Grain Marketing
C

1976

EFFECTS OF CHANGES IN THE LEVEL OF U.S. GRAIN EXPORTS

by

James Trapp

and

Stanley R. Thompson*/

ABSTRACT

The magnitude and duration of the economic shock of the 1972 change in grain exports upon the U.S. crop and livestock markets is examined using an agricultural sector simulation model. In light of the 1972 case, consideration is given to the role of alternative government stock positions in cushioning the shock of grain export changes.

Key Words: Grain exports, dynamic simulation, grain stocks, stock policy.

Agricultural Economics Staff Paper # 76-18
Michigan State University
May 1976

---

* James Trapp and Stanley R. Thompson are Research Specialist and Assistant Professor, respectively, in the Department of Agricultural Economics at Michigan State University.

Paper presented AAEA annual meetings, Penn State University, Aug. 15-18, 1976

EFFECTS OF CHANGES IN THE LEVEL OF U.S. GRAIN EXPORTS

In 1976 U.S. agricultural exports are expected to reach an unprecedented value of nearly $23 billion -- three times larger than the 1970 level. Similarly, export volume is expected to reach a record level of over 100 million metric tons, of which wheat and feed grain exports will total 37 and 43 million tons, respectively (USDA, p. 8).

Given recent large and unexpected increases in U.S. exports, the environment faced by U.S. farmers is becoming considerably more uncertain, thus contributing substantially to agricultural price instability. Many agricultural policy analysts have recently professed that price instability, especially in grains, will be the dominant issue facing agricultural policy makers in the U.S. over the next few years (Robinson). Accordingly, some analysts contend that long-term agreements of the type recently worked out with the Soviet Union on the sale of grain will contribute to stable prices while many believe that the only viable alternative is for the U.S. to establish, maintain and periodically use a reserve of grains, oilseeds, and other selected commodities.

Indeed, recent erratic export grain sales have been considered a principal contributor to domestic price instability. Much of this instability has been attributed to the recent entrance of the Soviet Union into the world grain market. In light of these recent export "shocks", to what extent have increased grain exports affected the U.S. agriculture sector? Specifically, what portion of the total 1972 "shock" can be attributed to the Russian grain purchases? Moreover, what effect did U.S. government grain reserve stock policies have on dampening the impact of the 1972 export "shock" and how might this effect have differed had the government held different levels of grain stocks?

In addressing these questions, this paper presents some results of using an econometric-simulation model to assess the dynamic effects of alternative levels of grain exports on crop and livestock prices under various scenarios of U.S. grain reserve levels.

THE ANALYTICAL MODEL

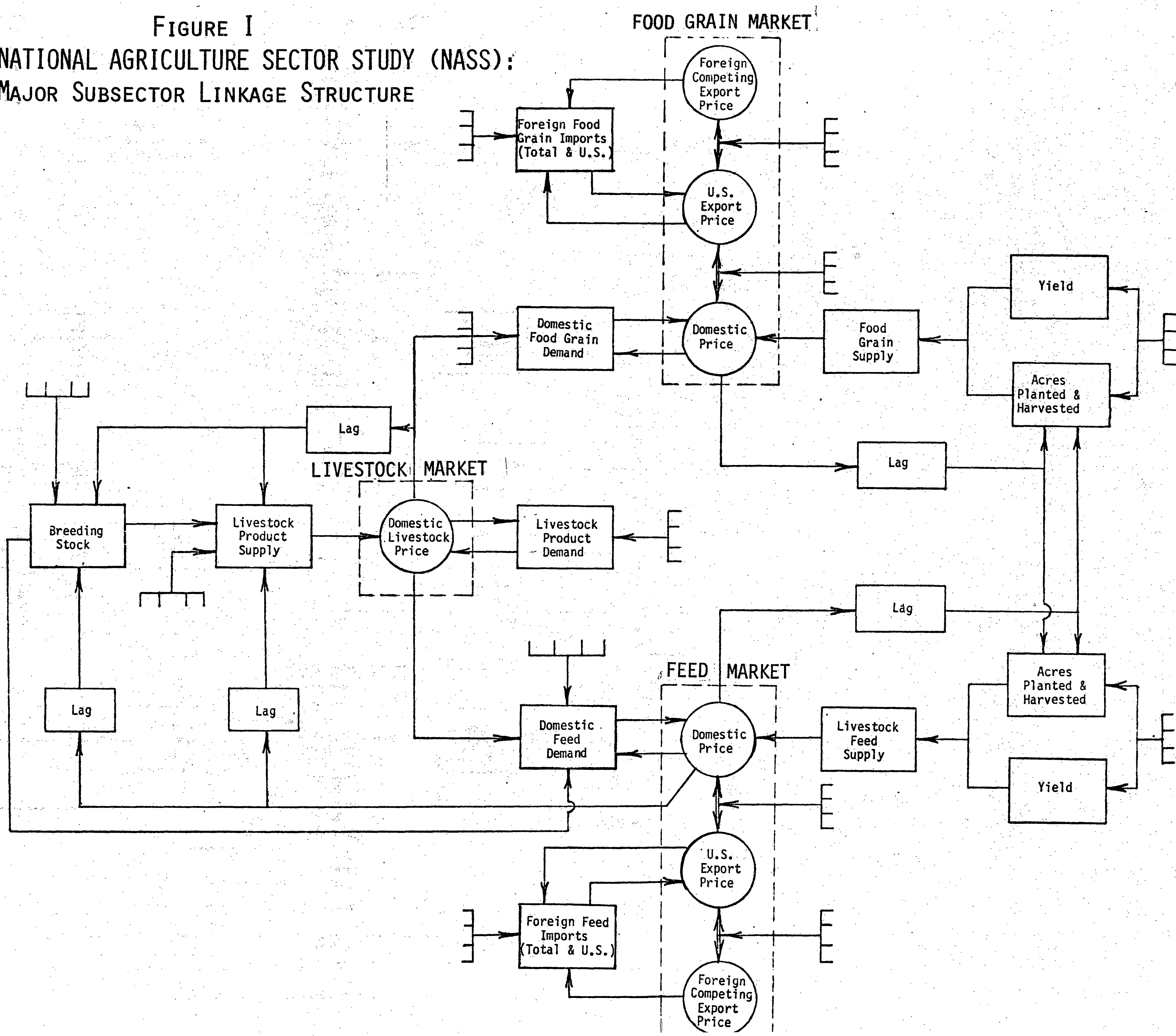
An econometric-simulation model has been developed to assess the effects of changing domestic and international market conditions on the grain, livestock and oilseed sectors of U.S. agriculture (Trapp). Relationships have been estimated for each of the following three major components of the model: (1) a domestic supply component for food grains, feed grains, oilseeds, low grade beef, high grade beef, pork, poultry and dairy products; (2) a domestic demand component for each of the above commodities, and; (3) an international trade component to account for U.S. exports of food grains, feed grains, and oilseeds as well as imports of low grade beef. The interaction of these three components provides estimates of prices, quantities both produced and consumed, and grain inventories (figure 1).

The left hand part of figure 1 represents the U.S. livestock market with an international component which allows for imports of low grade beef. The comb-like configurations pointing into various activity blocks indicate entry points of exogenous variables that influence the system. The analysis of the livestock market begins with an estimate of breeding stock production which leads to an estimate of domestic production of livestock products which in turn interacts with demand to determine a price. Price is fed into the supply analysis for succeeding years to generate a recursive mechanism for estimating quantities of livestock supplied through time.

FIGURE I

NATIONAL AGRICULTURE SECTOR STUDY (NASS):

MAJOR SUBSECTOR LINKAGE STRUCTURE



The upper portion of figure 1 depicts the foodgrain market, which contains both a foreign and a domestic component. After the domestic supply and demand conditions for food grains are established they are linked to the foreign market for U.S. food grain. Foreign and domestic demand interact to simultaneously determine prices and allocation of grain between these marekts. The same general format is indicated for feed grains in the lower section of the diagram, but in this case vis à vis food grains, domestic demand maintains a stronger link to the livestock market.

The analytical model is capable of generating estimates of the following endogenous price and quantity variables: fed beef, non-fed beef, pork, dairy, chicken, eggs, turkey, feed grains (corn, barley, oats and sorghum), food grains (wheat), oilseeds and cotton.[1] Finally the international component interacts with the domestic supply and demand components to enable projection of U.S. exports of food grains, feed grains, and oilseeds. Import projections of non-fed or low grade beef into the U.S. can also be obtained.

MODEL PERFORMANCE

For the sample period (1952-71) the predicted values of the endogenous agriculture sector variables were compared to their actual values. Meaningful evaluation of these results are, of course, complex; however, one indication of the model's performance is the simple correlation coefficient between the actual and predicted endogenous variables. For this ex post evaluation of all domestic equations the average coefficient of correlation (r) is 0.79.[2] In addition, Theil's inequality coefficient (U_1) was calculated for each respective equation. The mean

U_1 coefficient for all domestic equations was 0.04.[3]

In table 1, point forecasts of selected endogenous variables are compared to the actual values for the years 1970, 1971 and 1972. The forecasts for both 1970 and 1971 are made within the sample period whereas the 1972 forecasts are outside the sample period. Actual values of exogenous variables are used for all three forecasts.[4]

With the exception of wheat quantities and chicken prices, all turning points in 1972 are predicted correctly. The inability of the model to precisely forecast quantity of wheat can be traced to a failure to predict a decline in wheat yields in 1972. The reason for missing the chicken price turning point is less clear but a likely factor is the under-estimation of turkey meat, which is a strong substitute for chicken.

SIMULATION OF DYNAMIC EXPORT EFFECTS

In a dynamic simulation model, the impact of a change of a given exogenous variable can be traced through the system's structure to every endogenous variable in the system. A quantified description of these dynamic impacts can be accomplished by calculating a set of "dynamic multipliers".[5]

In this study a one-period change in the level of feedgrain, wheat and soybean exports is used to "shock" the agricultural system model previously described. The dynamic short and long-run responses to this shock as simulated by the model are used to calculate a set of "conditional dynamic multipliers."[6]

In order to derive dynamic multipliers and examine the dynamic impact of the 1972 feedgrain, wheat and soybean export shocks, the effect of these shocks must be isolated from all other exogenous shocks

Table 1. Forecast and Actual Values of Selected Endogenous Variables

	1970		1971		1972	
	Actual	Point Estimate	Actual	Point Estimate	Actual	Point Estimate
<u>Crops</u>						
Prices:[c/]						
Wheat ($/bu.)	1.14	1.26	1.10	1.06	1.40	1.44
Corn ($/bu.)	1.14	1.25	.89	.85	1.25	1.11
Soybeans ($/bu.)	2.45	2.65	2.50	2.45	3.49	3.60
Quantity:						
Wheat (Bil. bu.)	1.351	1.371	1.618	1.619	1.545	1.680
Corn (Bil. bu.)	4.152	4.115[a/]	5.641	5.699	5.573	5.437
Soybeans (Bil. bu.)	1.127	1.136	1.176	1.204	1.207	1.276
<u>Livestock</u>						
Prices:[c/]						
Fed Beef ($/cwt.)	25.70	24.67	28.59	28.74	34.41	30.98
Pork ($/cwt.)	14.52	17.11	18.81	20.91	28.45	25.06
Milk ($/cwt.)	5.02	5.01	4.94	5.07	5.30	5.21
Chicken ($/cwt.)	11.69	10.26	11.29	11.48	11.25	12.06
Quantity:						
Fed Beef (Bil. lbs)	30.479	30.895	30.454	30.614	29.336	30.614[b/]
Pork (Bil. lbs.)	22.815	21.240	20.886	20.404	18.805	19.330
Milk (Bil. lbs.)	118.086	118.336	120.069	119.539	116.505	119.340
Chicken (Bil. lbs.)	8.463	8.284	8.503	8.504	8.889	8.718
<u>Government Stocks</u>						
Food Grain (Mil. tons)	17.088	16.693	21.432	23.417	6.345	9.062
Feed Grains (Mil. tons)	1.105	1.154	1.964	2.225	1.344	1.089

a/ Dummy variable included in 1970 Corn yield function for the corn blight.

b/ The naive model of no change was assumed for beef due to various exogenous shocks occurrir to beef in the 1972 crop year not considered by the model, i.e., the termination of the price freeze.

c/ Prices are deflated by the Consumer Price Index where CPI=100 in 1967.

occurring in the 1972 crop year and subsequent periods. This isolation can be achieved by use of the aforementioned agricultural sector simulation model. A base run, which is free of any exogenous variable changes (including grain export shocks), after the 1971 crop year is made first.[7] A second run is then made injecting a one period change in feedgrain, wheat and soybean export quantities comparable to the actual 1972 increase in exports of approximately 16, 16, and 9 million tons, respectively, of feedgrains, wheat and soybeans (where soybean exports are measured in meal equivalents). The difference between the dynamic paths of the endogenous variables of the model are then compared for these two runs. In this manner the simulated dynamic impact of the 1972 grain and soybean export shock can be analyzed. Table 2 presents the calculated differences in the time paths of these two runs for some selected key endogenous variables. The following discussion is our interpretation of these differences, or alternatively, what we have termed conditional dynamic multipliers.

THE SIMULATED DYNAMIC IMPACT OF 1972 EXPORT CHANGES

Crop Sector Response: The model indicates that upward pressure was exerted upon wheat, feedgrain (represented by corn price) and soybean prices in the period of the export shocks. The estimated initial period effect of the increased grain and soybean exports in 1972 was to increase wheat prices by 44.6 cents, corn prices by 6.7 cents and soybean prices by 149 cents (table 2). By way of comparison, recall that according to the model predictions in table 1, which were made by injecting representations of all exogenous factor changes occurring in 1972, predicted price increases for wheat, corn and soybeans were 38, 26, and 115 cents respectively. Hence, the export shock of 1972 is simulated to have accounted for nearly all of

Table 2: Estimated Effects of the 1972 Grain Export Increase on Selected Endogenous Variables

	Estimated 1971 Level	Current and Intermediate Effects 0	1	2	3	4	Cumulative Long Run Effect
Crops							
Prices:							
Wheat ($/bu.)	1.06	.446	.000	.000	.000	.000	.446
Corn ($/bu.)	.85	.067	.000	.000	.000	.000	.067
Soybean ($/bu.)	2.45	1.490	-.342	-.697	-.264	.075	.374
Quantity c/							
Wheat (Bil. bu.)	1.619	.0	.231	.0	-.012	.0	.271
Corn (bil. bu.)	5.699	.0	-.476	.058	.104	.292	-3.450
Soybean (bil. bu.)	1.204	.0	.363	.177	-.580	-.115	.357
Gross Crop Value a/ (Bil. $)	11.673	3.143	-.146	-.432	-.207	.357	2.047
Livestock							
Prices: c/							
Fed Beef ($/cwt)	28.74	0	5.960	-1.270	-.786	.980	1.010
Pork ($/cwt)	20.91	0	4.330	- .710	1.740	5.210	8.760
Milk ($/cwt)	5.07	0	.082	- .038	.038	.118	.123
Chicken ($/cwt)	11.48	0	8.907	-5.244	-4.891	2.569	.871
Quantity c/							
Fed Beef (bil.lbs)	30.614	0	-3.051	.234	3.762	-.207	- .311
Pork (bil. lbs)	20.404	0	.407	-.227	-3.556	-2.335	-4.196
Milk (bil. lbs)	119.539	0	- .399	-1.547	-1.976	- .414	-1.574
Chicken (bil. lbs)	8.504	0	-1.024	.674	.250	- .225	- .455
Gross Livestock Value b/ (Bil. $)	23.283	0	3.491	-1.214	-3.588	1.478	-2.061
Government Reserves							
Food Grain (mil tons)	23.417	-15.925	-10.665	-8.531	-8.006	-7.112	-84.057
Feed Grains (mil tons)	2.225	-25.238	-36.353	-21.673	-3.069	.141	-171.348

a/ Gross value includes gross revenues from wheat, corn, soybeans, corn, oats, barley, sorghum, and cotton

b/ Gross value includes gross revenues from pork, fed beef, non-fed beef, milk, chicken, turkey, and eggs.

c/ No response occurs for these categories during the first period by definition of the recursive model.

Note: All prices and gross values are in 1971 dollars.

the price change occurring in wheat during 1972, with other exogenous factors partially offsetting the export shock. Likewise, the simulation indicates that increases in exports accounted for the majority of the soybean price change with other exogenous factors acting to reduce the upward price pressure generated by the simulated export shock. On the other hand, feed grain export increases are estimated to have accounted for only about one-fourth of the predicted rise in 1972 feedgrain prices.

Several simulated responses can be observed in the model which help "cushion" the export shock. First, conditions in the model led to excess capacity in the corn and wheat activities entering the simulated 1972 crop year.[8] This excess capacity was simulated to be utilized to fill part of the increased export demand. Secondly, if historical stock liquidation responses were to have been followed in this simulated situation, the simulation run indicates that the government would have liquidated 10.2 million tons of wheat stocks and its entire estimated feedgrain stock holdings (i.e. 6.1 million tons) in an effort to cushion the effect of the export shock upon crop prices.[9]

The effects of the simulated 1972 export shock extend beyond the shock period in the crop sector in several ways. Corn and wheat prices in both the base run and shock run return to support price levels in the first period after the shock, thus the difference in these prices between the two runs is zero after the shock period. Different stock purchases are required in the shock run as compared to the base run to maintain these support prices for corn and wheat. Over a fifteen year period the model simulates that in any given year the government's typical stock position for the shock run would have been approximately 5.6 million tons (-84.057/15) below the base run level for foodgrain stocks and approximately 11.4 million tons (-171.348/15) below the base run for feedgrains.

Since the upward price pressures are simulated to be the strongest for wheat and soybeans relative to corn, some adjustment in the crop sector is simulated to occur in order to alleviate this imbalance in subsequent periods. Specifically, during the 15 simulated periods following the shock the model predicts corn production will fall a cumulative total of 3.45 billion bushels or an average of approximately 4 percent per year below the base run, while on the average wheat and soybean production are simulated to rise 1.1 percent and 2.0 percent per year, respectively, above the base run values.

With respect to soybeans, model conditions indicate that no excess capacity existed nor did the U.S. government hold soybean stocks with which to cushion the 1972 shock; hence, the initial price response for soybeans was simulated to be relatively large (table 2). Predicted soybean price decreases in subsequent periods are attributed to a simulated over-reaction of producers to the initial period price increase. Under the simulated shock run situation, government purchases would have been required to maintain the soybean support prices in the second period after the shock. After soybean prices are simulated to have dropped below the base run level for the first few periods of the shock run, they begin to rise and converge on the base run level. Hence, the 15 year cumulative effect of 37.4 cents is less than the estimated difference in the initial period.

Livestock Sector Response: The simulated crop sector responses indicate that corn and wheat prices are quickly stabilized by government action and excess capacity. However, soybean prices are simulated to be extremely volatile because of a lack of stock holdings and excess capacity (table 2). The initial sharp increase in soybean prices coupled with an associated fall in corn production results in a simulated decline in livestock production during the 15 year period following the export shock. In particular, the simulated increase in soybean prices is indicated to cause protein intensive livestock production to fall. That is, over the 15 year period pork and chicken production are indicated to fall by a cumulative total of 1.33 and .37 percent respectively, and cumulative beef and milk production decline by 0.06 and 0.08 percent respectively below the base run cumulative levels.

While the simulated 15 year cumulative reductions in livestock production appear relatively small, the simulated intermediate single period impacts are quite significant. For example, during the first, second, and third periods following the shock differences between the base and shock runs ranged from .33 percent for milk in period one to 15.5 percent in the third period for pork, with the typical percentage difference being about 5 percent.

It is interesting to note that during the third and fourth simulated periods after the shock, which hypothetically compare to the crop years 1975 and 1976, substantial dynamic responses from the simulated 1972 export shock still remain -- particularly in the livestock sector. In fact, these simulated dynamic residual effects are actually estimated to be larger for beef, pork and milk quantities in the third period after the shock than in the first period.[10] General observation of model output indicates that most of the simulated livestock responses occur in some four to seven years, or roughly one cycle, but frequently some adjustments carry in to the next cycle.

Gross Value of Crops and Livestock: The gross value of crop production in the shock run is simulated to rise sharply over the base run level in the period of the shock, namely by 3.143 billion dollars. The simulated shock period increase in gross crop revenue is due solely to increased crop prices since crop quantities are fixed for the period. In subsequent periods the gross revenue of the crop sector simulated in the shock run drops below the base run due to falling prices and reduced corn production. Hence the cummulative simulated net difference between the two runs for crop sector gross income is only 2.047 billion dollars.

Livestock gross revenue is not influenced in the shock period due to the recursive specification of livestock supply response. In the first period after the shock the simulated response in the livestock sector to the export shock generates (in comparison to the base run) relatively greater price increases than corresponding simulated production declines. Hence in the shock run, the livestock gross revenue levels during the first period are higher than the base run. Over a longer period however, the relatively larger long-run elasticities of livestock supply response to increased input cost cause (for the shock run in comparison to the base run) relatively greater declines in quantity than increases in price (the opposite case of the single period effect). Hence, the shock run cummulative simulated livestock gross income response is 2.061 billion dollars below its respective base run.

The 1972 Soviet Union Purchase: A simulation run was made which injected an export shock into the system equivalent to the 1972 Soviet Union grain purchases (9.5 and 4.5 million tons of wheat and feedgrains respectively). Although the injection of these purchase levels into the model represent a significant proportion of the total 1972 export shock, their simulated effect does not create any large deviations from base run values of endogenous crop and livestock quantities and prices.

Specifically, the representative Soviet Union purchase shock generates no deviation from the base run for corn prices (excess capacity and government stocks fully offset the shock) and wheat prices are simulated to deviate from the base run by 16 cents for one period (as compared to 44.6 cents under the full shock). Soybean prices in this case are simulated to rise over the base run by no more than 6 cents (as compared to a maximum of 149 cents under the full shock). Since soybean prices are simulated to change very little and corn price none at all relative to the base run, the simulated deviations from the base run are very small in the livestock sector.

The marked absence of a large simulated response to the shock representative of the Soviet Union grain purchases is interpreted to be due in part, to the following: (1) the lack of any soybean export shock; (2) the existence of simulated excess capacity for corn and wheat, and (3) government stock liquidations.

STABILITY AND THE LEVEL OF GRAIN RESERVE STOCKS

The simulated effects of three different levels of increased grain exports given three alternative government grain reserve scenarios are empirically examined. The three levels of grain export shocks (in millions of tons) are (1) level A: 16.0 food grain, 16.0 feed grain, 9.0 soybeans: (2) level B: 6.0 food grain, 6.0 feed grain, 4.5 soybeans, and; (3) level C: 2.0 food grain, 2.0 feed grain, 1.0 soybeans. Level A represents the largest expected export sales increase, while level B represents a a more typical increase--roughly the magnitude that the recent long term Russian grain purchase agreement would allow. Level C represents a minimum expected purchase increase.

Since the magnitude of above simulated export effects are largely influenced by the size of the government grain reserves held at the time of the export shock, reserve stock levels (in millions of tons) for food grains and feed grains of 20.0 food grain and 6.0 feed grain (high), 10.0 wheat and 3.0 feed grain (medium) and 0.0 food grain and feed grain (low) respectively, are programmed into the model and examined. These three levels would appear to cover the range of feasible reserve stock levels. Using the identical analytical procedure employed above, consideration is now given to how the dynamic responses would have differed had different levels of export purchases and reserve stocks existed.[11]

As the level of grain reserves becomes smaller, the simulated sensitivity of the agriculture sector to a given export "shock" becomes increasingly more pronounced. For example, if the low (instead of high) reserve stock level exists in the model when the 1972 export is simulated, the model estimates the price of wheat would have more than quadrupled in the short run while the prices of corn and soybeans would have advanced by 18 and 62 percent respectively, over the base run values. Accordingly, the quantities of wheat and soybeans produced in the period after the shock are simulated to increase by 127 and 18 percent, respectively, while the quantity of corn produced would have decreased by 40 percent.[12] The increases in livestock prices with simulated low government stocks, vis à vis those occurring with high stocks, are relatively the same in the short run but in the long run the effects are substantially different, with considerably larger increases occurring when reserve stocks are low.

Table 3: Estimated Effects of Three Increased Levels of Grain Exports Under Three Alternative Government Stock Levels

		A (Large)						B (Typical)				C(Small)	
		Government Reserve Stock Level											
	1971	High		Medium		Low		High Medium		Low		High Medium Low	
	(est.) level	S - R	L - R	S - R	L - R	S - R	L - R	S - R	L - R	S - R	L - R	S - R	L - R
Crops													
Prices:													
Wheat ($/bu.)	1.06	.446	.446	.518	.518	3.266	3.266	.052	.052	.159	.159	.014	.014
Corn ($/bu.)	.85	.067	.067	.112	.112	.156	1.094	.0	.0	.0	.0	.0	.0
Soybean ($/bu.)	2.45	1.490	.374	1.490	.371	1.470	.559	.715	.149	.714	.170	.160	.044
Quantity c/													
Wheat (Bil. bu.)	1.619	.231	.271	.254	.299	2.049	18.044	.020	.034	.099	.083	.241	.012
Corn (Bil. bu.)	5.699	-.476	-3.450	-.512	-3.817	-2.253	-20.496	-.127	-.052	-.203	-.011	-.385	-.016
Soybean (Bil. bu.)	1.204	.363	.357	.360	.347	.216	.097	.183	.173	.177	.174	.407	.035
Gross Crop Value a/ (Billion $)	11.673	3.143	2.047	3.572	14.015	8.467	10.791	1.156	.526	1.077	.664	.177	.063
Livestock													
Prices: c/													
Fed Beef ($/cwt)	28.74	5.960	1.010	6.600	1.200	5.990	9.700	2.760	-7.800	2.150	.030	-.030	.0
Pork ($/cwt)	20.91	4.330	8.760	4.780	9.200	5.190	18.830	1.960	10.710	1.980	3.340	.000	.230
Milk ($/cwt)	5.07	.082	.123	.093	.153	.088	1.100	.033	.027	.011	.020	-.005	-.010
Chicken ($/cwt)	11.48	8.907	.871	9.398	.955	9.784	4.952	4.153	.275	3.739	.360	.455	.080
Quantity c/													
Fed Beef (Bil. lbs.)	30.614	-3.051	-.311	-3.328	-.362	-3.572	-2.626	1.393	.066	-1.160	-.017	-.044	.986
Pork (Bil. lbs.)	20.404	.407	-4.196	.377	-4.383	.341	-7.716	.204	-1.758	.229	-1.635	.075	-.073
Milk (Bil. lbs.)	119.539	-.399	-1.574	-.663	-2.797	-.925	-42.871	-.123	-.198	.095	-.150	-.227	.343
Chicken (Bil. lbs.)	8.504	-1.024	-.455	-1.030	-.439	-1.024	-.166	-.489	-.402	-.483	-.403	-.102	-.331
Gross Livestock Value b/ (Billion $)	23.283	3.491	-2.061	3.742	-2.108	3.695	-.882	1.675	-.122	1.374	-9.899	.001	.131
Government Reserves													
Food Grain (mil. tons)	23.417	-15.925	-84.057	-15.663	-73.440	-5.970	+407.235	6.542	-56.987	-5.670	-34.685	-1.967	-17.051
Feed Grains (mil tons)	2.225	-25.238	-171.348	-22.608	-142.503	-19.642	--237.441	1.395	-124.996	-13.687	-163.886	-5.770	-53.110

a/ Gross value includes gross revenues from wheat, corn, soybeans, corn, oats, barley, sorghum, and cotton

b/ Gross value includes gross revenues from pork, fed beef, non-fed beef, milk, chicken, turkey, and eggs.

c/ Short-run is defined as two years for these catagories as opposed to one year for other catagories. No response occurs in the first period for these catagories.

Note: All prices and gross values are in 1971 dollars.

For the "typical" or "most likely" export level, the simulated effects are identical for both medium and high "shock" levels and only when reserve stock levels are simulated as extremely low are severe stability problems predicted. On the other hand, when very small increases in exports are simulated the effects are identical regardless of the level of government reserve stocks.

Finally, in the long run the simulated gross revenue to crop producers is increased for all simulated export levels while the gross revenue predicted for livestock producers is reduced.

SUMMARY AND CONCLUSIONS

Some important findings are apparent from the use of an econometric-simulation model of the U.S. agriculture sector to estimate the effects of changes in the levels of U.S. grain exports and the ability of grain stocks to cushion the impact.

The levels of government grain reserve stocks held were found to be extremely important in providing stability to the agriculture sector. For instance, "low" grain stock levels coupled with "high" increases in exports are predicted to necessitate extraordinary short and long-run adjustments within the agricultural environment. The predicted dynamic adjustment processes are particularly long in the livestock and soybean markets.

Empirically observing the important stability implications of existing levels of food and feed grain stocks, provides tacit support for government holdings of soybean stocks. It appears that a substantial dampening of price and quantity fluctuations due to an export "shock" can be attained via reserve soybean stocks.

Finally, the "net effect" of the 1972 Russian grain purchase was found to provide only a partial explanation for the dramatic price increases which occurred that year. Simultaneous changes in other exogenous factors contributed to the actual 1972 changes that took place within the agriculture sector.

REFERENCES

Robinson, K.L., "Unstable Farm Prices: Economic Consequences and Policy Options," Amer. J. Agr. Econ., 57(1975):769-777.

Theil, Henri. Principles of Econometrics, John Wiley and Sons, Inc., 1971

Trapp, James. "An Econometric Simulation Model of the National Agriculture Sector." Ph.D. Thesis, Michigan State University, 1976.

USDA, ERS. Foreign Agricultural Trade of the U.S., December, 1975.

FOOTNOTES

*/ James Trapp is an assistant professor in the Department of Agricultural Economics at Oklahoma State University and Stanley R. Thompson is an assistant professor in the Department of Agricultural Economics at Michigan State University.

The authors wish to acknowledge the helpful suggestions and criticisms of James Bonnen, Vern Sorenson, Derek Byerlee, John Ferris and David Watt.

1. While the demand for meat products is not subdivided, the demand for grain is broken into the following five sources: 1) direct demand for human consumption; 2) derived demand for use as livestock feeds by category of livestock; 3) public stock demands; 4) private stock demands; and 5) seed demand.

2. Included as domestic equations are total export equations for food grains, feed grains and soybeans.

3. U_1 is a forecast evaluation statistic that is standardized to lie between zero and one, where $U_1 = 0$ is a perfect forecaster and $U_1 = 1$ is the worst possible forecast (Theil, pp. 32-35).

4. The quantity of exports which can be specified as either endogenous or exogenous to the model were specified as exogenous in making this set of estimates.

5. Dynamic multipliers are generally defined as the effect of a one-period change in the level of an exogenous variable on the time path of the values of an endogenous variable. The effect of a single period change of an exogenous variable on the endogenous variables generally extends over more than one period. Hence, a short-run effect can be defined as the change in the endogenous variables occurring in the period of the exogenous change while a long-run effect can be defined

as the "total responsiveness" of the endogenous variables over time to a given change of an exogenous variable.

6. The dynamic multipliers presented in this paper are a modification of the "general" concept of a dynamic multiplier in that the system has not been purged of initial conditions before imposing the export shocks. The initial conditions used in this analysis are those existing in 1971. This enables a specific study of the 1972 export shock in its actual historical setting and a study of several alternative export shocks in the context of the 1971 situation.
7. The base run does not generate constant values of the endogenous variables after 1971. Various shocks and conditions existing prior to and during 1971, i.e., the corn blight of 1970, are still exerting lagged effects on the endogenous variables. In addition, the dynamic interaction between the endogenous components of the model that remain in operation generate cyclical tendencies, etc.
8. This is reflected in the model by the fact that the base run simulation required the government to purchase 1.1 and 6.7 million tons of feedgrain and wheat respectively, in the simulated 1971 crop year to maintain corn and wheat support prices. It should be recalled in this regard, that in the 1971 crop year the crop and livestock sectors were recovering from the 1970 corn blight. Favorable crop production incentives were being offered by the governemnt in 1971 to speed recovery, which, according to the model were generating excess capacity in the form of corn and wheat stock accumulations.
9. In the base run where no export shock occurred the government is simulated to have had to purchase 5.7 and 19.1 million tons of wheat

and feedgrains, respectively, to maintain support prices. Hence in table 2 a total difference in period 0 between the base run and shock run of 15.0 = 10.2 + 5.7 and 25.2 + 6.1 + 19.1 for government foodgrain stocks (wheat) and feedgrain stocks, respectively, is indicated.

10. The positive sign on pork quantity in period one is due to an immediate simulated reaction in which breeding stock is liquidated as the first response to unfavorable economic conditions. This liquidation temporarily raises pork production.

11. The level A export level coupled with high government reserve grain stock is the 1972 export shock case, i.e., the first two columns of short and long-run effects in table 3 can be derived from table 2.

12. Because the U.S. government has not generally held soybean stocks (and is simulated to not be holding soybean stocks), the change in price of soybeans is effectively simulated to be constant regardless the level of government reserve stocks specified.