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Trade Barrier Volatility and Agricultural Price Stabilization

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Summary. — National barriers to agricultural trade are often varied to insulate domestic markets from international price variability, especially following a sudden spike. This paper examines the extent of that behavior by governments using new annual estimates of agricultural price distortions in 75 countries. Responses to price spikes are shown to be equally substantial for agricultural-importing and agricultural-exporting countries, thereby weakening the domestic price-stabilizing effect of their interventions. Bringing discipline to export restrictions through new World Trade Organization rules could help alleviate the extent to which government responses to exogenous upward price spikes exacerbate those shocks.

Key words — commodity price stabilization, price transmission, domestic market insulation, distorted incentives, developing and high-income countries

1. INTRODUCTION

Restrictions on food exports received much publicity when prices in international food markets rose from 2005 and spiked in mid-2008. The rapid rise during 2007–08 was fueled in part by the news that some developing countries—so as to slow the rise in domestic prices –were suspending their grain exports. Agricultural prices came down somewhat in the final few months of 2008, but the US dollar price of wheat rose by more than half again in the northern summer of 2010, despite the replenishment of global stocks (Figure 1). That 2010 rise was triggered by Russia's announcement to suspend wheat exports in the wake of its drought and wildfires. In the latter half of 2010 Ukraine, Belarus, Uzbekistan, and Kazakhstan also restricted or banned their wheat exports. Meanwhile, India has retained effectively an export ban on both wheat and rice since 2008.

These events suggest sudden export restrictions can contribute to spikes in international food prices. Sharp price rises also prompt food-deficit countries to reduce their import restrictions (or even subsidize imports) temporarily, which can further exacerbate an international price spike. And the opposite tends to occur when international food prices spike downward: some food-surplus countries lower their export barriers or subsidize exports while some food-importing countries raise their import barriers. In each case the aim of national governments appears to be to insulate the domestic market from international price volatility. However, when many countries so intervene, their combined effect adds to the cost of exogenous supply or demand shocks to food buyers or sellers in the rest of the world. Such beggar-thy-neighbor behavior of national governments thus is a concern for all trading nations, because it reduces the stability and predictability of trade opportunities. In addition, typically it is also not in the best economic interests of the intervening countries, as there are almost always more-efficient instruments than trade measures to avert losses for politically significant interest groups.

The international community recently recognized the need to encourage better national and multilateral responses to agricultural price volatility, by placing the issue on the agenda of the November 2011 meeting of the G20 in Paris and requesting the key international organizations to prepare a Policy Report for consideration during the 6 months prior to that meeting (FAO *et al.*, 2011). Also necessary for better policy making is more empirical evidence of how governments have acted during past price spikes. The purpose of this paper is to provide such evidence, by drawing on a new database of annual distortions to agricultural incentives in 75 countries since the 1950s.

Specifically, we address the following empirical questions: How much do countries try to dampen international-to-domestic food price transmission? Has this tendency lessened since many countries began reducing their trade barriers in the 1980s? How different are trade restrictions in periods of international price spikes? Do food-deficit countries vary their trade restrictions more than food-surplus countries? Do governments respond differently in periods of upward versus downward spikes in international food prices? Do developing countries vary their trade restrictions more than high-income countries? How much do the various trade policy instruments, and domestic measures, contribute to NRA changes during price surges? And how successful have national governments been in stabilizing domestic agricultural prices relative to those in international markets?

The paper begins by briefly explaining the potential price, trade and welfare impacts of such trade barrier variability. It then addresses the above questions by comparing indicators

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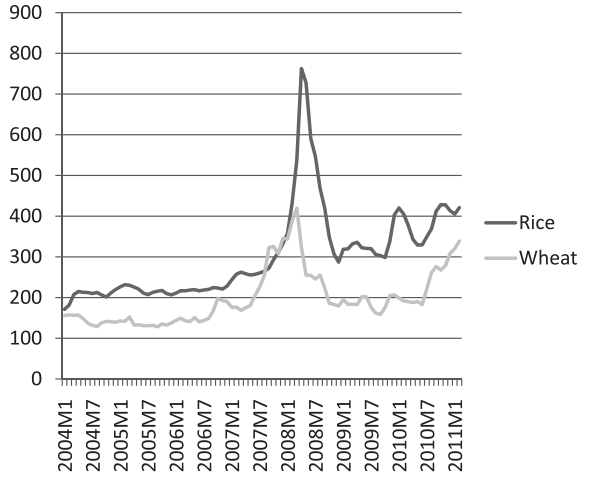

Figure 1. *International prices for rice and wheat, 2004 to February 2011 (current US dollars). Source: World Bank, Pink Sheets, \http://econ.worldbank.org, accessed March 28, 2011.*

of recent trade barrier changes with those associated with the upward price spike around 1973–74, and also with the downward spike in international food prices in the mid-1980s. Responses by food-importing and food-exporting countries are shown to be almost equally substantial, ensuring that each group reduced the effectiveness of the other's domestic market stabilizing intervention effort while exacerbating the international price spike. The paper concludes 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 price spikes, and new initiatives that might be undertaken multilaterally.

2. POTENTIAL IMPACTS OF TRADE RESTRICTION RESPONSES TO INTERNATIONAL FOOD MARKET SHOCKS

Fluctuations are to be expected in commodity markets subject to periodic supply or demand shocks, especially if adverse supply shocks occur when stocks are at low levels (Deaton & Laroque, 1992). They are even more likely in the presence also of sporadic changes in government storage activity. Many governments seek to shield their domestic market somewhat from those fluctuations, and especially from severe spikes in international prices, by altering the restrictiveness of their trade policies.

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 can lower the consumer tax equivalent of any such measure.

However, 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.[1] In the case of small intervening countries unable to influence their terms of trade, such trade measures also are likely to reduce their national economic welfare, because they distort domestic production in addition to lowering the consumer price of food.[2] They are also wasteful 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 downward 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.

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. If only food-exporting countries respond to an upward price spike, the international terms of trade would turn even further in their favor because of the additional reduction in available supplies on the international markets (and conversely if only food-importing countries alter their trade restrictions when the world price of food collapses); and the extent of that extra terms of trade benefit is greater, the larger the proportion of global trade so affected by the exporting countries' policy response. Such action would thus add both to the extent of the international price spike and to the transfer of welfare from food-deficit to food-surplus countries (or from food-surplus to food-deficit countries when the price spike is downward and only food-deficit countries respond).

However, Martin and Anderson (2011) show that when both sets of countries seek to insulate their domestic markets from an external shock, their impacts on the international price spike are reinforcing but their impacts on the volume they trade internationally—and hence on their domestic prices—are offsetting. In the extreme case in which food-deficit countries expand their imports to exactly the same extent as food-surplus countries reduce exports, the domestic price in both sets of countries would be no different than if neither country altered their trade measures following the exogenous shock. That is, the initial international price change from the initial shock would be fully transmitted to both sets of countries, despite their efforts to fully insulate their domestic markets in that extreme case. Moreover, the more countries that participate and thus the more the international price spike is accentuated, the more compelled will other countries feel to join the bandwagon and push that price even higher.

3. EMPIRICAL EVIDENCE

This section first describes a new database of distortions to agricultural incentives in 75 countries and then addresses sequentially the questions posed in the introduction.

(a) *Database on government distortions to domestic prices of farm products*

A recently compiled World Bank database provides, in a single source, a set of indicators of the extent to which trade restrictions and other price-distorting border and domestic 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 & Valenzuela, 2008, with summary estimates in Anderson, 2009 and Ch. 2 of Anderson, 2010). The sample includes 75 countries (listed in the Appendix) that together account for all but one-tenth of global agriculture, and the 75 most important products so as to cover around 70% of the gross value of agricultural output in each focus country.

While those estimates only go up to 2007 (and only to 2004 for most developing countries), and so do not include the most-recent price-spike period, price data are now available for sufficient countries to enable us to update the estimates in Anderson and Valenzuela (2008) for rice and wheat. These new estimates are based, for high-income countries (including those that recently acceded to form the EU-27), on producer support estimates reported in OECD (2010). For developing countries, the updated estimates make use of FAO and World Bank data sources for producer and border prices, respectively. [3]

The key indicator used for present purposes is the national nominal rate of assistance to agricultural producers (NRA). This is the extent to which the domestic producer price exceeds the border price, and hence is negative if farmers receive less than the price at the country's border for a similar product (adjusted for such things as distribution costs and quality differences). That is the appropriate indicator in times of international price downturns when governments seek to provide more assistance to farmers; but it turns out to be very highly correlated with the appropriate indicator of consumer protection (the consumer tax equivalent, or CTE) in times of upward international food price spikes when governments seek to provide more protection to consumers. [4] The high correlation between the NRA and CTE reflects the fact that most interventions in national food markets occur at the border, rather than in the form of domestic food consumer or producer subsidies or taxes.

Since part of our interest is in examining proportional changes in the NRA, that can best be done by converting it to a nominal assistance coefficient, where NAC = 1 + NRA/100. This is especially so when some NRAs are negative, in which case the NAC is below rather than above one.

(b) *How much do governments insulate their domestic agricultural markets?*

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, 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. This is evident from the first 3 columns of Table 1, which reports regressions of product NRAs on various explanatory variables in the panel dataset for six key crop products. Those highly significant regression coefficients suggest 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.

Agricultural policy regimes tend also to have an anti-trade bias. In high-income countries, that has manifested itself in import restrictions. There have been no substantive export restrictions on high-income countries' farm products since the 1950s and, even where export subsidies have been used, they have provided much less assistance to exporters than that enjoyed by import-competing farmers of high-income countries. For the developing country group, the anti-trade bias manifests itself mostly as taxes and other restrictions on agricultural exports, although their impact has declined since the 1980s and there has also been some growth in agricultural import protection by developing countries. This anti-trade bias is reflected in the negative coefficient on the dummy variable for exportables in column 5 of Table 1 (as well as in the anti-trade bias and trade reduction indexes reported in Anderson, 2009).

More 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. [5] NRAs are negatively correlated with deviations from trend in the international price of the product in question (column 4 of Table 1). [6] Perhaps the most notable case is rice in Asia (Figure 2), where the negative coefficient of correlation between the NRA and international price is well above 0.5; but, during 1965–2007, it is also above 0.5 globally for cotton, maize, and sugar, and is 0.41 for wheat and 0.2 for soybean (Anderson, 2010, Table 2.7).

This domestic price-insulating behavior by governments is of concern because it means there is less international trade in farm products than would be the case otherwise. Such

Table 1. *Regressions aimed at understanding variations in product NRAs across 75 countries, 1955–2007 (no country fixed effects)*

	Log of real GDP *per capita*	Log of real GDP *per capita*, squared	Log of arable land *per capita*	% deviation of int'l price from its trend	Dummy if exportable	Constant	No. of obs.	Adjusted R^2
Rice	−2.022***	0.157***	−0.390***	−0.320***	−0.732***	5.988***	1281	0.514
	(0.152)	(0.00988)	(0.0219)	(0.0532)	(0.0447)	(0.562)		
Wheat	−0.921***	0.0707***	−0.158***	−0.317***	−0.424***	2.823***	1661	0.347
	(0.116)	(0.00728)	(0.0159)	(0.0529)	(0.0368)	(0.454)		
Maize	−0.432***	0.0334***	−0.167***	−0.236***	−0.195***	1.307***	1525	0.208
	(0.0937)	(0.00602)	(0.0145)	(0.0504)	(0.0292)	(0.354)		
Soybean	0.957***	−0.0424**	−0.548***	−0.0372	−0.128	−5.229***	703	0.310
	(0.345)	(0.0212)	(0.0368)	(0.155)	(0.0893)	(1.366)		
Sugar	−1.021***	0.0843***	−0.244***	−0.582***	−0.414***	3.180***	1648	0.413
	(0.178)	(0.0113)	(0.0255)	(0.0338)	(0.0554)	(0.670)		
Cotton	−0.370***	0.0320***	0.00829	−0.274***	−0.270***	1.057***	883	0.275
	(0.0897)	(0.00607)	(0.0159)	(0.0363)	(0.0429)	(0.315)		

Source: Authors' revision of Table 2.14 in Anderson (2010).
*** Indicates statistically significant at the 1% level.
** Indicates statistically significant at the 5% level.

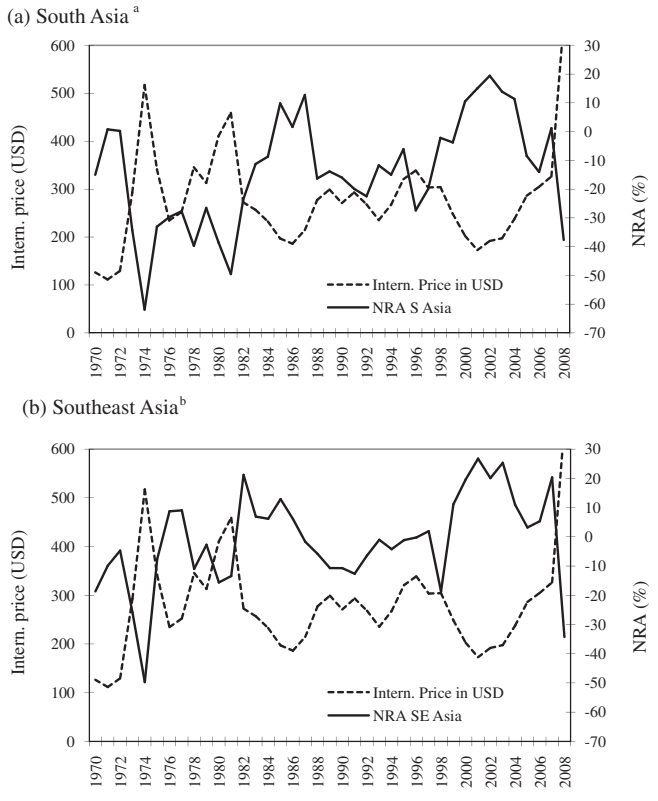

Figure 2. *Rice NRAs and international rice price, South and Southeast Asia, 1970–2008 (left axis is int'l price in current US dollars, right axis is weighted average NRA in percent). (a) South Asia: Correlation coefficient is −0.70. Countries included are Bangladesh (except for 1970–73), India, Pakistan, and Sri Lanka. (b) Southeast Asia: Correlation coefficient is −0.57. Countries included are Indonesia (except for 1970–74), Malaysia, Philippines, Thailand, and Vietnam (except for 1970–85 and 2005–08). Source: Authors' compilation based on their update of data in Anderson and Valenzuela (2008).*

'thinning' of international markets for these weather-dependent products in turn makes prices and quantities traded more volatile. Using a stochastic model of world food markets, Tyers and Anderson (1992, Table 6.14) found that instability of international food prices in the early 1980s was three times greater than it would have been under free trade in those products. A further simulation exercise by Tyers (1991) suggests that between three-fifths and three-quarters of the global cost of agricultural protection in high-income countries in the early 1980s was due to the insulating component of their policies.

To examine how much that behavior has continued since the early 1980s, we estimate the elasticity of transmission of the international product price to the domestic market for key farm products. 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 1985–2004. Specifically, we assume that associated with the border price P_t there is a 'target' domestic price p_t^*, toward 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:

$$p_t^* = p_0 + \phi_{LR}(P_t - P_0) \tag{1}$$

where ϕ_{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 inflation-deflated domestic price adjusts only partially each year to any change in the target domestic price:

$$p_t - p_{t-1} = \delta(p_t^* - p_{t-1}) \tag{2}$$

where the parameter δ gives the fraction of the ultimate adjustment that takes place in 1 year. By substituting (1) into (2) to eliminate the unobservable target price, the following reduced form, which is suitable for fitting to data, is obtained:

$$p_t = \delta(p_0 - \phi_{LR}P_0) + (1-\delta)p_{t-1} + \delta\phi_{LR}P_t = a + bp_{t-1} + cP_t \tag{3}$$

where, again, if the prices are expressed in logarithms, the short-run (1 year) elasticity of price transmission is simply δ times the long-run elasticity. Thus the short-run elasticity estimate is the regression coefficient c and the long-run elasticity estimate is $c/(1-b)$. If the policy objective was to hold the level of protection constant on average over time but to stabilize the domestic price around the trend border price, ϕ_{SR} would be less than one and ϕ_{LR} would be one. But in general even ϕ_{LR} could be less than one, for example if the government sought to raise the trend level of agricultural protection as *per capita* income grew (as suggested by the first two columns of Table 1).

Table 2 summarizes the estimates. The average of estimates for the short-run elasticity range from a low of 0.3 for sugar to around 0.5 for rice, wheat, and pork, not quite 0.6 for cotton, cocoa, maize, and poultry, and around 0.7 for beef, soybean, and coffee. The unweighted average across all of those key products is 0.56, suggesting that within one year, little more than half the movement in international prices of those farm products has been transmitted domestically on average over the past quarter century. [7] Even the long-run elasticity appears well short of unity after full adjustment: the average of the elasticities for those eleven products across the 75 sample countries is just 0.69 (last row of Table 2).

(c) *Has the extent of insulation diminished since the 1980s?*

The tendency for each country to alter its individual product NRAs from year to year around their long-run trend does not appear to have diminished since trade-related policy reforms

Table 2. *Global average price transmission elasticities, key agricultural products, 75 focus countries, 1985–2004 (weighted average using value of national production at undistorted prices as weights)*

Product	Short-run elasticity	Long-run elasticity
Rice	0.52	0.71
Wheat	0.47	0.60
Maize	0.57	0.70
Soybean	0.72	0.79
Sugar	0.31	0.49
Cotton	0.57	0.53
Cocoa	0.57	0.73
Coffee	0.71	0.87
Beef	0.68	0.53
Pork	0.49	0.87
Poultry	0.58	0.77
Unweighted average, 11 products	0.56	0.69

Source: Authors' estimates based on NRAs from Anderson and Valenzuela (2008).

Table 3. *Deviation of national NRA around its trend value,* [a]*key farm products,* [b]*developing and high-income countries, 1965–84 and 1985–2004*

	Deviation of national NRAs around trend[A]				Weighted average of NRAs (%)			
	Developing countries		High-income countries		Developing countries		High-income countries	
	1965–84	1985–04	1965–84	1985–04	1965–84	1985–04	1965–84	1985–04
Rice	32	64	66	229	−20.1	1.9	136.8	419.3
Wheat	33	47	80	91	5.5	10.0	16.1	29.3
Maize	36	33	53	58	−3.4	0.6	7.5	13.9
Soybean	46	117	75	61	2.7	−1.2	0.1	6.6
Sugar	53	66	179	173	17.2	15.5	106.5	141.2
Cotton	38	33	42	28	−16.0	−12.5	33.1	32.2
Coconut	22	20	na	na	−11.5	−20.8	na	na
Coffee	41	27	na	na	−37.3	−12.2	na	na
Beef	45	52	128	127	−12.4	2.7	22.3	47.0
Pork	81	60	92	77	23.6	−7.5	35.6	14.7
Poultry	109	74	164	197	26.3	12.3	24.0	25.8

Source: Authors' compilation based on NRAs from Anderson and Valenzuela (2008).
[A] Deviation, measured in NRA percentage points, is computed as the absolute value of (residual—trend NRA) where national trend NRA in each of the two sub-periods is obtained by ordinary least squares linear regression of the national NRA on time. Estimates shown are an unweighted average of national NRA deviations each year, averaged over the number of years in each period.

began in the mid-1980s. In Table 3 we focus on the NRA's annual average deviation from trend in the two decades before and after 1985. The average deviation from trend NRA is more than one-tenth higher in the latter two decades than in the earlier two decades in just as many cases as it is more than one-tenth lower. This suggests the tendency for each country to alter its individual product NRAs from year to year around their long-run trend has not diminished, despite the trade-related policy reforms that began in many countries in the 1980s. Nor is there much difference as between developing and high-income countries. Notice too that the deviations are non-trivial: except for rice in high-income countries, the average deviation is well above the mean NRA for each product (which is reported in the right-hand half of Table 3).

(d) *How different are trade restrictions in periods of international price spikes?*

We move now to a closer examination of periods of extreme spikes in international food prices. The only such periods prior to 2008 in the World Bank's distortions database are those around 1974 (an upward price spike) and in 1986 (a downward price spike). In Table 4 we focus on the annual average nominal assistance coefficient (NAC = 1 + NRA/100)[8] in the spike year plus the 2 years each side of it, relative to the longer period either side of each spike period.

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 4. *Average annual NACs*[a] *and percentage changes in them, key crops, developing and high-income countries, 1965–2008 (1 + NRA/100)*

	Developing countries						High-income countries					
	1965–72	***1972–76***	1976–84	***1984–88***	1988–2004	***2004–08***	1965–72	***1972–76***	1976–84	***1984–88***	1988–2004	***2004–08***
(a) Average annual NACs (1 + NRA/100)												
Rice	0.97	**0.91**	1.02	**1.27**	1.30	**1.20**	1.23	**1.07**	1.37	**2.53**	2.31	**1.87**
Importers	1.06	**0.99**	1.09	**1.35**	1.35	**1.23**	1.85	**1.70**	2.28	**5.78**	6.99	**3.47**
Exporters	0.76	**0.65**	0.78	**1.02**	1.16	**0.91**	0.99	**0.81**	1.01	**1.89**	1.53	**1.02**
Wheat	1.10	**0.90**	1.10	**1.18**	1.19	**1.00**	1.39	**0.92**	1.41	**2.00**	1.58	**1.41**
Importers	1.01	**0.94**	1.24	**1.36**	0.91	**0.71**	1.20	**0.97**	1.08	**1.46**	1.27	**1.02**
Exporters	1.12	**0.89**	1.09	**1.18**	1.22	**1.05**	1.45	**0.91**	1.50	**2.18**	2.05	**1.87**
Maize	1.09	**0.99**	1.03	**1.13**	1.07	na	1.38	**1.21**	1.37	**1.62**	1.42	na
Soybean	1.20	**0.99**	1.19	**1.27**	1.42	na	0.97	**1.00**	1.45	**1.90**	1.22	na
Sugar	1.39	**0.78**	1.10	**1.49**	1.37	na	2.95	**1.17**	2.19	**3.29**	2.58	na
	1972–76		1984–88		2004–08		1972–76		1984–88		2004–08	
(b) Percentage change in NAC from previous non-spike period												
Rice importers	−7		24		−9		−8		154		−50	
Rice exporters	−14		31		−22		−18		87		−33	
Wheat importers	−7		10		−22		−19		35		−20	
Wheat exporters	−21		8		−14		−37		45		−9	
Maize	−9		10		na		−12		18		na	
Soybean	−18		7		na		3		31		na	
Sugar	−44		35		na		−60		50		na	

Source: Authors' calculations based on updated NRA estimates from Anderson and Valenzuela (2008).
[a] Unweighted average of national NACs each year, averaged over the number of years in each period.

Table 4, where the spike periods are shown in bold italics and the percentage changes in their average NACs from the prior non-spike period are shown in the lower half of the table.

Looking more closely at rice and wheat, for which new NAC estimates are available for the period since 2004 when their international prices were gradually rising before spiking in mid-2008, they too are lower than in the preceding 1988–2004 non-spike period. The proportional extent to which the rice and wheat NACs were lowered is greater in the recent period than in the 1970s' spike period. That difference may be even greater once estimates are available for the 2 years following the 2008 spike instead of having to use, as a substitute, estimates for 2004 and 2005 when international rice and wheat prices were lower (see Figure 1).

(e) *Do food-deficit countries vary their trade restrictions more than food-surplus countries?*

Evidence on whether food-exporting and food-importing countries both alter their trade restrictions in offsetting ways is easiest to see in periods of extreme price spikes. NACs before and during the three price spike periods in our dataset are shown in Table 4. Part (b) of that table reveals that for both rice and wheat, exporting and importing countries do indeed alter their NACs in the same direction, reducing them when prices spike up, raising them when international prices slump. The changes are somewhat larger for importers than exporters, but both are non-trivial. They thus tend to offset each other's efforts to avoid transmitting the international price shock to their home markets. These changes can be seen on an annual basis in the first pair of rows in Table 5 not only for rice and wheat but also for all covered agricultural products.

(f) *Do developing countries vary their trade restrictions more than high-income countries?*

Historically, governments in developing countries have tended to discriminate against farmers and in favor of food consumers whereas in high-income countries they have tended to do the opposite (Anderson, 2009). That suggests in developing countries consumers are more likely to be protected from an upward price spike than producers would be from a downward spike in international prices, and conversely in high-income countries. Assuming the CTE is the same as the NRA (that is, only border distortions matter), that in turn might lead one to expect the percentage change in the NAC to be less for developing countries and more for high-income countries in the 1980s downturn period than in the two upward spike periods. That indeed is what is shown for all but one of the eleven cases reported in the bottom part of Table 4 for high-income countries, and is also evident in five of the six cases of rice and wheat illustrated in Figure 3(a). However, it is true for only 10 of the 18 cases shown in Table 4(b). When the developing country group was subdivided into low- and middle-income countries though (not shown in the table), the expected result for rice and wheat held true for three-quarters of the cases.

Such comparisons of period averages are blunt, however, because the averages hide a lot of year-to-year variation. A more-precise picture of the annual changes in the first half of the price spike periods can be seen in Table 5. It shows that the decline in NACs was more gradual in the recent price surge period than it was in the 1970s when all 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,

Table 5. *Annual NACs for rice, wheat, and all farm products, by country group*[a]*, 1972–2008 (1 + NRA/100)*

	1972	1973	1974	1975	1976	1984	1985	1986	1987	1988	2005	2006	2007	2008
(a) Rice														
World exporters	0.87	0.62	0.56	0.73	0.88	1.11	1.31	1.52	1.69	1.58	1.05	0.97	1.05	0.75
World importers	1.37	1.03	0.75	1.07	1.17	1.45	1.61	1.62	1.64	1.49	1.51	1.47	1.52	1.07
High-income countries	1.29	0.95	0.77	1.07	1.26	1.70	2.09	2.82	3.17	2.85	2.27	1.89	1.70	1.61
Developing countries	1.11	0.83	0.64	0.91	1.03	1.24	1.37	1.28	1.29	1.15	1.27	1.24	1.34	0.81
Asia	1.15	0.84	0.58	0.89	1.02	1.26	1.42	1.35	1.46	1.25	1.30	1.22	1.28	0.74
Africa	1.10	0.84	0.66	0.99	1.06	1.21	1.17	1.16	1.29	1.12	1.06	1.15	1.36	0.79
Latin America	1.05	0.81	0.75	0.82	0.96	1.27	1.65	1.34	0.90	0.96	1.44	1.35	1.44	0.94
(b) Wheat														
World exporters	1.14	0.88	0.83	0.97	0.98	1.17	1.19	1.71	1.70	1.41	0.90	0.95	0.90	0.86
World importers	1.09	0.73	0.76	0.96	0.94	1.29	1.46	1.74	2.04	1.79	1.50	1.43	1.14	0.97
High-income countries	1.11	0.82	0.80	0.93	0.94	1.47	1.71	2.17	2.51	2.13	1.86	1.70	1.19	1.16
Developing countries	1.10	0.72	0.74	1.01	0.95	1.06	1.09	1.22	1.33	1.20	1.07	1.00	0.98	0.80
Asia	1.35	0.80	0.89	1.21	1.01	1.20	1.20	1.28	1.42	1.46	1.08	1.00	0.92	0.59
Africa	0.99	0.73	0.64	0.87	0.84	0.92	0.91	1.20	1.38	1.11	1.13	0.99	1.10	0.92
Latin America	1.02	0.63	0.72	0.96	1.07	1.14	1.27	1.20	1.16	1.09	1.01	1.02	0.93	0.84
	1972	1973	1974	1975	1976	1984	1985	1986	1987	1988				
(c) All covered farm products														
World exporters	0.94	0.83	0.80	0.87	0.80	0.86	0.99	1.16	1.15	1.04				
World importers	1.49	1.30	1.22	1.40	1.58	1.73	1.89	2.05	2.22	1.88				
High-income countries	1.46	1.34	1.26	1.40	1.62	1.81	1.96	2.25	2.44	2.04				
Developing countries	1.02	0.88	0.86	0.95	0.93	0.99	1.09	1.10	1.11	1.05				
Asia	1.30	1.04	0.98	1.09	1.16	1.29	1.45	1.46	1.42	1.36				
Africa	0.90	0.80	0.78	0.83	0.80	0.80	0.85	0.90	0.97	0.91				
Latin America	1.01	0.92	0.92	1.08	1.06	1.10	1.28	1.16	1.03	0.99				

Source: Authors' calculations based on updated NRA estimates from Anderson and Valenzuela (2008).
[a] Unweighted average of national NACs.

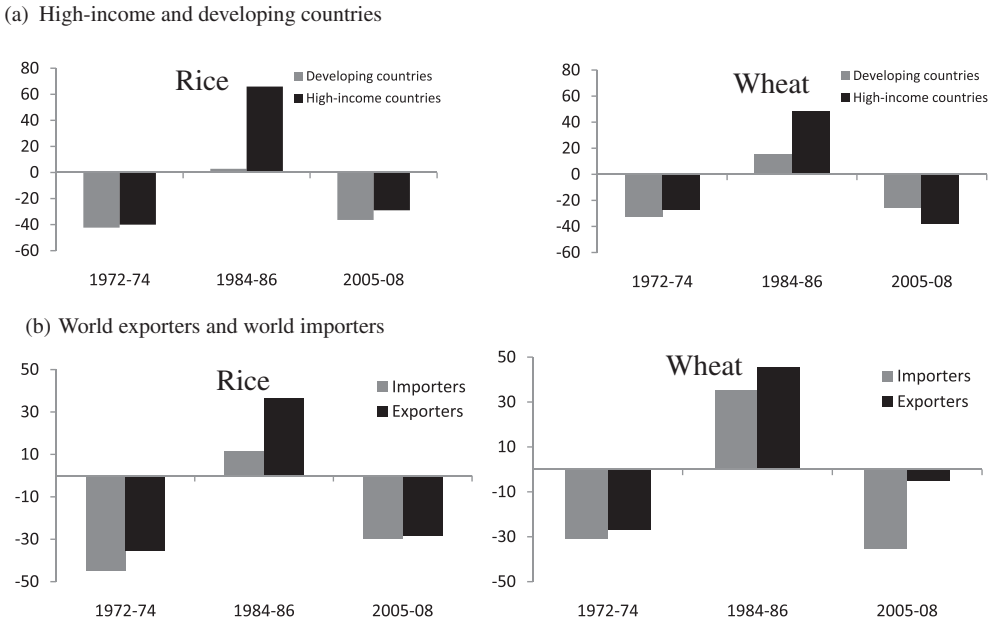

Figure 3. *Changes in nominal assistance coefficients for rice and wheat, High-income and developing countries, and world exporters and world importers, 1972–74, 1984–86, and 2005–08 (percentage changes). Source: Authors' compilation from Table 5.*

the magnitude of the annual NAC changes was greater then than in the recent period to 2008.

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 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 except for high-income wheat, and not quite as rapid: between 2005 and 2008 the NAC for rice fell 29% for high-income countries and 36% for developing countries, and for wheat it fell around 37% for both high-income and developing countries (calculated from 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 cereals in 2005–08 than in the early 1970s.

Turning to all covered farm products (bottom segment of Table 5), the NAC for developing countries fell by 16% in the first 2 years before rising by half that amount in the subsequent 2 years of the 1970s' spike period. The fall for high-income countries was almost the same (14%) but it more than recovered in the subsequent 2 years. As for the mid-1980s price slump period, the NAC rise for all farm products was larger for high-income countries and smaller for developing countries in1984–86 than the fall in 1972–74, consistent with the findings discussed above from Table 4(b) and Figure 3(a).

(g) *Do governments respond differently to upward versus downward price spikes?*

Table 6 offers a comparison between the mid-1980s, and the two upward price spike periods, of annual price changes in NACs. For rice, for wheat, and for all farm products there

Table 6. *Annual changes in NACs, by country group*[a]*, 1972–74, 1984–86, and 2005–08 (percent)*

	1972/73	1973/74	1984/85	1985/86	2005/06	2006/07	2007/08
(a) Rice							
World exporters	−29	−10	18	16	−7	8	−29
World importers	−24	−27	11	1	−3	3	−30
High-income countries	−26	−19	23	35	−17	−10	−5
Developing countries	−25	−23	10	−7	−3	8	−40
(b) Wheat							
World exporters	−22	−6	2	43	5	−5	−5
World importers	−33	4	14	19	−5	−21	−14
High-income countries	−26	−2	17	27	−8	−30	−3
Developing countries	−34	3	3	12	−6	−3	−19
	1972/73	1973/74	1984/85	1985/86			
(c) All farm products							
World exporters	−12	−3	15	17			
World importers	−13	−6	9	8			
High-income countries	−8	−6	8	15			
Developing countries	−13	−3	10	1			

Source: Authors' calculations based on updated NRA estimates from Anderson and Valenzuela (2008).
[a] Unweighted averages of national NACs changes.

appears to be little difference in the extent of change in NACs in the mid-1980s and their extents of change in the two upward price spike periods.

Table 6 also suggests there is little difference not only in the magnitude but also in the timing of the responses of food-importing and food-exporting countries. That is the case not only for rice and wheat but also for all products included in the World Bank's database, shown in part (c) of Table 6.

(h) *How much do the various trade measures contribute to NRA changes?*

The NRAs have been decomposed in Table 7 into the various border measures plus domestic measures for developing and high-income countries, for all products covered by the World Bank's database, following the methodology in Croser and Anderson (2011). The annual estimates are shown for the upward spike period of 1972–76 and the downward spike period of 1984–88. Export restrictions were the dominant instrument for developing countries in both those periods, becoming more and then less important in the upward spike period of 1972–76 (when import tariffs were lowered and then raised), and conversely in the downward spike period of 1984–88. In high-income countries there are virtually no taxes or other restrictions on exports, but the component of their NRAs due to export subsidies, as one would expect, have followed the same path as dominant import tariffs over those spike periods: U-shaped during the upward spike, inverted U-shaped in the downward spike. The bolded rows of Table 7 (showing the NRAs from border measures and the aggregate NRAs which include also domestic producer taxes and subsidies) reveal that border measures account for the vast majority of the distortions to producer prices in both subsets of countries.

In Table 8 the decomposition by instrument for those two previous spike periods is reported in terms of instrument welfare reduction and trade reduction indexes (ITRIs and IWRIs), again following the methodology in Croser and Anderson (2011). The ITRI (IWRI) is defined as the ad valorem trade tax rate for a particular policy instrument which, if applied uniformly across all tradable agricultural commodities in a country, would generate the same reduction in trade volume (or same economic welfare loss) as the actual cross-product structure of NRAs and CTEs for that instrument in that country subset. Table 8 reveals that those indexes, after tracing a U-shape or inverted U-shape during a spike period, tend to return to the pre-spike period average within 2 years after the peak of the spike.

(i) *How successfully do national governments stabilize their domestic markets?*

How successfully has policy action reduced instability in domestic relative to international markets for farm products? Three statistical indicators can help answer this question, following Schiff and Valdés (1992): the standard deviation around the sample mean of the domestic price relative to that for the border price, the coefficient of variation (the standard deviation divided by the sample mean) of the domestic price relative to that for the border price, and the Z-Statistic of the domestic price relative to that for the border price. The Z-Statistic is a measure of the average deviation of the price from its value in the preceding period (annual price change). It is defined as the square root of the average squared deviation of the price from its value lagged 1 year (or of the first difference of the price):

$$Z = \left(\frac{\sum_{t=2}^{n} (P_t - P_{t-1})^2}{n-1} \right)^{1/2} \tag{4}$$

Table 9 provides the average of each of these three relative indicators for various developing country regions, for high-income countries, and for the full sample of 75 countries, for the periods 1955–84 and 1985–2004 (that is, before and following the major economic policy reforms that began for many countries in the mid-1980s). Note that there is little difference between the two periods' indicators, at least for high-income countries and globally. Among the developing country regions the numbers are between two-thirds and four-fifths for Asia, quite close to one for Latin America, and close to or slightly above one for Africa. That is, while interventions in developing Asia were severe enough to provide some insulation, in Africa they were such (perhaps for reasons of poor policy timing) as to possibly even de-stabilize domestic markets. Taken

Table 7. *Contributions to total agricultural NRA*[a] *from different policy instruments, developing and high-income countries, 1972–76 and 1984-88 (percent)*

	1972	1973	1974	1975	1976	1984	1985	1986	1987	1988
(a) Developing countries										
Border measures										
Import tax equivalent	22	2	2	8	6	7	7	8	9	8
Export subsidies	4	0	0	1	1	1	1	1	1	1
Export tax equivalent	−26	−18	−24	−22	−9	−20	−10	−14	−19	−22
Import subsidy equivalent	−6	−5	−5	−2	−1	−1	−1	−1	−1	−2
All border measures	−22	−21	−28	−16	−4	−14	−3	−6	−11	−15
TOTAL NRA(incl. domestic measures)	3	−14	−29	−17	−2	−15	−2	−5	−9	−13
(b) High-income countries										
Border measures										
Import tax equivalent	25	18	15	21	30	33	34	50	49	42
Export subsidies	4	2	1	2	2	2	4	7	7	5
Export tax equivalent	0	−1	0	0	0	0	−1	0	0	0
Import subsidy equivalent	−1	−3	−3	−1	−1	0	0	0	0	0
All border measures	27	17	13	22	31	35	37	57	56	46
TOTAL NRA (incl. domestic measures)	29	18	13	24	32	46	52	70	69	59

Source: Authors' calculations based on NRA estimates from Anderson and Valenzuela (2008).

[a] All entries have been generated by dividing the producer subsidy equivalent of all (including domestic price, non-product-specific and 'decoupled') measures by the total agricultural sector's gross production valued at undistorted prices.

Table 8. *Contributions to total agricultural welfare and trade reduction indexes (WRIs and TRIs) from different policy instruments, developing and high-income countries, 1965–2004 (percent)*

	1965–71	1972	1973	1974	1975	1976	1977–83	1984	1985	1986	1987	1988	1989–2004
(a) WRI													
Developing countries													
Import tax equivalent	12	15	4	3	11	13	12	12	17	18	17	13	11
Export tax equivalent	19	16	31	34	28	18	23	30	22	28	33	32	10
Import subsidy equivalent	3	4	8	7	3	2	4	2	2	1	2	2	2
All (incl. domestic) measures	38	42	47	55	53	38	51	60	46	53	58	51	29
High-income countries													
Import tax equivalent	48	39	25	24	37	53	58	61	64	86	99	73	51
Export subsidies	7	6	3	1	3	3	4	4	7	11	11	8	5
All (incl. domestic) measures	57	46	34	31	41	60	66	68	77	113	119	83	61
(b) TRI													
Developing countries													
Import tax equivalent	9	13	3	2	10	11	9	10	13	14	15	11	9
Export tax equivalent	19	15	29	32	26	17	22	28	20	26	32	30	9
Import subsidy equivalent	−3	−3	−8	−7	−3	−2	−4	−2	−2	−1	−2	−2	−2
All (incl. domestic) measures	25	22	20	28	37	25	27	39	32	38	45	39	15
High-income countries													
Import tax equivalent	34	29	20	17	24	35	37	40	41	60	60	51	35
Export subsidies	−4	−4	−2	−1	−2	−2	−3	−3	−5	−8	−8	−6	−3
All (incl. domestic) measures	29	24	16	12	22	32	33	37	37	53	53	47	32

Source: Authors' calculations based on WRIs and TRIs in Anderson and Croser (2009).

Table 9. *Relative stability*[a] *of domestic producer and border prices of all covered agricultural products, 1955–84 and 1985–2004*

		1955–84	1985–2004
Africa	SDd/SDb	0.88	1.11
	CVd/CVb	1.06	1.15
	Zd/Zb	0.80	1.26
Developing Asia	SDd/SDb	0.67	0.71
	CVd/CVb	0.70	0.69
	Zd/Zb	0.88	0.80
Latin America	SDd/SDb	0.84	0.99
	CVd/CVb	0.96	0.99
	Zd/Zb	0.80	1.03
All developing countries	SDd/SDb	0.73	0.80
	CVd/CVb	0.80	0.79
	Zd/Zb	0.66	0.90
High-income countries	SDd/SDb	1.26	1.27
	CVd/CVb	0.94	0.93
	Zd/Zb	1.12	1.14
All focus countries	SDd/SDb	1.02	1.01
	CVd/CVb	0.88	0.86
	Zd/Zb	0.91	1.01

Source: Authors' estimates based on prices compiled by Anderson and Valenzuela (2008).

[a] SDd/SDb is the standard deviation of the domestic producer price relative to that for the border price, CVd/CVb is the coefficient of variation (the standard deviation divided by the sample mean) of the domestic producer price relative to that for the border price, and Zd/Zb is the *Z*-Statistic (defined in Eqn. (4) of the text) of the domestic producer price relative to that for the border price.

together, the indicators for the world as a whole suggest that market interventions by governments appear to have had very little impact in preventing domestic market prices from gyrating less than prices in international markets. As mentioned in Section 2 above, such an outcome is shown by Martin and Anderson (2011) to indeed be possible when food-exporting and food-importing countries both alter their trade restrictions in offsetting ways when prices move away from trend.

(j) *Summary of evidence*

The above empirical findings can be summarized as follows:

- Product NRAs are significantly negatively correlated with fluctuations around trend in the product's international price, with little more than half the movement in international food prices being transmitted to domestic markets within the first year;
- That insulation tendency appears to be no less in the two decades following the trade-related policy reforms that began in the mid-1980s than it was in the previous two decades;
- 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 both export and import measures contributing to that finding;
- The extent and speed of NAC changes in each spike period are similar for food-exporting and food-importing countries, suggesting both types of countries actively insulate their domestic market from international food prices spikes;
- The extent and speed of the annual NAC changes during an upward price spike were greater in the early 1970s than in the recent period to 2008, consistent with the fact that international food prices rose proportionately less per year in the latter period;
- The percentage change in the NAC was less for developing countries and more for high-income countries in the mid-1980s' downward price-spike period than in the two upward spike periods, suggesting that in developing countries consumers are more likely to be protected from

an upward price spike than producers would be from a downward price spike, and conversely in high-income countries;
- Border measures account for the vast majority of the distortions to producer prices in both high-income and developing countries, and in both agricultural-exporting and agricultural-importing countries; and
- Governments appear to have had very little impact in preventing domestic market prices from gyrating less than prices in international markets for agricultural products.

True, the above findings are based in part on distortion estimates for the most-recent food price spike that are preliminary and cover just border measures for the two main food staples. However, the behavior of policy makers indicated by those estimates is so similar to that indicated by past responses to price spikes that tentative policy implications can now be drawn with reasonable confidence, pending the availability of a more-comprehensive update of distortion estimates and more-elaborate statistical analysis of them.

4. POLICY IMPLICATIONS

Trade policy interventions are varied in response to international food price spikes to achieve various stated or hidden objectives of governments. The most commonly stated one 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, but those concerns could be better handled via monetary or exchange rate policies, respectively. As for downward price spikes, the commonly stated objective of altering a country's trade barriers is to protect poor farmers from income losses.

Corden (1997, pp. 72–76) suggests the pattern of intermittent border interventions, aimed at lowering the hurt to those adversely affected by an external shock even though it harms those helped by the shock and the overall economy, implies a conservative social welfare function. A more formal model of loss-averting reactions of governments, based on utility theory, has been developed by Freund and Özden (2008), building on the pioneering lobbying model of Grossman and Helpman (1994).[9] Helpful though this may be in explaining why governments intervene, more work is needed to explain why governments attempt to provide loss-averting assistance by varying their trade restrictions rather than via more-direct and thus more efficient domestic policy instruments.[10]

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 of extreme weather events. The larger the number of countries insulating their domestic markets, the more other countries perceive a need to do likewise, exacerbating the effect on world prices such that even greater changes in trade barriers are desired by each nation—both exporters and importers. They also transfer welfare between food-surplus and food-deficit countries, and may even add to rather than reduce poverty.

The above suggests there is considerable scope for improvement in national policy responses to price spikes, and for new multilateral initiatives.

(a) *Scope for improved national policy responses*

An additional justification sometimes given for price-stabilizing intervention in poor countries is that credit markets are underdeveloped, or inefficient because of local monopoly lenders, so low-income consumers and producers have difficulty smoothing their consumption over time as prices fluctuate. If that is the case, the first-best policy response would be to improve the credit market. The same is true for markets for futures and options (Sarris, Conforti, & Prakash, 2010). More generally, where domestic markets are underdeveloped, there can be a high payoff from investing more in efficient institutional arrangements (for such things as contract enforcement and market information services) and in infrastructure (transport, communications), as well as ensuring a level playing field in terms of incentives (Byerlee, Jayne, & Myers, 2006). Holding national public grain stocks is more problematic, not only because it crowds out private stockholding but also because bureaucrats are typically less likely than private firms to buy and sell optimally.

A price spike is but one of many situations in which an economic change disadvantages some households. There is a strong case for developing better 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 *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. Moreover, the information and communication technology revolution has made it possible for conditional cash transfers to be provided 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)).

(b) *Scope for new multilateral initiatives*

Clearly there is scope for governments to multilaterally agree to stop intermittently intervening in these ways. The World Trade Organization (WTO) is the most obvious place to seek restraints on variable trade restrictions. Indeed one of the original motivations for the Contracting Parties to sign the 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 have been set well above applied rates by most countries, leaving great scope for varying them without dishonoring those legal commitments.

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 import barriers above their bindings for a significant proportion of agricultural products in the event of a sudden international price rise or an import surge. This is the opposite of what is needed by way of a global public good to reduce the frequency and amplitude of food price spikes (Hertel, Martin, & Leister, 2010).

Moreover, proposals to broaden the Doha agenda to also introduce disciplines on export restraints have struggled to date to gain traction. [11] This reflects the facts that traditionally the demanders 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.

Could greater supply assurances from food-surplus countries, in the form of stronger disciplines on export restrictions, provide a Doha breakthrough? Potentially it could reduce the need for an SSM, which has been one of the more contentious issues in the Doha talks and the one that triggered their suspension in mid-2008. But more than that, it could reduce the concerns food-deficit countries have over relying on food imports in general, thereby increasing the chances of lowering not only the variance of but also the mean NRAs of those countries.

NOTES

1. 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).

2. Variable trade restrictions can also affect long-term investments and hence economic growth rates. 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 are more prone than farm households to squander the windfall either in poor investments or in extra consumption.

3. The new developing country estimates are less reliable than the high-income country ones, and 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 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 2008. Likewise, to overcome delays in obtaining export and import volumes and values, from which border prices could be derived, the authors simply used the Thailand 5% broken rice and Canadian wheat prices (from World Bank, 2010) to create indexes set at 100 for 2004 for those international reference prices, and the 2004 border prices in Anderson and Valenzuela (2008) were updated using the changes in each of those indexes through to 2008. The coefficients of correlation between those international reference prices and the border prices used for each of the developing countries in Anderson and Valenzuela (2008) over the period 1970–2004 are 0.58 for wheat and 0.69 for rice.

4. The coefficient of correlation between the NRA and CTE for the 75 countries and 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, Kurzweil, Martin, Sandri, and Valenzuela (2008).

5. 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 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 a policy's legislation– even though the use of that provision may lay dormant in all but extreme periods. In what follows such possibilities will be treated no differently than any formal change of policy: both will show up as a change in the NRA.

6. There is a risk that the estimations are biased by including the deviation of international price from trend as an explanatory variable. When it is excluded, the coefficients are very similar and the adjusted R^2 values are just one or two points lower (see Table 2.14 in Anderson, 2010).

7. 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.

8. 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, 2010), where production weights are used to calculate NRA averages (and consumption weights for CTE averages).

9. See also Thompson, Schmitz, Iwai, and Goodwin (2004), Tovar (2009) and Martin and Anderson (2011, 2012).

10. Even if the policy objective was explicitly to reduce food import dependence, Nettle, Britten-Jones, and Anderson (1987) show that trade policy alone is second best to an import tariff plus a tariff-funded production subsidy.

11. 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. 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).

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APPENDIX A. COUNTRIES IN THE AGRICULTURAL DISTORTIONS DATABASE

African developing countries	*European transition economies*
Benin	Bulgaria
Burkina Faso	Czech Republic
Cameroon	Estonia
Chad	Hungary
Côte d'Ivoire	Kazakhstan
Egypt, Arab Rep. of	Latvia
Ethiopia	Lithuania
Ghana	Poland
Kenya	Romania
Madagascar	Russian Federation
Mali	Slovak Republic
Mozambique	Slovenia
Nigeria	Turkey
Senegal	Ukraine
South Africa	
Sudan	*High-income countries*
Tanzania	Australia
Togo	Austria
Uganda	Canada
Zambia	Denmark
Zimbabwe	Finland
	France

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

Germany
Iceland
Ireland
Italy
Japan
Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
United Kingdom
United States

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

Source: Anderson (2009, Appendix B).