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THE ECONOMICS OF POSSIBLE FOOD RESERVE SYSTEMS AND THEIR RELATION TO COMMERCIAL MARKETS

by

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For many years the United States has implemented farm programs which have resulted in food and feed grain surpluses. The decade of the 1950s was a period of large grain stock build-up. In the early sixties, these programs were successfully modified to discourage further stock build-up and to facilitate stock draw down. After major exporting countries expanded output sharply in the late sixties, stocks expanded again. But production shortfalls in the USSR in 1972 and other parts of the world, particularly South Asia 1972 and including the United States in 1974, further depleted stocks to the lowest level in 22 years. To the extent that annual consumption depends on production of that year, this has resulted in a period of uncertainty about food supplies and high food prices. One of the key issues that has emerged from the situation is whether future programs should provide for the accumulation and maintenance of specific stock levels.

Should stock accumulation and maintenance be left mainly to existing market institutions or should other possibilities be explored and developed? If public or international programs are chosen, how could they be used along with other supply-management programs already at hand to insure some element of stability in market prices and supply availability? Such issues gave rise to the focus of this paper.

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Food Reserve System Defined

The definition of a food reserve system used in this paper is limited to the food-feed-livestock sector and concerned primarily with the modus operandi of commodity marketing. While emphasis is on grain, an effort is made to provide for the impact of the flexible feed relationship between grain and livestock. Stock levels, as determined by the short-term supply and demand situation and longer-term policies are considered to be the key elements of the systems discussed below.

Objective of Paper

The objective of this paper is to describe and evaluate alternative food reserve systems in the context of a number of different food policy goals. While some of the policy goals in question are identified, no attempt is made to arrange the order of priorities. Since the goals themselves may be contradictory, the relative weight given to each goal ultimately decides which food reserve system is preferable. For example, if price stability is paramount, a very rigid system might be chosen. If, on the other hand, price variability is desired so as to be a resource allocater, a system that permits price flexibility would be chosen.

The objective of this paper is to explore basic relationships that can provide a framework for evaluating alternative systems, given the goals, not to advocate particular policy goals or particular food reserve systems. Also, it is the intent of this paper to provide a sound basis for policy decision making without confusing systems operations with systems objectives.

Are the Goals of a Food System Conflicing?

A food reserve system, or more precisely a commodity marketing framework, can continue in effect only if it meets the needs and furthers the goals of the major sectors of the economy. In a very broad sense, a food reserve system has to be tailored in some optimum fashion to apparent contradictory goals of the producers processers, traders, speculators, consumers, and the general public. In real life, a precise definition of each sector's goals may not be possible nor is each sector necessarily neatly or homogenously defined. But the most obvious objectives of each may differ enough to warrant discussion if only to define areas of mutual interest or conflict. The goals listed here are discussed later.

A. Producing Sector:
   1. Strong prices and/or increasing net farm income
   2. Assurance against production and price shortfalls

B. Processing Sector:
   1. Stable and/or increasing processing margins
   2. Price stability and price certainty
   3. Large volume

C. Trade Sector:
   1. Large volume
   2. Some price variability

D. Speculative Sector:
   1. Price instability
   2. Large volume

E. Consuming Sector:
   1. Certainty of food supplies
   2. Low and stable prices

F. Public Sector:
   1. Certainty of food supplies (including production) to meet food commitments at home and abroad
   2. Price certainty
   3. Price variability

At first glance, the listing suggests that price stability goals are common to most sectors and should consequently be high on the priority list. But closer inspection indicates that price variability--or price fluctuation within a defined range--may also be high on the list as a goal itself and as an acceptable proxy in many cases for price stability. For example, any food reserve system that would prevent prices from following much below long-run equilibrium levels but did not interfere with price rises where supplies are tight would meet the pricing goals of the producing, trade, public and, to a more limited extent, processing sectors. Of course in each of these sectors price goals would be tied directly to key farm income, trade volume, processing margin and public resource reallocation goals.

The prime processing margin concern of the processing sector is self-evident provided this sector is concerned only with the sale of services. The goals of the trade sector are harder to define. As a sector providing marketing services, large volume and relative price stability would appear to be logical goals particularly if traders can be distinguished from speculators.

But all of the these sectors, particularly the trade sector, may be interested in enhancing their profit position through speculation. Large profits and losses are only possible in a setting of price variability. The speculative sector can in turn perform a valuable function by pointing up resource reallocation needs.

Nature of Food Reserve Systems

Analysis of all of the food systems treated in this paper centers on two key questions: (1) Who are the decision makers?

and (2) In what institutional setting are decisions made? Each different combination of a decision maker and an institutional setting defines a separate food reserve system. As will be seen later the number of combinations possible is large. However, this discussion is limited to identifying and evaluating only some systems.

In the area of defining decision makers there are four basic possibilities: (1) Private firms (national, multi-national, and quasi-public) make all the decisions: (2) A board or group composed of representatives of the public and private sector makes all decisions; (3) Government makes all the direct decisions; and (4) Some combination of governments and private sectors sharing the decision making process. For example, a government board might negotiate all sales between countries while all sales to private interests would be transacted by private firms.

The institutional setting in which decisions are made can take on several forms:

1). Food reserve systems can operate in unilateral, bilateral or multilateral international setting. So far in the area of agricultural trade the United States has tended to make more unilateral decisions, though many of these past decisions were made recognizing the likely decisions of the other countries involved. For example, the major exporters (United States, Canada and Australia) have taken into account the likely action of the other major exporters in their evaluation of a prospective coarse of action. On the other hand, the International Grains Arrangement of a few years ago and the International Wheat Agreement are

multilateral efforts.

2) Food reserve systems can operate within the context of widely differing government programs. A specific government program which supports prices at certain levels or sets specific objectives as to storage levels both with respect to the accumulation of stocks and disposal of stocks is a setting quite different from one in which no direct government program exist.

3) Food reserve systems can also operate in a context of comprehensively defined governmental rules and regulations or in a context of general regulations leaving considerable latitude for private firm decision making.

Traditionally, when it comes to operation of an economic system, we have avoided multinational approaches at least partially due to the belief that the competitive strength of the United States would insure better results than a negotiated arrangement.

Traditionally, we have also tended to associate broad latititude on the part of private interests with the free enterprise system and more comprehensively defined regulations with government controls. It should be noted that regulation under the guise of protecting the free enterprise system can stifle or result in largely ineffective decision making. Specifically, it should be possible to formulate the two to a set of regulations that would achieve the same objective as a very explicit government program taking direct action.

Operational Strategies

Several operational strategies are available for use in managing

the level and distribution of market supplies. They are:

(1) Adjusting grain production (expanding or contracting)

(2) Adjusting international grain trade

(a) Inducing or inhibiting exports (use of quotas, embargoes, calendars)

(b) Inducing or inhibiting imports

(3) Maintaining contingency grain reserve stocks

(4) Adjusting international trade in livestock products

In the area of production adjustment, short term supply management is possible due to the substituability of feed grain and wheat for both feed and production, and to the difference in hemispheric planting seasons. For example, in the United States, in September when the size of the corn crop is known, adjustments can be made in area planted to winter wheat and barley due for harvesting the following June--the ninth month of the feed grain marketing year. On a world basis, the planting dates in the southern hemisphere differ widely enough from those in the northern hemisphere to allow for sizeable increases or decreases in wheat and coarse grain production in the second half of the marketing year. Production adjustments, however, are generally a cumbersome way of stabilizing supplies and market prices.

The case for export controls needs no further elaboration. Export embargoes are the extreme form of export quotas designed to completely cut off the flow of exports in periods of tight supply. Since an embargo is a drastic action with international repercussions, it should be used only as a last resort after other strategies have

failed.

Contingency stocks, for example, can be used with greater precision and immediatly to raise or lower market supplies and thereby stabilize prices. In the case of extreme fluctuations of crop output or export demand, a great advantage of a contingency reserve stock is its immediate availability as a solution to market shortages. A disadvantage is the cost of holding such stocks, cost of storage and investment in inventory.

Little needs to be said of adjusting livestock feeding as a means of managing supplies, feeding adjustments in the United States this past year served much the same purpose as actual stocks held in reserve in previous years.

The Economics Involved

The major economic components of a food reserve system include production, consumption, trade, stock, price, and cost variables. All may be incorporated into a system of equations quantifying interrelationships. Quantifying the interrelationships tying the food-feed-livestock sectors together is complex enough to make modeling difficult if not impossible. Professor Labys has ably surveyed efforts in this area. However, two characteristics of the commodity markets should be reaffirmed. First, direct food demand for farm commodities tends to be inelastic in general and particularly so the shorter the time period involved. Second, supplies available in any one crop year are relatively fixed. Thus, relatively small changes in supply in a relatively fixed period can result in large changes in price. Therefore, when market supplies continue at near normal levels from one year to the next, prices remain relatively

stable even in the absence of government programs. However, cyclical over-production and "random" production shortfalls have punctuated periods of normal production levels and introduced periods of price instability in the past and probably will continue to do so.

While evaluating the impact on prices using conventional supply and demand interrelationships may be satisfactory in normal or near normal situations, analysis based on these same relationships proves inadequate when supplies are tight. This paper will attempt to show that the key relationship applicable in both the normal and abnormal supply situations is that current price related to anticipated ending stocks of grain. The paper attempts to demonstrate the importance of this relationship in evaluating the different food reserve systems and their relationships to commodity markets.

The anticipated level of ending stocks serves as the single most important summary indicator of a commodity supply and demand situation at any period in the marketing year. Comparison of previous ending stock levels, with anticipated ending stocks indicates the anticipated change in the supply-demand balance, which is particularly critical in years of short supply. Thus, it is logical to expect the food-feed-livestock marketing system to find this single indicator used in conjunction with their expectations about the following year's crop essential in deciding to sell or to hold grain (farmer), to buy or obtain commitments for future use (processor and importer), and to buy, to sell and how much to set aside for future sales (traders). The right decision comes easier as more is known about the amount of grain that will be available at the close of the marketing season

and the size of the new crop that will replenish the bins.

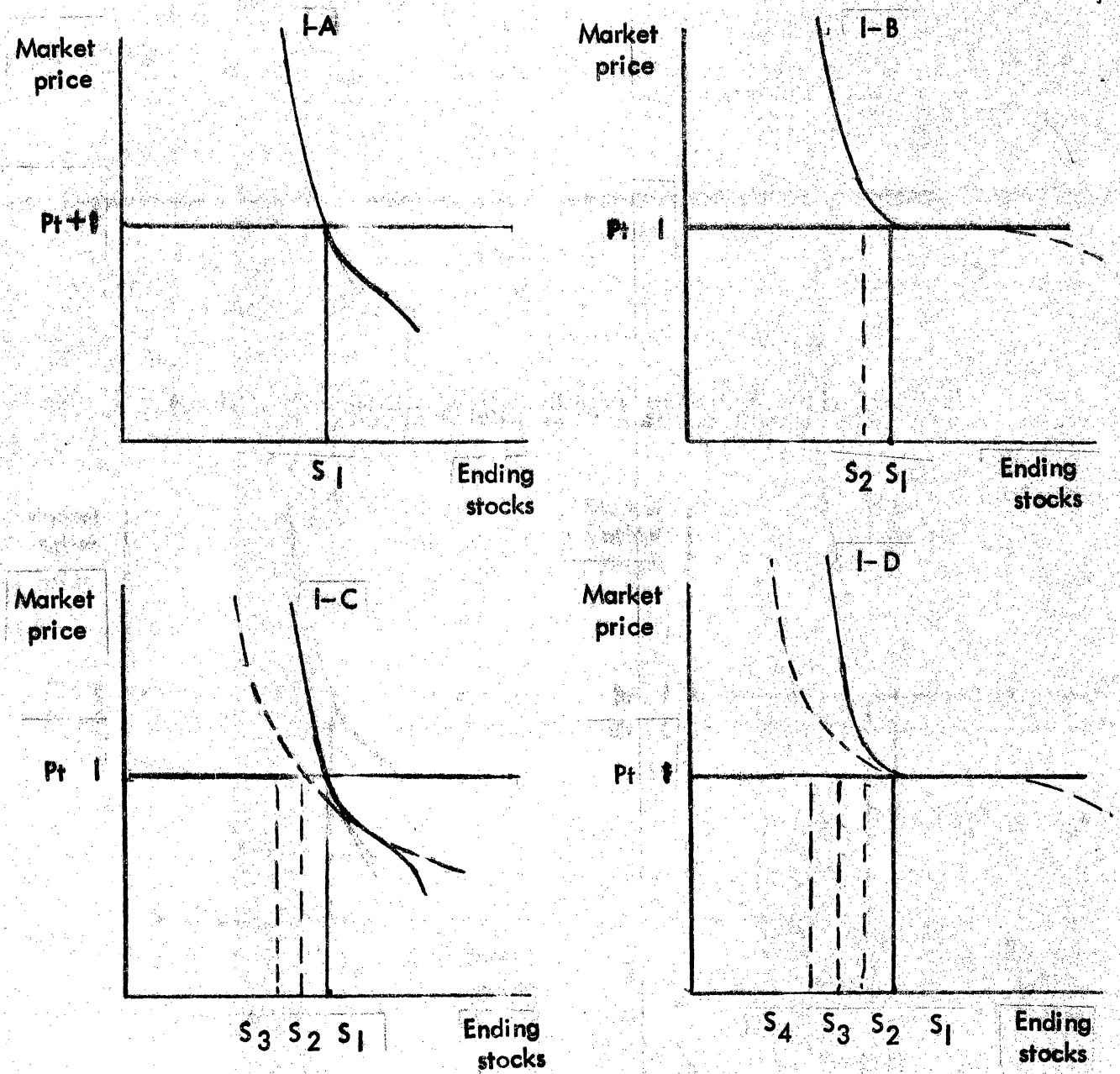
Figure I depicts the nature of the price-anticipated stock relationship under several different assumptions. In each of the charts, the expected price in the following year is assumed to be the same. Figure IA shows the expected demand for ending stocks in a food reserve system in which private firms make decisions under a system of minimum regulation and the country is basically a cereals economy. Without foreign trade the stock demand function could be expected to be steep. The amount of stocks held by private firms at any point in time would differ very little from the level of working stocks if the market price was near the expected price for the following season. Stocks would be carried over only if the market price was sufficiently below expected price for the following year to at least cover cost of storage. The private incentive to carry over stocks is lacking unless current market prices are considerably below the prices anticipated for the following year. Thus, considerable price fluctuations could be expected from production shortfalls unless the country's shortfall could be offset by imports from the world market.

Figure 1B depicts a system in which the Government underwrites a producer price level and maintains minimum price levels in periods of surplus supplies through direct purchases. As the market price approaches the price from above, the slope of the curve becomes flat. It will stay that way as stocks accumulate but then will begin to fall again as stocks reach large levels and become a price depressing force on the market. If the target price remains above normal equilibrium price in a series of "good" years, an otherwise extremely expensive

grain marketing program can be bailed out only by periodic droughts or by some other unusual short supply circumstance. Such was the case in the United States from 1950 to 1972. Of course, if a shortfall occurs before stocks can be accumulated as has been the case in the last two years, the slope becomes steep below some critical level of stocks. When Government holds stocks it is possible that this critical level is S_2 instead of S_1. We would expect more price sensitivity when ending stocks reach some critical level and further escalation as speculative demand comes into play.

Now, suppose we superimpose a livestock economy on the food reserve marketing system described in Figures 1A and 1B. Figure 1C shows the adjustment in the stock functions when all marketing decisions are made in a framework similar to the 1A situation. If the price of grain becomes too high, the amount fed to livestock will be reduced, releasing more grain for food use--the more price inelastic use. Thus prices would not rise as much as they would have in the absence of the livestock economy. This is tantamount to a shift in the demand stock function to the left. It reduces the critical level of stocks to S_3 as food users feel confident that the livestock sector will adjust if necessary. This is what happened in the United States in the 1974 crop year when feed use dropped by about 33 million metric tons and in the USSR during the two droughts in the mid 1960s. As a result of this domestic livestock feeding adjustment, the impact of Soviet shortfalls in the 1960s was much less than the impact in 1972 when the USSR livestock sector was not used as a buffer stock. When supplies become relatively large and feed becomes relatively cheap, livestock

Figure 1. Hypothetical Relation of Price to Anticipated Ending Stocks



feeding will be encouraged and this tends to keep prices higher than that would be expected under a simple food demand situations. Figure 1D is the counterpart for 1B and shows the shift effect of the livestock sector under Government programs for grains. Thus, countries that have only a minimum livestock industry are more dependent on imports to supplement their shortfalls unless they are willing to carry large contingency stocks. In contrast, countries with larger grain-fed livestock sectors would need smaller stocks to meet an equivalent shortfall so long as they were willing to adjust feeding. Because of the adjustments following the 1974 grain shortfall, we can say that the U.S. consumer did give up some grain-fed livestock products and the rest of the world had more grain at lower prices than would have otherwise been possible.

Analysis

We have discussed several world food reserve systems. No single analytical system to my knowledge has been developed to weigh and evaluate the many different aspects of food reserve systems. Results from three types of analysis are presented here. The first supports the short-term price effects suggested by figure I. The second looks at results from a long-run projections model. The third is concerned with results obtained from a simulation model designed to test different operational strategies for the U.S. wheat economy by varying the purchase price (loan rate) and the target price. Figures 2 and 3 show the short-term price effects of levels of ending stocks for U.S. wheat and corn. The relationships are based on multi-variate graphic analysis. Thus, in the case of wheat, the price-stock relationship is net after taking into account effects of wheat feed, PL-480 shipments, U.S. commercial export demand and population growth. For course grains the effects of population, income levels, both domestic and abroad, are taken into account. In short, an attempt was made to abstract away from the usual or normal supply and demand effects.

As expected, the price response is very low when stock levels are high. However, prices become very sensitive when anticipated ending stocks become low. In the case of wheat, the analysis suggests that when ending stocks reach a critical low, the response increases as supplies tighten. For each change of supplies of 1 million metric tons, the price of wheat could change by $10 per ton. For corn, the price response of $4 per ton is less because adjustments in the livestock sector dampens demands.

The next analytical step was to use our world grain-oilseeds-livestock model to project supply, demand, price and trade for major regions

of the world. This comprehensive model incorporates long run supply and demand elasticities and assumes normal weather. The model was asked two questions: (1) How much per metric ton would the world price level of wheat rise if some single world agency increased its contingency reserve level by 1 million m. tons. (2) How much of this added contingency reserve should come from the United States based on supply and demand elasticities? The answer is $0.66 (1975 dollars) per ton with 60 percent of the additional tonnage reserved by the United States if all the major exporters shared the responsibility. If the United States held all the stocks unilaterally, the increase in world price levels would be the same. When the same questions were asked for coarse grains, the increase in world prices was about $0.30 per ton. Thus, in "good" weather years, it would cost the world user 30 cents per ton for corn and 60 cents per ton for wheat. Of course the cost to the group carrying the contingency stocks would be the market price for stocks.

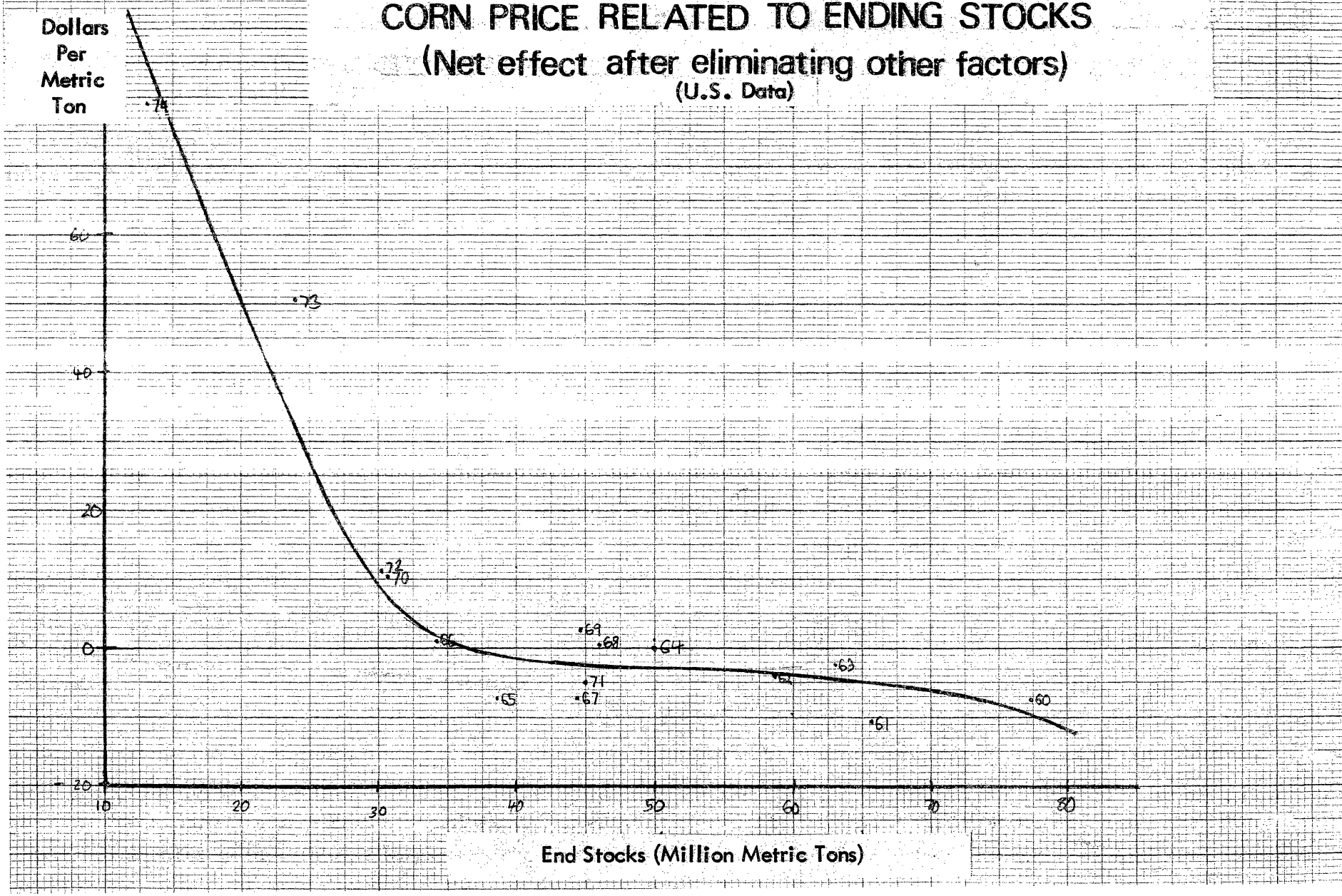
ERS has some work under way studying the stock reserve issue. As part of this research project, Jerry A Sharples and Rodney L. Walker at Purdue ( ) gave devekioed a Wheat Reserve Stocks Simulators Model. Such Mmodels are useful for evaluating different operational strategies discussed above. It was used to examine a continuation of legislation similar to the present wheat legislation, but with laternative levels of loan rates and target prices for the period 1975 to 1981. Both the production function and export demand function have random disturbance terms of 300 million bushels for production and 225 million bushels in terms of standard deviations. The conclusions reached were that there was only a small change that any CCC stocks would be purchased during this period if the current $1.37 loan rate and $2.05 target price were maintained. They also state "raising the target price increases the probability that

deficiency payments will be made and increases that expected value of deficiency payments. With higher target prices, farmers' income from wheat sales plus deficiency payments increase and are less variable". Raising the loan rate relative to the target price increases the probability of building CCC wheat stocks, reduces price and income variability, reduces the chance of being out of reserve stocks of grain, and reduces the expected value of combined government costs of deficiency payments and CCC wheat stocks management costs".

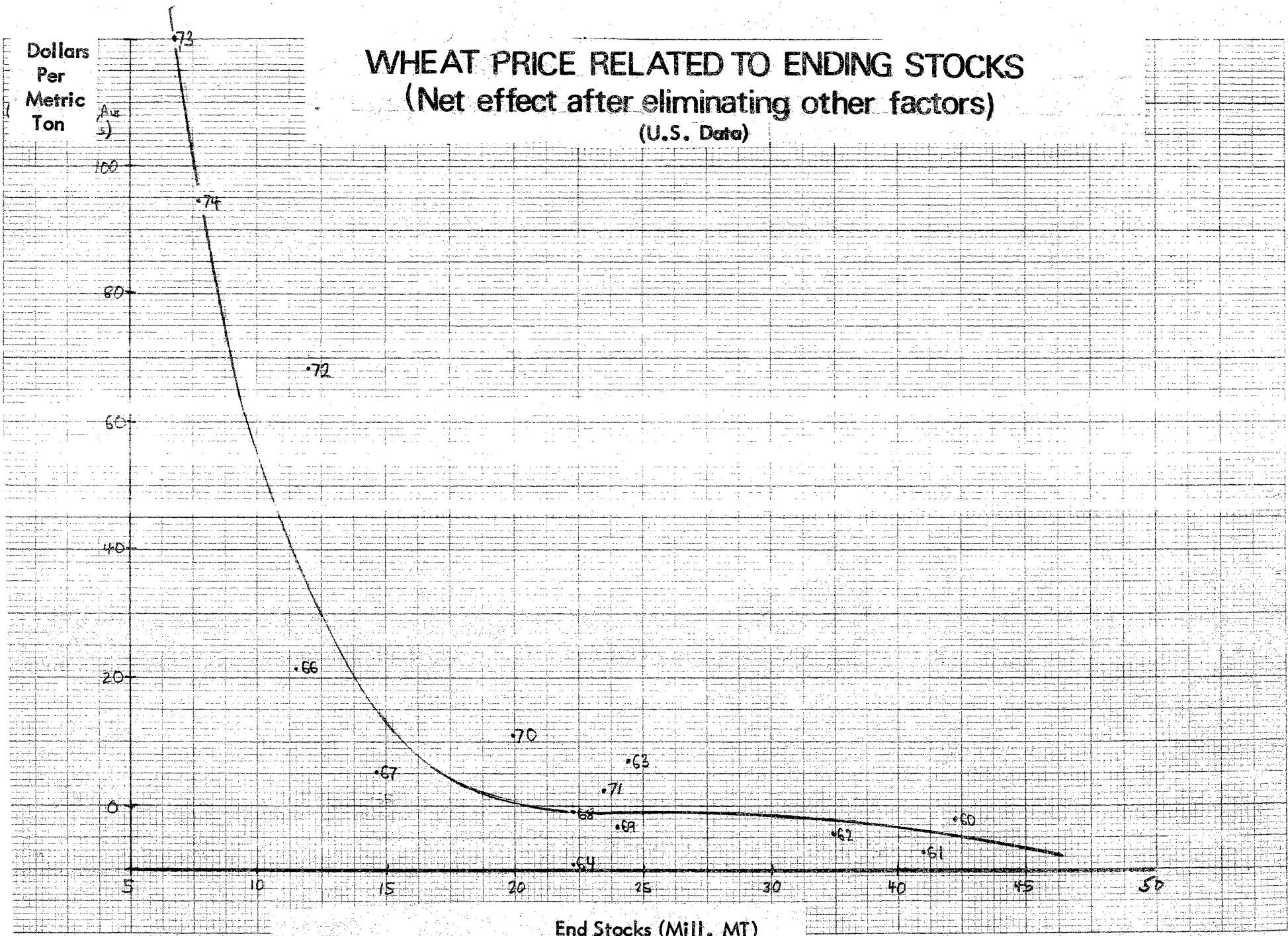
CORN PRICE RELATED TO ENDING STOCKS

(Net effect after eliminating other factors)

(U.S. Data)



WHEAT PRICE RELATED TO ENDING STOCKS
(Net effect after eliminating other factors)
(U.S. Data)



Implications for Food Reserve Systems

The economic lessons of the last three decades touched on in the analysis presented above and outlined in a number of other studies re-emphasizes the importance of the interrelationships tying the grain-oilseeds-livestock sectors together. The experience in the 1950s and 1960s provides a number of insights into what is likely to happen in a setting of large stock levels and government control. Programs will be modified so that gradual adjustments do take place if supply and demand factors get out of balance. It also indicates that in spite of the most sophisticated analyses available to anticipate future balances, the vagaries of weather and political decisions dispel the notion that fine tuning is possible.

The missing link in our analysis is recent experience in the kind of supply response we can expect following several years of a tight supply-demand balance and high prices. We have only the limited experience of the costly adjustments made following production expansion during World Wars I and II. However, the modern commercial farm sector which produces the bulk of U.S. production is highly integrated, more specialized and highly capital-intensive. We do not know whether the modern structure needs a nudge for downward adjustments. It has always responded on the upside.

Let us explore the economic implications that can be inferred in such a setting:

(1) The knowledge of the frequency and extent of weather variability is a pre-condition for the choice of a food reserve system. Progress in this area has been slow.

(2) The balance between import variability and export variability for countries and for particular groups of countries is also a key consideration. The inclusion of USSR, India and possibly China into a world commodity marketing system increases the frequency and the range of variability in world import demand and prices. As a result the food reserve system needs to counterbalance this impact.

(3) A food reserve marketing system that carries reserve levels that permits periods where stocks reach critically low levels is costly to final consumers.

(4) Crop shortfalls not compensated by adequate reserves could be profitable to crop producers if the marketing system protected producers from low price levels. Oligopsonistic grain traders, however, are likely to be the chief benefiters from such developments.

(5) The benefits versus costs accruing to the livestock sector in volatile versus stable prices needs to be studied.

(6) Because of the time necessary for making adjustments in the meat sector (depending on position in the production cycle), windfall profits can be made but serious losses can also be experienced, as happened to cattle feeders this past year.

(7) What happens in large countries such as the United States, USSR, India and possibly China has very serious implications for world commodities markets, particularly if each intends to use world commodity markets to solve internal policy problems. Thus, a food reserve system might consider special treatment for these countries.

(8) If two or three major countries that have considerable impact on world commodity markets do not assume the responsibility for stable prices, the remaining smaller producing and consuming countries may in self defense seek to form their own coalitions.

(9) Frequent decline of world stock levels to critical levels increases the profitability of speculative market manipulation. This could involve participation of multinational firms or even foreign governments. Preventing this from happening might be very difficult.

(10) The analysis indicates that private firms would find it unprofitable to carry large enough stocks for price stabilization unless they are publicly supported. Single firms should not be expected to carry the cost without compensation.

(11) The overriding conclusion from the econometric part of the analysis seems to favor a food reserve system that would keep the level of commodity reserves somewhere between low critical levels and price depressing high levels.

(12) Of the systems considered here, it appears that a well regulated free enterprise system (supervised particularly with respect to developing public information about transactions of multinational firms) could accomplish a satisfactory balance of the goals outlined. On the other hand, systems that involve more government control can also achieve some of the same ends. The real question is the efficiency, the information aspects and, more importantly, the responsiveness of the system to the needs of all the sectors.