Agricultural Export Restrictions
(William Liefert, USDA, Economic Research Service, Organizer)

Export Restrictions and Price Insulation During Commodity Price Booms

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Prices of grains and other storable are characterized by long periods in the doldrums, punctuated by short but intense price spikes (Deaton and Laroque 1992). Those spikes are of concern not least because they can have large impacts on poverty in developing countries (Ivanic and Martin 2008). Accounts of the food price spikes of 1973–74, 2006–8 and 2010–11 include discussion of a wide range of contributing factors such as exogenous shocks to supply or demand, below-trend stock levels, speculative behavior, and trade policy responses to the shock. Johnson (1975) emphasizes policy responses in his analysis of the 1973–74 price spike, as have most of the available assessments of the 2006–08 shock (Baffes and Haniotis 2010; Bouët and Laborde 2010; Hochman et al. 2010; Robles, Torero and von Braun 2008).

Several suggest that export restrictions (and maybe also import subsidies) played an important role, just as intensified export subsidies and triggered import restrictions played a significant role in 1986–8 when international food prices slumped. However, we are unaware of any attempts to quantify the aggregate contribution across countries of trade policy responses to international price surges.

In this paper, we address this issue directly. Following Freund and Özden (2008), we assume national trade policy responds to the risk of losses for significant groups by insulating the domestic market to some extent from international price fluctuations for staple foods. This is consistent with the behavior of many governments, and it provides an economic rationale for the econometric estimation of price transmission elasticities. We use a standard conceptual framework to derive a simple equation that provides at least a rough way to estimate the contribution of domestic market-insulating policy behavior to international price spikes for homogenous farm products. We then examine evidence from two major upward price spikes (1973–4 and 2006–8) for the key commodities of wheat and rice. Policy implications are drawn out in the final section of the paper.

International Price Volatility and National Policy Responses

Consider a weather- (or financial market-) induced exogenous shock to the global market for a food staple that causes a surge in its international price. Suppose that, in response, exporting countries impose or raise an export tax or tighten export restrictions (or lower any export subsidy), and importing countries reduce their tariff or other import restrictions (or introduce or raise an import subsidy) to reduce the rise in their domestic price. If both sets of countries try to reduce the impact of the shock on domestic prices to the same extent, we show in our Working Paper version that their attempts will be collectively futile. Insulation generates 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

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standing, but any that remain seated get a worse view. This collective action is, unfortunately, not just completely ineffective—it generates an international public "bad" by amplifying the volatility in the world price of the product, and hence the volatility of the income transfers associated with terms-of-trade changes.

To assess the implications of price insulation on a homogenous product"s international price, p*, we begin with the global market equilibrium condition:

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

where S_i is the supply in region i; p_i is the region's producer price; v_i is a random production shift variable for that region; D_i is demand in region i (assumed not to be subject to shocks from year to year); and P_i is the consumer price in region i. We assume that $p_i = (1 + t_p)p^*$ where t_p is the distortion rate between the producer price and international price, and that $P_i = (1 + t_c).\ p^*$ where t_c is the distortion rate between the consumer price and international price. With a focus on border measures, we can use a single variable for the power of the trade tax equivalent, $T = (1 + t)$ where $t = t_p = t_c$.

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:

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

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 better or worse weather than average; η_i is the elasticity of demand; γ_i is the elasticity of supply; G_i is the share at international prices 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 in country i depends on the importance of that country in global supply and demand, as well as the responsiveness of its production and consumption to price changes in the country, as represented by γ_i and η_i. With large proportional changes in trade policies and other shocks, the effects are no longer purely additive as in equation (2) and we need to take into account the interaction between these two proportional changes.

A notable implication of equation (2) is that a uniform policy response by all countries ($\hat{T}$ is the same for all i) will make the elasticities of supply and demand irrelevant to the impact on international prices: if all countries alter their distortions by a uniform amount, the international price will change by an exactly-offsetting amount, leaving domestic prices unchanged.

If we assume that output cannot respond in the short run and that inventory levels are low enough that stock adjustments have limited effect, then $\gamma_i = 0$. If we further assume that the national elasticities of final demand for the product (η_i) are the same across countries, then equation (2) suggests we can estimate the contribution to international price changes resulting from changes in national trade policies as simply the negative of the consumption-weighted global average of the $\hat{T}_i's$.

Incidentally, if we consider the case where protection varies endogenously in response to changes in the international price, trade distortions are no longer an exogenous source of shocks, and international prices will change only in response to exogenous shocks such as weather-induced shocks to output. In this case, the counterpart to equation (2) is:

$$(3) \qquad \hat{p}^* = \frac{\Sigma_i H_i \hat{v}_i}{\Sigma_i (G_i \eta_i \theta_i - H_i \gamma_i \phi_i)}$$

where θ_i is the elasticity of transmission from the international price to the consumer price in country i; and ϕ_i is the elasticity of transmission from the international price to the domestic producer price. Where we focus only on trade measures, such that these elasticities of price transmission are the same, it follows that the impact of price insulation on the international price is larger the smaller are those price transmission elasticities. If the short-run elasticity of price transmission is, for instance, 0.5 in all countries (a finding in line with that of Anderson et al. (2010) for key commodities such as rice and wheat since 1985, and consistent with the results in Tyers and Anderson (1992) for earlier periods), the impact of any exogenous shock on the international price will be twice as large as it would be with full price transmission. In this situation, the variance of the international price will be four times as large as it would be in the absence of price insulation. If all countries used the price transmission elasticity of 0.15 implied by the 85 percent compensating duty under the proposed Special Safeguard Mechanism

(Hertel, Martin and Leister 2010), then the impact of any shock on the international price would be magnified by a factor of 6.7, and the variance by a factor of 44.

The Uruguay Round agreement of the WTO attempted to address this problem by banning variable import levies and other directly insulating policies, and by counting protection provided by measures involving administered prices under both the market access and domestic support measures. However, the Uruguay Round bindings on import tariffs and subsidies are at levels well above historically applied rates in most cases, providing room for countries to raise applied rates without infringing their WTO commitments. Furthermore, no effective disciplines yet apply in the WTO to variations in export restrictions. With that in mind, we turn now to seeing how much of a contribution insulating behavior of national governments had on international prices of rice and wheat in price spike periods before and after the Uruguay Round, that is, around 1974 and 2008.

The Cases of Rice and Wheat

The two food commodities that have received the most attention because of price surges are the key staples of wheat and rice. The length of their international price spikes around 1974 were broadly similar to those around 2008, but the height of the spike – particularly for rice – was greater in 1974. The recent price rises were more gradual though, so we consider an extra year (2005) in the lead-up to the 2008 spike.

Estimates of the T_i"s are available for all key rice and wheat countries, in the form of nominal assistance coefficients (NACs), from three sources. Anderson and Valenzuela (2008) provide them to 2004 for developing countries and to 2007 for high-income countries (summarized in Anderson 2009). They are similarly available for high-income countries for 2008 in OECD (2010). For developing countries, Anderson and Nelgen (2012) provide estimates based on FAO and World Bank data on producer and border prices, respectively, for 2005 to 2008. The most-recent developing country estimates are less reliable than the NAC estimates in Anderson and Valenzuela (2008), for several reasons. One is that the coverage is not as extensive, because domestic prices are not available for some countries. Another is that the FAO"s producer prices and World Bank international prices are not always as reliable as previously-used domestic and border prices from national statistical agencies. The FAO producer prices in US current dollars (FAO 2010) were converted into an index set at 100 for 2004, and the 2004 US dollar prices in Anderson and Valenzuela (2008) updated using the changes in these indexes through to 2008. Likewise, the Thailand 5 percent broken rice and Canadian wheat prices from World Bank were converted to indexes set at 100 for 2004, and the 2004 border prices in Anderson and Valenzuela (2008) updated using changes in those indexes through to 2008.

These NAC estimates are reported in table 1 for the two upward price spike periods. For each of the regions shown, as well as for the world as a whole, the patterns are strikingly similar: falls in the NAC as the international price rose. The proportional changes in NACs in the first half of each spike differ across products and country groups, however. As shown in figure 1, the proportional change was very similar for high-income and developing countries in the 1970s spike, albeit only half as large for wheat as for rice. In the more recent spike, the proportional change for high-income countries was somewhat smaller in the case of rice and very much smaller in the case of wheat than for developing countries.

Assuming that output was able to respond only to a limited degree in the first half of each spike, and that the national elasticities of demand (including stock demand) are similar across countries for each product, we set the γ_i"s to zero and use equation (2) to estimate the contribution to international price changes of price-insulating behavior resulting from national price-insulating policy behavior is the (negative of the) consumption-weighted global average change in the national T_i"s. For rice the cumulative decline shown in the world row of table 1 was 46 percent between 2005 and 08, which is in the same order of magnitude as the decline between 1972- and 1974 of 58 percent. For wheat, the globally-weighted $\hat{T}$ was −28 percent over the 2005–08 period, compared with −30 percent in 1972–74.

According to World Bank price data, the world price of rice increased by 127 percent between 2005 and 2008, and the price of wheat increased by 114 percent. By taking the interactions between the proportional changes in trade policy and other factors into account, we can estimate the magnitude of the non-trade shocks. Comparing these with the

Table 1. Weighted Average T_i"s for Rice and Wheat,[a] 1972–76, and 2005–08

Rice	**1972**	**1973**	**1974**	**1975**	**1976**	**2005**	**2006**	**2007**	**2008**
World	**1.30**	**0.93**	**0.54**	**0.90**	**0.98**	**1.33**	**1.24**	**1.15**	**0.72**
High-income countries	3.06	2.29	1.26	1.71	2.35	3.35	2.66	2.28	2.10
Developing countries	1.03	0.73	0.45	0.82	0.87	1.25	1.19	1.10	0.66
ASIA	1.03	0.71	0.42	0.82	0.86	1.24	1.17	1.08	0.66
Africa	0.97	0.60	0.38	0.66	0.86	0.99	1.09	1.29	0.70
LAC	1.00	1.08	0.89	0.90	0.98	1.51	1.46	1.39	0.86
Wheat	**1972**	**1973**	**1974**	**1975**	**1976**	**2005**	**2006**	**2007**	**2008**
World	**1.15**	**0.81**	**0.81**	**0.95**	**0.94**	**1.19**	**1.14**	**1.02**	**0.86**
High-income countries	1.11	0.83	0.80	0.90	0.92	1.20	1.17	1.04	1.03
Developing countries	1.22	0.77	0.81	1.02	0.96	1.18	1.13	1.00	0.75
ASIA	1.33	0.82	0.88	1.02	0.94	1.21	1.15	1.01	0.70
Africa	1.03	0.75	0.63	0.82	0.92	1.15	1.03	0.93	1.08
LAC	0.95	0.57	0.67	1.11	1.07	1.02	1.02	0.97	0.84

[a]Weights are consumption shares for the sample countries. *Source:* Anderson and Nelgen (2012).

Figure 1. Percentage changes in T_is for rice and wheat, high-income and developing countries, 1972–74, 1984–86, and 2005–08.

Source: Anderson and Nelgen (2012).

estimated trade shocks suggest that in 2005–08 more than 45 percent of the explained change in the international price of rice is due to the changes in border restrictions that countries used in an attempt to insulate themselves from the initial increases in price. For wheat, the corresponding estimate was 29 percent. In 2008 alone, the change in protection on rice explains almost half of the 90 percent increase in rice prices observed for that year.

One important and encouraging difference between the 2008 price surge and the earlier one around 1974 is an apparent sharp reduction in the extent of price insulation in high-income countries. For rice, their NAC declined 45 percent between 1973 and 1974, while it fell only 8 percent between 2007 and 2008. In the case of wheat, the comparable numbers were 28 percent and 12 percent. While desirable, the reduction in insulating behavior by these countries has a very limited beneficial impact in the world market for rice as the high-income countries account for only 5 percent of world rice consumption. For wheat, where high-income countries have a consumption share of 28 percent, the benefit is likely somewhat greater. However, it is clear from these trade shares that the key trade policy influence on the stability of world markets is what happens in developing countries.

Are rice and wheat representative of other farm products in terms of insulating behavior by governments? There is no global database for all farm products for the most recent spike period, but there is for the upward spike of 1974–6 and the slump of 1984–8. Anderson and Nelgen (2010) decompose the nominal rate of assistance (NRA) estimates, for the overall agricultural sector of all 75 countries in the Anderson and Valenzuela (2008) database, into the various border and domestic measures for developing and high-income countries. The annual estimates summarized for the upward spike period of 1972–76, and the downward spike period of 1984–8, are reported in table 2.

Table 2. Contributions to Total Agricultural NRA[a] from Different Policy Instruments, by Region, 1972–76 and 1984–88, %

(a) Developing countries	1972	1973	1974	1975	1976	1984	1985	1986	1987	1988
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	1972	1973	1974	1975	1976	1984	1985	1986	1987	1988
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**

[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. Source: Anderson and Nelgen (2010).

Export restrictions were the dominant instrument for developing countries in both of those periods; they became more and then less important in the upward spike period of 1972–76, and conversely in the downward spike period of 1984–88. In high-income countries there were virtually no taxes or other restrictions on exports, but export subsidies followed the same path as import tariffs over those spike periods: U-shaped during the upward spike, inverted U-shaped in the downward spike. Together these estimates suggest the experiences with rice and wheat are not inconsistent with the pattern for farm products in general, especially when bearing in mind that the NRA estimates in table 2 include numerous nontradable products whose NRAs tend to remain close to zero and hence dampen year-to-year fluctuations in the aggregate estimates.

Conclusions and Policy Implications

Trade policy changes—and particularly export restrictions—are frequently discussed as contributing factors to food price surges. This paper examines the role of trade barriers in contributing to surges. It first highlights the collective action problem associated with the use of these measures as stabilization policies, noting that the use of these measures by all countries would be ineffective in stabilizing domestic prices, while magnifying international price instability associated with exogenous shocks to food markets. We develop a simple approach to assessing the contribution of price insulating trade policy actions on international price changes for individual agricultural commodities, and use this approach to estimate the extent to which changes in trade policy measures have contributed to price surges for the key staple foods of rice and wheat.

Our analysis shows that changes in trade policies contributed very substantially to the increases in world prices of these staple crops in both the 1973–4 and 2006–8 price surges. In the 2006–8 surge, insulating policies affecting the market for rice explain 45 percent of the increase in the international rice price, while almost 30 percent of the observed change in the international price of wheat during 2005–08 can be explained by the changes in border protection rates.

The evidence in figure 1 suggests that at least high-income countries altered their NACs less in the most recent price spike period than in the two previous ones. That is not inconsistent with the fact that the Uruguay Round Agreement on Agriculture, which came into force with the creation of the WTO in 1995, involved commitments to bind tariffs and subsidies. Nor is the finding that developing countries are still very active users of variable border measures and especially export restrictions, given (a) that developing country bindings are well above applied rates and (b) that the WTO has no effective restrictions on agricultural export measures. However, more-comprehensive empirical analysis over a broader range of products is needed before it would be possible to say how much of these changes can be attributed to WTO disciplines.

Since bindings on import tariffs and subsidies even for many high-income countries were made at levels well above historically applied rates, plenty of "wiggle room" for countries to raise applied rates without infringing their commitments to other WTO members remains. Furthermore, with no effective disciplines yet applying to export restrictions, the WTO membership is yet to address the other half of this beggar-thy-neighbor problem. And if a Special Safeguard Mechanism were to be introduced as part of a Doha Development Agenda agreement, the problem would be become even worse (Hertel, Martin and Leister 2010). An obvious solution is to seek a collective agreement to limit the extent of price-insulating policy use. Perhaps the most-recent experience with price spikes in 2005–8, and again in 2010–11, will make WTO members more willing to address this issue.

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