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**An Economic Analysis of a Food Security Reserve: Commodity vs. Cash**

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**ABSTRACT:** The cost of operating the Food Security Commodity Reserve as a commodity reserve was compared with the cost of a cash reserve to purchase food aid supplies only in the period of need.

Preliminary simulation results reveal the cash reserve to be less costly in almost all cases.

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## **An Economic Analysis of a Food Security Reserve: Commodity vs. Cash**

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Large changes in commodity prices combined with a projected rise in food gaps for developing countries increased the importance and visibility of food aid policy issues in recent years. Global food aid donations have fallen since 1994 and are estimated to have equaled about 5 million tons in 1996/97, down from about 10 million tons annually in the late 1980's and early 1990's. However, recent U.S. and EU food aid donations to Russia have partially offset this downward trend. Even if food aid donations stabilize, they will fall well short of filling projected food gaps in developing countries (Shapouri and Rosen).

The Food Security Commodity Reserve (FSCR) provides for Government storage of up to 4 million metric tons (mmt) of grain for supplemental food aid.<sup>1</sup> The FSCR can be used in two different ways. Grain can be released from the reserve to meet “unanticipated needs” for urgent humanitarian aid that cannot be met with available P.L. 480 funding. The reserve can also be used in cases of “short domestic supplies,” when high prices limit the effectiveness of P.L. 480 funding.

This study evaluates the merits of operating the reserve as a commodity reserve and as a cash reserve with a primary focus on governmental costs. With a commodity reserve, food aid needs are met by acquiring grain when prices are low and storing it until needed for a food aid donation. With a cash reserve, grain is purchased at current market prices when needed for donations without any storage. Cost comparisons are made for different donation frequencies (once in two years and once in three years) as well as for selected donation magnitudes ranging from 100,000 tons to 2 million tons. Wheat price implications of purchase/donation situations are discussed for each option.

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<sup>1</sup> Currently about 2.5 million tons of wheat are in the FSCR.

## **Background of the Reserve**

Following the surge in world grain import demand and decline in world stock levels during the early 1970's, a public dialogue ensued about establishing a grain reserve to provide stability for both farm and food prices and to meet domestic and international humanitarian needs (Sharples and Walker). In an analysis of grain reserves in the mid-1970's, Johnson concluded that

“food security depends not only on reserves but also on other food and farm policies. In particular, liberalization of agricultural trade continues to be an important objective in periods of tight supplies as well as in periods of ample supplies. . . . By freeing up market forces yet assuring supplies when needed, a reserves program could be a useful link to a more liberalized trading world.”

Trade barriers magnified the consequences of grain market fluctuations. USDA proposed an International Emergency Food Reserve in the late 1970's of up to 6 mmt as a way to prevent critical food shortages and assure supply availability. During this time period the 1979 Russian grain embargo prompted the Carter Administration to establish the Food Security Wheat Reserve (FSWR) in order to purchase wheat previously committed to the Soviet Union.

Since then the agricultural economic situation has changed dramatically, as the agricultural sector both in the United States and throughout the world has become more market oriented and less dependent on government programs. In the United States, the 1996 Farm Act expanded the market orientation of U.S. agriculture begun in previous farm policies (Young and Westcott). Over the last 15 years Government loan programs and stocks policies changed so that USDA's Commodity Credit Corporation (CCC) no longer owns large stocks of grain. The Uruguay Round Agreement on Agriculture further liberalized world agricultural trade through reductions in barriers to trade, reductions in export subsidies, and restraints on domestic support (Normile). As such the role and form of the reserve in this changed economic environment needs to be revisited.

## **Reserve Operation**

The Secretary of Agriculture has the authority to release commodities from the reserve when unanticipated food aid needs occur or when P.L. 480 funds are insufficient to meet food aid needs due to short domestic supplies and high prices (Hanrahan). The reserve has been tapped 6 times since its inception in 1981, 3 times to meet unanticipated emergency needs and 3 times to meet P.L. 480 commitments when domestic supplies were limited. The volume released has ranged from 58,500 metric tons in 1991 to 1.4 mmt in 1988. Presently, about 2.5 million tons of wheat are in the reserve. Since the program's inception in 1981, the rate of release has been about 1 out of 3 years. During the past 10 years, use of the reserve has increased to 1 out of every 2 years.

The Secretary of Agriculture has authority through fiscal year 2002 to replenish commodities released from the reserve by designating CCC stocks for the reserve or through additional purchases. The 1990 Farm Act required replenishment to occur no later than 18 months after stocks are released. The 1996 Farm Act authorized replenishment of the reserve, but did not set a specific time for replenishment. Funds for any commodity purchases for replenishment must be authorized in an appropriations act.<sup>2</sup>

## **Economic Framework**

The analysis compares the costs of a commodity reserve (replenishing and storing) with the costs of a cash reserve without commodity storage where food aid supplies are purchased in the period of need. Two type of food aid donations are assumed. An *unanticipated needs situation* occurs when market conditions are such that prices are at or below average levels. A *short supply situation* occurs when grain is in short supply and prices are relatively high.

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<sup>2</sup> Beginning in FY 2000, up to \$20 million from P.L. 480 reimbursements can be held as cash or used to purchase grain to replace supplies released from the reserve.

## Operating Rules and Assumptions

The current program allows wheat, corn, sorghum, and rice to be purchased for the reserve. However, to simplify the analysis only wheat is assumed for the reserve and for donations. Purchases of other grains would change the average cost of the reserve regardless of the option, but the conclusions regarding the relative costs of a commodity reserve compared with a cash reserve would not change.<sup>3</sup>

Food aid needs from the reserve are assumed to occur on a periodic basis. The rate of release in future years is likely to be more frequent than historically, because needs for food security assistance in the future are projected to be greater. In the 1990's, the frequency of release increased to every other year. Thus, this analysis evaluates two alternative rates of release: 1 out of 2 years and 1 out of 3 years. It is possible that the reserve could be tapped in consecutive years as occurred in 1989, 1990, and 1991.

## Reserve Costs

The costs of operating a commodity reserve include (1) purchase, (2) storage and (3) interest costs. Purchase costs occur when adding grain to the reserve. For this analysis, the reserve is assumed to be replenished in the year following a release. Alternative operating levels for the commodity reserve are assumed at 2.5 or 4.0 million tons. Storage and interest costs are incurred for any grain in storage during a year. No storage costs are incurred for grain released from the reserve during a year. The analysis assumes that between 0.1 to 2.0 mmt of wheat are needed for each food aid donation.

The costs of operating a cash reserve include purchase costs charged for food aid in the year of a donation. For the cash reserve, grain is assumed to be purchased when needed for food donations and then immediately donated for food aid.

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<sup>3</sup> In the case of rice, purchase costs would be considerably higher for all options, and for a commodity reserve rice storage costs would also be higher.

### Commodity Price Assumptions

To simplify the analysis, prices are set at two different levels.<sup>4</sup> For the short supply scenario, a pattern of year-to-year wheat price changes is assumed in the cost analysis. Low-year prices are assumed at \$3/bushel. Subsequent high-year prices are assumed at \$4/bushel during periods of tight supplies.

For commodity reserve options analyzed it is assumed that the reserve is replenished when wheat prices are relatively low (\$3/bushel). For cash reserve options, purchases occur at the time of donation at a price of \$3/bushel for unanticipated needs situations and at \$4/bushel for higher-price, tight supply situations.

The assumed price difference of \$1/bushel between low price years and high price years is important for the relative costs comparisons. This range represents the approximate price range for wheat seen in recent years. The standard deviation of annual wheat prices since 1980 is approximately \$0.56/bushel, so a \$1 range would capture close to two-thirds of the variability in prices (assuming a normal statistical distribution in prices). Highly variable wheat prices are assumed for analyzing short domestic supply scenarios. Prices are assumed to decline by \$1/bushel in the subsequent year and that the CCC will be able to purchase grain at the lower price and thus benefit from the price decline.

### Other Costs

Operating costs assumed for the FSCR reflect historical data obtained from CCC records. Costs of storing grain include a physical storage charge of \$0.26/bushel. We also include an interest cost of 6 percent of the value of grain stored in the reserve.

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<sup>4</sup> Price implications of purchases and releases in different reserve option situations are discussed later.

### Simplifying Assumptions

The analysis understates total costs of the reserve program for both a commodity and cash reserve under an unanticipated need scenario because shipping costs beyond export ports are not included. Under the unanticipated need scenario the CCC is required to pay shipping costs from the port to the recipient countries.<sup>5</sup> These costs are the same with either reserve alternative and can thus be ignored in the relative cost comparisons.

The CCC also incurs a load-in cost of about \$0.085/bushel when grain is purchased. Load-in costs are not included in the analysis, since they would be incurred for both a cash and a commodity reserve. These assumptions do not affect the relative costs of the two alternatives.

The analysis does not account for the 1-time transition costs and benefits of moving from the current situation with 2.5 mmt in the FSCR to the alternatives being evaluated. A 1-time benefit would be realized when moving to a cash reserve option; no transition costs would occur if operating a 2.5 mmt reserve; and 1-time costs would be incurred if building to a 4 mmt reserve. The focus of the analysis is a comparison of expected annual operating costs of the reserve alternatives, implicitly after these 1-time transitions have taken place.

This analysis assumes that appropriated funds (ie., the CCC has spending authority) are available continuously for grain purchase, either for replenishing stocks for a grain reserve or for purchasing grain for donation under a cash reserve. If appropriated funds are not available, food aid supplies may be inadequate. In the case of a commodity reserve with limited funding, acquisition costs could be higher since grain may not be acquired for the reserve at low prices.

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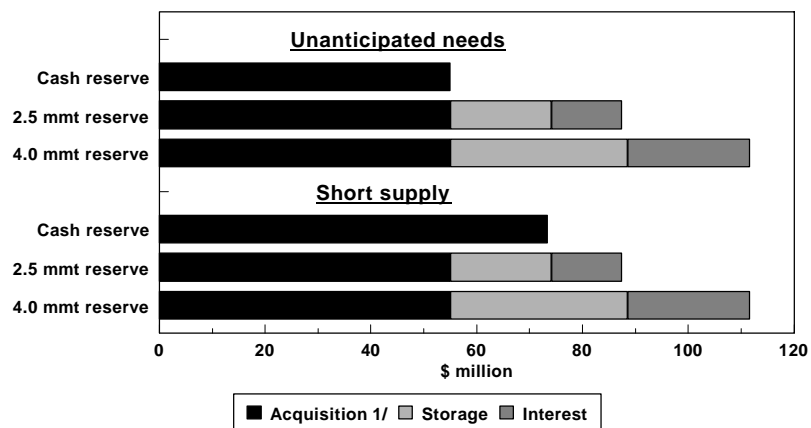
<sup>5</sup> No such requirement exists for *short domestic supply* situations. Food aid sponsors or recipient countries pay shipping costs for these donations.

## Results

A commodity reserve is preferred if the cost of grain purchased (at a relatively low price) plus the costs of storage are less than the costs of purchasing grain at the time of donation. Otherwise, a cash reserve would be preferable. A commodity reserve may also store more grain than is subsequently released as food aid, thus incurring additional storage costs.

The annual costs of providing 1 mmt of food aid every other year are illustrated in figure 1. Operating a 2.5 mmt commodity reserve and releasing 1 mmt one time in two years costs an average of \$87 million per year. For this scenario, 1 million tons of grain is purchased every other year at \$3/bushel, implying an average annual cost of \$55 million. Average annual storage costs of \$19 million are incurred on 1 mmt one year out of two and on 1.5 mmt every year. In addition, interest charges of \$13 million are included on grain owned by the CCC. For the alternative operating size for the commodity reserve of 4 mmt, larger storage and interest costs reflect the additional 1.5 mmt stored.

**Figure 1. Average annual costs of providing 1.0 mmt of food aid every two years**



1/ For the commodity reserve options, grain is purchased at \$3/bushel. For the cash reserve options, grain is purchased at \$3/bushel for unanticipated need situations and at \$4/bushel for the higher-price short, supply situations.



For the cash reserve, in contrast, in an unanticipated needs scenario grain prices are assumed to be low and are purchased for immediate donation. Thus, purchase costs of \$3/bushel are incurred for only the quantity donated, resulting in average annual costs of \$55 million.

In the case of the short supply scenarios, the costs for the two commodity reserve operating-size options are the same as in unanticipated needs situations, since grain is purchased at a lower price (\$3/bushel) and released when prices are high. Costs for the cash reserve increase, however, since the purchase price for the grain is \$4/bushel. However, the additional expense of \$1/bushel in purchase costs at the time of donation is less than multi-year storage costs for the commodity reserve.

Additional scenarios for commodity and cash reserves were analyzed with 0.1, 1.0, and 2.0 mmt released one time in two years and one time in three years (table 1). When releases occur one time in three years, average annual acquisition costs decline, while storage and interest costs increase. When the size of the reserve is 4 mmt, storage and interest costs are higher to reflect the additional 1.5 mmt of grain stored, adding about \$24 million annually. This substantially increases the advantage of a cash reserve alternative.

A cash reserve in a short supply situation only experiences acquisition costs at higher per bushel prices (\$4/bushel). For the unanticipated need cases, acquisition costs are assumed to remain at \$3/bushel. Costs for these options reflect the amount of grain donated.

The analysis summarized in table 1 reveals the general result that a cash reserve is less costly in almost all cases except when each of the following 3 conditions hold:

- 1) the amount of grain donated from the commodity reserve approaches 100 percent of the reserve volume,
- 2) the rate of food aid donations from the reserve is frequent, and
- 3) grain prices are highly variable and grain is donated from a commodity reserve only in short supply situations.

**Table 1. Average Annual Costs of Food Security Commodity Reserve: Cash Versus Commodity <sup>1/</sup>**

	Purchase price	Food aid needs (mmt)		
		0.1	1.0	2.0
	\$/bushel	----- \$ million -----		
<b><u>Release every two years</u></b>				
<b>Unanticipated needs</b>				
Cash reserve	\$3.00	5.5	55.1	110.2
2.5 mmt commodity reserve	\$3.00	45.1	87.4	134.5
4.0 mmt commodity reserve	\$3.00	69.4	111.7	158.7
<b>Short supply</b>				
Cash reserve	\$4.00	7.3	73.5	147.0
2.5 mmt commodity reserve	\$3.00	45.1	87.4	134.5
4.0 mmt commodity reserve	\$3.00	69.4	111.7	158.7
<b><u>Release every three years</u></b>				
<b>Unanticipated needs</b>				
Cash reserve	\$3.00	3.7	36.7	73.5
2.5 mmt commodity reserve	\$3.00	43.6	71.8	103.1
4.0 mmt commodity reserve	\$3.00	67.8	96.0	127.4
<b>Short supply</b>				
Cash reserve	\$4.00	4.9	49.0	98.0
2.5 mmt commodity reserve	\$3.00	43.6	71.8	103.1
4.0 mmt commodity reserve	\$3.00	67.8	96.0	127.4

1/ Average annual costs are simulated over 6 years.

When each of these 3 conditions holds, per-unit costs of holding grain from the time of acquisition to a later donation are less than the difference in prices from the acquisition date to the subsequent donation date. A cash reserve was more costly than a 2.5 mmt commodity reserve only when a donation of at least 2.0 mmt occurs every other year due to short supplies and high prices.

A cash reserve is more cost effective when the rate of release is less frequent (such as 1 out of 3 years). The cost advantage of a cash reserve becomes even greater at lower release volumes (less than 2 mmt in the analyses presented here) or if the commodity reserve is larger. The cost-effectiveness of a cash reserve increases if prices are less variable than the \$1/bushel range analyzed here.

Because increasing food aid needs may cause the level and rate of donations to increase from historical levels (i.e., conditions one and two), we tested the sensitivity of the cash versus grain reserve to the assumption of price variability (condition 3). A year-to-year change in annual wheat prices of \$1/bushel has been observed four times during 1980-97. If we instead assume a year-to-year annual price change of \$1.50/bushel, the costs of the cash reserve remain less than the costs for a commodity reserve in each of the analyses presented in table 1, except when 2 mmt is released every other year.

### **Price Effects**

The alternative reserve options would have somewhat different impacts on market prices for wheat. To estimate price effects for the alternative reserve options, an annual model for the U.S. wheat sector model is used. The model is initially calibrated to alternative price situations, with selected food aid donation situations then simulated for the different reserve options. Demand adjustments in the donation simulations are made on the basis of assumed elasticities of -0.50 for exports (in addition to direct export changes due to the food aid donations), -0.70 for feed, and -0.10 for food. Price adjustments in the donation simulations are estimated using a wheat price model that utilizes a stocks-to-use formulation augmented by factors that represent agricultural policies including price support and stockholding programs (Westcott and Hoffman).

For the cash reserve, governmental purchases of wheat are made for immediate food aid donation. Assuming full additionality with no displacement of other domestic or foreign trade, these donations add directly to U.S. exports.<sup>6</sup> Price effects reflect movements to a tighter domestic supply/demand situation as reflected in the stocks-to-use ratio. Price effects differ, however, in an unanticipated needs situation and in a

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<sup>6</sup> Full additionality of food aid donation exports is assumed because these donations are typically to countries that, at the time of the donation, have limited effective demand and commercial sales. Price impacts reported would be somewhat lower if less-than-full additionality of the donations were assumed. While no direct displacement of trade is assumed for these donations, the new equilibrium levels of U.S. exports is increased by somewhat less than the full donation amount as relatively small reductions in other exports occur in response to the increase in prices.

short domestic supply situation. In the unanticipated needs situation, with prices initially near \$3/bushel, price impacts are estimated at \$0.05/bushel for a 1 million metric ton purchase and donation, and \$0.10/bushel for a 2 million metric ton purchase. In the short domestic supply situation, market supply/demand balances are tighter so price impacts are larger for the same grain purchase/donation transactions. With prices initially near \$4/bushel, price impacts are estimated at \$0.09/bushel for a 1 million metric ton purchase and donation, and near \$0.19/bushel for a 2 million metric ton purchase.

For a commodity reserve, price impacts occur in 2 parts in separate years, first when purchasing grain to enter the reserve and then later in a subsequent year when donated. Purchases of grain to add to the reserve when prices are near \$3/bushel would push prices up \$0.02 to \$0.03/bushel for a 1 mmt purchase and \$0.05/bushel for a 2 mmt purchase. These price effects primarily reflect the movement of supplies into government-owned stocks which are generally not readily accessible to the marketplace.

Price effects in a later year when grain from the commodity reserve is released for a food aid donation depend on the market conditions at that time. Releasing grain from a commodity reserve for unanticipated need donations, with prices near \$3/bushel, would increase prices by \$0.02/bushel for a 1 mmt release and \$0.04/bushel for a 2 mmt release. In a short domestic supply situation with prices near \$4/bushel, price impacts are estimated at about \$0.06/bushel for a 1 million metric ton reserve release and food aid donation, and about \$0.13/bushel for a 2 million metric ton donation. These price impacts reflect the combined effects of lower government-held stocks and increased exports.

### **Other Issues**

The analysis of reserve alternatives does not account for several issues likely to arise in operation of the FSCR. For example, when prices are low there is frequently political pressure from farm groups to purchase grain, thereby raising prices, regardless of the need for food aid. Similarly, the commodity reserve

option will be better received when grain is released under a short domestic supply situation and when grain is replenished during low prices.

## **Conclusions**

Government costs of meeting food aid needs by acquiring grain when prices are low and releasing as needed for food aid (a commodity reserve) are compared to meeting food aid needs by holding cash and purchasing food aid supplies in the period of need (a cash reserve). An analysis is conducted to evaluate the merits of a commodity versus a cash reserve. Costs of a 2.5 million metric ton and a 4 million metric ton commodity reserve are compared to a cash reserve under short supply and unanticipated needs scenarios, assuming periodic releases ranging from 100,000 tons to 2 million tons.

A cash reserve was found to be less costly than a commodity reserve in nearly all cases. A commodity reserve is less costly only when reserve releases are frequent, release volumes represent a large percentage of the reserve, yearly grain prices are highly variable, and the releases occur during times of tight supply and high prices. In most cases, the benefits of buying at low prices for future donation are more than offset by the storage costs incurred from time of purchase to time of release. If more grain is stored in a commodity reserve than is subsequently released, additional storage costs are incurred.

This analysis does not specifically address the optimal size of a food security commodity reserve, although the results presented here suggest that the economically optimal size of a commodity reserve is zero. In almost all cases, a cash reserve is less costly to operate than a commodity reserve.

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