated and calculate the implied changes in global price, regional welfare, domestic prices and poverty.

Our results show that the observed insulation policies likely increased significantly the global price of the commodities whose price they intended to insulate—rice insulation policies raised the global price of rice by 70.3 percent while the more modest wheat price insulation caused the price of wheat rise by 33.1 percent.

In the second set of columns of Table 6, we report the changes in regional welfare due to the implementation of the protection policies. Clearly, the policy shift observed in 2008 resulted in significant shifts of welfare, dominated by changes in terms-of-trade. These shifts in terms of trade reflect the fact that net exporters that insulate their domestic prices from the rising global by imposing export restrictions improve their terms-of-trade by raising their export price while net importers who can only insulate by lowering their import restrictions suffer a terms-of-trade loss due to paying higher prices for their imports.

In line with our earlier finding that mutual insulation does not affect domestic prices, we find that the result of the 2008 actions on domestic prices was very small, as shown in the last set of columns in Table 6. Clearly, those regions that insulated more than the rest enjoyed smaller increases, or even reductions (rice in MENA), in their domestic prices, while those regions that did not insulate often experienced significant domestic price increases (wheat in Oceania, MENA and Sub-Saharan Africa).

With the assumption that the poorest countries may be unable to protect their domestic prices due to the lack of resources required for insulation, we calculate and report in Table 7 the poverty implications if the global prices were fully transmitted through the border and affected the domestic prices by raising the price of the imported share of consumption. We observe that in most countries, the higher prices of rice and wheat are likely to raise poverty to a small degree which may be translated into an increase of global poverty by 8 million people, a significant increase considering that this number includes the impact of only two commodities.

Robustness check

To analyze the representativeness of the model of the global economy, we compare the level of price volatility that was observed in the period of 1993–2009 (with the exception of 2008 price change) with the volatility predicted by our model. The comparison of the commodity price standard deviations is shown in Table 8. This comparison shows that the standard GTAP model with trade policy exogenous greatly understates the level of global price volatility. However, the introduction of the insulation policies as estimated makes the model capable of representing the observed price volatility to a very large degree, which supports the validity of the conclusions of our analysis of the role of insulating policies on global prices, welfare and poverty.

Conclusions

In this work, we evaluate the role of price-insulating policies which were hypothesized to be a common option used by governments to protect their domestic prices from the change in the world prices. Using econometric methods on the available trade protection data for rice, maize, soybeans and wheat, we find that trade policies aimed at preserving the level of domestic price against the changes in the global price are indeed used by a vast majority of governments to reduce or completely offset the transmission of the global price shocks in those commodities to their own economies.

Insulation of domestic prices is also found to greatly raise the volatility of global prices, however, without reducing overall volatility of the domestic prices. Only when countries insulate at considerably different rates, domestic price volatility may be shifted from those countries that insulate more to those that insulate less, however the level of regional price-volatility "exportation" observed in our model is rather small given that most regions insulate at roughly similar levels.

Illustrating the ineffectiveness of price insulation, we modeled the price, welfare and poverty impacts of the observed increases in trade protection in 2008 for rice and wheat, ostensibly aimed at insulating domestic prices from their rising prices. We found that the collective effect of the insulation itself significantly raised global prices without effectively reducing domestic prices. For that reason, this policy can be considered completely ineffective in protecting collectively countries from rising prices. However, it appears that many of the poorest countries may find themselves unable to insulate, perhaps due to the lack of resources, their exposure to the global prices further inflated by the insulation of the others, could result in significantly higher food prices and poverty during food price surges.

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Figure 1: World Bank Food Price Index in constant prices (2000=100)

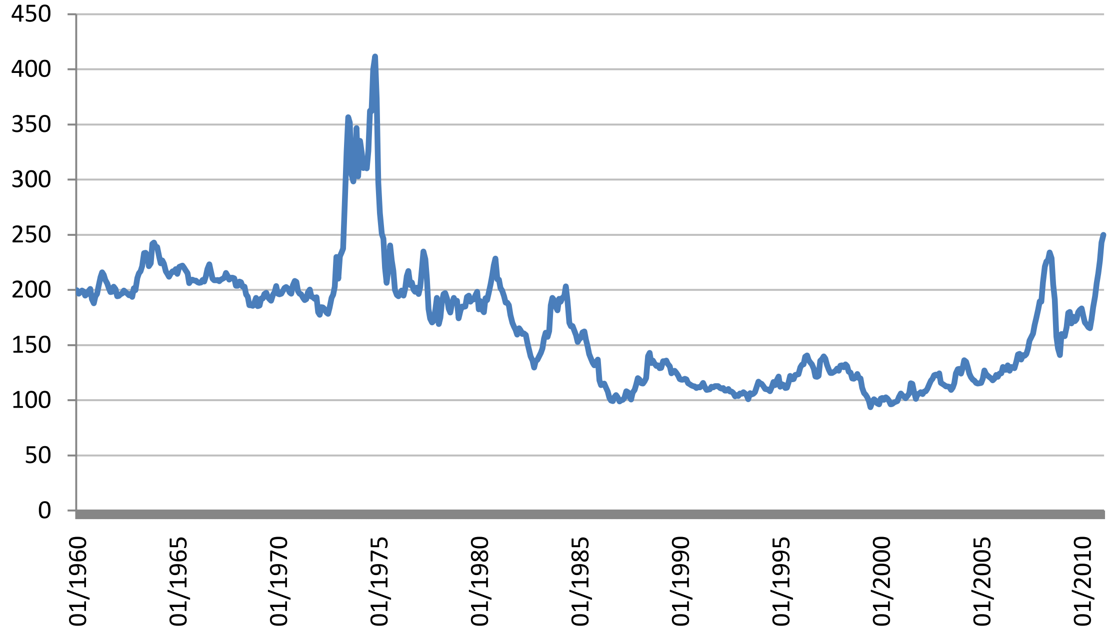

Figure 2: Key impacts of export restrictions

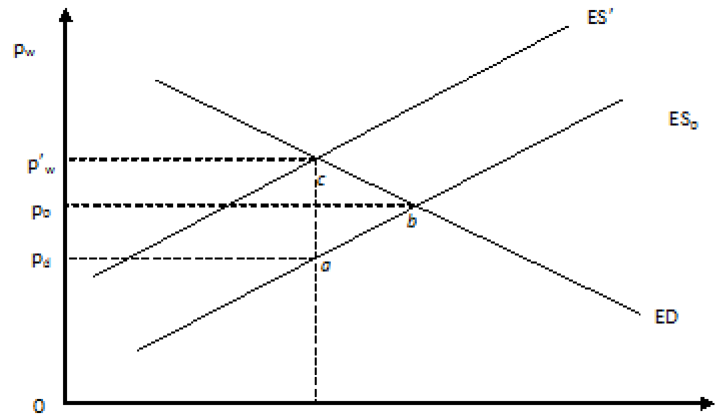

Figure 3: Impacts of equal export barrier increases and import barrier reductions

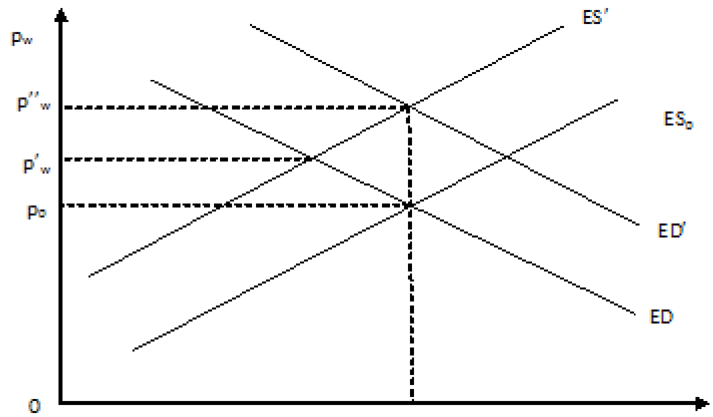

Table 1: Regional aggregation

Region	Key countries
Oceania	Australia, New Zealand
East Asia	China, Japan
South East Asia	Indonesia, Vietnam
South Asia	India
North America	USA, Canada
Latin America	Brazil, Mexico
EU	
MENA	Egypt
Sub-Saharan Africa	Nigeria
Rest of the World	Russia, Norway

Table 2: Estimated country-wide insulation coefficients

Country	Commodity	α	β	γ	δ	R^2	N
Argentina	Maize	-0.46***	-0.24	0	1.09	0.27	45
Argentina	Soybean	-0.38**	-0.04	0	0.84	0.08	28
Argentina	Wheat	-0.49***	-0.05	0	-1.11	0.22	45
Australia	Maize	-1.01***	0	0	0	0.47	46
Australia	Rice	-0.48***	-0.05**	-0***	5.03***	0.31	46
Australia	Soybean	-1.02***	0	0	-0.01	0.48	46
Australia	Wheat	-0.52***	-0.1***	0	1.69	0.34	46
Austria	Maize	-0.19**	-0.58***	0	5.07	0.62	51
Austria	Wheat	-0.14**	-0.72***	0	0.94	0.62	46
Bangladesh	Rice	-0.78***	-0.45**	0	-0.21	0.48	30
Bangladesh	Wheat	-0.87***	-0.25	0	7.62	0.38	30
Brazil	Maize	-0.37**	-0.29**	0	-2.97	0.25	39
Brazil	Rice	-0.8***	-0.27***	0.01**	-17.92**	0.6	32
Brazil	Soybean	-0.6***	-0.3***	0	-2.22	0.43	39
Brazil	Wheat	-0.53***	-0.37**	-0.01*	11.79*	0.31	39
Canada	Maize	-0.29**	-0.1***	0	-0.06	0.39	46
Canada	Soybean	-0.82***	-0.01	0	-0.41	0.4	46
Canada	Wheat	-0.25**	-0.03**	0	0.37	0.16	46
Chile	Maize	-0.54***	-0.47***	0	-4.71	0.51	45
Chile	Wheat	-0.61***	-0.49***	0	-6.77	0.45	45
China	Maize	-0.35**	-0.5**	0.01	-18.52	0.37	24
China	Rice	-0.39**	-0.22	0.01	-20.34	0.22	24
China	Soybean	-0.47**	-0.26	0	-8.06	0.21	24
China	Wheat	-0.43**	-0.28	0	2.38	0.3	24
Colombia	Maize	-0.39***	-0.67***	0	-4.05	0.43	45
Colombia	Rice	-0.12*	-0.62***	0	-3.5	0.54	45
Colombia	Soybean	-0.23***	-0.71***	0	2.15	0.64	44
Colombia	Wheat	-0.31***	-0.73***	0	2.62	0.73	45
Denmark	Wheat	-0.16**	-0.6***	0	-1.45	0.61	51
Dominican Republic	Rice	-0.19**	-0.63***	0	-2.98	0.36	50
Ecuador	Maize	-0.37***	-0.4**	0	2.56	0.32	37
Ecuador	Rice	-0.4***	-0.8***	0	-5.08	0.65	37
Ecuador	Soybean	-0.69***	-0.72***	0	8.67	0.56	37
Finland	Wheat	-0.15**	-0.73***	0	3.39	0.43	51
France	Maize	-0.33***	-0.33***	0	1.71	0.32	51
France	Rice	-0.04	-0.8***	0	-0.53	0.79	51
France	Soybean	-0.25*	-0.32	0	1.44	0.1	34
France	Wheat	-0.15**	-0.66***	0	-0.33	0.61	51
Germany	Maize	-0.22**	-0.54***	0	1.97	0.48	45
Germany	Soybean	-0.42	-0.03	-0.01	18.38	0.03	14

Country	Commodity	α	β	γ	δ	R^2	N
Germany	Wheat	-0.14**	-0.68***	0	0.9	0.6	51
India	Maize	-0.46*	-0.3	0	6.81	0.23	33
India	Wheat	-0.19*	-0.97***	0	-1.57	0.74	29
Indonesia	Maize	-0.53***	-0.36***	0	-5.94	0.65	34
Indonesia	Rice	-0.46**	-0.17	0	-0.19	0.2	29
Indonesia	Soybean	-0.38***	-0.31**	0	4.96	0.25	34
Ireland	Wheat	-0.17***	-0.6***	0	0.13	0.6	51
Italy	Maize	-0.18**	-0.38***	0	0.91	0.27	51
Italy	Rice	-0.16*	-0.8***	0	-5.07	0.35	51
Italy	Soybean	-0.25**	-0.34	0	0.16	0.11	39
Italy	Wheat	-0.14**	-0.67***	0	0.18	0.6	51
Japan	Rice	0.01	-0.87***	0	6.11	0.48	52
Japan	Soybean	-0.06	-0.41***	0	3.42	0.88	28
Japan	Wheat	-0.18**	-0.78***	0	-6.66	0.73	52
Korea	Rice	-0.31***	-0.99***	0.01***	-23.69***	0.65	49
Korea	Soybean	-0.61***	-0.3*	0.03***	-60***	0.34	50
Korea	Wheat	-0.19**	-0.56***	0.01	-10.74	0.24	49
Madagascar	Maize	-0.12	-0.96*	0.02	-48.34	0.52	11
Malaysia	Rice	-0.08	-0.82***	0	-0.14	0.82	44
Mexico	Maize	-0.58***	-0.47***	-0.01**	20.87**	0.52	25
Mexico	Rice	-0.33**	-0.81***	0.01	-14.27	0.74	25
Mexico	Soybean	-0.64***	-0.38	-0.01**	28.94**	0.45	25
Mexico	Wheat	-0.58***	-0.65***	0.01*	-20*	0.57	25
Mozambique	Rice	-0.39*	-0.08	0.02	-39.6	0.05	22
Netherlands	Maize	-0.32***	-0.1**	0	2.73	0.23	45
Netherlands	Wheat	-0.26***	-0.78***	0	-6.65	0.26	51
New Zealand	Maize	-0.18	0.01	0	0.87	0	28
New Zealand	Wheat	-0.09	0.01	0	0.71	0.02	46
Nicaragua	Maize	-0.98**	-0.22	-0.01	21.82	0.36	13
Nicaragua	Rice	-0.99***	-0.86***	0.05**	-90.14**	0.72	13
Nicaragua	Soybean	-0.27	-1.21**	-0.01	19.81	0.44	13
Norway	Wheat	-0.32**	-0.69***	-0.01	15.25	0.69	28
Pakistan	Maize	-0.85***	-0.3	0	-6.68	0.4	44
Pakistan	Wheat	-0.26***	-1.3***	0	0.35	0.74	43
Philippines	Maize	-0.49***	-0.63***	0	-6.32	0.53	43
Philippines	Rice	-0.13	-0.74***	0	-0.75	0.72	42
Portugal	Maize	-0.3***	-0.42***	0	-1.23	0.35	47
Portugal	Rice	-0.14	-0.25**	0	-0.61	0.12	47
Portugal	Wheat	-0.15*	-0.5***	0	1.33	0.44	47
Russia	Maize	-0.7**	-0.08	-0.05**	103.08**	0.49	12
Russia	Wheat	-0.68**	0.14	0	6.2	0.44	12
Spain	Maize	-0.2**	-0.68***	0	1.62	0.59	51

Country	Commodity	α	β	γ	δ	R^2	N
Spain	Rice	-0.03	-0.84***	0	-0.17	0.77	51
Spain	Soybean	-0.25**	-0.69**	0	2.39	0.24	37
Spain	Wheat	-0.17**	-0.65***	0	-0.63	0.6	51
Sri Lanka	Rice	-0.36***	-0.31***	0	1.65	0.3	49
Sweden	Wheat	-0.12*	-0.49***	0	0.82	0.45	51
Switzerland	Maize	-0.07	-0.72***	0	3.86	0.44	28
Switzerland	Wheat	-0.14	-0.65***	-0.01	11.64	0.36	28
Taiwan	Rice	-0.27**	-0.55***	0.01**	-16.45**	0.3	47
Taiwan	Wheat	-0.12**	-0.54***	0	-4.29	0.91	24
Thailand	Maize	-0.66***	-0.14	0	1.71	0.42	34
Thailand	Rice	-0.53***	-0.29***	0**	-9.92**	0.54	34
Thailand	Soybean	-0.26	-0.77***	0.01	-17.1	0.67	20
Turkey	Maize	-0.11	-0.96***	0.01	-19.27	0.91	23
Turkey	Rice	-0.03	-0.76***	0.01	-28.81	0.47	16
Turkey	Wheat	-0.36**	-0.49***	0	-5.37	0.63	25
Uganda	Maize	-0.56***	-0.13**	0	2.23	0.34	39
Uganda	Rice	-0.33***	-0.15***	0	3.29	0.27	39
United Kingdom	Wheat	-0.18***	-0.56***	0	-0.95	0.57	51
United States	Maize	-0.28**	-0.12***	0	-0.66	0.49	52
United States	Rice	-0.11*	-0.28***	0	-0.9	0.67	52
United States	Soybean	-0.25**	-0.09***	0	-0.65	0.27	52
United States	Wheat	-0.16*	-0.19***	0	-0.12	0.41	52
Viet Nam	Rice	-0.58**	-0.12	0.02*	-32.82*	0.25	19
Zambia	Maize	-0.32***	-0.84***	0	-4.82	0.54	44
Zambia	Rice	-0.35***	-0.6**	0	-5.86	0.25	35
Zambia	Soybean	-0.28**	-0.98***	0.01	-14	0.77	32
Zambia	Wheat	-0.18*	-1.19***	0.01	-16.68	0.41	39
Zimbabwe	Maize	-0.27***	-0.82***	-0.01**	13.39**	0.88	50
Zimbabwe	Soybean	-0.61***	-0.82***	-0.02*	32.09*	0.5	36
Zimbabwe	Wheat	-0.44***	-0.26	-0.02***	30.79***	0.23	49

Table 3: Estimated insulation parameters for regions

	Oceania	East Asia	SE Asia	South Asia	North America	Latin America	EU	MENA	SSA	Rest of World
Rice	-0.05	-0.90	-0.40	-0.41	-0.28	-0.58	-0.78	-0.47	-0.18	-0.76
Wheat	-0.10	-0.70	-0.41	-1.03	-0.14	-0.51	-0.66	-0.41	-1.19	-0.53
Maize	-0.31	-0.50	-0.42	-0.31	-0.12	-0.42	-0.43	-0.31	-0.75	-0.92
Soybeans	-0.24	-0.39	-0.56	-0.24	-0.09	-0.30	-0.69	-0.24	-0.97	-0.24

Table 4: Top ten variances/covariances in yields (in percentage points)

Element 1	Element 2	Covariance
Wheat (Oceania)	Wheat (Oceania)	556.3
Soybeans (Oceania)	Soybeans (Oceania)	195.9
Soybeans (South Asia)	Soybeans (South Asia)	166.3
Rice (Oceania)	Rice (Oceania)	158.2
Soybeans (Oceania)	Wheat (Oceania)	-146.4
Soybeans (SSA)	Soybeans (SSA)	123.6
Wheat (Oceania)	Wheat (SE Asia)	-122.9
Soybeans (EU)	Soybeans (EU)	110.0
Soybeans (Rest of World)	Soybeans (Rest of World)	109.7
Soybeans (South Asia)	Wheat (Oceania)	105.0

Figure 4: Observed volatility of domestic prices (standard deviation of percentage points)

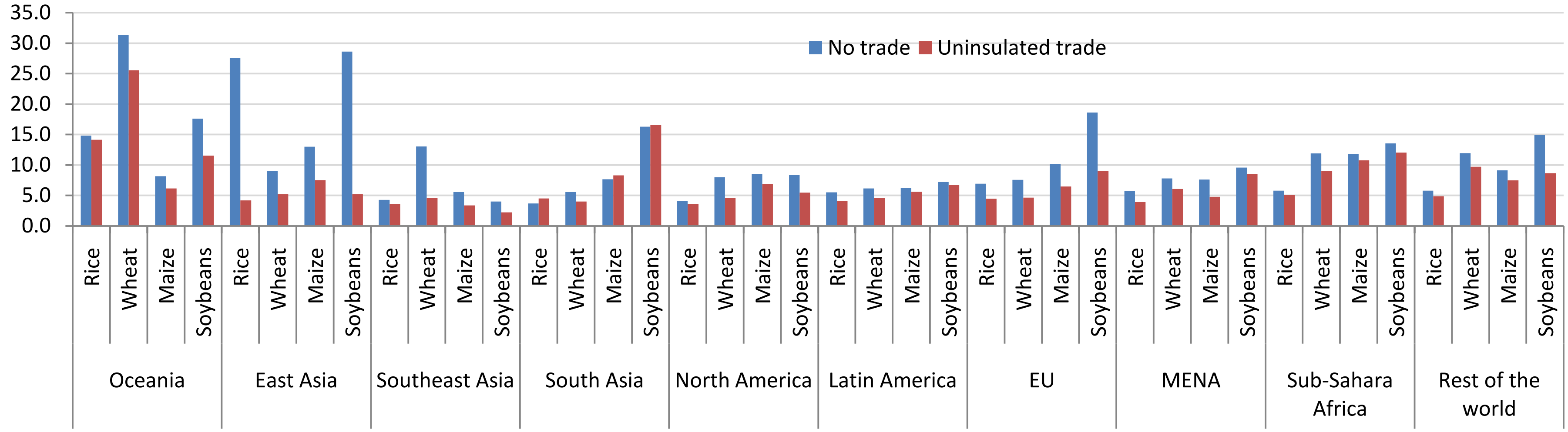

Table 5: Comparison of global price volatility (standard deviation, in percentage points)

	Uninsulated trade	Insulated trade
Rice	1.8	2.9
Wheat	4.3	7.5
Maize	3.3	7.5
Soybeans	3.3	5.5

Figure 5: Consumer price volatility (standard deviations, in percentage points)

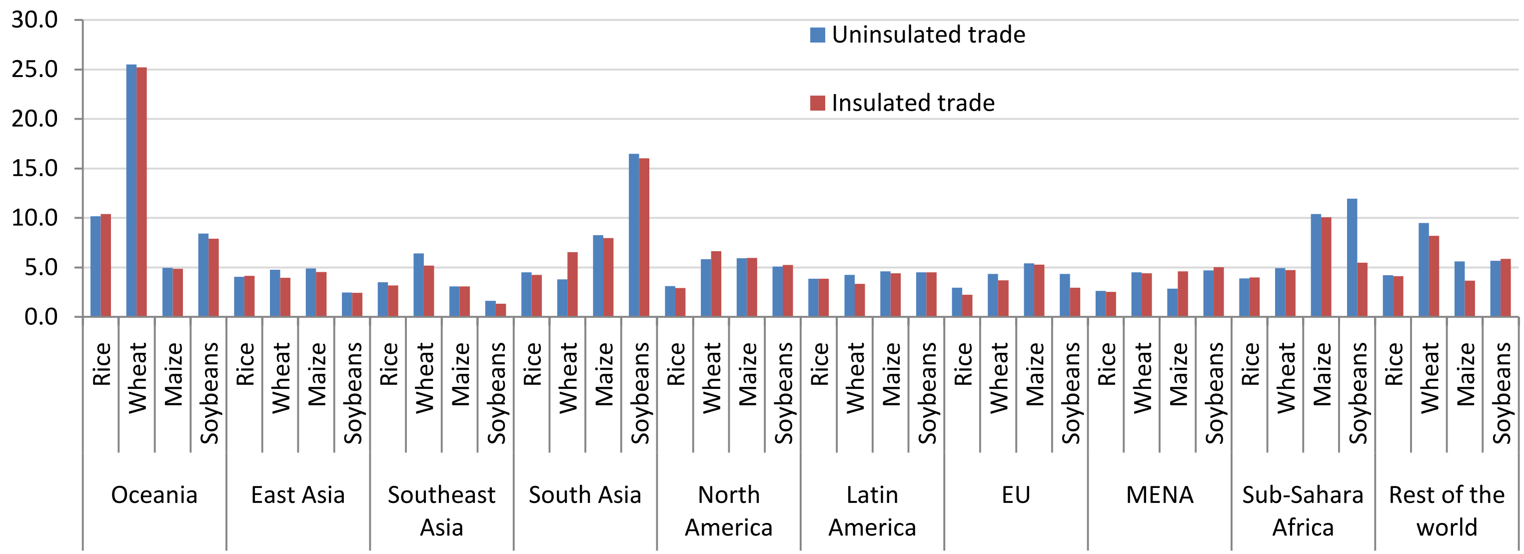

Table 6: Changes in protection policy (2007-2008) in percentage points

	Change in protection		Change in welfare		Change in consumer prices	
	Wheat	Rice	EV	Terms of trade	Wheat	Rice
Oceania	5.7	-41.9	385.4	566.7	10.3	-1.6
East Asia	-20.3	-45.8	-776.4	-2,422.5	-0.2	-0.9
Southeast Asia	—	-43.0	1,919.4	1,734.0	15.2	-0.9
South Asia	-31.7	-53.0	1,430.7	1,862.3	-2.1	-0.6
North America	-27.2	-37.5	4,296.7	5,032.7	-2.6	0.5
Latin America	-11.8	-23.4	-423.2	-358.2	6.6	1.2
EU	-37.9	-11.3	-2,679.9	-1,819.2	-5.7	9.5
MENA	—	-64.0	-6,235.9	-4,091.3	11.5	-19.7
SSA	-4.9	-24.4	-2,201.2	-2,008.3	11.5	8.2
Rest of World	-22.1	—	1,261.0	1,506.2	1.0	5.2

Table 7: Changes in poverty due to 2008 policies

	Change in poverty headcount
Albania	0.01%
Armenia	0.03%
Bangladesh	0.15%
Belize	0.11%
Cambodia	-0.61%
Côte D'Ivoire	0.26%
Ecuador	0.02%
Guatemala	0.06%
India	0.20%
Indonesia	0.03%
Malawi	0.08%
Moldova, Republic of	0.06%
Mongolia	0.20%
Nepal	0.06%
Nicaragua	0.05%
Niger	0.24%
Nigeria	0.21%
Pakistan	0.09%
Panama	0.01%
Peru	0.05%
Rwanda	0.08%
Sri Lanka	0.04%
Tajikistan	0.08%
Timor Leste	0.44%
Uganda	0.01%
Viet Nam	-0.03%
Yemen	0.30%
Zambia	0.23%

Table 8: Observed and simulated global price volatility (standard deviations of percentage points)

	Observed	Simulated insulation	Exogenous policy[3]
Maize	8.4	5.9	3.3
Rice	5.9	3.0	1.8
Soybeans	6.8	5.7	3.3
Wheat	8.8	7.9	4.3

[3] Bare model