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**AGRICULTURAL TRADE DISTORTIONS DURING THE GLOBAL FINANCIAL CRISIS**

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# AGRICULTURAL TRADE DISTORTIONS DURING THE GLOBAL FINANCIAL CRISIS

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# ABSTRACT

## Agricultural trade distortions during the global financial crisis*

The recent upward spike in the international price of food led some countries to raise export barriers. As in previous price spike periods, that response by some food-exporting countries was accompanied by a lowering of import restrictions by numerous food-importing countries. Both actions exacerbate the international price spike. This paper provides new evidence n the extent of change in domestic relative to international prices in both groups of countries, and compares it with responses during previous food price spike periods. Stronger WTO disciplines on export restrictions are needed to limit government responses that exacerbate such price shocks.

JEL Classification: F14, Q17 and Q18
Keywords: commodity price stabilization, distorted incentives and domestic market insulation

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# Agricultural trade distortions during the global financial crisis

## I. INTRODUCTION

Within a year of the onset of the global financial crisis in 2008, and again since then, concerns have been expressed that protectionist forces were leading to beggar-thy-neighbor increases in trade restrictions (Evenett 2009, 2011; Bown 2011). Such policy responses could exacerbate the crisis, not least through lowering the demand for and hence prices received by exporters of affected tradable goods. Yet at the same time as demand was shrinking for manufactures and services, real international prices of food and fuel spiked upwards in 2008, having risen steadily in the previous three or four years. They fell back somewhat in 2009, but rose again in 2010-11 (Figure 1). Evidently there has been a different dynamic affecting these goods than that affecting the markets for non-primary products in recent years.

{Figure 1 about here}

The upward spike in the international price of food led some countries to raise export barriers, thereby exacerbating both the price spike and the international welfare transfer associated with that change in the terms of trade. Those restrictions on food exports received much publicity in the mass media, and in international fora including the G20 (FAO et al. 2011). What has received relatively little publicity, though, was a lowering of restrictions on food imports: the response by food-exporting countries was accompanied by a reduction or suspension of import tariffs (and possibly some provision of import subsidies) by food-importing countries. That further exacerbated the spike in international food prices. Such beggar-thy-neighbor behavior of national governments is a concern for all trading nations, because it reduces the stability and predictability of trade opportunities and lowers the gains from trade (Jacks, O'Rourke and Williamson 2011). It may also slow economic growth of primary-exporting countries. In addition, typically it is not even in the best economic interests of the intervening countries to so insulate their domestic markets, as there are almost always more-efficient instruments than trade measures to avert losses for politically significant interest groups.

The key question this paper addresses is: How and to what extent have border restrictions on trade in farm products (a) altered during this recent period of rising food prices and (b) contributed to the price spikes?[1] In addressing that question, the paper summarizes political economy explanations for that policy behavior (Section II) before examining the domestic and international market and welfare effects we should expect if many countries so intervene (Section III). It then provides new evidence up to 2010 on the extent of the change in domestic relative to border prices in both grain-exporting and grain-importing countries, and compares it with evidence of responses during previous food price spike periods (Section IV). Responses by both grain-importing and grain-exporting countries are shown to be substantial, ensuring that each group (a) reduced the effectiveness of the other's domestic market stabilizing intervention effort while (b) exacerbating the international price spike. Upper-bound estimates of the extent to which those policy responses contributed to the spike in international prices are then provided (Section V). The paper concludes in Section VI by exploring more-effective national policy options than trade measures for reducing the harm to key groups that are at risk of being hurt by such prices spikes, and new initiatives that might be undertaken multilaterally.

## II. POLITICAL ECONOMY CAUSES OF DOMESTIC MARKET INSULATION

Why do countries act unilaterally to insulate their domestic market from international food price fluctuations? To address that question, it is possible to draw on and adapt recent political economy theory by Freund and Özden (2008), who in turn built on the pioneering work of Grossman and Helpman (1994). They show how the preference for policies that insulate domestic prices from year-to-year changes around a desired level that differs from world prices can be specified in a welfare function.

Corden (1997, pp. 72-76) suggests that pattern of intermittent border interventions implies a conservative social welfare function. An objective function that represents this type of preference has been suggested by Jean, Laborde and Martin (2010) and is closely related to one developed by Freund and Özden (2008). That is, Jean et al.'s model predicts that the higher the international price of food in any year relative to its long-run trend value, the lower

[1] Fluctuations are to be expected in commodity markets subject to periodic supply or demand shocks, especially if an adverse supply shock or a surge in demand occurs when global stocks are at low levels and even more so if there are unanticipated changes in government storage activity (Deaton and Laroque 1992; Wright 2011; Carter, Rausser and Smith 2011; Gouel 2011). An analysis of why fuel prices spiked over the same period can be found in Turner, Farrimond and Hill (2011) and the references cited therein.

will be the rate of distortion of domestic food prices that year, ceteris paribus. More than that, the key coefficient in their model is one minus the coefficient of price insulation in the international-to-domestic price transmission equation estimated by Tyers and Anderson (1992). It suggests that such policy makers will adjust their rates of distortion to domestic food prices to partially offset deviations of international prices from their trend value.

Even in the absence of generic national social safety nets, governments may be able to directly assist consumers when international prices spike upwards (or assist farmers when prices slump) at lower economic cost and more effectively than via altering their restrictions on trade. But if only trade measures are considered by policy makers to be the only feasible political instrument available to them, this would mean that when international food prices rise above trend, agricultural export restrictions will rise in food-exporting countries, and food import restrictions will be eased (or import subsidies introduced or raised) in countries that are net importers of food – and conversely when international food prices fall below trend.

## III. ECONOMIC EFFECTS OF DOMESTIC MARKET INSULATION

An export tax or its equivalent lowers the domestic price below the border price of a tradable product such as grain (as does an import subsidy), whereas an import tax or its equivalent raises its domestic price above the border price (as does an export subsidy). Hence it is not surprising that governments, in seeking to protect domestic consumers from an upward spike in international food prices, consider a change in trade measures as an appropriate response, since that raises the consumer subsidy/lowers the consumer tax equivalent of any such measure.

However, such domestic market insulation using trade measures is inefficient, possibly inequitable (it may even *add to* poverty), and – most importantly from a global viewpoint – not very effective in reducing domestic price instability.

### III.1 Inefficient and possibly inequitable

An import tax (or export subsidy) is the equivalent of a consumer tax and a producer subsidy, hence lowering it also reduces the extent to which the measure assists producers of the product in question. Likewise, since an export tax (or import subsidy) is the equivalent of a consumer subsidy and a producer tax, raising it not only helps consumers but also harms farmers. If farming is discouraged, the demand for labor on farms falls, and with it the wages of unskilled workers not only in farm jobs but also in non-farm jobs – and more so the more agrarian is the economy. Thus while poor households may benefit on the expenditure side from a measure that reduces the extent to which the price of food would otherwise rise, they could be harmed on the earnings side if they are sellers of food or suppliers of unskilled labor. Such trade policy responses therefore could add to rather than reduce poverty.[2]

In the case of a small food-exporting country unable to influence its terms of trade, an increase in export restrictions is likely to reduce its national economic welfare, because such measures distort domestic production in addition to lowering the consumer price of food.[3] Trade measures are wasteful too if it is only the poorest consumers who need to be helped, since a trade measure affects all food consumers in the country.

Conversely, in the case of opposite changes to trade measures aimed at protecting farmers from a spike *downwards* in international prices, it is consumers who are inadvertently harmed by such trade policy responses, and all producers rather than just the poorest are helped – and in proportion to their output, thereby adding to farm income inequality.

### III.2 Moreover, not very effective

Trade measures are not only *inefficient* at protecting a needy group from being harmed by a temporary shock to international food markets, they are also *ineffective* if many countries respond similarly. The ineffectiveness comes about because trade barriers of *both* food-exporting *and* food-importing countries often are altered in an effort to prevent the transmission of the international price shock. To see why this leads to ineffective outcomes, it is helpful to refer to Figure 2, which depicts the international market of food which involves, in a normal year, the excess supply curve ($ES_o$) for the world's food-exporting countries and the excess demand curve for the world's food-importing countries ($ED_o$). In the absence of

[2] Recent empirical studies provide numerous cases of where trade restrictions have added to or would add to poverty. See, for example, Warr (2005), Hertel and Winters (2006), Anderson, Cockburn and Martin (2010) and Aksoy and Hoekman (2010).

[3] Variable trade restrictions can also affect long-term investments and hence economic growth rates. Williamson (2008) found evidence for this during the 19th century. Drawing on a broad range of developing country case studies, Bevan Collier and Gunning (1990) and Collier, Gunning and Associates (1999) suggest that faster economic growth would result from allowing producers access to high prices in those rare occasions when they spike, rather than taxing it away. According to the evidence in their case studies, this is because governments have been more prone than farm households to squander the windfall either in poor investments or in extra consumption.

any trade costs such as for transport, equilibrium would be at $E_o$ with $Q_o$ units traded at international price $P_o$.

{Figure 2 about here}

Suppose there is an adverse season in some exporting countries at a time when global stocks are low, which shifts the excess supply curve leftwards to $ES_1$. If there were no policy responses, the equilibrium would shift from $E_o$ to $E_1$ the international price and quantity traded across national borders would change from $P_o$ and $Q_o$ to $P_1$ and $Q_1$. However, if the higher price prompts governments to alter their trade restrictiveness, there will be additional effects. Consider three possible policy reactions.

First, suppose some of the food-exporting countries choose to impose an export tax. That would move the excess supply curve further to the left, say to $ES_2$. This would move the equilibrium to $E_2$ and raise the international price further, to $P_2$, but the domestic price in those export-restricting countries would be $P_x$ which is below $P_1$. Such a reaction thus provides partial insulation in those exporting countries from the initial exogenous shock to the international market. Furthermore, even if each of those countries is so small as to be unable to influence the international market, their combined actions reduce aggregate exports to $Q_2$ and cause the international terms of trade to turn even further in their favor, because of the additional reduction in available supplies on the international market. That means, however, that food-importing countries face an even higher international price, at $P_2$ instead of $P_1$. Whether economic welfare falls or rises in food-exporting countries depends on whether the national benefit from imposing (or increasing) their export restrictions more or less than offsets the gain from the terms of trade change when many exporting countries so act.[4]

Alternatively, suppose some protective food-importing countries were to reduce their barriers to food imports in response to the international price rising from $P_0$ to $P_1$. That would shift the excess demand curve to the right, say to ED'. In that case the new equilibrium would be at E', involving Q' units traded at international price P', but it would provide partial insulation in those food-importing countries from the initial exogenous shock to the international market: their domestic price would rise by only MN instead of by ME' in Figure 2. However, the combined actions of those importing countries cause the international terms of trade to turn even further against them, to the benefit of food-exporting countries' farmers but also to the detriment of consumers in those exporting countries who would have to pay P'

[4] For a country with an export subsidy in place prior to the exogenous shock abroad, lowering that subsidy would improve that country's welfare.

for food. Whether economic welfare rises or falls in food-importing countries depends on whether the national benefit from reducing their import restrictions more or less than offsets the loss from the terms of trade change when many importing countries so act.

The third and more-realistic possibility is that both country groups intervene, each seeking to at least offset the effect on their domestic price of the other country group's policy response. In that case, the more one group seeks to insulate its domestic market, the more the other group is likely to respond. One example of such actions is shown in Figure 2 involving the curves shifting to $ES_2$ and ED', in which case the international price is pushed even higher to $P_3$ while the domestic price in each country group would be lower by $E_3E_1$. That is, in that particular case the domestic price (and the quantity traded internationally, $Q_1$) would be exactly the same as if neither country group's governments had altered their trade restrictions. The terms of trade would now be even better for the food-exporting country group, and even worse for food-importing countries. Aggregate global welfare would be the same as when neither country group so intervenes, but there would be a transfer from food-importing to food-exporting countries, via the terms of trade change, equal to areas $P_1E_1E_3P_3$.

Conversely, if the exogenous weather shock was of the opposite sort (a bumper harvest) which even after purchases by stockholders depressed the international price, and if governments sought in that case to protect their farmers from the full force of the price fall, the international price fall would be accentuated to the benefit of food-importing countries.

Clearly, such attempted price insulation exacerbates international price volatility while doing little or possibly nothing to assist those most harmed by the initial exogenous weather shock.

**III.3 How to estimate how much policy responses exacerbate international price spikes**

With the help of some simplifying assumptions, it is possible to estimate the extent to which government reactions contribute to any international food price spike. Martin and Anderson (2012) point out that this can be done by assuming a homogenous product whose global market equilibrium condition, assuming perfect competition and zero trade costs, is:

(1) $\Sigma_i (S_i(p_i)+v_i) - \Sigma_i D_i(p_i) = 0$

where $S_i$ is the supply in country i; $p_i$ is the country's domestic price; $v_i$ is a random weather-related exogenous production shift variable for that country; and $D_i$ is demand in country i (assumed to be not subject to shocks from year to year). Assume further that border measures are the only price-distorting policy intervention to be used, in which case we can define a single variable for the power of the trade tax equivalent, $T_i = (1+t_i)$ where $t_i$ is country i's rate of tax on trade.

Totally differentiating equation (1), rearranging it, and expressing the results in percentage change form yields the following expression for the impact of a set of changes in trade distortions on the international price $p^*$, assuming the policy changes are independent of the exogenous supply shocks:

$$(2) \qquad \hat{p}^* = \frac{\sum_i H_i \hat{v}_i + \sum_i (H_i\gamma_i - G_i\eta_i).\hat{T}_i}{\sum_i (G_i\eta_i - H_i\gamma_i)}$$

where $\hat{p}^*$ is the proportional change in the international price; $\hat{v}_i$ is an exogenous stochastic shock to output such as might result from above or below average weather; $\eta_i$ is the price elasticity of demand; $\gamma_i$ is the price elasticity of supply; $G_i$ is the share, at the international price, of country i in global demand; and $H_i$ is the share of country i in global production. That is, the impact on the international price of a change in trade distortions by country i depends on the importance of that country in global demand and supply ($G_i$ and $H_i$), as well as the responsiveness of its production and consumption to price changes in the country (as represented by $\gamma_i$ and $\eta_i$).

If it is assumed that output cannot respond in the short run, and that inventory levels are low enough that stock adjustments have limited effect (as is typically the case in a price spike period – see Wright 2011), then $\gamma_i=0$. If one further assumes that the national elasticities of final demand for the product ($\eta_i$) are the same across countries, then equation (2) reduces to:

$$(3) \qquad -\sum_i G_i \hat{T}_i = \hat{T}$$

which is simply the negative of the consumption-weighted global average of the $\hat{T}_i$'s, which we call $\hat{T}$.

However, if the changes in trade restrictiveness are not independent of the exogenous supply (or any other) shocks, then

$$(4) \qquad \hat{p}^* = \hat{T} + R + (\hat{T} * R),$$

from which it follows that $R = (\hat{p}^* - \hat{T})/(1 + \hat{T})$, where R refers to the rest of the influences on p*. In that case, and if the interaction term is distributed proportionately, the contribution of the changes in trade restrictiveness to the international price change, in proportional terms, is $\frac{\hat{T}}{\hat{T} + R}$.

With these equations in hand, we now examine national estimates of annual NRAs, then price transmission elasticities over the entire time period, and then changes in restrictions when international prices spike severely.

## IV. EVIDENCE OF FOOD MARKET INSULATION FROM WORLD PRICE FLUCTUATIONS

To provide systematic evidence of insulating behaviour by governments requires time series of estimates of annual changes in domestic and international prices for a representative set of commodities and countries.

### IV.1 Price data and indicators of price distortions

Fortuitously, an ideal database has recently been compiled for the period just prior to the current global financial crisis. It provides, in a single source, a set of indicators of the extent to which price-distorting policies have altered annual average domestic producer and consumer prices of farm products away from their international price levels over the past half century (Anderson and Valenzuela 2008, with summary estimates in Anderson 2009). The original sample includes 20 high-income countries and 55 developing and transition countries that together account for all but one-tenth of global agriculture, and the 75 most important products so as to cover around 70 percent of the gross value of agricultural output in each focus country.

Those Anderson and Valenzuela estimates go up to only 2004 for most developing countries and 2007 for high-income and European transition countries. We have therefore updated the estimates so as to be able to also assess recent changes in trade restrictions. These newest estimates are based, for high-income countries (including those that recently acceded to the European Union), on the market price support component of the producer support estimates (PSEs) for each product to 2010 that are reported in OECD (2011), making sure they are comparable with the estimates to 2007 in Anderson and Valenzuela (2008). We have also added five more small high-income countries for the period 1986 to 2010, again based on OECD estimates. PSE estimates for several large developing countries are included in OECD (2011), as noted in the footnote of the Appendix to this paper. For other developing countries, we updated the Anderson and Valenzuela estimates by making use of FAO and World Bank data sources for producer and border prices, respectively.[5]

The key indicator used for present purposes is the national nominal rate of assistance to agricultural producers (NRA). The NRA is the percentage by which the domestic producer price exceeds the border price of like products at the same point in the value chain (that is, appropriately adjusted to include internal trade and processing costs).[6] Hence the NRA is negative if producers receive less than the price would be for a like product in the absence of government intervention. Over the past half-century the NRA has been very highly correlated with the consumer tax equivalent (CTE),[7] suggesting that most price-distorting interventions in national agricultural markets occur at the border, rather than in the form of domestic consumer or producer subsidies or taxes. Since part of our interest is in examining proportional changes in the NRA (and CTE), that can best be done by converting the NRA to a nominal assistance coefficient, where NAC = 1+NRA/100. This is especially so when some NRAs/CTEs are negative, in which case the NAC is between zero and one.

A change in NRA may not require any policy action on the part of the government, but rather be part of the original policy design. For example, the use of specific rather than ad valorem rates of trade taxation or trade subsidization automatically ensures some insulation of the domestic market from international price changes, as does the use of quantitative restrictions on trade such as fixed import or export quotas or bans. Explicit formulae for

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[5] Two more developing countries are added to the original Anderson and Valenzuela database, namely Israel (from OECD 2011) and Morocco (compiled by Ernesto Valenzuela from estimates in Tyner (2010) and updated by the present authors). The updated estimates for developing countries not included in OECD (2011) are available only to 2009 because that is the latest year on the FAO's producer price series; they are not as reliable as those based on the OECD's PSEs or the earlier estimates for developing countries in Anderson and Valenzuela (2008), for several reasons. One is that, to do the update promptly, producer prices reported to FAO had to be used for focus developing countries rather than more-nuanced prices available only in national statistical agencies. To minimize the errors this might introduce, the FAO producer prices in US current dollars were converted into an index set at 100 for 2004, and the 2004 prices in Anderson and Valenzuela (2008) were updated using the changes in that index for each country through to 2009. Likewise, to overcome delays in obtaining export and import volumes and values, from which border prices could have been derived, we simply used the reference international prices from World Bank (2011) to create indexes set at 100 for 2004 so as to be able to update the 2004 border prices in Anderson and Valenzuela (2008) using the changes in each of those indexes through to 2009.

[6] This assumes other wedges such as trade costs enter multiplicatively rather than additively. It also assumes those wedges are not correlated with food prices, and are not subject to variable monopolistic markups. If they were, then the NRA would be an upper-bound estimate of the intervention policy's effect. Given that food and fuel prices have become more-highly correlated in the past few years, thanks largely to biofuel subsidies and mandates in the US and EU, one might presume that the extent of this over-estimation in the most recent price spike period is greater than in the 1972-74 period. However, a glance at Figure 1 suggests that may not be so, as it reveals that food and fuel price movements were highly correlated in 1972-74 too – and the proportional fuel price rise was more than twice as large as the food price spike then.

[7] The coefficient of correlation between the NRA and CTE for the original 75 countries and 75 products over the five decades covered by Anderson and Valenzuela (2008) is 0.93. For details of the methodology for estimating the NRAs and CTEs, see Anderson et al. (2008).

varying the import or export duty according to international price movements also may be part of the policy regime. And in some cases explicit provisions for restricting or relaxing trade barriers in price spike periods also are part of some policy packages – even though they may lay dormant in all but extreme periods. In what follows such provisions will be treated no differently than any formal change of policy: both show up as a change in the NRA.

Needless to say, governments do not limit their interventions in markets for farm products to periods of extreme prices. In the past developing countries have tended to set NRAs below zero, especially if they are food-surplus countries, while high-income countries have tended to assist their farmers (NRAs above zero), especially if they are food-deficit. That is, NRAs tend to be higher the higher a country's income per capita and the weaker the country's agricultural comparative advantage. That pattern is shown to be statistically significant for the panel data in the Anderson and Valenzuela (2008) database, suggesting that agricultural NRAs tend to rise over time as a country's per capita income rises, and more so the more that growth is accompanied by a decline in agricultural comparative advantage (Anderson 2010, Ch. 2).

**IV.2 NRA estimates**

Pertinent to the present paper is the fact that around the long-run trends in NRAs for each country there is much fluctuation from year to year in individual product NRAs. NRAs are negatively correlated with deviations from trend in the international price of the product in question (Anderson 2010, Table 2.14). Perhaps the most notable cases are grains, for which the coefficients of correlation between their international price and national NRAs for the full sample of countries from 1970 to 2010 are -0.74 for rice, -0.40 for wheat and -0.55 for maize (Figure 3).

{Figure 3 about here}

It is clear from Figure 1 that the largest upward spikes in the international food price index over the past half-century are in 1973-74 and 2006-08 (with a further spike in late 2010 and 2011); and the sharpest downward price spike was in 1985-86. Those three spikes are also evident for each of the three grains shown in Figure 3, when their NRAs also spiked in the opposite direction. One would expect that strong negative correlation between the international price and the estimated NRA to become weaker the more products are in the sample. Yet even when the NRAs for the full sample of 75 agricultural products are aggregated, the weighted average NRA (using the gross value of production at undistorted prices as weights) still spikes during those three price-spike periods (Figure 4).

{Figure 4 about here}

### IV.3 Price transmission estimates

It is also evident from Figures 3 and 4 that NRAs fluctuate around trend not only in extreme price spike periods. To examine what proportion of any international price fluctuation is transmitted to domestic markets within twelve months, we estimate a short-run elasticity of transmission of the international product price to the domestic market for the three key grains. Following Nerlove (1972) and Tyers and Anderson (1992, pp. 65-75), we use a partial-adjustment geometric distributed lag formulation to estimate elasticities for each key product for all focus countries for the period 1985 to 2010. Specifically, we assume that associated with the border price $p_t^*$ there is a 'target' domestic price $\overline{p_t}$, towards which policy ensures that the actual domestic price, $p_t$, moves only sluggishly. Changes in this target price might respond incompletely, even in the long run, to corresponding changes in the border price. If all prices are expressed in logarithms, the target domestic price then has the following relationship with the border price:

(5) $$\overline{p_t} = p_0 + \phi_{LR}(p_t^* - p_0^*)$$

where $\phi_{LR}$ is the long-run price transmission elasticity and the values of $p_0$ and $p_0^*$ are the domestic and border prices in the base period. In the short-run, the domestic price adjusts only partially each year to any change in the target domestic price:

(6) $$p_t - p_{t-1} = \delta(\overline{p_t} - p_{t-1})$$

where the parameter $\delta$ gives the fraction of the ultimate adjustment that takes place in one year. By substituting (3) into (4) to eliminate the unobservable target price, the following reduced form, which is suitable for fitting to data, is obtained:

(7) $$p_t = \delta(p_0 - \phi_{LR}p_0^*) + (1-\delta)p_{t-1} + \delta\phi_{LR}p_t^* = \text{a} + \text{b}\,p_{t-1} + \text{c}\,p_t^*$$

where, again, if the current US dollar prices are expressed in logarithms, the short-run (one-year) elasticity of price transmission, call it $\phi_{SR}$, is simply $\delta$ times the long-run elasticity. Thus the estimate of the short-run elasticity is the regression coefficient c and the long-run elasticity estimate is c/(1-b).

Incidentally, Martin and Anderson (2012) show that if trade interventions vary endogenously in response to changes in the international price, then the counterpart to equation (2) is:

$$(8) \qquad \hat{p}^* = \frac{\sum_i H_i \hat{v}_i}{\phi_{SR} \sum_i (G_i \eta_i - H_i \gamma_i)}$$

where $\phi_{SR}$ is the elasticity of transmission from the international price to the domestic market in country i.

Table 1 summarizes the estimates. The average of estimates for the short-run transmission elasticity over the 25 years to 2010 range from 0.63 for maize down to just 0.49 for rice. The unweighted average across these plus seven other key farm products is 0.56, suggesting that within one year, barely half the movement in international prices of farm products is been transmitted domestically on average.[8]

{Table 1 about here}

### IV.4 Proportional NAC changes when prices spike

We move now to a closer examination of periods of extreme spikes in international grain prices. The most-extreme periods prior to the 2008 spike since 1960 are those around 1974 (an upward price spike) and around 1986 (a downward price spike). In Table 2 we focus on the annual average nominal assistance coefficient (NAC = 1 + NRA/100)[9] in the spike year plus the two years each side of it, relative to the longer period either side of each spike period. For the latest spike we have yet to have a post-spike period, but at least we can compare it with the immediately prior long period of relatively stable food prices (1988 to 2006 – see Figure 1).[10]

{Table 2 about here}

The expectation is that the NAC would be lower in the upward spike periods than in the average of the two adjoining longer non-spike periods, and conversely for the downward spike period around 1986. That is indeed what is evident in Table 2, where the spike periods

[8] In a recent study of 11 Sub-Saharan African countries and using a somewhat different methodology, Minot (2011) estimated short-run price transmission elasticities for key staple foods which averaged 0.63. Earlier multicountry studies are by Comforti (2004) and Mundlak and Larson (1992), as well as Tyers and Anderson (1992, Appendix 2) who generally got short-run estimates below 0.5.

[9] The national NACs are averaged across countries without using weights, so that each polity is treated as an equally interesting case. The aggregate estimates therefore differ from those reported for country groups in Anderson (2009 and 2010), where production weights are used to calculate NRA averages (and consumption weights for CTE averages).

[10] Some of the figures in this sub-section are revisions of ones presented in Anderson and Nelgen (2012a), based on a fuller sample of countries than was available at the time of completing that earlier study.

are shown in bold italics. The percentage changes in the average NACs from the prior non-spike period to the shorter price spike period are shown in Table 3. Notice that the signs of the NAC changes in the two upward price spikes are negative in all but one minor case, while those in the downward spike period are all positive. That is true for both high-income and developing countries. More importantly from the viewpoint of this paper, it is also true for both grain-exporting and grain-importing country groups.

{Table 3 about here}

If we focus on just the sub-periods of rising prices, Figure 5 again reveals for the three grains the uniformity of this pattern. In particular, by this proportional measure importing countries responded during the latest spike as much as exporting countries in the case of rice and maize and they dominated in the case of wheat. They thus tend to offset each other's efforts to avoid transmitting the international price shock to their home markets. Both groups' responses were less proportionally than in the early 1970s, however. Comparisons of period averages are somewhat blunt because the averages hide a lot of year-to-year variation. These changes can be seen on an annual basis in the first pair of rows in Table 4 for rice, wheat and maize.

{Figure 5 and Table 4 about here}

A more-discernable picture of the annual changes in the first half of the price spike periods is provided in Table 5. It shows that the decline in NACs was more gradual in the recent price surge period to 2008 than it was in the 1970s surge when most of the change was in 1973 for wheat and in 1973 and 1974 for rice (whose harvest dates are less concentrated around the end of the year than are those for wheat). Because of that faster price change in the 1970s than in recent years (see the bold italics rows in Table 5), the magnitude of the annual NAC changes was greater then than in the period to 2008.

{Table 5 about here}

The rice NACs over the 1972-74 period fell by more than two-fifths for both high-income and developing countries. The NAC falls for wheat were not quite as severe as for rice, but were still substantial at more than one-quarter for high-income countries and nearly one-third for developing countries. The extent of annual decline in the NACs in the most recent price spike is slightly less than in the 1970s, and not quite as rapid (Table 5). That slightly smaller and slower decline also is consistent with the fact that there were smaller and slower proportionate rises in the international prices of those grains during 2006-08 than in the early 1970s.

## V. HOW MUCH DO NRA CHANGES CONTRIBUTE TO UPWARD PRICE SPIKES?

Martin and Anderson (2012) point out that insulating policies generate a classic collective-action problem akin to when a crowd stands up in a stadium to get a better view: no one gets a better view by standing, but those that remain seated get a worse view and so are induced to stand as well. This collective action not only is ineffective from a national viewpoint, but also it generates an international public 'bad' by amplifying the volatility in international food prices, and hence also the volatility of the income transfers associated with terms-of-trade changes. It also involves a transfer between food-importing and food-exporting countries, akin to tall people benefitting at the expense of short people when all stand up in the stadium.

We show above that with some simplifying assumptions, it follows from equation (2) that the proportional contribution to international price changes resulting from changes in national trade restrictions is $\frac{\widehat{T}}{\widehat{T}+R}$, where $\widehat{T}$ is the negative of the global consumption-weighted average proportional change in the NAC for each product and R is 'other' influences, calculated as R = $(\hat{p}^{*} - \widehat{T})/(1 + \widehat{T})$. Estimates of those indicators are summarized for the key grains in Table 6.

{Table 6 about here}

For rice the cumulative proportional decline in the NAC shown in the first row of Table 6 is 0.37 between 2006 and 2008. The comparable numbers for wheat and maize are 0.12 and 0.08, respectively. According to World Bank (2011) data, the international price of rice increased by 113 percent between 2006 and 2008, and the prices of wheat and maize by 70 and 83 percent, respectively (middle rows of Table 6). Thus these estimates suggest that altered trade restrictions during the 2006-08 period caused international prices to be higher by 0.40 for rice, 0.19 for wheat, and 0.10 for maize (bottom third of Table 6). The unweighted average of these three, at 0.23, is the same as for 1972-74 (first column of Table 6), although the price spikes were somewhat larger then.

It is possible to apportion those policy contributions between country groups. In Table 7 we report the contributions of high-income versus developing countries, and also of exporting versus importing countries. During 2006-08, developing countries were responsible for the majority of the policy contribution to all three grains' price spikes, whereas in 1972-74 the opposite was the case except for rice. As for exporters versus importers, it appears exporters' policies had the majority of the influence, other than for wheat in the 1970s, but importers made a very sizeable contribution as well. This is an important finding, since it has been mostly exporting countries who have been blamed for exacerbating the recent food price spike.

{Table 7 about here}

## VI. HOW MUCH DID DOMESTIC GRAIN PRICES RISE RELATIVE TO INTERNATIONAL PRICES?

With changes in trade restrictions contributing to the spike in international food prices, the question arises as to how effective those interventions are in limiting the rise in domestic prices? The proportional rise in the international price *net of* the contribution of changed trade restrictions is $R/(\widehat{T} + R)$. That fraction, when multiplied by the international price rise shown in the middle part of Table 6, is reported in the second column of Table 8, where it is compared with the proportional rises in the domestic price in our sample of countries. The numbers for 2006-08 suggest that, on average for all countries in the sample, domestic prices rose slightly more than the adjusted international price change for wheat, and only slightly less for maize and just one-sixth less for rice. The extent of insulation was greater in developing countries, especially for wheat and maize, which is consistent with the finding from the middle columns of Table 7 that their policymakers contributed more to the price spike than governments of high-income countries. This recent experience contrasts with the early 1970s, when high-income countries were much more insulated than recently. These results suggests that the combined responses by governments of all countries have been sufficiently offsetting as to do very little to insulate domestic markets from this recent international food price spike.

{Table 8 about here}

## VII. SUMMARY OF EVIDENCE AND IMPLICATIONS FOR POLICY

The above empirical findings can be summarized as follows:

- Farm product NRAs are significantly negatively correlated with fluctuations around trend in each product's international price, with less than half the movement in international food prices being transmitted to domestic markets within the first year;
- NACs were substantially lower in the two upward price spike periods (and higher for the downward price spike period around 1986) than in adjacent non-spike periods, with changes in both export and import restrictions contributing to that finding;
- The extent and speed of NAC changes in each spike period are similar for grain-exporting and grain-importing countries, suggesting both types of countries actively insulate their domestic market from international food prices spikes;
- Consistent with the fact that international food prices rises were greater in the earlier period, the extent and speed of the annual NAC changes during an upward price spike was less in the recent period to 2008 than in the early 1970s, but they were nonetheless substantial;
- The changes in restrictions on global grain trade during 2006-08 are responsible for estimated increases in the international prices of rice, maize and wheat of around two-fifths, one-fifth and one-tenth, respectively;
- In the absence of those changes in trade restrictions, domestic prices of wheat would have risen *less* on average across all countries; and
- Those altered trade restrictions caused rice price rises in developing countries to be only 30 percent less than what they otherwise would have been.

It is possible, given the listed assumptions that had to be made to get the bottom-line results reported in Tables 6 and 7, that these numbers overstate the extent of governmental variations in trade restrictions. Even so, the numbers are sufficiently large as to be of concern, especially since in a many-country world the actions of individual countries are being offset by those of other countries and so the interventions are rather ineffective in achieving their stated aim. The most commonly stated objectives of governments in developing countries in the case of upward price spikes is to ensure domestic food security for consumers, that is, to have adequate supplies at affordable prices for all domestic households. Related stated objectives are to reduce inflationary or balance of payments pressures from an upward price spike. Yet most governments could respond much more efficiently with more-direct domestic measures rather than by varying their trade restrictions. For example, monetary policy could deal with inflationary concerns, and balance of payments pressures could be better handled via more exchange rate flexibility, while food-affordability concerns of the poor can best be dealt with using generic social safety net policies that can offset the adverse impacts of a wide range of different shocks on poor people – net sellers as well as net buyers of food – without imposing the costly by-product distortions that necessarily accompany the use of $n^{th}$-best trade policy instruments.

A program of targeted income supplements to only the most vulnerable households, and only while the price spike lasts, is possibly the lowest-cost intervention. It is often claimed that such payments are unaffordable in poor countries, but recall that in half the cases considered above, governments *reduce* their trade taxes, so even that intervention is a drain on the finance ministry's budget in food-importing countries. Moreover, the information and communication technology revolution has made it possible for conditional cash transfers to be provided electronically as direct assistance to even remote and small households, and even to the most vulnerable members of those households (typically women and their young children – see, e.g., Fiszbein and Schady (2009), Adato and Hoddinott (2010) and Skoufias, Tiwari and Zaman (2010)).

Traditional national government trade policy reactions to food price spikes are undesirable also because, collectively, they are not very effective in stabilizing domestic prices, and not least because they add to international price volatility by reducing the role that trade between nations can play in bringing stability to the world's food markets. That adverse aspect will become ever more important as climate change increases the frequency and severity of extreme weather events – and if current biofuel policy responses to it continue to strengthen the link between food and volatile fossil fuel markets (Hertel and Beckman 2011). The larger the number of countries insulating their domestic markets, the more other countries perceive a need to do likewise (the standing-up-in-the-stadium problem). This exacerbates the effect on international prices such that even greater changes in trade barriers are desired by each nation, both exporters and importers. These policy variations also transfer welfare between food-surplus and food-deficit countries, and may even add to rather than reduce poverty (Ivanic and Martin 2008). They do not necessarily lead to lower volumes of farm trade though, as that depends on whether the greater export restrictions are more or less than offset by the lowering of barriers to imports of farm products.

The above suggests there is considerable scope for governments to multilaterally agree to stop intermittently intervening in these ways. The World Trade Organization (WTO) is the most obvious place for them to seek restraints on variable trade restrictions. Indeed one of the original motivations for the Contracting Parties to sign the General Agreement on Tariffs and Trade (GATT, WTO's predecessor) was to bring stability and predictability to world trade. To date the membership has adopted rules to encourage the use of trade taxes in place of quantitative restrictions on trade (Article IX of the GATT), and has managed to obtain binding commitments on import tariffs and on production and export subsidies as part of the Uruguay Round Agreement on Agriculture. However, those bindings continue to be set well above applied rates by most countries, leaving plenty of scope for varying import restrictions without dishonoring those legal commitments under WTO.

In the current Doha round of WTO negotiations there are proposals to phase out agricultural export subsidies as well as to bring down import tariff bindings, both of which would contribute to global economic welfare and more-stable international prices for farm products. At the same time, however, developing countries have added to the WTO's Doha agenda a proposal for a Special Safeguards Mechanism (SSM) that would allow those countries to raise their agricultural import barriers above their bindings for a significant proportion of agricultural products in the event of a sudden international price fall or an import surge. This is the exact opposite of what is needed by way of a global public good to reduce the frequency and amplitude of downward food price spikes (Hertel, Martin and Leister 2010). Moreover, the above evidence from the mid-1980s experience suggests that if food-importing countries were to exercise that proposed freedom, food-surplus countries would respond by lowering their export restrictions – thereby weakening the efforts of the food-importing countries to insulate their domestic markets from the international price fall, *and* further depressing that price.

Moreover, proposals to broaden the Doha agenda to also introduce disciplines on export restraints have struggled to date to gain traction. A proposal by Japan in 2000, for example, involved disciplines similar to those on the import side, with export restrictions to be replaced by taxes and export taxes to be bound. A year later Jordan proposed even stronger rules: a ban on export restrictions and (as proposed for export subsidies) the binding of all export taxes at zero. However, strong opposition to the inclusion of this item on the Doha Development Agenda has come from several food-exporting developing countries, led by Argentina (whose farm exports have been highly taxed since its large currency devaluation at the end of 2001). This reflects the facts that traditionally the demandeurs in WTO negotiations have been dominated by interests seeking market access, and that upward price spikes are infrequent. Yet the above analysis reveals the need for symmetry of treatment of export and import disciplines in the WTO.

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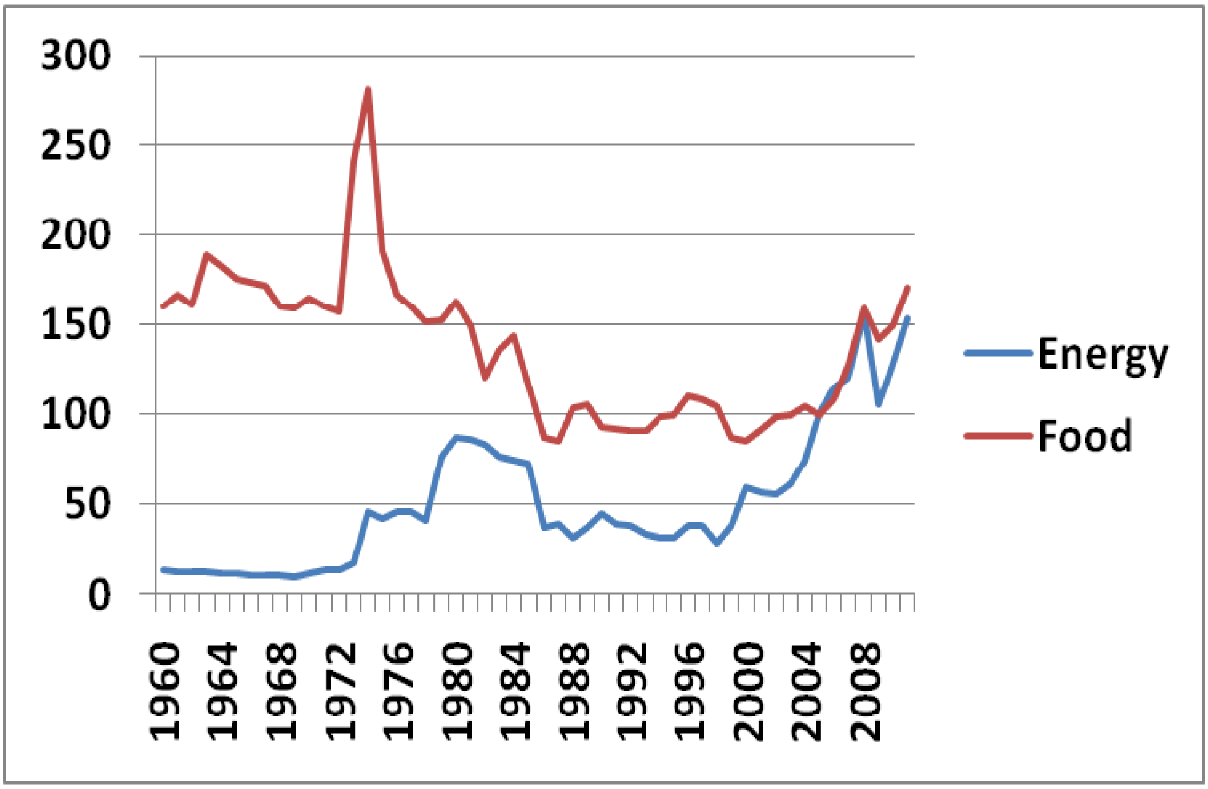
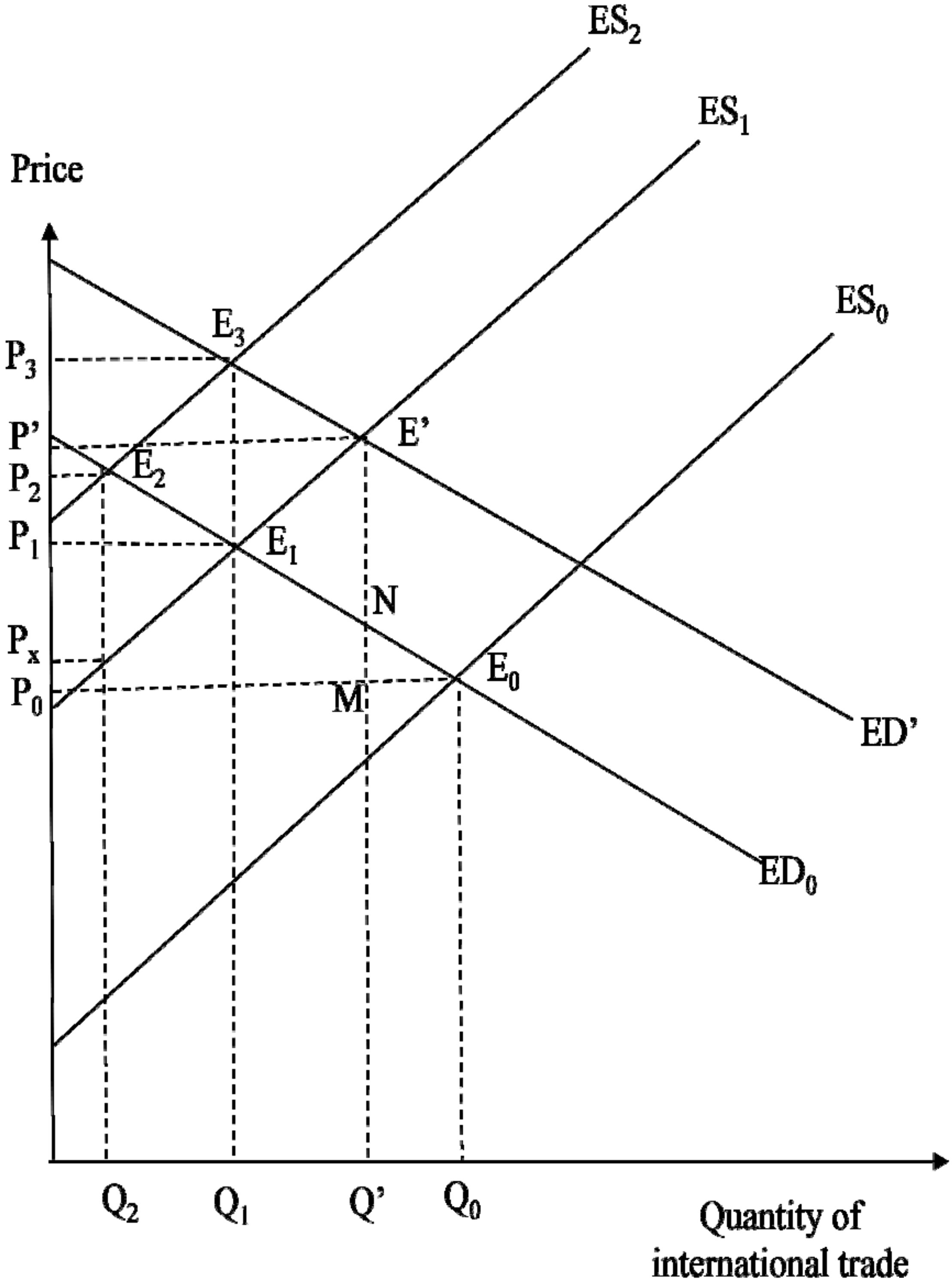
Figure 1: Real international prices for food and for fossil fuels, 1960 to 2011

(constant US dollars, 2005 = 100)




Source: World Bank (2012).

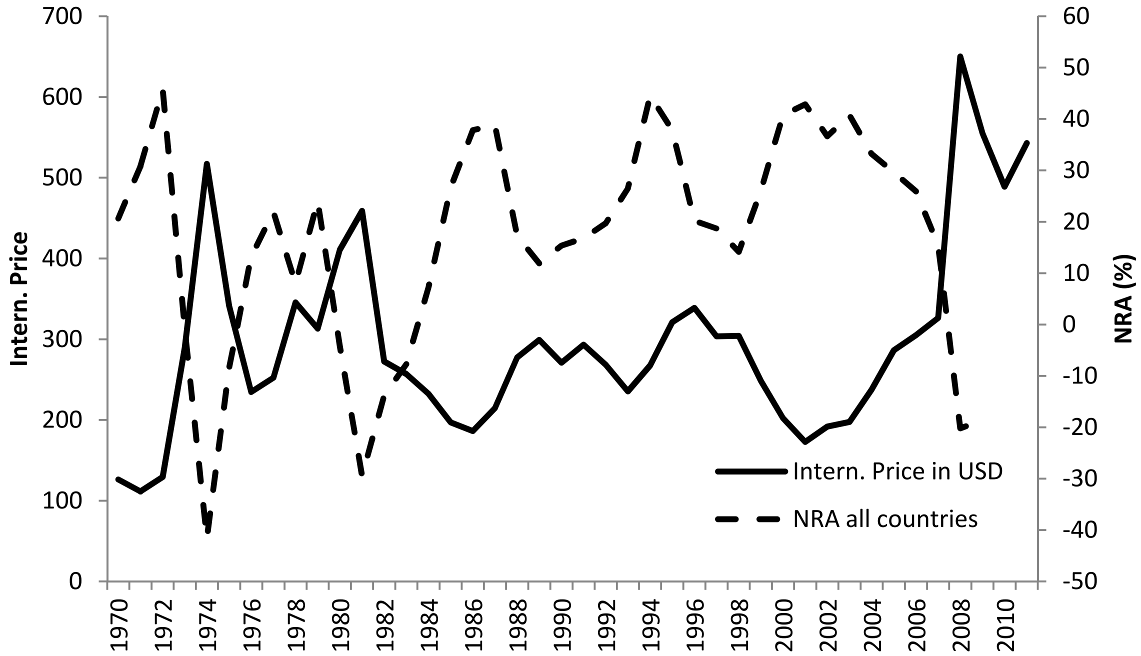
Figure 2: Effects of offsetting export barrier increases and import barrier reductions in the international market for food




Source: Authors' depiction

Figure 3: Grain NRAs and their international price, 82 countries,[a] 1970 to 2011
(left axis is international price in current US$, right axis is weighted average NRA in percent)

(a) Rice




(b) Wheat

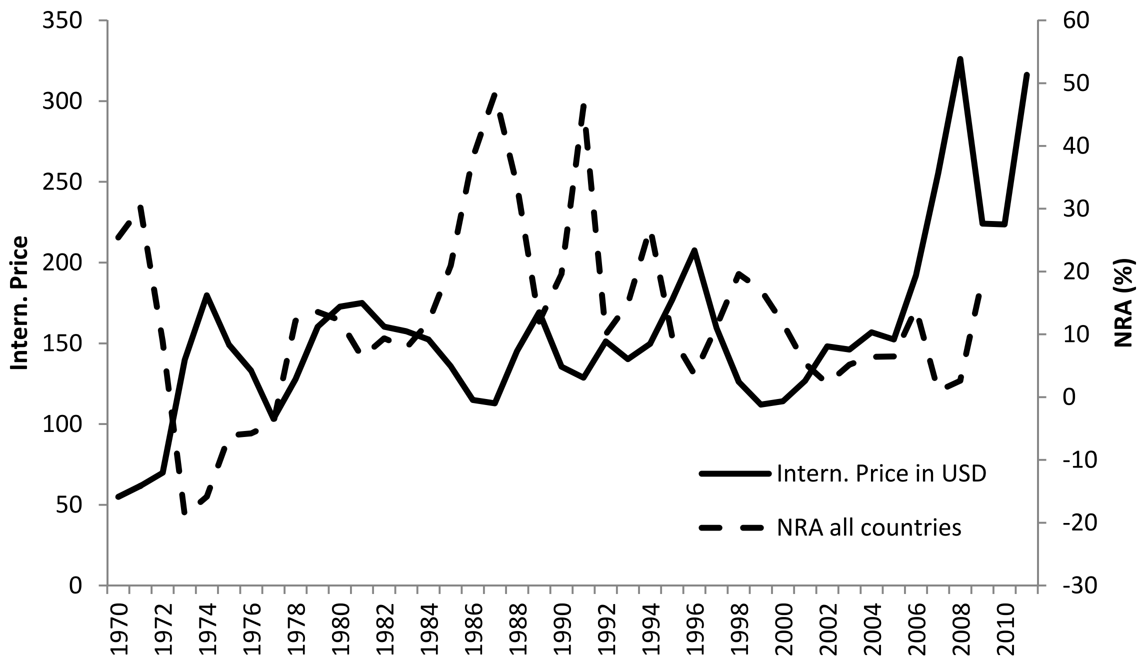
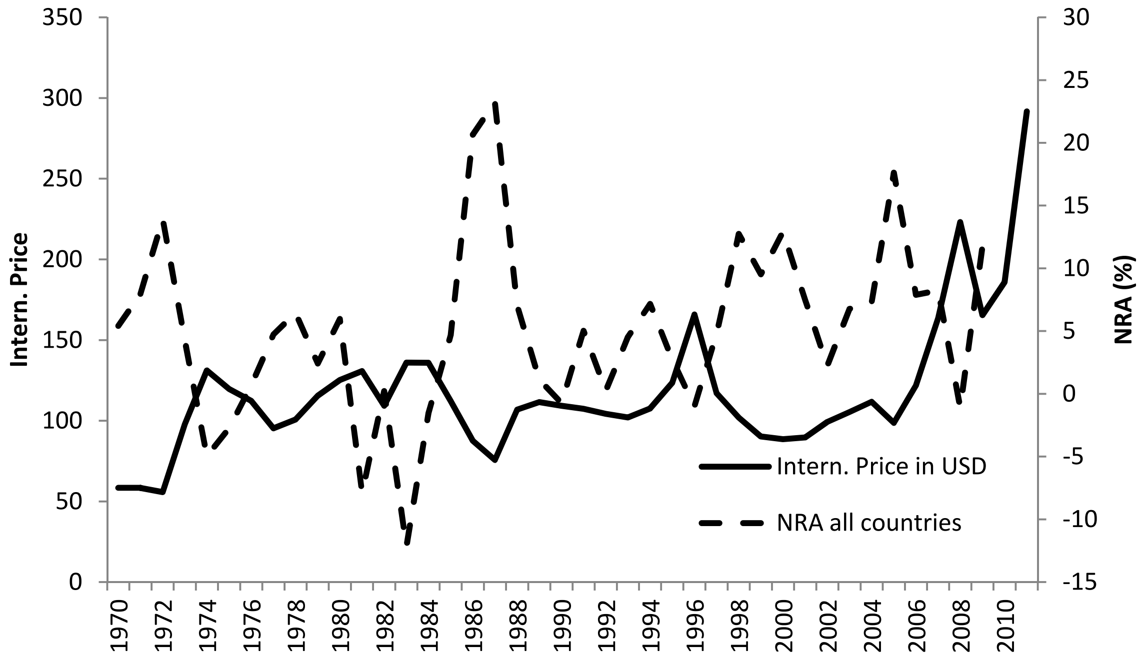


Figure 3 (continued): Grain NRAs and their international price,[a] 82 countries, 1970 to 2011 (left axis is international price in current US$, right axis is weighted average NRA in percent)

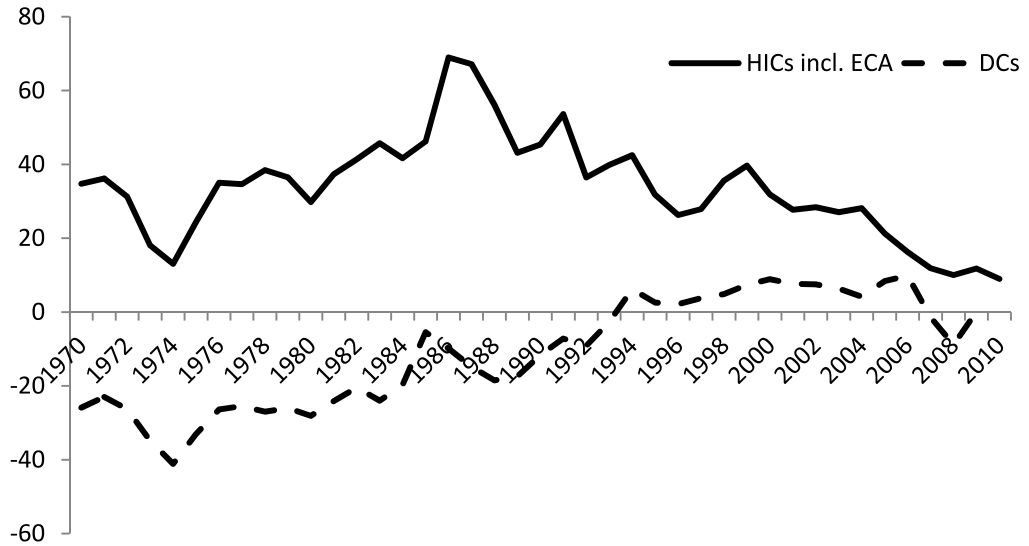
(c) Maize




[a] The NRA is a weighted average of the nominal rate of assistance to producers in each country, using production valued at undistorted prices as weights. The international prices are from World Bank (2011). Coefficients of correlation between the price and NRA are -0.76 for rice, -0.32 for wheat and -0.45 for maize.

Source: Authors' compilation using NAC estimates from Anderson and Nelgen (2012b).

Figure 4: NRA, all products,[a] high-income and developing countries,[b] 1970 to 2010 (percent)




[a] Weighted average of the nominal rate of assistance to producers in each country, using production valued at undistorted prices as weights.

[b] The high-income countries include all European transition economies in the sample (ECA, those now members of EU-27 plus Russia and Ukraine). See Appendix for full list of countries.

Source: Authors' compilation using NAC estimates from Anderson and Nelgen (2012b).

Figure 5: Changes in nominal assistance coefficients for grains, 1972-74, 1984-86, and 2005-08

(percentage changes in weighted averages of national NACs)[a]

(a) world exporters and world importers

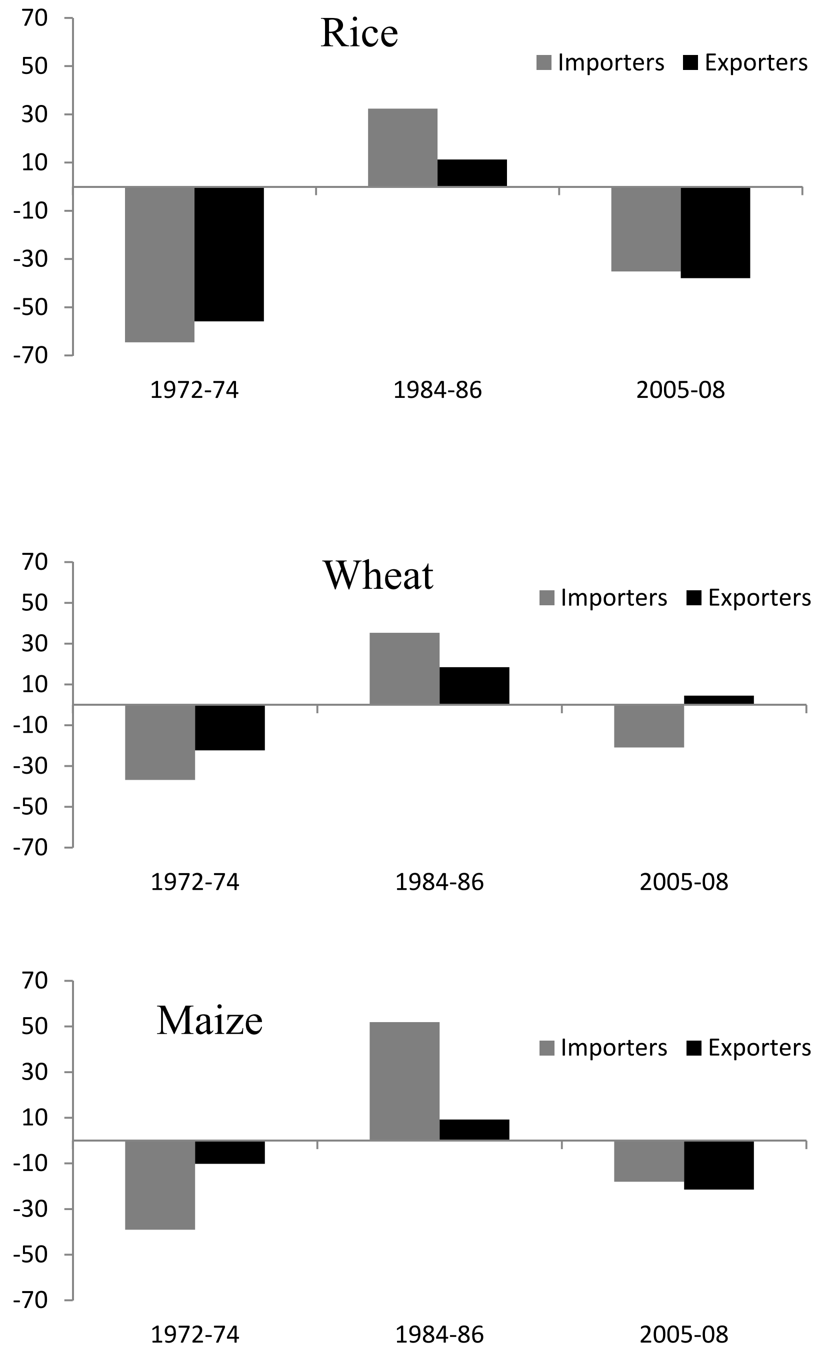
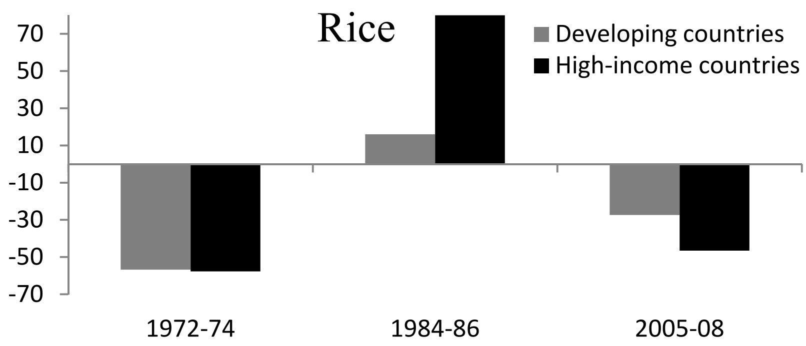
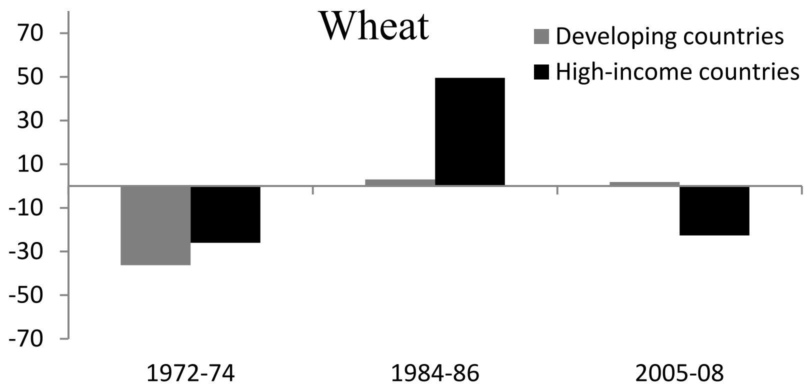


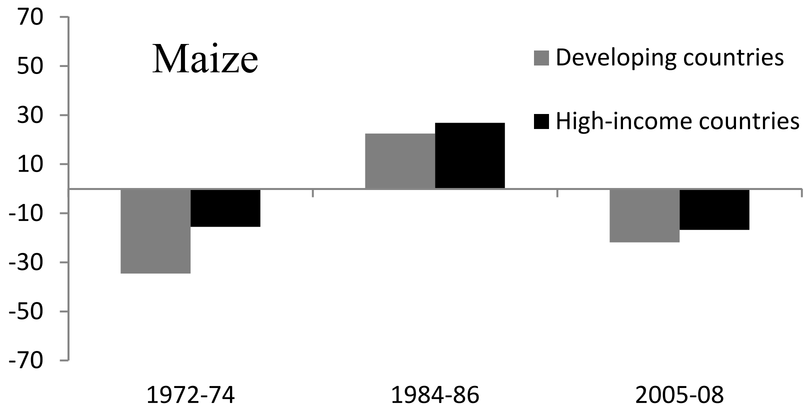
Figure 5 (continued): Changes in nominal assistance coefficients for grains, 1972-74, 1984-86, and 2005-08

(percentage changes in weighted averages of national NACs)[a]

(b) developing countries and high-income countries




[a] Consumption weights are used in the first and third periods when international prices spiked upwards, and production weights in the mid-1980s period when prices spiked downwards.

Source: Authors' calculations using NAC estimates from Anderson and Nelgen (2012b).

Table 1: Global average short-run price transmission elasticities,[a] key grains, 1985 to 2010 (weighted average across all of the 82 countries for which NRAs are available, using value of national production at undistorted prices as weights)

| | |
|---|---|
| Rice | 0.49 |
| Wheat | 0.55 |
| Maize | 0.63 |

[a] The proportion of a change in the international price that is transmitted to the domestic market of a country within a year, estimated using equation (7) in the text.

Source: Authors' calculations using price data compiled by Anderson and Nelgen (2012b).

Table 2: Average annual NACs[a], key crops, developing and high-income countries, 1965 to 2010

(1 + NRA/100)

| | Developing countries | | | | | | High-income countries | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1965-1972 | ***1972-1976*** | 1976-1984 | ***1984-1988*** | 1988-2006 | ***2006-2009*** | 1965-1972 | ***1972-1976*** | 1976-1984 | ***1984-1988*** | 1988-2006 | ***2006-2010*** |
| Rice | 0.97 | ***0.91*** | 1.02 | ***1.27*** | 1.29 | ***1.17*** | 1.23 | ***1.07*** | 1.37 | ***2.37*** | 2.19 | ***1.25*** |
| Importers | 1.06 | ***0.99*** | 1.09 | ***1.35*** | 1.34 | ***1.24*** | 1.85 | ***1.70*** | 2.28 | ***4.20*** | 4.84 | ***1.71*** |
| Exporters | 0.76 | ***0.65*** | 0.78 | ***1.02*** | 1.14 | ***0.87*** | 0.99 | ***0.81*** | 1.01 | ***1.92*** | 1.50 | ***1.03*** |
| Wheat | 1.10 | ***0.90*** | 1.10 | ***1.18*** | 1.19 | ***1.10*** | 1.37 | ***0.91*** | 1.38 | ***1.95*** | 1.43 | ***1.06*** |
| Importers | 1.12 | ***0.89*** | 1.09 | ***1.18*** | 1.23 | ***1.13*** | 1.41 | ***0.90*** | 1.46 | ***2.09*** | 1.71 | ***1.38*** |
| Exporters | 1.01 | ***0.94*** | 1.24 | ***1.36*** | 0.93 | ***0.99*** | 1.20 | ***0.97*** | 1.08 | ***1.46*** | 1.18 | ***0.99*** |
| Maize | 1.09 | ***0.99*** | 1.03 | ***1.18*** | 1.07 | ***1.11*** | 1.39 | ***1.22*** | 1.36 | ***1.60*** | 1.34 | ***1.07*** |
| Importers | 1.20 | ***1.14*** | 1.15 | ***1.29*** | 1.12 | ***1.13*** | 1.42 | ***1.24*** | 1.41 | ***1.70*** | 1.42 | ***1.09*** |
| Exporters | 0.95 | ***0.78*** | 0.85 | ***0.87*** | 1.00 | ***1.05*** | 1.03 | ***1.02*** | 1.04 | ***1.18*** | 1.07 | ***1.01*** |

[a] Unweighted average of national NACs each year, averaged over the number of years in each period.

Source: Authors' calculations using NAC estimates from Anderson and Nelgen (2012b).

Table 3: Percentage changes in NACs from previous non-spike period,[a] key crops, developing and high-income countries, 1965 to 2010

| | Developing countries | | | High-income countries | | |
|---|---|---|---|---|---|---|
| | 1972-1976 | 1984-1988 | 2006-2009 | 1972-1976 | 1984-1988 | 2006-2010 |
| Rice importers | -6 | 24 | -7 | -8 | 84 | -65 |
| Rice exporters | -14 | 31 | -24 | -18 | 90 | -32 |
| Wheat importers | -21 | 9 | -8 | -37 | 44 | -19 |
| Wheat exporters | -6 | 9 | 6 | -20 | 36 | -16 |
| Maize importers | -6 | 12 | 1 | -13 | 21 | -23 |
| Maize exporters | -17 | 2 | 5 | -1 | 14 | -5 |

[a] Calculated from unweighted-average NACs in Table 2.

Source: Authors' calculations using NAC estimates from Anderson and Nelgen (2012b).

Table 4: Annual NACs for rice, wheat and maize, by country group,[a] 1972 to 2010

(1 + NRA/100)

(a) Rice

| | 1972 | 1973 | 1974 | 1975 | 1976 | 1984 | 1985 | 1986 | 1987 | 1988 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World exporters** | 0.87 | 0.62 | 0.56 | 0.73 | 0.88 | 1.11 | 1.31 | 1.58 | 1.79 | 1.66 | 1.01 | 0.99 | 0.96 | 0.84 | na |
| **World importers** | 1.37 | 1.03 | 0.75 | 1.07 | 1.17 | 1.45 | 1.61 | 1.62 | 1.64 | 1.49 | 1.41 | 1.44 | 1.19 | 1.24 | na |
| High-income countries | 1.29 | 0.95 | 0.77 | 1.07 | 1.26 | 1.70 | 1.97 | 2.53 | 2.84 | 2.82 | 1.38 | 1.24 | 1.26 | 1.17 | 1.23 |
| Developing countries | 1.11 | 0.83 | 0.64 | 0.91 | 1.03 | 1.24 | 1.37 | 1.28 | 1.29 | 1.15 | 1.28 | 1.30 | 1.06 | 1.06 | na |
| Asia | 1.15 | 0.84 | 0.58 | 0.89 | 1.02 | 1.26 | 1.42 | 1.35 | 1.46 | 1.25 | 1.25 | 1.22 | 0.85 | 0.97 | na |
| Africa | 1.10 | 0.84 | 0.66 | 0.99 | 1.06 | 1.21 | 1.17 | 1.16 | 1.29 | 1.12 | 1.16 | 1.25 | 1.05 | 0.91 | na |
| Latin America | 1.05 | 0.81 | 0.75 | 0.82 | 0.96 | 1.27 | 1.65 | 1.34 | 0.90 | 0.96 | 1.45 | 1.47 | 1.40 | 1.36 | na |

(b) Wheat

| | 1972 | 1973 | 1974 | 1975 | 1976 | 1984 | 1985 | 1986 | 1987 | 1988 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World exporters** | 1.14 | 0.88 | 0.83 | 0.97 | 0.98 | 1.17 | 1.19 | 1.71 | 1.70 | 1.41 | 1.00 | 0.97 | 0.98 | 1.00 | na |
| **World importers** | 1.09 | 0.73 | 0.76 | 0.96 | 0.93 | 1.28 | 1.46 | 1.77 | 2.07 | 1.80 | 1.35 | 1.10 | 1.08 | 1.33 | na |
| High-income countries | 1.10 | 0.79 | 0.80 | 0.92 | 0.94 | 1.42 | 1.65 | 2.13 | 2.46 | 2.10 | 1.14 | 1.03 | 1.02 | 1.07 | 1.06 |
| Developing countries | 1.10 | 0.72 | 0.74 | 1.01 | 0.95 | 1.06 | 1.09 | 1.22 | 1.33 | 1.20 | 1.14 | 1.02 | 1.01 | 1.24 | na |
| Asia | 1.35 | 0.80 | 0.89 | 1.21 | 1.01 | 1.20 | 1.20 | 1.28 | 1.42 | 1.46 | 1.20 | 0.97 | 0.83 | 1.19 | na |
| Africa | 0.99 | 0.77 | 0.64 | 0.87 | 0.84 | 0.92 | 0.91 | 1.20 | 1.38 | 1.11 | 1.20 | 1.13 | 1.22 | 1.44 | na |
| Latin America | 1.02 | 0.63 | 0.72 | 0.96 | 1.07 | 1.14 | 1.27 | 1.20 | 1.16 | 1.09 | 1.03 | 0.93 | 0.91 | 1.03 | na |

(c) Maize

| | 1972 | 1973 | 1974 | 1975 | 1976 | 1984 | 1985 | 1986 | 1987 | 1988 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World exporters** | 0.95 | 0.89 | 0.75 | 0.75 | 0.71 | 0.83 | 0.86 | 1.01 | 1.14 | 0.87 | 1.11 | 1.22 | 0.95 | 0.97 | na |
| **World importers** | 1.51 | 1.14 | 0.95 | 1.12 | 1.20 | 1.06 | 1.15 | 1.62 | 1.98 | 1.54 | 1.12 | 1.17 | 1.01 | 1.17 | na |
| High-income countries | 1.54 | 1.14 | 0.98 | 1.17 | 1.26 | 1.16 | 1.26 | 1.78 | 2.16 | 1.67 | 1.15 | 1.18 | 0.99 | 1.01 | 1.02 |
| Developing countries | 1.23 | 1.02 | 0.87 | 0.91 | 0.95 | 0.90 | 0.97 | 1.22 | 1.41 | 1.13 | 1.07 | 1.18 | 0.98 | 1.18 | na |
| Asia | 1.30 | 0.99 | 0.91 | 0.87 | 0.98 | 0.95 | 1.05 | 1.10 | 1.31 | 1.22 | 1.10 | 1.18 | 0.82 | 1.30 | na |
| Africa | 1.24 | 1.01 | 0.86 | 0.95 | 0.95 | 0.86 | 0.93 | 1.34 | 1.56 | 1.15 | 1.09 | 1.38 | 1.11 | 1.14 | na |
| Latin America | 1.12 | 1.06 | 0.83 | 0.85 | 0.90 | 0.93 | 0.98 | 1.03 | 1.16 | 1.00 | 1.03 | 0.96 | 0.97 | 1.12 | na |

[a] Unweighted averages of national NACs.
Source: Authors' calculations using NAC estimates from Anderson and Nelgen (2012b).

Table 5: Annual changes in NACs and international reference prices, by country group,[a] 1972-74, 1984-86, and 2005-10

(percent)

(a) Rice

| | 1972/73 | 1973/74 | 1984/85 | 1985/86 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---|---|---|---|---|---|---|---|---|
| **World exporters** | -29 | -10 | 18 | 20 | -2 | -3 | -13 | na |
| **World importers** | -24 | -27 | 11 | 1 | 2 | -18 | 5 | na |
| High-income countries | -26 | -19 | 16 | 29 | -10 | 1 | -7 | 5 |
| Developing countries | -25 | -23 | 10 | -7 | 1 | -18 | 0 | na |
| *****Reference price*** | ***124*** | ***79*** | ***-15*** | ***-5*** | ***7*** | ***99*** | ***-15*** | ***-12*** |

(b) Wheat

| | 1972/73 | 1973/74 | 1984/85 | 1985/86 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---|---|---|---|---|---|---|---|---|
| **World exporters** | -22 | -6 | 2 | 43 | -3 | 1 | 2 | na |
| **World importers** | -33 | 4 | 14 | 21 | -18 | -2 | 22 | na |
| High-income countries | -28 | 1 | 17 | 29 | -10 | -1 | 4 | -1 |
| Developing countries | -34 | 3 | 3 | 12 | -11 | -1 | 22 | na |
| *****Reference price*** | ***100*** | ***29*** | ***-11*** | ***-15*** | ***33*** | ***28*** | ***-31*** | ***0*** |

(c) Maize

| | 1972/73 | 1973/74 | 1984/85 | 1985/86 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---|---|---|---|---|---|---|---|---|
| **World exporters** | -6 | -16 | 4 | 16 | 10 | -23 | 3 | na |
| **World importers** | -25 | -17 | 9 | 40 | 5 | -13 | 16 | na |
| High-income countries | -26 | -14 | 9 | 41 | 3 | -16 | 3 | 1 |
| Developing countries | -17 | -15 | 8 | 26 | 10 | -17 | 20 | na |
| *****Reference price*** | ***75*** | ***34*** | ***-17*** | ***-22*** | ***34*** | ***36*** | ***-26*** | ***12*** |

[a] Unweighted averages of national NACs changes.

Source: Authors' calculations using NAC estimates from Anderson and Nelgen (2012b) and, for international reference prices, World Bank (2011).

Table 6: Contributions of policy-induced trade barrier changes to changes in the international prices of key agricultural products, 1972-74 and 2006-08

| | **1972-74** | **2006-08** |
|---|---|---|
| ***Consumption-weighted proportional decline in NAC, that is,-*** $\hat{T}$ [a] | | |
| Rice | 0.56 | 0.37 |
| Wheat | 0.30 | 0.12 |
| Maize | 0.21 | 0.08 |
| ***Proportional international price rise,*** $\hat{p}^*$ | | |
| Rice | 3.00 | 1.13 |
| Wheat | 1.57 | 0.70 |
| Maize | 1.35 | 0.83 |
| ***Proportional contribution of changed trade restrictions to the international price change*** [b] | | |
| Rice | 0.27 | 0.40 |
| Wheat | 0.23 | 0.19 |
| Maize | 0.18 | 0.10 |

[a] $\hat{T}$ is the negative of the weighted average of proportional changes in national NACs over the period, using national shares of global consumption valued at undistorted prices ($G_i$'s) as weights.

[b] The proportional contribution of altered trade restrictions is $\frac{\hat{T}}{\hat{T}+R}$, where R is 'other' influences and is derived from the equation $\hat{p}^* = \hat{T} + R + (\hat{T} * R)$, from which it follows that $R = (\hat{p}^* - \hat{T})/(1 + \hat{T})$.

Source: Authors' calculations based on the NAC estimates in Anderson and Nelgen (2012b).

Table 7: Contributions[a] of high-income and developing countries, and of importing and exporting countries, to the proportion of the international price change that is due to policy-induced trade barrier changes, 1972-74 and 2006-08

| | TOTAL PROPORTIONAL CONTRIBUTION | High-income countries' contribution | Developing countries' contribution | Importing countries' contribution | Exporting countries' contribution |
|---|---|---|---|---|---|
| **1972-74** | | | | | |
| Rice | 0.27 | 0.04 | 0.23 | 0.10 | 0.17 |
| Wheat | 0.23 | 0.15 | 0.08 | 0.18 | 0.05 |
| Maize | 0.18 | 0.14 | 0.04 | 0.06 | 0.12 |
| **2006-08** | | | | | |
| Rice | 0.40 | 0.02 | 0.38 | 0.18 | 0.22 |
| Wheat | 0.19 | 0.09 | 0.10 | 0.07 | 0.12 |
| Maize | 0.10 | 0.05 | 0.05 | 0.03 | 0.07 |

[a] Expressed such that the two numbers in each subsequent pair of columns add to the total proportion shown in column 1 of each row.

Source: Authors' calculations based on the NAC estimates in Anderson and Nelgen (2012b), with the left column coming from bottom one-third of Table 6.

Table 8: Comparison of the domestic price rise with the rise in international grain prices net of the contribution of changed trade restrictions, rice, wheat and maize, 1972-74 and 2006-08

(percent, unweighted averages)

| | **International price rise** | | **Domestic price rise** | | |
|---|---|---|---|---|---|
| | Including contribution of changed trade restrictions | Net of contribution of changed trade restrictions | All countries | Developing countries | High-income countries |
| **1972-74** | | | | | |
| Rice | 300 | 220 | 59 | 72 | 27 |
| Wheat | 157 | 121 | 64 | 77 | 55 |
| Maize | 135 | 111 | 49 | 48 | 52 |
| **2006-08** | | | | | |
| Rice | 113 | 68 | 56 | 48 | 74 |
| Wheat | 70 | 56 | 77 | 65 | 81 |
| Maize | 83 | 75 | 73 | 62 | 82 |

Source: Authors' calculations based on the NAC estimates in Anderson and Nelgen (2012b)

**Appendix: List of 82 countries in the updated agricultural distortions database[a]**

**Sub-Saharan African developing**
Benin
Burkina Faso
Cameroon
Chad
Côte d'Ivoire
Ethiopia
Ghana
Kenya
Madagascar
Mali
Mozambique
Nigeria
Senegal
South Africa
Sudan
Tanzania
Togo
Uganda
Zambia
Zimbabwe

**Asian developing**
Bangladesh
China
India
Indonesia
Korea, Rep. of
Malaysia
Pakistan
Philippines
Sri Lanka
Taiwan, China
Thailand
Vietnam

**Latin American developing**
Argentina
Brazil
Chile
Colombia
Dominican Republic
Ecuador
Mexico
Nicaragua

**European transition & Mediterranean**
Bulgaria
Czech Republic
Egypt, Arab Rep. of
Estonia
Hungary
Israel
Kazakhstan
Latvia
Lithuania
Morocco
Poland
Romania
Russian Federation
Slovak Republic
Slovenia
Turkey
Ukraine

**Other high-income countries**
Australia
Austria
Belgium
Canada
Cyprus
Denmark
Finland
France
Germany
Greece
Iceland
Ireland
Italy
Japan
Luxembourg
Malta
Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
United Kingdom
United States

[a] NRA updates are computed in part from OECD (2011) PSEs for all high-income and European transition countries plus Brazil, Chile, China, Israel, Korea, Mexico, South Africa and Turkey.

Source: Anderson and Nelgen (2012b), modified from Anderson (2009, Appendix B).