Grain Storage in Market Determined Economies

by
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The United States government has had grain storage programs since 1933. These programs have been operated through the Commodity Credit Corporation. The Corporation makes loans to farmers who use their crops to secure the loan. Under the program the government must accept the crop for payment of the loan if the farmer chooses to forfeit the commodity. The program has been an essential element of the basic price support system, because it has kept prices received for grains above long run market clearing prices and has supported the incomes of producers. No limits were placed on the amount that could be put under loan in the regular nonrecourse loan program. As stocks accumulated in government ownership, acreage reduction and export subsidy programs were used to reduce stocks and alleviate storage problems.

During the development of the Food Security Act of 1985 arguments were raised concerning the desirability of providing for market oriented commodity programs. A primary tenet of those promoting market orientation has been that commodity prices should reflect the relative abundance or scarcity of the commodity, serve to allocate output among consumers, and signal the need for more or fewer resources in production. However, the focus of the discussion remained fuzzy because there was not a general agreement on the meaning of "market orientation". And, it remained unclear during the debate as to whether, or how, market determined prices were to function in allocating resources to agriculture and in distributing output.

Current debate has focused more on the cost of programs than on the purpose of the programs. However, two basic factors remain important in agriculture policy and program implementation.(5) The first is that output increases faster than consumption, particularly with programs in place. And, secondly, commodity output, prices and earnings are subject to a high degree of variability.

Efforts by the government to move to a market-oriented system for grains have raised questions about loan and storage programs. And, some have expressed a renewed interest in stocks programs to respond to variability rather than as a device to defend minimum prices. To evaluate whether there is a need for government storage programs in a free market it is necessary to consider what factors give rise to the need for commercial storage in a free market. And, it is also necessary to determine whether commercial storage will provide the storage capacity to meet perceived societal objectives. That is, are there forces in agricultural markets that give rise to the need to store more than commercial firms are likely to hold.

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The following sections of this paper address issues associated with the biologically induced variability in commodity output. The behavior of the sector under market pricing and the ability of commercial firms to deal with the sources of price and quantity variability are examined. The possibilities for quantity and price stabilization, as opposed to price support, are considered. And, a proposed quantity triggered stocks program is presented.

BIOLOGICAL SOURCES OF QUANTITY AND PRICE VARIABILITY

Agricultural production is a biological process, subject to seasonality, perishability of output, and weather related problems. These factors are manageable to some extent, because we can modify the environment using inputs that permit adequate returns for investing in the environmental modification. The implications of allowing the commercial sector to deal with these problems under free market conditions are considered in the following sections.

Seasonality

Seasonality results in an imbalance between output and consumption on an intra annual basis. It results in depressed prices at harvest and higher prices in other periods of the year. Seasonality of production is the primary reason for commercial storage. Consumption -- final demand -- tends to be stable and evenly distributed through time. For the most part no more or less grain would be required on any given day, week or month (except for seasonality in livestock production). However, harvest of grain tends to take place in a limited number of days or weeks and an entire years supply is available early in the marketing year. Commercial storage serves to allocate stocks (production) through out the marketing year.

If the commodity can be stored, producers build storage or contract for storage prior to harvest so they can obtain a return from selling the commodity in periods of short seasonal supply. Producers decide among the returns from holding seasonal inventory and the returns from immediate sale. Although seasonality results in intra-annual price variability the prices differences are due to the cost of storage and the relatively constant demand among seasons.

Perishability

For some commodities, perishability precludes storage and, because production is seasonal, intra-annual price instability is a virtual certainty. Abundant supplies are available in some seasons and shortages occur in others. Production of perishable commodities is a high risk venture, yet, producers are able to cope with the problem. Perishability is not a major factor with respect to grains, because they are easily stored, yet perishability does impact on the level of investment for commercial storage facilities.

The Weather Factor

Weather results in unplanned changes in output that shift the quantity available for market. Because of the combination of an inelastic demand and weather induced supply shifts, prices and earnings change dramatically.

The following sections isolate specific weather phenomena and evaluate how such conditions suggest a role for public or private sector intervention in markets.

Local Random Events: Farmers are subject to weather conditions that may

destroy their crop but leave their neighbors' crop untouched. Such localized events have no impact on prices or national farm income. Hail and wind are the main examples and, of all weather factors, they tend to be the most nearly random in occurrence. However, certain areas of the country are more prone to have high winds or tornadoes and more likely to be affected by hail. But within the area, the risks are nearly equal. The randomness of the events in the affected area makes it possible to calculate the probability of occurrence of specific output changes and to compute the cost for insuring against losses. This pooling of the risk, through private insurers, reduces the possibility of an individual incurring a disastrous loss. If the long term level of prices is relatively easy to determine through the market, the cost and value of an insurance scheme are easily determined. However, if estimation of expected prices and revenues is difficult, deciding on the level of insurance becomes much more complex.

Local Non random Events: For some farmers, local weather and topography conditions make their farms subject to drought, flood or frost. These conditions are spatially confined and non random from the standpoint of area impacted. All producers in the area are likely to be impacted in any year and a risk sharing pool developed by those likely to be impacted would be insufficient to cover losses in any particular year. Thus, risk pooling is unfeasible and such conditions are not insurable by private firms.

Whether society chooses to provide aid to such producers, by underwriting insurance programs or through other forms of support, depends on the perceived need for the output, the perceived impact on other sectors of the economy and on societies perception of the ability of the individual to evaluate the risks of production in such an area. Currently, in the United States, all risk crop insurance, disaster payments, and disaster and economic emergency loans are all directed at such problems. The economic implications of these programs are rather clear, they encourage farmers to produce in high risk areas. Whether society needs the production from these high risk areas and wants to encourage continued production is a major question that must be answered. If the answer is no, then the question of whether there is a societal role in encouraging and assisting producers to leave these areas or to shift to the production of crops, which have a low risk from the environmental factors, should be addressed. In the absence of public programs, a natural economic process would dictate the crops to be grown in an area. Producers in frost, flood or drought areas should understand the risk involved and choose to produce or sell based on their evaluation of the cost and returns.

General Yield Variation: The major source of annual variability in agricultural output and prices is the generalized variability in weather. The United States has an open economy and world wide weather changes must be considered as impacting on the total supply of commodities to our markets and the total demand for commodities. Because the national or global impact of weather on the quantity of output for any production season is unknown when a crop is planted, producers must formulate their production decisions on some expected normal yield and expected price. Once the resources are committed to production the producer has little control over output, and yields may vary sharply from the expected level. The wide variation in yield results in large aggregate shifts in quantity produced and in price changes that are magnified beyond the size of the yield changes, because of the inelastic aggregate demand. Thus, income from production can vary from large positive returns to losses as the result of weather induced variability in yields.

Ex post prices for a particular crop are those which allocate the production among the consumers in an efficient manner. They have little relationship to the resources employed in producing the crop. Discovery of long run prices and returns is therefore difficult if not impossible. Without information on long run prices, determining the level of capital and other resources to commit to the production process is a very "risky" process because of the uncertainty over whether the quantity supplied and demanded are in balance or are diverging.

Lack of correspondence between the input decisions based on ex ante expectations of price and revenue and the ex post price and quantity determined by market allocation of output is an important problem for the agricultural sector. Production and consumption do not adjust simultaneously; yield is stochastic; and, to the extent that it is affect by weather, random and normally distributed; and, there is not a fixed relationship between units of input and units of output. Although producers can plan for an expected output and, given sufficient experience, estimate how that output might vary, they have no basis for determining how much, or in what direction, output will vary in any one year.

The offset of planting, harvesting and marketing, and the quantity shock that occurs because of weather induced yield variability, are not trivial conditions to be dismissed as part of the expected variability in agriculture. If no other changes occurred, weather, alone, would distort the market by bringing about a mismatch between expected and actual yield and therefore expected and actual prices, because the market allocates the actual output at whatever price consumers will pay. As a result of weather changes, it often takes several production periods to identify the existence of fundamental market changes caused by economic forces.

REASONS FOR GOVERNMENT STORAGE

A societal decision to store commodities is likely to be based on different objectives than are commercial storage decisions. The private sector may try to equate marginal cost and marginal revenue from storage, but, society at large may desire to reduce the shock of weather changes, assist in long run price discovery, provide aid to the hungry, or minimize resource redistributions. By capturing a larger quantity of the production in storage, in high yield crop years, rather than permitting it to be allocated among consumers, and by releasing this stored commodity in years of low yield, total resources required for production are effectively reduced.

The greater the inter-annual variation in output, the more plausible the societal role in providing storage. Viewed in an otherwise stable situation, that is, no changes in technology and no abrupt shift in consumption, it is in the interest of society for the Government to intervene in the market to even out available supplies from large crop years to small crop years. How this intervention is conducted is critical to the effectiveness of other farm support activities. Also, the underlying tendencies in the market, in terms of supply/demand balance, determine the effectiveness of stocks management.

HOW MUCH SHOULD GOVERNMENTS STORE

The primary questions with respect to storage are: For the nation, in any given year, how should we decide on our storage objective? How much grain should be put into or removed from government storage?

A stocks program or a grain reserves program must be based on a set of acquisition and dispersal rules. Much of the research related to stock holding addresses the potential for determining an optimal expected level of stocks with a concept of covering negative supply deviations 80, 90, or 95 times out of 100.(3,7,and 8) In reality, a storage policy stated in terms of a desired level of storage, can never be shown to be optimal because there is no objective way for showing that one level is better than another. Although there can not be an optimal stock level determined at the beginning of any particular year, there can be an optimum acquisition and dispersal program that is reactive to current year yield.

Theoretically, a stocks program managed by a yield rule would stabilize prices with minimal interference with the allocation function. Prices would be free to respond to changes in demand and real changes in supply, and the prices so generated would not be clouded by the noise of price changes that resulted from yield changes.

Timing of the government storage decision is critical to a yield rule program. Given the inability to forecast yield at planting time, government storage decisions must be made on the basis of yields estimated for the current crop. Thus, the decision on how much of the crop to store or offer to store must be made just prior to harvest when current year yields and acreage to be harvested are most easily estimated.

International Stocks Programs

Following the yield storage rule, world wide, would provide international rationality on stock-holding policy. All producing countries would store the positive deviations from trend yield and dispose of them during periods of domestic negative yield deviations or high world prices. Storing more than the positive deviations from trend would require that in some year the market would have less available than had been planned for by producers or expected by consumers. Storing less than the positive deviations means that the probability of incurring a shortfall in stocks is increased because the positive increment from yield has not been stored, but consumed, and future consumption must be reduced below what it could have been if stocks had been retained.

If the U.S. and other countries changed their policy from encouraging excess production with supported prices to free market pricing, then the appropriate response to changes in export demand would be to allow the market to clear. The exception would be that they would stand ready to buy or sell the additions to or shortfalls from domestic trend yield on whatever acreage was planted. Under such conditions the countries would lessen the impact of their domestic variability on the world market.

Under conditions where long term supply and demand were in balance the smoothing effect of the yield storage rule on quantity would result in a

Net Cash Returns

Nearly one-half of the farms not receiving payments had losses.

Of the 1.4 million farms not receiving payments, 673,357 had losses in 1987 (table 2). Losses on these farms averaged $5,113. Nearly one-third, or 442,130, of the farms that did not receive payments had losses of $1,000 to $9,999. These losses reduced the taxable income of operator families that had nonfarm occupations.

Of the 700,600 farms receiving payments, 123,077 had losses. The other 577,523 had net returns that averaged $41,861.

A reported 713,793, or 51 percent, of the farms not receiving payments had positive net cash gains as reported by the census. This compares with 577,523, or 82 percent, of the farms receiving payments that had positive net returns. Farms not receiving payments had net cash returns that averaged about one-half the size of the net cash returns of farms that received payments. While 21 percent of the farms receiving payments had net cash returns over $50,000, only 61,073, or 4 percent, of those not receiving payments had gains above $50,000.

Table 2--Farms with cash gains and losses from farm production, 1987

Farms not receiving payments accounted for 1,387,150 farms, and 673,357, or nearly one-half, of these had losses.

Item	Unit	Farms receiving payments[1]	Farms not receiving payments
All farms	Number	700,600	1,387,150
	Percent	34	66
Average net gain	Dollars	33,146	9,255
Farms with net gain	Number	577,523	713,793
	Percent	45	55
Average net gain	Dollars	41,861	22,808
Gain of:			
Less than $1,000	Number	23,878	137,725
	Percent	15	85
$1,000-$9,999	Number	155,938	345,005
	Percent	31	69
$10,000-$49,999	Number	249,810	169,990
	Percent	60	40
$50,000 or more	Number	147,897	61,073
	Percent	71	29
Farms with net loss	Number	123,077	673,357
	Percent	15	85
Average net loss	Dollars	7,747	5,113
Loss of:			
Less than $1,000	Number	21,848	161,065
	Percent	12	88
$1,000-$9,999	Number	76,803	442,130
	Percent	15	85
$10,000-$49,999	Number	22,566	65,974
	Percent	25	75
$50,000 or more	Number	1,860	4,188
	Percent	31	69

Nearly one-half of farms not receiving payments had net losses.

[1]1987 Census of Agriculture, Vol. 2, Part 5, Page 26, Table 2. Number of farms receiving and not receiving payments may not agree exactly among tables because the numbers are estimates based on expansions of survey data.

stability of domestic consumption and a stable supply for export. Such a stocks management policy would minimize the impact of domestic weather variation on commodity prices. All other factors would be reflected in the market including demand and supply shifts as a result of technology or changes in financial or macro policy variables. The effects of weather in importing countries and on competing exporters would be transmitted through the market to the extent that they did not follow the yield storage rule. Also the impact of their policies would be felt.

CONCLUSIONS

Farm commodity producers are subject to the risk of low income because of the impact of weather and economic forces on the production, marketing consumption and prices of the commodities they produce. If resources are committed with the expectation of normal yields and prices and the output results in a significantly better or poorer crop, prices and incomes can be dramatically altered, although the producers planned appropriately given their limited information.

Although there are many differing points of view as to how farm policy should be accomplished, the basis for a stocks policy in a free market appears to be linked to the societal belief that farmers should receive some degree of protection from the random force of weather. Neither the Government nor the farmer can correctly anticipate or forecast the outcome of a specific crop at planting time except by chance, therefore, programs should be designed to be reactive to crop output rather than anticipate crop output. With weather induced variability, current year market prices do not allocate resources to the production of commodities in an efficient manner in the short run because of the temporal dislocation of inputs and production and because output is to some extent random. In the long run, with storage of the yield surpluses, resources would tend to be allocated by output prices because long run market prices would be more easily determined.

Providing protection against random shocks to the system need not distort long-term market signals if the shocks are due entirely to weather. However, if income declines as a result of a change in the business cycle, providing price protection against the shift in demand will result in commitment of more resources in production than would be required. Or, if demand shifts as a result of a change in foreign exchange rates, establishing a price floor could result in a greater reduction in trade than would result from a market determined price.

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