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Food Price and Supply Stabilization: National Buffer Stocks and Trade Policies

David Bigman and Shlomo Reutlinger

Trade policies are likely to have a greater impact on the stability of a country's food grain supply than any reasonable size buffer stock. At the margin, countries need to trade off the cost of additional stocks against the cost of unstable foreign exchange balances associated with free trade. A stochastic simulation model is specified to assess the impact of trade and buffer stock policies on the stability of consumption and prices and the expected values and standard deviations of costs and gains to consumers, producers, and the government, and the balance of payments.

Key words: buffer stocks, food grains, stabilization, trade policies.

The stability of food grain supply and price is of continuous concern to many governments. In the past decade, fluctuations of grain prices and the threat of widespread famine in times of major crop failures have become a major preoccupation of the international community. In most discussions, both at the theoretical and at the policy-making level, attention is on national and international stock policies as the main instrument of stabilization (Turnovsky). In practice, however, most governments are engaged in a wide variety of policies that have direct or indirect effects on food grain supply and price. They include subsidies to low income families, support prices to farmers, and various trade policies relating to agricultural products (Sarris, Abbot, Taylor).

The effects of international trade, in general, and of trade policies, in particular, on domestic food grain supply and prices have not always been appreciated adequately; and as a result, free trade in these products is unpopular in many quarters. It often has been accused of depressing agricultural production in importing countries, increasing their dependence on the exporters of these products, and thereby exposing them to a higher risk of shortages in supply. At times of poor domestic harvests and/or high prices for imported grain, it is not uncommon for governments to pronounce themselves in favor of large buffer stocks while protectionist sentiments grow stronger. Free trade is presumed to "import" instability because of the growing dependence on surpluses that may be temporary. Isolation from the world market combined with national stock policy would thus not only encourage domestic food production but also reduce instability in the domestic market.

This paper has three principal objectives: first, to analyze the effects of international trade on the domestic market of food grains, particularly on the stability of domestic supply and price; second, to examine the contribution of internal policies—notably subsidy and stock policies—and of external policies—notably free trade versus restricted trade—on the stability of grain prices and supplies; third, to provide estimates for the direct financial costs, the overall economic costs, and the distributional consequences of the various policies and programs.

We commence the analysis by discussing the limitations of some of the strong assumptions which are necessary in the more stylized models generally used in the theoretical litera-

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This paper is part of an extensive study undertaken by the World Bank (RPO 671-24) on various aspects of food market stabilization policies. Some results have been already reported by Reutlinger; Reutlinger, Eaton, Bigman; and Bigman and Reutlinger.

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ture. To overcome these limitations, we develop a simulation model which provides a framework for analyzing (*a*) the extent to which annual instability in a country's food grain production and the world market price of food grains translate into instability in the country's food grain consumption and price under alternative trade policies and market structures, and (*b*) the extent to which a buffer stock of varying sizes contributes stabilization, at what social and financial costs or gains, to producers, consumers, and the government. While our method of analysis lends itself to consideration of a wide range of domestic and external trade policies, we have opted to emphasize the effect of protectionist trade policies. Our analysis leads to the conclusion that for most countries, especially the developing countries, free trade and avoidance of protectionist policies would be a far more powerful instrument for stabilizing domestic grain prices and ensuring the continuity of supplies than any reasonably sized buffer stock.

The Analytical Framework

The merits of stabilization policies from a theoretical point of view have been discussed quite extensively by economists. Most have taken the approach initially advanced by Waugh, Oi, and Massel (1969, 1970) and have examined the welfare implications of price stabilization as measured by changes in consumer and producer surplus. The early literature on the subject dealt with a single market in a close economy. In recent years, however, increasing attention has been paid to price stabilization in international trade. Hueth and Schmitz have extended the basic framework of Waugh, Oi, and Massel to examine the welfare gains from stabilizing the price of internationally traded goods. Just et al. (1977) examined the distribution of welfare gains from international price stabilization under distortions.

It has been recognized, however, that the scope of this analytical framework is quite limited because a number of common assumptions underlying the Waugh-Oi-Massel analysis and most of the subsequent literature are highly restrictive (see Just et al. 1976, 1977; Turnovsky). First, a key assumption in most of these works is that of linear demand and supply schedules. Recently it has been demonstrated that certain important propositions of this analysis do not generalize to the nonlinear case. Second, a typical assumption in this model is that of complete price stabilization, achieved by means of a sufficiently large buffer stock; that is, a buffer stock of the commodity is set up which is large enough to ensure a fixed price for any random disturbance. It is quite apparent that the cost of a "sufficiently large" stock required for complete stabilization invariably would exceed the gains. In practice, the authorities are more likely to set an upper limit on storage capacity and to engage in only partial stabilization. Practical interest, therefore, focuses on gains and costs from partial stabilization and on the degree of stability achievable with a given storage capacity. Third, the costs of operating the buffer stocks and maintaining the storage facilities generally are ignored. Our analysis shows that taking these costs into account drastically changes and often reverses the conclusions about the benefits of stabilization. Fourth, the Waugh-Oi-Massel analysis assumes supply and demand to be determined by the actual market price. On the supply side, especially with regard to agricultural commodities, this assumption is unrealistic because most, if not all, production decisions are made before the actual price is known (on the basis of expected price). Fifth, in the context of the two-country model, the analysis of Hueth and Schmitz assumes away trade barriers such as transportation costs and tariffs. For a country which is normally self-sufficient, these barriers may prohibit trade even when there is a price differential between the domestic and the international market. Trade will be permitted only at times of a severe shortfall or large excesses in domestic production. From an analytical point of view, taking these barriers into account may make the analysis almost unmanageable.

These restrictive assumptions, which are rather technical in nature, raise serious doubts about the validity of the propositions emerging from the Waugh-Oi-Massel type analysis. We find, however, more fundamental difficulties with this approach. Most important, this analysis evaluates the desirability of price stabilization on the basis of welfare gains only. Stabilization is presumed to be desirable only to the extent that it increases the combined consumer and producer surplus. We argue that while economic efficiency is an important consideration, it is only one among several objectives of stabilization policy. In most countries the primary objective of buffer stocks and other stabilization policies is to ensure a regular flow of supplies to consumers and to meet the needs of vulnerable sections of the population. A recent study undertaken by the United Nations Food and Agriculture Organization (FAO) shows that most countries rate the insurance of a continuous flow of supply as the main objective of their cereal stock policies. The promise of welfare gains "over the long run" from price instability provides only little comfort to consumers who may find themselves unable to buy food at times of very high prices. In our view, the expected economic and financial losses to consumers, and possibly also to the economy at large, due to price stabilization should be regarded as an insurance premium paid by the market participants in order to avoid scarcity and famine. In addition, stabilization of food prices may have significant macroeconomic effects which a complete cost-benefit analysis must take into account.

Another weakness of this analytical work is its vagueness regarding the mechanism and the specific policy instruments engaged in stabilization. Typically, in this literature the desirability of price stabilization is assessed by comparing two extreme cases: one in which prices are permitted to fluctuate freely, and the other in which the price is fixed. In practice, governments implement a variety of policies affecting the level of stability of commodity prices, such as price supports for farmers, subsidized rations to low income consumers, and various controls on imports and exports. In assessing the desirability of buffer stocks, for example, the relevant question is what are the incremental effects of stocks on prices and on welfare, given the price policies which already are practiced. In a more general context, the inquiry should be extended to analyze the effectiveness of different combinations of policies in achieving prespecified stabilization goals.

Finally, little attention has been paid in the literature to the stabilizing (but potentially also destabilizing) effects of international trade per se. An open economy can offset potential price instability caused by fluctuations in domestic supply through exports and imports. On the other hand, trade can transmit fluctuations in supply in other countries to the domestic market. Consequently, the possible gains from stabilization measures in a given country will differ substantially in the presence or absence of trade.

The stochastic simulation model presented was developed to demonstrate that economists can do better in providing analytical underpinnings to policy than to espouse general propositions whose validity depends on a large number of unrealistically restrictive assumptions about the nature of the problem and the objectives of stabilization policy. We have no reservations in recommending the stochastic simulation-modeling approach for the purpose of analyzing the consequences of policy in a specified environment. However, we are aware, and the reader should be aware, that this approach cannot and does not yield readily definable generalizations because the results will depend on the specific parameters applied in the analysis. By means of sensitivity analysis we are able, however, to determine the range of applicability of our conclusions.

The Model

The model is of an open economy principally concerned with stabilization policies for food grains. It examines the effects of random fluctuations in the country's production and in the international price of grain on the various parameters of the domestic market, such as prices, quantities available for consumption for individual consumer groups, welfare gains and losses, the fiscal budget, and the balance of payments—given a set of policies implemented by the government. The country is assumed to be "self-sufficient" in the sense that in a "normal" year, when both the country's production and the world price are at their median level, there would be no differential between the price in the world and in the country to provide an incentive for trade. Yet random fluctuations in the supply of either the country or the world may create at times price differentials to an extent that despite transportation costs and tariffs, imports or exports could occur. Thus, even countries which embark on the objective of self-sufficiency in food supply can realize substantial gains from trade as a consequence of (uncorrelated) random fluctuations between food grain production in the country and in the rest of the world.

For any given level of grain production in the world and in the country, the model estimates (*a*) world price; (*b*) price and quantity of grain consumed, stored, and traded by the country; and (*c*) gains and losses to consumers, producers, government, and society. The structure of the model is described briefly below.

World Price

Examination of the effect of trade policies on the stability of a country's grain market requires an estimate of the distribution of the world price. Because there is little direct historical evidence for estimating future variability of the world price, a simple (much too simple a model for other purposes) world price model is postulated which transforms any production level into a world price on the basis of a prespecified world demand function. World production is a random variable with a specified probability distribution.

Country's Production

Production of grain in the country is a random variable with a specified probability distribution. In the present version of the model, planned production remains constant, i.e., the model is stationary. The implicit assumption permitting extrapolation of the results from the model over time is that the growth rates of food production and consumption are equal, so that the country remains self-sufficient. Allowances are made for the possibility of year-to-year serial correlation in production and for correlation between the country's production and world production (and, therefore, the world price).

Country's Demand

The country's demand for grain is assumed to consist of the combined demand of two consumer groups defined by income levels, a low income group and all other consumers. The government is assumed to have an explicit food policy by which the low income group's consumption is assured not to fall below a desired level by means of an adequate subsidy program. The demand function for the economy at large is piecewise linear with a kink at the mean, reflecting the inelastic demand induced by the government's intervention on behalf of the low income group when supplies are scarce.

International Trade

Trade activities between the country and the world are carried out by the free market within limits of a specific trade policy implemented by the government. Thus, grain is imported when the domestic price exceeds the import price and exported when the export price exceeds the domestic price. Import and export prices are determined by the world price, transportation costs, and tariffs. The instruments for enforcing government goals with respect to trade are tariffs. Those goals need not be restricted to the balance of payments and we also have considered policies deliberately designed to prevent wide fluctuations in supply or price beyond certain critical levels caused by trade. Thus, exports are not permitted when the quantity available for domestic consumption is below a prespecified lower level, and import is restricted never to let the domestic price fall below a specified lower limit.

Storage Policies

Storage policies consist of rules which determine the desired amount of grain to be stored or released in any year and a storage capacity constraining the actual level of storage activity. In the present paper, storage rules are defined by a quantity band. Within the boundaries of the band, supply is allowed to fluctuate freely with no storage activity. When domestic production (Q) exceeds the upper limit of the band (Q_H), the amount of grain stored is the excess of production above Q_H—up to the capacity limit of the facility. When production is less than the lower limit of the band (Q_L), the amount of grain taken out of storage is the amount by which production falls short of Q_L—up to the quantity limit of grain available in storage.

It should be noted that trade and storage activities can substitute for each other on occasion to achieve stabilization objectives. When production is short, the world price is low and stored up grain is available, grain can be imported or withdrawn from storage. Likewise, when production is plentiful, export prices are high and there is vacant storage capacity, grain can be exported or stored. We assume that the authorities emphasize the food security aspect of the storage operations; and thus grain is imported prior to releasing from storage in times of scarcity, and excess supply is put first into storage and only the remaining quantity is released for exports in times of good domestic harvest.

One point is worth emphasizing with respect to these storage rules: the domestic price in any given year depends on the quantity produced domestically, the world price, and the quantity of grain in storage—or the vacant storage capacity—at that year. The latter, in turn, depends on the quantities of grain produced domestically, on world prices in previous years, and on the initial stock and the storage capacity. Consequently, some degree of serial correlation is introduced into the time series of domestic prices due to the storage operations, even when production events are not correlated.

Gains and Losses from Stock Operation

The gains and losses from buffer stocks to society and their distribution among consumers, producers, and the government depend largely on the difference between the price of grain with and without stock operations. When grain is withdrawn from the market into storage, the price is raised; consumers lose and producers gain. Vice versa, when grain is withdrawn from storage to augment current supply, the price is reduced; consumers gain and producers lose.

These gains and losses, as well as the costs and revenues to the government when grain is put into or withdrawn from storage, are illustrated in figures 1(a) and 1(b) and are summarized in table 1 in terms of the designated areas on the graph. The quantity available for current consumption without storage is Q and with storage Q'. P and P' are the corresponding prices without and with storage.

Data and Parameters

The specific parameters selected for the simulation experiments are not representative of any particular country; they are, however, deliberately chosen to approximate orders of magnitude of a country like India. This section describes briefly the data and parameters underlying illustrative results presented in the next section.

The results reported in this paper were obtained by simulating 300 runs of thirty-year sequences of random production "events." The total sample size consists, therefore, of 9,000 observations drawn at random from the specified probability distributions.

The country is assumed to produce an average of 110 million tons of food grains. Specifically, production is assumed to be distributed normally, with a mean of 110 million tons and a standard deviation of 7 million tons.

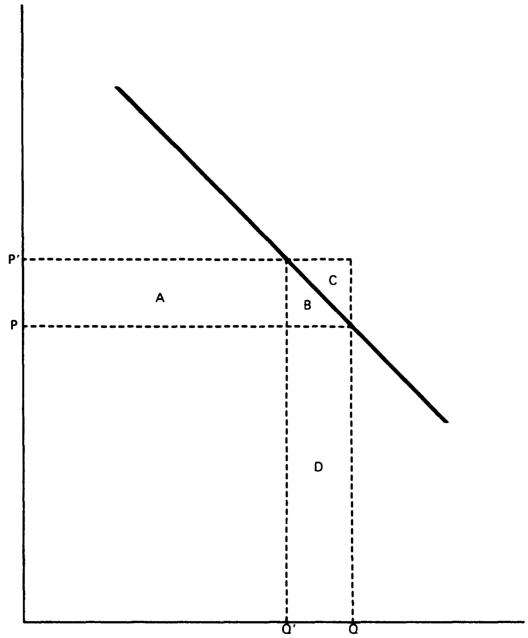

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Figure 1(a). Gains and losses from storage operation: grain into storage

Total market demand is assumed to be the sum of the separate demand of "low" and "high" income consumers. Consumption of

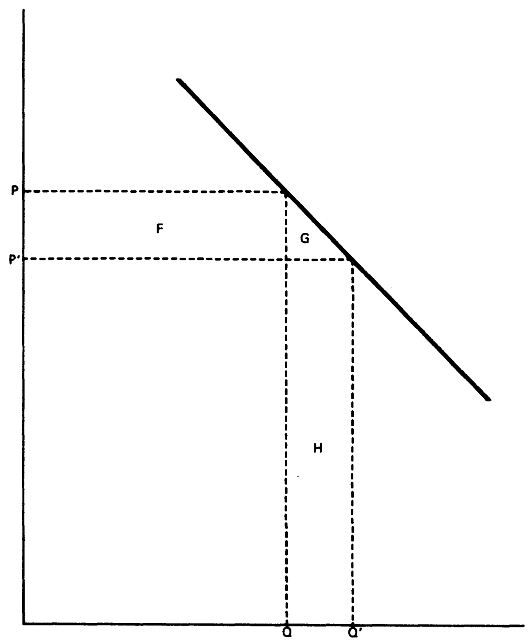

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Figure 1(b). Gains and losses from storage operation: grain out of storage

Table 1. Types of Gains and Losses When Grain Is Stored and When Grain Is Withdrawn from Storage by Reference to Areas Shown in Figure 1a–1b

Types of Gains and Losses	Designated Area of Gain or Loss
Grain into storage [Fig. 1(a)]	
Consumers	− A − B
Producers	A + B + C
Government (financial)	− B − C − D
Overall (economic)	− B − D
Grain withdrawn from storage [Fig. 1(b)]	
Consumers	F + G
Producers	− F
Government (financial)	H
Overall (economic)	G + H

the "low" income population is maintained through government intervention at a minimum level. This level is assumed to correspond with the "low" income population's consumption at the median price of $125 per ton. The consumption maintenance policy is implemented through a price subsidy scheme for the low income population. The specific parameters of the demand schedules adopted for the numerical analysis are listed in table 2. Equal food grain consumption by the low and the high income group at the median price of $125 subsumes that the low income group consists of more than half of the total population and per capita consumption is less in the low income group.

World wheat production is assumed to be distributed normally, with a mean of 350 million tons and a standard deviation of 14 million tons. This distribution is transformed to a distribution of the world price on the basis of a kinked demand function. At the mean level of world production, the price is $125 per ton, and the price elasticities of the two segments of the demand function at that point are as follows:

$$\eta = 0.1 \text{ for } P > \$125$$
$$\eta = 0.3 \text{ for } P > \$125.$$

Notice that while production is assumed to be distributed normally, the transformed distribution of price is skewed, with its mean being larger than the median.

Shipping costs are assumed to be $25 per ton. Trade policies are implemented by the level of tariff. In any event, imports are not permitted to reduce the domestic price below .95 of the median price (i.e., increase total supply above 112 million tons). Exports are not permitted to reduce the quantity available for domestic consumption below 108 million tons. In addition, the following general three trade policies are examined in the base case: Free Trade, no tax is imposed on exports or imports; Restricted Trade, the government imposes a tax of $25 per ton on all imports and exports; No Trade, the government imposes a tax high enough to rule out all trade.

Grain production in excess of 112 million tons is put into storage to the extent that there is vacant storage capacity. Grain is taken out of storage when domestic production is less than 108 million tons to the extent of the deficit or to the extent of available stocks in storage, provided the world price is so high as to prevent any imports. A handling charge of $2 per ton is assumed at the time grain is loaded into storage. The rate of interest is 8%; construction costs are assumed to be $100 per ton of capacity and storage facilities are assumed to be amortized within a period of thirty years.

Simulation Results

Tables 3 and 4 summarize the stabilization effects of buffer stocks and of the three trade policies. Our attention is given to the stability of food grain supply, and specifically, on the lower tail of its probability distribution;

Table 2. Country Demand Parameters

	"Low" Income Population	"High" Income Population	Total Population
Quantity consumed (million tons) at $P = \$125$	55	55	110
Price Elasticity of demand			
for $P < \$125$	0.4	0.2	0.3
for $P > \$125$	0.0	0.2	0.1

Table 3. Stability of Food Grain Consumption under Alternative Trade Policies, with and without a Buffer Stock

	No Trade		Restricted Trade		Free Trade	
Storage Capacity: (mill. tons):	0	6	0	6	0	6
	Probability (%)					
No Correlation between Country and World Production						
Consumption (million tons)						
< 100	7.2	4.2	0.8	0.4	0.3	0.1
100 – 105	16.3	9.9	9.8	5.2	5.9	2.9
105 – 115	52.9	72.0	72.4	83.6	81.1	88.0
115 – 120	16.0	10.2	12.4	8.3	11.0	8.0
> 120	7.6	3.7	4.6	2.5	1.7	1.0
Correlation (R^2 = 0.3) between Country and World Production						
Consumption (million tons)						
< 100	7.2	4.2	1.8	1.0	0.7	0.3
100 – 105	16.3	9.9	12.4	7.3	8.5	4.8
105 – 115	52.9	72.0	65.8	78.8	74.2	83.2
115 – 120	16.0	10.2	14.1	9.7	13.5	9.7
> 120	7.6	3.7	5.9	3.2	3.1	1.9

Table 4. Stabilization Effects of Buffer Stocks and Alternative Trade Policies

	No Trade		Restricted Trade		Free Trade	
Storage Capacity (mill. tons)	0	6	0	6	0	6
No Correlation between Country and World Production						
Consumption (mill. ton)						
Average	110	110	110	110	110	110
(standard deviation)	(6.9)	(5.3)	(5.0)	(4.0)	(3.9)	(3.3)
Price ($/ton)						
Average	145	140	139	136	136	134
(standard deviation)	(54)	(43)	(35)	(28)	(27)	(22)
Balance of trade ($ mill.)						
Average	—	—	3	−2	−4	−16
(standard deviation)	—	—	(600)	(515)	(767)	(696)
Subsidy payments ($ bill.)						
Average	1.70	1.20	1.17	0.93	0.90	0.75
(standard deviation)	(2.5)	(2.05)	(1.47)	(1.18)	(1.15)	(0.90)
Farmers' revenue ($ bill.)						
Average	15.65	15.20	15.07	14.82	14.80	14.64
(standard deviation)	(4.75)	(3.60)	(3.04)	(2.30)	(2.43)	(1.94)
Correlation (R^2 = 0.3) between Country and World Production						
Consumption (mill. ton)						
Average	110	110	110	110	110	110
(standard deviation)	(6.9)	(5.3)	(5.6)	(4.5)	(4.6)	(3.8)
Price ($/ton)						
Average	145	140	140	137	137	135
(standard deviation)	(54)	(43)	(40)	(32)	(32)	(26)
Balance of trade ($ mill.)						
Average	—	—	−40	−31	−54	−43
(standard deviation)	—	—	(452)	(392)	(626)	(567)
Subsidy payments ($ bill.)						
Average	1.70	1.25	1.30	1.00	1.00	0.85
(standard deviation)	(2.50)	(2.05)	(1.70)	(1.40)	(1.35)	(1.10)
Farmers' revenue ($ bill.)						
Average	15.65	15.20	15.10	14.85	14.85	14.65
(standard deviation)	(4.75)	(3.60)	(3.40)	(2.60)	(2.80)	(2.20)

namely, the events of extreme shortfalls in the quantity available for consumption.

A noteworthy characteristic of our results is the strong stabilizing effect of international trade which far exceeds the effect of a sizeable buffer stock. The standard deviation of the quantity available for consumption is 6.9 million tons (6.3% of mean consumption) in the closed economy compared with 3.9 million tons (3.5% of mean consumption) under free trade. The probability of a shortage in excess of 5 million tons is 23.5% in the closed economy compared with 6.2% under free trade. In contrast, a buffer stock of 6 million tons in the closed economy reduces the standard deviation of the quantity available for consumption from 6.9 million to 6.3 million tons and the probability of a shortage in excess of 5 million tons from 23.5% to 14.1%. Equally noteworthy is the fact that as the country becomes more open to trade, the additional stabilizing effect of buffer stocks is progressively reduced. Thus, for instance, a buffer stock of 6 million tons reduces the standard deviation of the quantity available for consumption by 25%—from 6.9 million tons to 5.3 million tons—in the closed economy but by only 15%—from 3.9 million to 3.3 million tons—in the open economy.

The extent to which trade and stocks stabilize grain consumption and prices will depend, of course, on the relative variability of the world price and the country's price in the absence of trade. The country's price in the absence of trade will depend on its production variability and the shape of its demand function. To investigate the sensitivity of our conclusions, we simulated the effects of trade and stocks under two alternative assumptions about the variability of production in the country: "more stable" production (a coefficient of variation half that assumed in the base case) and "less stable" production (a coefficient of variation twice that assumed in the base case). The standard deviation of price ($/ton) with free trade or, alternatively, with a 6 million ton buffer stock under different scenarios is as follows:

	No Trade No Stock	Free Trade	6 Million Ton Stock
Base case	54	27	43
"More stable" production	27	19	21
"Less stable" production	108	33	94

Our results also indicate that a moderate degree of correlation between the country's grain production and that in the world does not change our basic conclusions. With a correlation coefficient of $R^2 = 0.3$, for instance, the standard deviation of the quantity available for consumption would still be reduced by 35%—from 6.9 to 4.6 million tons—with free trade (compared, however, with 45% when there is no such correlation).

Figure 2 illustrates the extent of supply stabilization attained by the three trade policies and by increasing sizes of buffer stocks (storage capacities). Here attention is given the availability of food grain for consumption measured by the probability of a serious shortfall in grain consumption. The graph illustrates that even as large a buffer stock as 12 million tons (11% of annual average consumption) would not provide the same degree of protection against extreme shortfalls as would free trade. The slope of the curves manifests the marginal stabilizing effect of each additional unit of storage capacity. Clearly, the marginal effect becomes smaller as trade restrictions are relaxed, and in all cases it declines sharply with increases in storage capacity. For instance, an increase in storage capacity from 6 million to 9 million tons would reduce the probability of a shortage in excess of 5 million tons from 14% to 11% if no trade is permitted, but from 3% to only 2.5%, if trade is free. Without trade, increasing the storage capacity from 0 to 6 million tons would reduce the probability of a shortage in excess of 5 million tons from 24% to 14% but a further increase from 6 million to 12 million tons would reduce this probability only from 14% to 11%.

One conclusion of these results is that the stabilization benefit from a buffer stock is generally much higher in a closed economy than in an economy open to trade. The diminished effect of stocks in an open economy also is reflected in its economic and financial benefits and costs. In general, net gains from storage operation are larger, the larger is the number of transactions (acquisitions for and sales from storage) and the larger is the difference between the price at which grain is purchased and sold.

In the free market economy, trade activities can replace storage activities and the variability of grain prices is generally reduced. As a result, buffer stocks would be operated much less frequently and the differential between

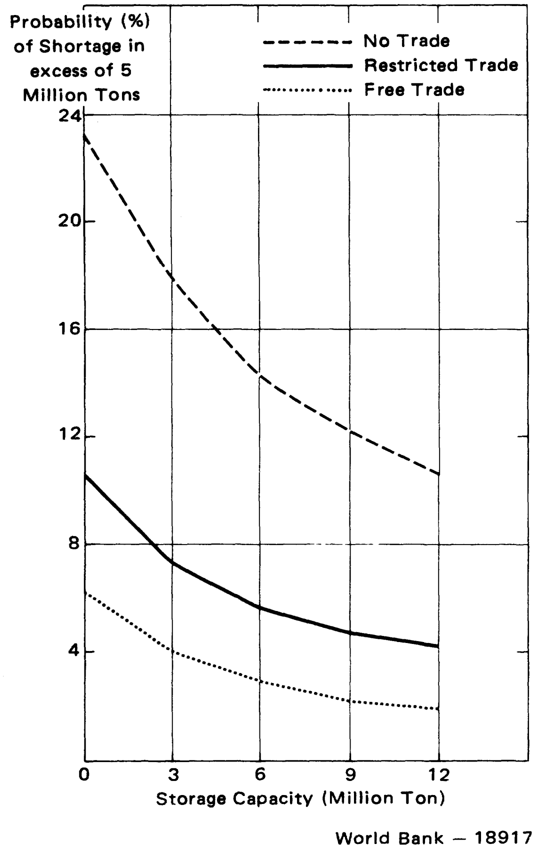

Figure 2. Relative frequency of serious supply shortfall with alternative storage capacities and trade policies

the purchase price and the sale price would be considerably lower in the open economy. The net result would be smaller gains, and even losses, from the operation of the storage facility to the extent that the amortization costs would far outweigh any possible gains.

Table 5 summarizes the gains and losses to society as a whole and their distribution among consumers, producers, and the government from a 6 million ton capacity storage operation. In a closed economy, net annual economic losses from a 6 million ton buffer stock would be relatively small ($12 million annually). However, in an open economy, the same size of buffer stock would not only contribute much less to stabilization but would also be much more costly ($70 million annually).

The distribution of losses and gains is, however, by far more important than the overall amounts. With the demand function specified in our model, price stabilization normally would yield gains to consumers and losses to producers. Our results show, however, that consumers would suffer losses rather than gain. The reason is that under the postulated subsidy program, low income consumers do not gain from the reduction in price when grain is removed from storage. They would pay the same subsidized price regardless of the actual market price when supplies are scarce. When

Table 5. Annual Economic and Financial Gains (Losses) from a 6 Million Ton Capacity Storage Operation

	No Trade	Restricted Trade	Free Trade
No Correlation between Country and World Production			
($ million)			
Total economic gains	−12	−59	−73
Consumer gains	−30	−35	−8
Producer gains	−380	−180	−125
Storage operation account[a]	−37	−62	−79
Change in tax revenue[b]	—	−12	−4
Saving on subsidy	435	230	143
Total government account	398	156	60
Correlation ($R^2 = 0.3$) between Country and World Production			
Total economic gains	−12	−46	−60
Consumer gains	−30	−65	−33
Producer gains	−380	−183	−131
Storage operation account[a]	−37	−53	−69
Changes in tax revenue[b]	—	−9	−2
Savings in subsidy	435	264	175
Total government account	398	202	104

[a] Including $53 million amortization costs.
[b] "Quantity restrictions" on imports and exports are implemented by an appropriate tariff. Thus, the government will have some tax revenues even under a "free trade" policy.

the subsidy program is practiced, gains from stabilization accrue primarily to the government in the form of saving on subsidy payments.

The more restricted is international trade and the larger is the buffer stock, the larger are these fiscal benefits from stocks. This should not be interpreted, however, to mean that governments should favor protectionist policies and large buffer stocks. To the contrary, the "gains" by the government from stocks only partially compensate for the additional fiscal burden the government incurs in the first place, as a consequence of greater instability in grain prices introduced by the trade restrictions. Put differently, total subsidy payments in the open economy are considerably lower than in the closed economy with buffer stocks.

Figure 3 illustrates the rapidly declining cost effectiveness of increasing levels of buffer stocks under all trade scenarios. While the probability of a shortage in consumption in the excess of 5 million tons declines with increasing stock levels, this increased protection is bought at rapidly accelerating cost to the economy. Only in the closed economy and for a very small stock would there be some gains at the same time that the probability of a shortage would be reduced. Under restricted trade, an annual outlay of $45 million for buffer stocks would reduce the probability of a severe shortfall for approximately 8% to 5%. However, an additional outlay for buffer stocks of the same magnitude would reduce the probability of such a shortfall only an additional 1.1%.

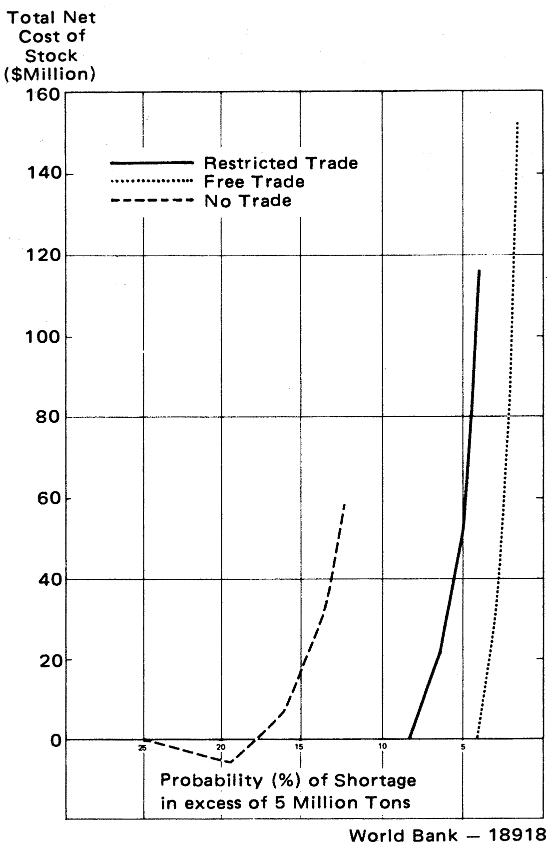

Figure 3. Economic cost and supply stabilization with alternate trade policies

Conclusions

The single most important observation based on our analysis is that for most countries international trade would be a good way of achieving greater stability in the domestic market. Although countries can choose between liberalizing their trade or maintaining buffer stocks as alternative ways of promoting stability, our analysis shows that buffer stocks sufficiently large to stabilize supplies can be very costly. Obviously, the trade option has its own costs as well, in the form of larger fluctuations in foreign exchange balances and the need to draw on large reserves in times of shortfall in domestic production or high world price. In this context and in recognition of the potentially strong stabilizing effects of trade, the international community also should reevaluate the directions of its efforts aimed at ensuring a stable food supply in developing countries.

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