A SIMULATION ANALYSIS OF A RESERVE STOCK MANAGEMENT POLICY FOR FEED GRAINS AND WHEAT*

Daryll E. Ray, James W. Richardson and Glenn S. Collins

During the last three years agriculture has exhibited characteristics that parallel those of a manic depressive. The livestock sector was flying high during 1973 and in the depths of despair in 1974. The crop sector was elevated from two decades of despondent but stable economic health to a state of price elation in 1973 and 1974. Over the last couple of years consumers, who enjoyed excellent food budget health for years, have slipped into a state of belligerent depression. Each group views the future with anxious dismay. Livestock producers fear that the feed prices will remain high, crop producers fear they will not. Neither livestock nor crop producers have a sound basis for making short or longer term production plans.

Current commodity programs can stabilize crop prices in times of downward price pressure but are of little aid on the up side when government stock levels are drawn down. Yet, as the livestock industry knows, extreme upward grain price fluctuations can be as much a source of financial debacle in livestock agriculture as extreme downward fluctuations are for grain agriculture. Mayer [5] and Tweeten [9] suggest that the future thrust of commodity programs should be one of systematically moderating price fluctuations, both upward and downward, for major food and feed grain. Stabilized grain and feed markets would then contribute to stability in markets for livestock and livestock products. Various forms of stabilization measures have been proposed [2, 3, 4, 10, 11].

The objectives of the study are to: (a) develop aggregate models of feed grain and wheat economies for use in evaluating the effectiveness of stock management policies in general, and (b) evaluate the level and variability of key economic variables. These include prices and incomes under Senate Bill S. 2005, the Humphrey proposal, as last amended on May 21, 1974 as compared with a slight modification of the Agricultural Consumer Protection Act of 1973.

THE SIMULATION MODEL

The stochastic simulation models of the feed grain and wheat economies developed for this study are conceptually similar to the wheat model used by Tweeten, Kalbfleisch and Lu [8].[1] Separate models were built for feed grains and wheat. The models' basic properties are identical. Each is an equilibrium model with price and utilizations determined by the economic requirement that quantity supplied equals quantity demanded. Demand components are domestic demand, export demand and stocks. In the wheat model, domestic demand is separated into feed demand and other domestic demand which includes food, seed and industry. Total demand at each price is a horizontal summation of sector demands. Export demands are assumed to be influenced by random processes and are stochastically shifted horizontally right or left.

The model also has stochastic supply characteristics. Supply is the sum of previous year carryover and current production, calculated as the product of harvested acreage and a randomly se-

Daryll E. Ray is associate professor, James W. Richardson is research associate and Glenn S. Collins is research assistant of agricultural economics at Oklahoma State University. Helpful comments of Luther Tweeten and the substantial input provided by Milton Ericksen, who is with ERS, are gratefully acknowledged.

* Oklahoma Agricultural Experiment Station Journal Article J-2923.

[1] A review of previous grain reserve management studies is made by Tweeten, Kalbfleisch and Lu [8] and to save space, will not be presented here.

lected yield. Specifics of estimated distributions used for drawing export and yield levels are discussed later.

A single run of the simulator generates values for endogenous variables that would be expected in the real world under similar conditions, for the years 1975 to 1979. Results of a single run are specific to the structural conditions and chance elements in that run, but repeated runs or iterations average out random elements and allow auditing of the five-year performance of the system.

Demand Relationships

Demand relationships used in the feed grain model are:

$$FGDU_t = 230.0 - .6304FGP_t + 1.875T$$
$$FGEX_t = 55.75 - .26338FGP_t + .5T + \varepsilon$$

where: FGP is feed grain price in dollars per ton; FGDU is the quantity consumed by the feed, seed, food and industry sectors; FGEX is the quantity exported, and T is a time variable with 1.0 for the first year, 1975, 2.0 for 1976 through 5.0 for 1979.

The slope coefficient for domestic demand relation assumes a 1975 equilibrium price ($71.19 per ton) and quantity (187.0 million tons) and a price elasticity of —.24. The intercept and time coefficient were calculated to complete the equation. In succeeding years the time coefficient increases equilibrium quantity by 1.875 million tons per year. The export relationship was developed similarly with an equilibrium 1975 export quantity of 37.5 million tons and a price elasticity of —.5. With an expected value of zero, ε is the stochastic component of the feed grain export equation. The purpose of ε is to randomly shift the export equations by the amount of a random draw taken from a normal distribution with mean zero and standard deviation of 9.8.[2] Assumed equilibrium levels of price and quantities were developed by the authors in consultation with USDA analysts. Elasticity estimates were reported by Brandow [1] and Rojko et. al. [7]. Demand relationships used in the wheat model are:

$$WFSI_t = 662.09 - 20.1467WP_t + 2.75T$$
$$WFED_t = 283.58 - 22.06WP_t + 3.25T$$
$$WEX_t = 1437.5 - 162.5WP_t + 25.0T + \varepsilon'$$

where: WP is the price of wheat in dollars per bushel; WFSI is quantity consumed by domestic food, seed, and industry sector; WFED is quantity consumed by domestic feed, sector; and WEX is quantity exported.

The wheat demand relationships are based on a $3.00 price and 1975 demand quantities (all in millions of bushels) of 604.4 for food, seed and industry; 220.6 for feed and 975 for exports with price elasticities of —.1 for WFSI [6]; —.35 for feed demand [8] and —.5 for exports [8]. The random element ε is distributed normally with a mean of zero and standard deviation of 265.3.

Addition of domestic and export demand relationships result in the following aggregate demand relationships for feed grains and wheat, respectively:

$$FGQ_t = 285.75 - .89378FGP_t + 2.375T + \varepsilon$$
$$WQ_t = 2383.12 - 204.7067WP_t + 31.0T + \varepsilon'$$

Supply Relationships

The supply available each year for domestic consumption, exports and carryover of each commodity is computed as the sum of carryover from the previous period and current year production—the product of acreage and yield. Yields for feed grains and wheat are randomly selected from normal probability distributions. The standard deviations used, derived from 1964 to 1974 data, are .1736 tons of feed grains and 1.18816 bushels for wheat. The 1975 mean yield for feed grains is 2.18 tons per acre and increases .04 million tons per acre per year. The mean yield assumed for wheat is 31.8 bushels per acre in 1975 with uniform yearly increases of .85 bushels in 1979.

For purposes of this analysis, it is assumed that feed grains and wheat acreages are set by the government in accordance with predetermined policy goals. A simple decision rule is assumed in which acreages are set at levels to meet expected domestic and export utilizations plus or minus an amount to adjust stocks to target levels.[3]

---

2 The standard deviations for feed grain and wheat exports and for feed grain and wheat yields referred to later, were calculated from 1964 to 1973 data.

3 The computation procedure used in determining acreage for both feed grains and wheat, in general notation, is:

$$AC_t = \frac{QD}{Y} + \frac{C^* - C_{t-1}}{Y}$$

where: AC is the target acreage; QD is the expected sum of domestic and export needs; C* is target carryover; C is actual carryover; Y is expected yield.
Initially the acreage response functions were used in the simulator but mammoth government stocks resulted after two or three years.

POLICIES SIMULATED

Two simulations are made with the system. One utilizes the provisions of an amendment in the nature of a substitute to Senate Bill S. 2005 (Second Session, 93rd Congress) which, if enacted, would raise target price and loan levels and provide for establishment management of reserve stocks. To analyze relative impacts of reserve management capabilities of S. 2005, another simulation is run in which the bill's target and loan levels are assumed but with no management of reserve stocks. Only the feed grain and wheat economies are considered. The export licensing provisions in the amendment are not incorporated in the simulation.

Under S. 2005, target prices are raised from $2.05 to $3.00 per bushel for wheat and from $1.38 to $2.00 per bushel for 1974 crop year corn. Minimum loan rates are set at two-thirds of the target prices. Target prices and minimum loan rates are held at these levels through 1979 in the simulation analysis. Adjustments in target prices reflecting annual changes in prices paid by farmers for production items, interest, taxes and wage rates beginning in crop year 1975 and succeeding years as required by the bill are not made in the simulations.

Reserve management provisions of the bill call for managing government stocks if total stocks or reserves fall below certain established levels. Government stocks can be sold only if market prices go above predefined levels depending on the stock level. Stocks are acquired only if market prices go below the loan rate as set prior to the marketing year. No action is taken in years in which stock levels satisfy established reserve requirements and market prices are between upper and lower threshold values. Stocks will be acquired if prices are (a) below 66 2/3 percent of target prices (minimum loan rates) in years when stocks are above critical levels or (b) below 90 percent of target prices when stocks are below critical levels. Stocks will be sold if market prices are above (a) 135 percent of target prices in years when stocks are below critical levels or (b) above target prices in years when stocks are above critical levels. Critical stock levels have two components. One is government stocks with critical levels set at 15 million tons for feed grains and 200 million bushels for wheat. The second component is total carryover

Table 1. RESERVE MANAGEMENT DECISION MATRIX USED IN THE SIMULATOR

Market Price[1]	Stock Levels[2]: T<T* and G≤G*	T>T* and G≥G*	T>T* and G<G*
Above 135% of Target[3]	Sell	Sell	Sell
Between 135% and 100% of Target[3]	-	Sell	-
Between 100% and 90% of Target[3]	-	-	-
Between 90% and 66 2/3% of Target[4]	Buy	-	-
Below 66 2/3% of Target[5]	Buy	Buy	Buy

[1] The target prices used are $2.00 per bushel for corn ($71.19 per ton of feed grains) and $3.00 per bushel for wheat.

[2] T* is the critical total carryover, 40 million tons for feed grains and 600 million bushels for wheat; T is expected total ending year carryover, G* is the critical government stock level, 15 million tons for feed grains and 200 million bushels for wheat; and G is the government stock level.

[3] Government sales are made at the market price.

[4] Government purchases are made at 90% of target price.

[5] Government purchases are made at 66 2/3% of target price.

stocks (private and government), set at 40 million tons for feed grains and 600 million bushels for wheat. Conditions under which the government accumulates or sells stocks are shown in Table 1. The bill states that the government will accumulate stocks through non-recourse loans to farmers. In the simulator, stocks are accumulated through market purchases. To illustrate its workings, suppose wheat expected carryover, T, and government stocks, G, are below their critical levels of T* and G* (600 and 200 million bushels respectively) and calculated wheat price is below $2.70 (90% of target). The government would purchase the quantity of wheat required to raise the price to $2.70. This quantity would be the difference between the quantity demanded at the market price and at $2.70 using equation (1).

In addition to simulating the reserve management policy indicated in Table 1, another situation was run which assumed the government will only buy when market prices fall below 66 2/3 percent of target prices and will sell when prices are above targets, irrespective of private or government stock levels. Both simulations were run (over the five-year period from 1975 to 1979) 1,000 times. The number of iterations was judged sufficient to allow draws of extreme values for yields and exports in tails of their distributions.

SIMULATION RESULTS

Summaries of the simulation results are presented in Tables 2, 3 and 4. Tables 2 and 3 contain mean and dispersion statistics for key variables by year from 1975 to 1979 while Table 4 displays variable means and standard deviations based on simulated values for the entire five-year period.

Table 2. SIMULATION RESULTS OF THE HUMPHREY STOCK MANAGEMENT PROPOSAL, 1975-1979

Crop and Items[1]	1975 Mean	1975 Standard Deviation	1975 Minimum Value	1975 Maximum Value	1976 Mean	1976 Standard Deviation	1976 Minimum Value	1976 Maximum Value	1977 Mean	1977 Standard Deviation	1977 Minimum Value	1977 Maximum Value	1978 Mean	1978 Standard Deviation	1978 Minimum Value	1978 Maximum Value	1979 Mean	1979 Standard Deviation	1979 Minimum Value	1979 Maximum Value
Feed Grain																				
Acreage[1]	108.00	0.00	108.00	108.00	100.35	10.43	70.84	107.14	97.07	9.09	67.44	106.02	100.58	5.51	83.84	106.10	98.51	6.81	72.75	105.80
Yield[2]	2.18	0.15	1.80	2.69	2.21	0.18	1.79	2.61	2.29	0.16	1.88	2.61	2.29	0.16	1.91	2.68	2.36	0.19	1.84	2.80
Production[3]	235.39	17.05	194.72	291.26	222.04	29.39	122.95	274.21	222.76	24.62	130.91	273.19	230.58	21.17	186.92	282.94	232.83	27.16	150.87	296.32
Supply[3]	260.39	17.05	219.72	316.26	254.98	20.49	202.32	296.78	254.62	16.79	197.48	286.86	260.58	17.25	225.69	304.99	265.77	21.84	206.78	320.39
Domestic Demand[3]	188.26	4.80	171.84	194.63	186.45	8.11	167.96	196.50	186.09	8.68	163.80	198.38	189.31	7.56	176.92	200.25	191.39	8.57	168.56	202.33
Exports[3]	39.17	8.50	20.72	62.06	36.68	8.91	1.98	56.01	38.53	9.71	20.37	63.14	38.34	8.50	16.32	55.18	38.72	8.24	15.33	59.79
Carryover[3]	32.95	12.95	16.55	79.37	31.86	13.29	1.82	68.76	29.99	9.74	2.29	53.88	32.94	9.82	15.60	65.67	35.65	15.31	2.42	89.17
Government Stocks[3]	5.17	8.05	0.00	33.86	7.76	7.67	0.00	29.61	7.89	6.61	0.00	23.56	9.65	6.56	0.00	27.39	11.60	8.25	0.00	38.19
Price[4]	69.18	7.62	59.09	95.24	75.04	12.86	59.09	104.36	78.58	13.77	59.09	113.94	76.45	12.00	59.09	96.11	76.13	13.58	59.08	112.34
Value of Production[5]	16185.52	1052.23	14285.19	20377.46	16350.08	1560.30	12210.38	20084.50	17252.93	2096.06	13673.35	24389.39	17423.82	1676.48	13450.67	21805.70	17424.79	1837.69	13886.36	22712.47
Storage Cost and Interest[5]	26.80	41.68	0.00	175.41	67.00	63.13	0.00	253.59	81.06	68.25	0.00	260.01	90.85	61.07	0.00	238.82	110.09	58.75	0.00	220.29
Deficiency Payments[5]	769.91	622.58	0.00	2155.11	611.84	676.08	0.00	2215.20	462.50	699.06	0.00	2275.30	505.43	712.20	0.00	2335.39	639.01	872.07	0.00	2395.49
Wheat																				
Acreage[1]	55.46	0.00	55.46	55.46	56.39	8.55	34.17	64.00	54.33	8.33	35.71	64.00	53.68	8.12	28.80	64.00	53.94	8.57	30.95	64.00
Yield[6]	32.89	1.09	30.27	35.65	33.52	1.27	29.57	36.04	33.95	1.14	31.38	36.93	34.58	1.22	31.94	37.17	35.19	1.25	32.79	37.99
Production[7]	1824.24	60.40	1678.99	1976.90	1889.43	292.66	1200.90	2306.87	1844.17	287.89	538.32	2262.17	1856.51	290.18	930.04	2357.76	1898.59	305.79	694.93	2359.16
Supply[7]	2224.24	60.40	2078.99	2376.90	2325.21	141.83	2007.82	2552.94	2327.69	137.83	1720.01	2581.74	2350.11	127.32	1942.80	2630.91	2394.17	141.05	1820.09	2719.81
Domestic Demand[7]	819.94	25.68	753.27	867.21	830.67	24.72	765.26	873.21	834.59	27.95	766.42	879.21	838.92	27.55	793.75	885.21	844.82	27.44	804.68	891.21
Exports[7]	966.52	192.91	500.19	1304.23	1011.02	177.09	400.01	1482.94	999.50	197.23	556.98	1396.67	1015.61	192.09	519.23	1432.37	1041.32	182.59	518.74	1439.25
Carryover[7]	435.79	173.95	119.45	854.96	483.52	172.04	37.23	1181.68	493.61	184.93	70.00	972.76	495.59	191.26	7.99	1125.16	508.03	160.83	186.37	1205.96
Government Stocks[7]	30.87	52.59	0.00	168.36	59.99	59.05	0.00	235.95	83.94	58.74	0.00	250.10	98.78	60.61	0.00	245.95	112.05	56.24	0.00	255.95
Price[8]	3.12	0.61	2.00	4.69	3.01	0.50	2.00	4.56	3.06	0.59	2.00	4.67	3.09	0.56	2.00	4.17	3.09	0.57	2.00	4.05
Value of Production[5]	5681.57	1066.11	3538.26	8350.84	5577.03	905.66	3138.94	8558.17	5568.47	1181.83	2515.21	8520.20	5663.53	1158.03	3139.43	8574.16	5803.23	1270.69	2814.46	9147.02
Storage Cost and Interest[5]	13.89	23.66	0.00	75.76	26.99	26.57	0.00	115.18	37.77	26.43	0.00	112.55	44.45	27.28	0.00	115.18	50.42	25.31	0.00	115.18
Deficiency Payments[5]	327.42	490.59	0.00	1776.20	415.61	533.57	0.00	1835.34	458.55	589.89	0.00	1887.68	432.72	632.31	0.00	1914.49	443.79	674.44	0.00	1947.32

[1] Millions of Acres. [2] Tons per Acre. [3] Million Tons. [4] Dollars per Ton. [5] Million Dollars.
[6] Bushels per Acre. [7] Million Bushels. [8] Dollars per Bushel.

Over the five-year period (Table 4), average levels of feed grain and wheat prices are much the same in the two simulations but variation in prices is significantly reduced in the Humphrey reserve management simulation. Feed grain price variability is reduced 20 percent and wheat price variability declined 19 percent compared to the simulation in which no reserve management was assumed. With the reserve management policy, value of production levels are somewhat higher and considerably less variable. The reserve management policy reduces price variability due to the requirement that loan rates must be increased to 90 percent of target price, and the selling price of government stocks must be raised to 135 percent of target price, whenever expected carryovers fall below threshold levels.

Total carryover stocks and government stocks are at a higher level and are more variable under the reserve management policy. Stock levels are higher due to the government's attempt to maintain government stocks at the threshold level, and

Table 3. SIMULATION RESULTS ASSUMING GOVERNMENTS STOCKS ARE BOUGHT WHEN MARKET PRICES FALL BELOW 66 2/3% OF TARGET PRICES AND SOLD WHEN MARKET PRICES EXCEED TARGET PRICES, 1975-1979

Crop and Items[1]	1975 Mean	1975 Standard Deviation	1975 Minimum Value	1975 Maximum Value	1976 Mean	1976 Standard Deviation	1976 Minimum Value	1976 Maximum Value	1977 Mean	1977 Standard Deviation	1977 Minimum Value	1977 Maximum Value	1978 Mean	1978 Standard Deviation	1978 Minimum Value	1978 Maximum Value	1979 Mean	1979 Standard Deviation	1979 Minimum Value	1979 Maximum Value
Feed Grains																				
Acreage[1]	103.04	0.0	103.04	103.04	101.67	2.95	87.65	106.66	99.71	3.03	90.30	104.85	100.88	2.65	93.98	106.10	100.19	2.5	91.76	104.81
Yield[2]	2.18	.16	1.80	2.70	2.21	.17	1.79	2.61	2.30	.16	1.89	2.61	2.29	.17	1.91	2.68	2.36	.19	1.84	2.80
Production[3]	224.58	16.27	185.78	277.89	224.99	20.09	177.13	272.01	228.91	16.65	170.48	267.92	231.31	18.46	192.22	278.93	236.56	20.86	175.74	284.82
Supply[3]	249.58	16.27	210.78	302.89	250.14	18.24	207.56	289.68	253.87	15.63	215.13	286.37	255.89	16.78	217.29	295.53	261.43	19.34	211.40	306.19
Domestic Demand[3]	186.15	8.08	167.31	202.03	187.89	9.88	167.60	203.91	189.38	9.59	166.49	205.78	191.69	8.82	173.03	207.66	194.70	10.95	167.26	209.53
Exports[3]	18.29	8.24	20.30	66.46	37.28	8.69	6.36	54.37	39.91	9.01	20.23	67.47	39.33	8.25	19.97	56.61	40.11	7.60	19.13	58.20
Carryover[3]	25.15	6.58	14.03	56.42	24.96	6.96	13.14	46.60	24.58	6.14	11.49	40.46	24.87	5.84	14.08	44.56	26.61	9.50	9.18	67.18
Government Stocks[3]	.45	2.45	0.0	16.55	.50	1.94	0.0	9.98	.38	1.29	0.0	6.02	.39	1.30	0.0	8.03	1.18	3.71	0.0	23.36
Price[4]	72.54	12.81	47.34	102.42	72.75	16.68	47.34	104.96	73.36	16.22	47.34	109.66	72.68	16.9	47.34	102.27	70.87	17.37	47.34	114.40
Value of Production[5]	16112.72	1975.42	11649.93	21174.54	16104.98	2410.40	10823.87	21126.54	16610.58	2707.90	11578.78	23222.20	16595.53	2260.98	11467.90	21031.42	16459.26	2875.17	11285.75	23703.46
Storage Cost and Interest[5]	2.34	12.72	0.0	85.71	4.91	17.45	0.0	103.40	4.58	14.40	0.0	75.74	4.05	10.95	0.0	57.00	8.15	20.57	0.0	121.02
Deficiency Payments[5]	805.22	1262.75	0.0	4246.83	1041.09	1441.88	0.0	4365.25	930.58	1410.85	0.0	4483.68	918.38	1484.64	0.0	4602.10	1459.71	1807.65	0.0	4720.53
Wheat																				
Acreage[1]	54.87	0.0	54.87	54.87	54.71	4.37	41.78	63.47	54.72	3.62	37.29	63.05	54.42	4.02	41.06	62.64	54.19	4.52	37.68	62.16
Yield[6]	32.89	1.09	30.27	35.65	33.52	1.26	29.57	36.04	33.95	1.14	31.38	36.93	34.58	1.22	31.94	37.17	35.20	1.25	32.49	38.00
Production[7]	1804.79	59.76	1661.08	1955.82	1832.93	157.01	1439.91	2206.94	1857.65	136.00	1277.91	2152.38	1881.71	153.88	1382.97	2276.75	1907.14	168.73	1249.66	2205.74
Supply[7]	2204.79	59.75	2061.08	2355.82	2236.61	69.88	2009.10	2392.76	2259.25	63.23	2113.24	2424.70	2291.22	66.85	2143.12	2438.84	2323.47	67.64	2167.77	2485.39
Domestic Demand[7]	822.54	30.53	751.11	867.20	829.29	25.42	759.09	873.20	837.81	30.03	766.78	879.20	843.11	28.86	775.46	885.20	848.73	26.57	786.40	891.20
Exports[7]	978.56	170.99	500.18	1295.96	1005.72	144.01	400.00	1392.95	1011.92	171.42	556.98	1372.34	1031.77	173.54	519.23	1353.35	1056.34	162.98	518.74	1350.25
Carryover[7]	403.68	146.02	110.92	835.53	401.59	122.96	118.64	994.27	409.51	139.19	125.25	871.85	416.33	159.13	135.71	997.56	418.41	146.43	155.03	978.95
Government Stocks[7]	7.47	26.59	0.00	149.93	8.02	30.82	0.00	237.83	7.19	29.82	0.00	193.74	12.12	37.81	0.00	239.65	16.32	46.56	0.00	230.73
Price[8]	3.05	0.72	2.00	4.75	3.04	0.60	2.00	4.70	2.98	0.71	2.00	4.66	2.99	0.68	2.00	4.60	3.00	0.63	2.00	4.48
Value of Production[5]	5509.06	1267.07	3500.53	8351.30	5556.15	1127.41	3244.29	8961.92	5532.04	1367.20	3420.41	8654.63	5620.98	1288.06	3194.04	8741.12	5737.39	1338.77	3094.39	9169.28
Storage Cost and Interest[5]	3.36	11.96	0.00	67.47	3.61	13.86	0.00	107.02	3.24	13.42	0.00	87.18	5.45	17.02	0.00	107.85	7.34	20.95	0.00	103.83
Deficiency Payments[5]	485.04	675.11	0.00	1776.20	398.99	594.04	0.00	1835.34	589.93	701.15	0.00	1887.68	555.32	700.78	0.00	1914.50	475.43	690.45	0.00	1947.32

[1] Millions of Acres. [2] Tons per Acre. [3] Million Tons. [4] Dollars per Ton. [5] Million Dollars.
[6] Bushels per Acre. [7] Million Bushels. [8] Dollars per Bushel.

because higher prices when stocks are below thresholds tend to reduce export demand. This can be seen by comparing mean exports under the two policies. The non-reserve policy results in higher mean exports under the two policies (Table 4). Variability of carryover stocks is greater since the government complies with buy-and-sell rules as well as using production control provisions to adjust expected production to maintain critical reserves. Since carryover is one of the determinants of acreage in the following year in the model, acreage and production are also more variable under the reserve management policy.

Storage and interest cost per unit used to calculate costs of holding government stocks were assumed to be $10.36 per ton for feed grains and $.36 per bushel for wheat. The storage component is $.15 per bushel of wheat and feed grains; the interest component is calculated on a price of 90 percent of target and an interest rate of 8 percent. Average storage and interest costs incurred by the government in the reserve management simulation was moderate ($75.2 million for feed grains and $34.7 million for wheat). Even though the government sells stocks at a higher price (above target prices) than it accumulates stocks (90% or 66⅔% of target prices), it started with zero stocks and hence incurred an average net loss of $28.7 million in its buying and selling activities for feed grain and $24.6 million in the case of wheat. Deficiency payments are also reported and were calculated as the product of allotted acreage, normal yield and the difference between the target and market price when price was below target. Lower deficiency payments occur in the reserve management simulation since the government supports price at 90 percent target prices whenever carryovers are less than 40 million tons of feed grains and 600 million bushels in the case of wheat. Under these conditions, the difference between target and market price is less than under no reserve management simulation and deficiency payments decline accordingly.

SUMMARY AND CONCLUSIONS

This study focused on estimating the impact of stock management provisions of S. 2005 on feed grain and wheat price variability. Aggregate feed grain and wheat models were developed, using random deviations from trend yields and exports based on specified probability distributions. Two simulations were run, each with a 1,000 iterations for the years 1975 to 1979. One simulation assumed enactment of the target prices and loan rates of S. 2005 and the bill's reserve stock management provisions. The other ignored special stock acquisition and release rules of S. 2005 but the target and loan levels were used. The latter alternative would be equivalent to modifying the Agricultural and Consumer Protection Act of 1973 by raising 1975 target prices to the levels specified in S. 2005, setting loan rates at two-thirds of target prices, and directing the Secretary of Agriculture to release stocks when market prices exceeded target prices.

Table 4. MEANS AND STANDARD DEVIATIONS OF THE WITH AND WITHOUT RESERVE MANAGEMENT SIMULATIONS OVER ALL YEARS AND ITERATIONS (5,000 OBSERVATIONS ON EACH VARIABLE)

Crop and Items[1/]	Simulation With Reserve Management		Simulation Without Reserve Management	
	Mean	Standard Deviation	Mean	Standard Deviation
Feed Grains				
Acreage	100.90	8.21	101.10	2.74
Yield	2.67	.18	2.67	.18
Production	228.71	24.77	229.27	19.00
Supply	259.27	19.18	254.18	17.77
Domestic Demand	188.30	7.89	189.96	9.30
Exports	38.23	8.79	38.98	8.41
Carryover	32.68	12.50	25.24	7.13
Government Stocks	8.42	7.73	.58	2.34
Price	75.07	12.54	72.43	15.05
Value of Production	16927.43	1760.46	16376.61	2467.11
Storage Cost	75.16	65.32	4.81	15.65
Deficiency Payments	597.74	726.47	1030.99	1503.64
Wheat				
Acreage	54.76	7.50	54.58	3.70
Yield	34.03	1.43	34.03	1.43
Production	1862.57	264.94	1856.85	144.58
Supply	2324.29	136.99	2263.07	77.31
Domestic Demand	833.78	27.88	836.29	29.76
Exports	1007.19	188.34	1016.86	166.35
Carryover	483.31	177.98	409.91	142.82
Government Stocks	77.12	64.16	10.23	35.09
Price	3.07	.57	3.01	.67
Value of Production	5654.77	1124.20	5591.13	1277.91
Storage Cost	34.71	28.87	4.60	15.79
Deficiency Payments	415.62	587.35	500.95	674.11

[1] Units are the same as in Tables 2 and 3.

With the reserve grain management provision in effect, feed grain price variability was reduced 20 percent and the variability of wheat price was reduced 19 percent. The storage and interest costs incurred by the government in the reserve management simulation was moderate at $75.2 million for feed grains and $34.7 million for wheat. In both alternatives, it was assumed the government would use set-aside to keep expected or normal supplies in line with expected or normal utilizations and desired stock adjustments. Storage costs would have been larger in both alternatives without the set-aside.

The results of this study suggest that enact-

ment of the grain management provisions of Senate Bill S. 2005 would benefit livestock producers by reducing grain price variability. It would also benefit grain producers because of higher and more stable cash receipts. As would be expected, storage costs are higher, but deficiency payments are lower under this plan. Cost estimates of production control activities are needed to complete government cost comparisons of the two policies simulated. Further research will include a sensitivity analysis of the model specification, target stock levels and rules under which the government acquires and sells stocks, as well as additional cost estimates.

REFERENCES

[1] Brandow, George E. "Interrelationships Among Demands for Farm Products and Implications for Control of Market Supply." Pennsylvania Agricultural Experiment Station Bulletin No. 680, August 1961.

[2] Cochrane, Willard. *Feast or Famine: The Uncertain World of Food and Agriculture and Its Policy Implications for the United States.* National Planning Association Report No. 136, February 1974.

[3] Cochrane, Willard. "Food, Agriculture and Rural Welfare." *American Journal of Agricultural Economics.* December 1974.

[4] Houck, James. "Some Economic Aspects of Agricultural Regulation and Stabilization." *American Journal of Agricultural Economics,* December 1974.

[5] Mayer, Leo V. "Experiences With Recent Price Stabilization Programs for Agriculture." *Southern Journal of Agricultural Economics,* Vol. 6, No. 1, pp. 1-5, July 1974.

[6] Meinken, Kenneth W. "The Demand and Price Structure for Wheat." U.S. Department of Agriculture Technical Bulletin 1136, November 1955.

[7] Rojko, Anthony, Frances Urban, and James Naive. "World Demand Prospects for Grains in 1980." Foreign Agriculture Economic Report No. 75, U.S. Department of Agriculture, 1972.

[8] Tweeten, Luther, Dale Kalbfleisch and Y. C. Lu. "An Economic Analysis of Carryover Policies for the United States Wheat Industry." Oklahoma Agricultural Experiment Station Technical Bulletin P-132, 1971.

[9] Tweeten, Luther. "Government Programs for the Farming Economy in the Great Plains." Paper presented at Seminar of Great Plains Resource Economics Committee of the Great Plains Agricultural Committee, Las Cruces, New Mexico, October 16, 1974.

[10] Tweeten, Luther and James Plaxico. "U.S. Policies for Food and Agriculture in an Unstable World." *American Journal of Agricultural Economics,* Vol. 56, No. 2, pp. 364-371, May 1974.

[11] Senate. 93rd Congress, Second Session. *Adequate Reserves of Certain Agricultural Commodities—Amendment (In the Nature of a Substitute),* S. 2005, May 21, 1974.