1978

AN EVALUATION OF BUFFER STOCKS:

The Case of Rice in Colombia

This study measures the magnitude, type and distribution of the benefits and the costs of a stockpiling program in a developing economy. Emphasis is placed on the trade policy implications. Ruetlinger's stochastic simulation model was used in the analysis.

Paper presented at AAEA meeting, Blacksburg, Va, Aug. 6-9, 1978.

AN EVALUATION OF BUFFER STOCKS:
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The debate over the establishment of national or global buffer stocks of grains, particularly coarse grains, has escaped the ivory towers of academia and is occupying center stage in the multilateral trade negotiations in Geneva. Discussions of national or international storage operations confront issues arising from incidences of benefits and losses to consumers and to producers (in this case, importing and exporting countries).

A buffer stock scheme for stabilization (of supply directly, and implicitly, price) is defined as the buying of commodity stocks when the price is low and supplies are plentiful; and selling these (releasing them from storage) when the price is high and supplies are scarce. The storage authority is assumed to be a non-profit public agency. Storage, however, is not cost free.

The purpose of this study was to determine the magnitude, type and distribution of the benefits and costs of establishing a buffer stock program in a developing country that borders on grain self-sufficiency. Emphasis was placed on the trade policy implications of the buffer stock. Ruetlinger's stochastic simulation model for evaluating reserve stocks was used in the analysis.[1]

Rice is important to both Columbia's agriculture and diet. Its major producers are large farm enterprises. For the country's poor, rice is the basic staple. Columbia is equipped with the organizational network (IDEMA, the national rice marketing board) and the storage facilities to initiate a buffer stock program. Generally, rice production is adequate for national needs; occassionally, Columbia has imported supplemental supplies of rice.

INPUT SPECIFICATIONS

World production was assumed to be normally distributed with a mean of 312.8 million metric tons (MMT) and a standard deviation of 8 MMT.

The world demand function was linear with a price elasticity of -.31, at the mean production level at a price level of $344 U.S. per metric ton (Royko). The demand equation was:

$P = 1458.963 - 3.563\ Q$ where P is the price and Q is the quantity.

Domestic rice production was assumed to have a normal distribution, with a mean of 0.976 MMT and a standard deviation of .07 MMT.[2]

Country demand was represented by a slightly kinked demand curve. The price elasticity at the mean production level, at the kink, was -.3 at a price level of $ US 319.4/MT. At production levels above the mean level, the demand equation used was:

$$P = 1385.155 - 1091.962\ Q.$$

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[1]A detailed flow chart and an explanation of the model will be provided upon written request to the author of this article.

[2]The estimated standard deviation for the country was deliberately kept small to avoid the possibility of negative prices.

production levels below the mean level, the demand equation used was:

$$P = 1385.159 - 1091.966\ Q.$$

The world and country production were assumed to be positively correlated by a :tor of .4.

Production levels were assumed independent of either trade or storage activities. :h an assumption is not necessarily appropriate if farmers adjust their supply in ;ponse to lower prices as the cobweb model suggests, and if reduced price fluctuations ;o affect supply decisions. The adjustments implied are in opposite directions and ttle is known of their magnitudes. The production independence assumption may not be reasonable.

Fluctuations in both the country and world production will lead to price differentials. ee trade was permitted subject to two limitations, an economic disincentive and a antitative restriction.

Imports were not permitted to increase the level of available grain supplies beyond 78 MMT. Nor were exports allowed to reduce the level of available supplies to less an .974 MMT.

When international trade was allowed, it was subject to tariffs and shipping charges. e domestic import price was defined as $8 U.S. above the world price, and the domestic port price was defined as $8 U.S. below the world price. In all trade transactions, e country paid the transportation charges.

The national government imposed a tariff of $4 U.S. on imports and $3 U.S. on ports.

The upper consumption bound was .978 MMT and the lower consumption bound was .974 IT.

Grain production outside a volume band of .974 and .978 MMT triggered either storage lditions or withdrawals. National production in excess of .987 MMT was put into storage, the extent that there was vacant storage space. Production below .974 MMT triggered release from storage.

Storage capacities were assumed to be, .001, .05, .10, .15, .20, .25, .30, and .40 IT.

A loading fee of $5 U.S. was charged to each metric ton of grain entering or leaving :orage. The storage authority payed this.

Eight percent was the interest rate used.

FINDINGS

Two basic runs were made. The first run allowed for relatively free international ade in the commodity under the storage program. The alternative run precluded trade mpletely. Each run simulated eight storage capacities (.001, .05, .10, .15, .20, .25, 30, and .40 MMT).

Figure 1 is a graph of storage capacity versus the frequency of serious shortfalls, surrogate for the stability of grain supplies. Two shortfalls are denoted; grain

There are obvious limits to the generalization of these results. The base case assumed many factors about the production, trade, storage, and consumption processes. The results reported are the expected value of the annual costs and benefits. It is possible that a sequence of years could occur with this basic case, where a reserve could be justified in the traditional efficiency terms.

TRADE POLICY

In both cases--the base case and the no trade case--an increase in the stock capacity resulted in a decrease in the frequency of supply shortfalls.

Of interest is the result that the presence of trade is a significant determinant of the frequency of shortfalls. With no trade, there is a greater chance of shortfalls. Trade is an effective tool for stabilizing grain supplies. The marginal stabilization effects of a buffer stock is greatest if no trade is allowed, in both relative and absolute terms.

A buffer stock investment tends to yield negative net economic benefits (losses). It tends to be an inefficient investment regardless of the trade policy as shown in Figure 4a.

When trade is not permitted, a small reserve may be justified in cost-benefit terms (approximately .15 MMT). Any incremental investments beyond that point quickly yield net economic losses. Without trade, substantial profits may be earned by buying grain when prices are low and selling in a year of a crop shortfall. However, these profits are inadequate to offset the fixed costs of even an intermediate size (.20MMT) grain reserve.

Consumers tend to lose from a reserve as shown in Figure 5. Under both trade policies, every addition to storage hurts consumers.

Farmers gain from the existence of a buffer stock when trade is not permitted as shown in Figure 6. Returns to farmers from a storage program are high because the storage authority provides the farmers with an additional outlet for their produce.

Government accounts behave in a consistent way under both trade policies. There is an initial small gain from the reserve operations, followed by a topping off of gains and an eventual incremental loss at higher capacity levels.

SUMMARY AND CONCLUSION

A grain reserve could reduce fluctuations of grain supplies, market prices, and the balance of foreign trade in Columbia. Low stock levels provide significant incremental stability, but there are decreasing marginal stabilization returns to increases in stock capacity.

Costs of a reserve usually exceed its quantifiable benefits. A buffer stock will, in most cases, be both an unprofitable private investment and an economically inefficient use of public funds though perhaps not a politically inefficient use of public funds. Economic loss increases with the size of the reserve. The marginal cost per unit of stabilization rises sharply as stock levels are increased.

The income distribution effects of grain reserves are strongly influenced by existing trade policies. The direction of these effects sometimes change with increasing levels of storage. In general, it is noted that producers' gains from the buffer stock far exceed those received by the consumer.

Trade seems to be the most effective policy for stabilizing prices, supplies and averting shortfalls. The purposes of establishing a grain reserve may be better served by first freeing trade. Storage may be viewed as a policy option which can supplement trade.

REFERENCES

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Rojko, A.S. World Demand Prospects for Grains in 1980. U.S. Department of Agriculture (Washington, D.C.: Economic Research Service, 1975).

Mean Values and Standard Deviations for Domestic Grain Consumption and Prices

No Trade

Table C:

	Storage capacity (million metric tons)							
Grain Consumption MMT	.001	.05	.10	.15	.20	.25	.30	.40
Average	.9755	.9746	.9738	.9730	.9723	.9714	.9706	.9692
Standard deviation	.0724	.0584	.0505	.0455	.0420	.0394	.0373	.0343
Grain Price dollars/metric ton								
Average	319.98	320.88	321.75	322.63	323.49	324.39	325.26	326.79
Standard deviation	79.06	63.76	55.14	49.67	45.84	43.02	40.74	37.47

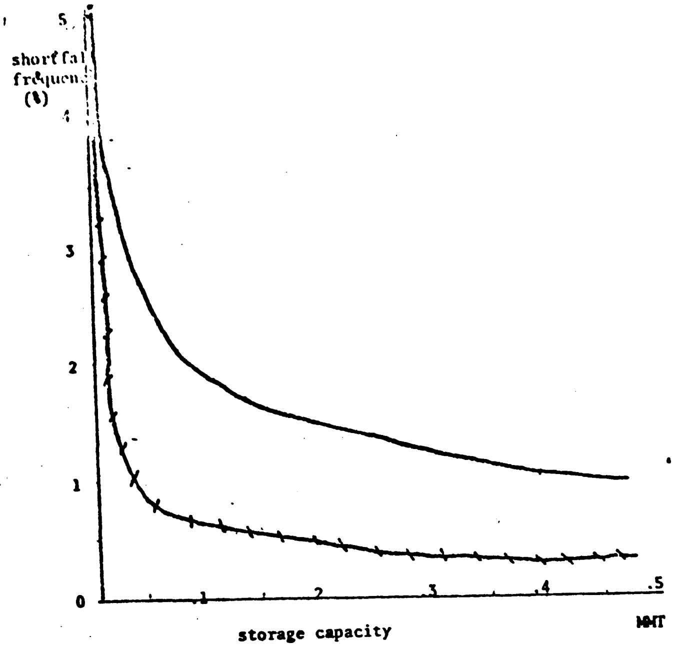

Figure 1.

Where:
Continuous line is consumption below .910 MMT.
Slashed line is consumption below .890 MMT.

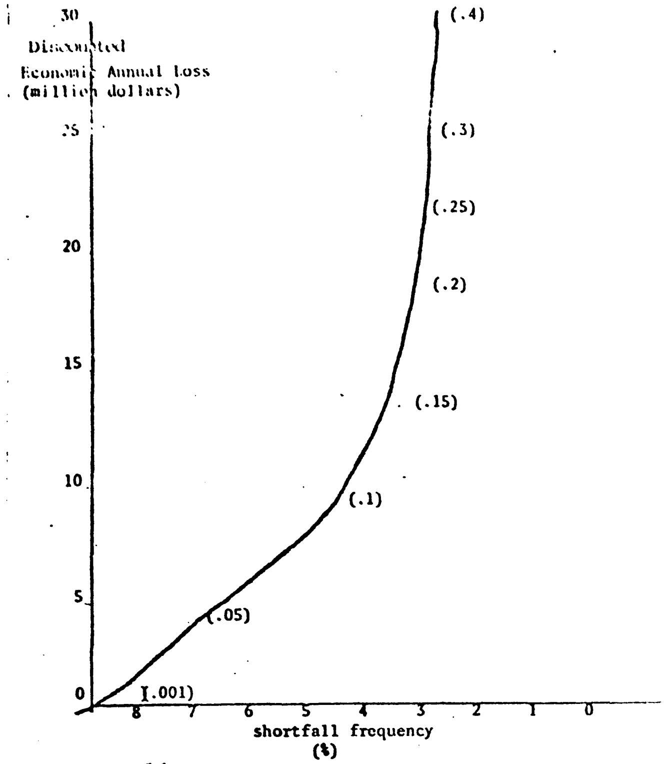

Figure #2

Where:
Shortfall frequency refers to annual supply being less than .920
Numbers in parenthesis are the corresponding storage capacities.

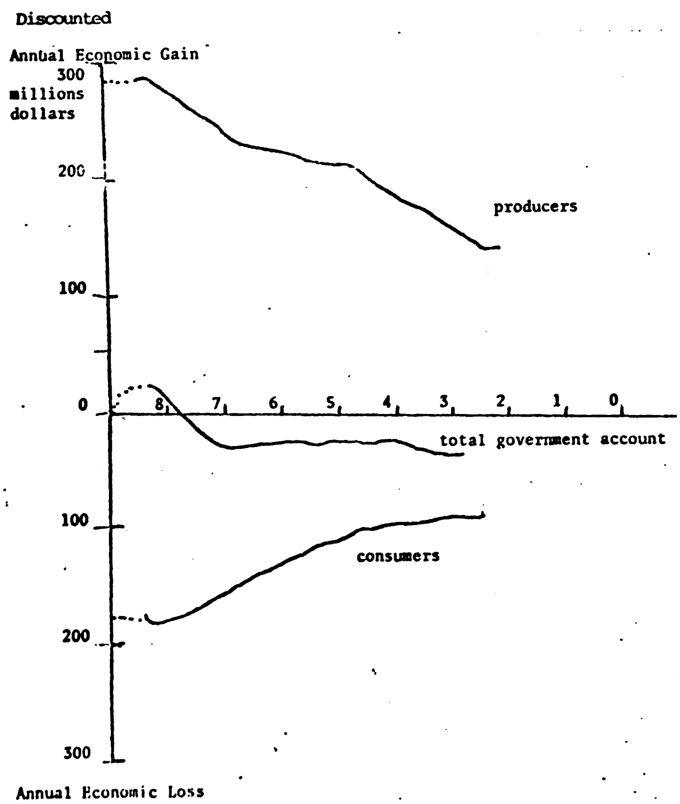

Figure #3
Annual Economic Losses and Gains from Storage and Trade

Where:

Shortfall frequency refers to supply being less than .920 MMT.

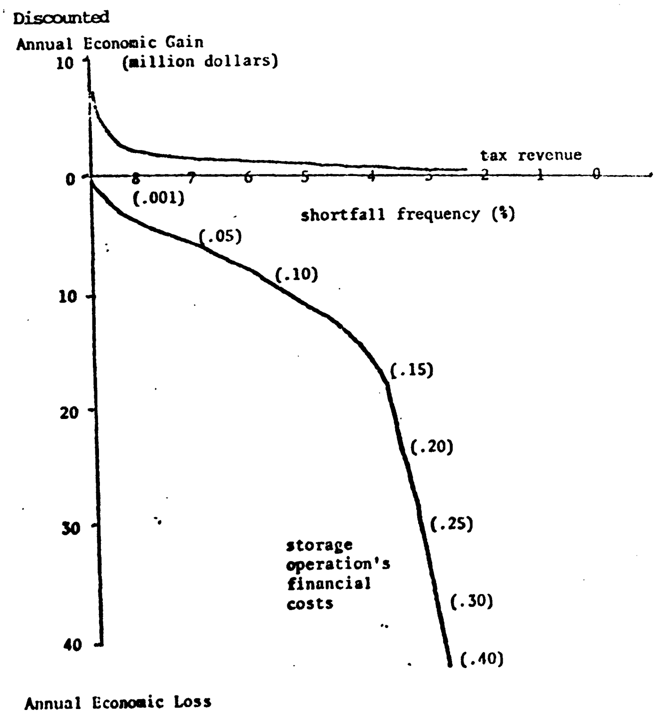

Figure #4

Annual Economic Gains and Losses from Trade and Storage: Government Accounts

Where:
Shortfall frequency refers to supply less than .920 MMT.

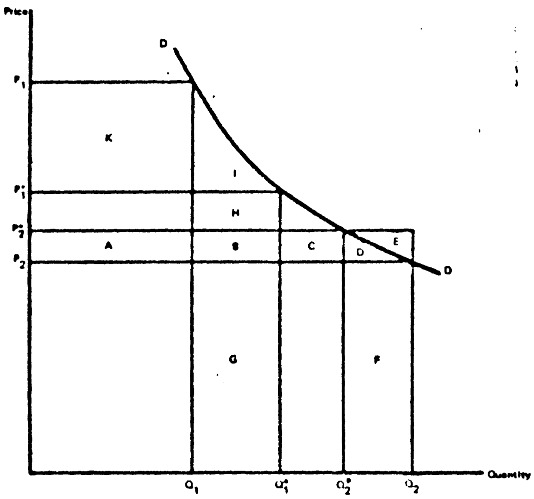

Table 1. Summary of Storage Benefits or Losses

	Benefits (+) and Losses (−)
Year of accumulation of stocks	
Consumer benefits	−A − B − C − D
Producer benefits	A + B + C + D + E
Financial benefits	−F − D − E
Economic benefits	−F − D
Year of release of stocks	
Consumer benefits	K + I
Producer benefits	−K
Financial benefits	G + B + H
Economic benefits	G + B + H + I

Graph A