ECONOMIC CONSEQUENCES OF FEDERAL FARM COMMODITY PROGRAMS, 1953-72

By Frederick J. Nelson and Willard W. Cochrane*

Farm programs of the Federal Government kept farm prices and incomes higher than they otherwise would have been in 1953-65, thereby providing economic incentives to growth in output sufficient to keep farm prices lower than otherwise during 1968-72. The latter result differs significantly from findings in other historical free market studies. These conclusions stem from an analysis of the programs in which a two-sector (crops and livestock) econometric model was used to simulate historical and free-market production, price, and resource adjustments in U.S. agriculture. Supplies are affected by risk and uncertainty in the model, and farm technological change is endogenous.

Keywords: Government farm programs, farm income, risk, technological change, free market.

THE OBJECTIVE

Policy decisions affecting future production, consumption, and prices of food and fiber in the United States need to be made with as full knowledge as possible of the likely longrun and shortrun consequences. The quantitative analysis of past farm commodity programs described here can provide useful information for analyzing the consequences of future alternative programs.

How would agricultural economic development in the United States have been different if major farm commodity programs had been eliminated in 1953? To help answer the question, an econometric model was set up to simulate the behavior of selected economic variables during 1953-72.[1]

Farm programs of the Federal Government have, in various ways, supported and stabilized farm prices and incomes since 1933, when the first agricultural adjustment act was approved. Since then, dramatic long-term changes have occurred in (1) the resource structure of agriculture, (2) the productivity of measured agricultural resources, and (3) agricultural output levels. Such long-term changes did not occur independently of the farm programs. These programs were operated in a way that reduced risk and uncertainty for farmers, affected their expectations of future income potential from farm production activities, and influenced their willingness and ability to invest, to adopt cost-reducing technology, and to adjust output levels.

In considering effects of the programs, it is desirable to specify a model in which shortrun and longrun agricultural output responses are affected by investments, current input expenditures, and farm technological changes. These, in turn, should be influenced by price and income expectations and experiences, by the extent of risk and uncertainty, and by technological change. Such ideas were used in developing this model. A unique feature of the model is that it includes endogenous risk and resource productivity proxy variables.

Not much quantitative knowledge exists about intermediate and longrun supply adjustments under a sustained free-market situation. No claim is made however, that this model's results represent the definitive word in free-market analysis of the period studied. The estimates of longrun and shortrun effects of farm programs are extremely sensitive to changes in several assumptions that affect total supply and demand elasticities in the model. Further, ordinary least squares regression analysis (OLS) was used to estimate the coefficients of behavioral equations. Thus, the results should be considered preliminary and subject to revision if alternative estimation techniques later reveal substantial differences for important coefficients.

A central feature of the model—the disaggregation of agriculture into two sectors, crops and livestock—can be seen as both an advantage and a limitation. Use of two sectors instead of only one does allow analysis of important interrelationships between crops and livestock over time. But future research efforts should be aimed at a further extension to include specific commodities for two reasons. First, persons and organizations that might be the most interested in the type of information available from the model would want answers for specific commodities. Second, commodity specific equations might provide more accurate quantitative results. For example, measures of price variability for each commodity are the most logical proxy measures of the

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[1] A number of agricultural sector-simulation models developed in recent years can be used to quantify the total impact of farm commodity programs. Some of these models were reviewed in this study (*3, 8, 23, 24, 26, 30*). The basic framework for this model resembles that in (*30*) and in (*24*). However, following Daly (*2*), a two-sector approach was used instead of the one-sector approach of Tyner (*30*) or the seven-sector method of Ray (*24*).

extent of risk and uncertainty. But they were not used in the two-sector model.[2]

THE MODEL: ANALYTICAL FRAMEWORK, THEORY, AND SIMULATION PROCEDURE

The analysis centers around a comparison of two simulated time series for each of several variables in 1953-72. One series shows estimates of the variables' actual historical value with programs; the other, estimates in a free market without programs. The impact on a particular variable is the difference between its historical and free-market values, shown as a percentage change in table 4 and figure 1 (see p. 59).

As a measure of alternative impacts possible, several simulation results were obtained, based on differing assumptions about demand elasticities and resource adjustment responsiveness in a free market. This provided a test of the sensitivity of the model's results to such changes. Detailed discussion is limited primarily to one simulation set.

Overview

The simulation model consists of 59 equations (33 identities and 26 behavioral equations) and contains 51 exogenous variables.[3] A resource adjustment approach to crop and livestock output and supply response was used in designing the model. The simulation procedure for each year is as follows (the calculation for 1953 is used as an example):

- Current input levels are determined for the initial year (1953) based on beginning-of-year asset levels, current and recent price and income experiences, and farm programs in use
- Crop productivity and production are determined endogenously, based on the level and relative importance of selected inputs assumed to be primarily used for crop production
- Crop and livestock supply and demand components (including livestock production) and prices are simultaneously determined once crop production is known and Government market diversions under the farm programs are specified
- Given the above results, the model computes various measures of income, price and income variability, and aggregate agricultural productivity.
- Asset, investment, and debt levels, number of farms, and farmland prices are adjusted from the previous end-of-year levels, based on 1953 and earlier price and income experiences
- The above results are used to make similar calculations for 1954 and later years given the complete time series for those explanatory variables not determined within the model.

The data used to measure the variables are based on published and unpublished calendar year information from the Economic Research Service, and the Agricultural Stabilization and Conservation Service in the U.S. Department of Agriculture. However, only a few of these variables are published in the exact form used here. To facilitate analysis, assets, inputs, production, and use statistics were measured in 1957-59 dollars; for price indexes, 1957-59 equal to 100 was generally used.

Farm Program Variables

The farm programs covered include those involving price supports, acreage diversions, land retirement, and foreign demand expansion. Programs involving domestic demand expansion, marketing orders and agreements, import controls, and sugar are not explicitly included. The programs included have affected agriculture in the past two decades by:

- Idling up to 16 percent of cropland (6 percent of land in farms) through programs involving long- and short-term acreage diversions to control output
- Diverting up to 16 percent of crop output from the market into Government inventories or subsidized foreign consumption through price support and demand expansion activities
- Providing farmers with direct Government payments equal in value to as much as 29 percent of net farm income (7 percent of gross income).

Table 1 contains values of the exogenous farm program variables used. Table 2 shows the relative importance of some of these variables in the crop sector. The following three sections explain more about use of these variables and indicate the level for each program variable in the free-market simulation.[4]

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[2] Ray's disaggregation approach (*24*) is one alternative. Separate resource adjustment equations and production functions are included for livestock products, feed grains, wheat, soybeans, cotton, tobacco, and all other commodities. However, a procedure that places less strain on the available data would be one that uses commodity acreage and yield equations "controlled" by simulated aggregate resource and resource productivity adjustment estimates. See (*22*, p, 10; *34*).

[3] For a complete discussion of the theory, model, data, and simulation procedure, see (*19*). This information will also be available later in a planned USDA technical bulletin. A description of the variables and a list of the actual model equations are available from the senior author on request.

[4] An argument can be made in favor of making some or all program variables endogenous. For example, CCC inventory changes and acreage diverted by programs are complicated functions of announced price supports (loan rates), diversion requirements, and other supply and demand variables. Thus, exogenous price supports, instead of exogenous CCC inventory changes, could be used to represent the price support through acquisition and disposition activities of the CCC (as in (*3*)). Further, one might want to specify only policy goals (such as net income) as exogenous so that program operation rules would need to be endogenous to determine program details each year in

Table 1.—Government farm program variables, 1950-72

Year	Acres of cropland idled by programs (AD)	Percentage of land in farms not idled (PCT)	Percentage of acres planted with hybrid seed (PCTHB)	Net Government (CCC) inventory increases (1957-59 dollars)		Exports under specified Government programs (1957-59 dollars)		Government assisted crop exports (1957-59 dollars) (ASCX)	Direct Government farm program payments (GP)
				Crops (CCCD)	Livestock (CCLD)	Crops (GCX)	Livestock (GLX)		
	Millions	*Ratio*		*Billion dollars*					
1950	0.0	1.0000	0.1900	-0.765	0.035	a			0.283
1951	0.0	1.0000	.1960	-.446	-.122	a		a	.286
1952	0.0	1.0000	.2010	.351	0.0	0.386	a	0.426	.275
1953	0.0	1.0000	.2040	2.164	.315	.369	0.063	.353	.213
1954	0.0	1.0000	.2060	1.028	.127	.531	.127	.319	.257
1955	0.0	1.000	.2130	1.289	-.203	.759	.214	.316	.229
1956	13.6	.9983	.2160	-.312	-.149	1.268	.231	.543	.554
1957	27.8	.9765	.2200	-.919	.051	1.219	.170	.933	1.016
1958	27.1	.9772	.2370	1.350	-.089	.978	.122	.737	1.089
1959	22.5	.9806	.2790	.282	-.031	1.030	.076	.775	.682
1960	28.7	.9753	.2910	.261	.049	1.351	.046	1.098	.702
1961	53.7	.9538	.2490	-.087	.113	1.308	.067	.950	1.493
1962	64.7	.9439	.2570	.191	.172	1.220	.089	.675	1.747
1963	56.1	.9514	.2750	-.016	-.103	1.227	.153	.755	1.696
1964	55.5	.9511	.2590	-.249	-.191	1.377	.176	.935	2.181
1965	57.4	.9500	.2600	-.532	-.031	1.183	.105	.780	2.463
1966	63.3	.9443	.2660	-2.008	-.037	1.214	.063	.923	3.277
1967	40.8	.9635	.2800	-1.192	.143	.920	.108	.783	3.079
1968	49.3	.9561	.2630	1.521	-.011	.870	.116	.528	3.462
1969	58.0	.9477	.2700	1.028	-.061	.711	.093	.550	3.794
1970	57.1	.9483	.2740	-.928	.010	.723	.070	.942	3.717
1971	37.2	.9663	.2970	-.213	-.007	.687	.096	.987	3.145
1972	62.1	.9433	.2740	-.862	-.008	.701	.044	1.137	3.961

[a]Not available or not yet estimated.

Government market diversions. The Federal Government supports farm commodity prices through operations of USDA's Commodity Credit Corporation (CCC). The CCC helps farmers in three ways. It buys or sells commodities on the open market, and extends loans to farmers who have the option of repaying the loan or delivering their commodity to the CCC in lieu of repayment. Also, the CCC encourages domestic and foreign consumption by subsidizing food use or by giving commodities away. Five exogenous variables represent this activity in the model:

- CCCD is net stock change for crops owned by or under loan with the CCC
- CCLD is net stock change for livestock products owned by or under loan with the CCC
- GCX is crop exports under specified Government programs
- GLX is livestock exports under specified Government programs
- ASCX is crop exports assisted by the payment of export subsidies by the CCC

In the free-market simulation, these variables have a value of zero.

Acreage diversions and Government payments. Farm program operations aimed at controlling supply—to reduce the need for costly Government market diversions—include offering farmers some combination of direct cash payments and price support through CCC loan privileges in return for their idling of productive

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the simulation. In the model, however, the procedure is to determine the impact of program operations, not policies, with such operations defined in a special way. The total impact of past program operations is the main goal rather than the effect of selected adjustments to specific annual policy variables or policy goals. See (*19*, pp. 139-149).

Table 2.—Farm program operations affecting crop output and marketings, 1950-72[a]

Year	Total Government market diversions[b]	Total acreage diversions	Crop-land plus diversions[c]	Total land in farms	Total crop production	Acres diverted as percentage of: Land in farms	Acres diverted as percentage of: Crop-land	Market diversions as percentage of production
	Billion dollars		Million acres		Billion dollars		Percent	
1950	d	0	377	1,202	17.0	0	0	d
1951	d	0	381	1,204	17.5	0	0	d
1952	1.2	0	380	1,205	18.4	0	0	7
1953	2.9	0	380	1,206	18.2	0	0	16
1954	1.9	0	380	1,206	17.9	0	0	11
1955	2.4	0	378	1,202	18.2	0	0	13
1956	1.5	14	383	1,197	18.3	1	4	8
1957	1.2	28	386	1,191	18.0	2	7	7
1958	3.1	27	382	1,185	19.9	2	7	16
1959	2.1	23	381	1,183	19.7	2	6	11
1960	2.7	29	384	1,176	20.8	2	7	13
1961	2.2	54	394	1,168	20.4	5	14	11
1962	2.1	65	396	1,159	20.7	6	16	10
1963	2.0	56	393	1,152	21.5	5	14	9
1964	2.1	56	391	1,146	20.7	5	14	10
1965	1.4	57	393	1,140	22.1	5	14	6
1966	0.1	63	395	1,132	21.6	6	16	1
1967	0.5	41	381	1,124	22.5	4	11	2
1968	2.9	49	384	1,115	23.2	4	13	13
1969	2.3	58	391	1,108	23.5	5	15	10
1970	0.7	57	389	1,103	22.6	5	15	3
1971	1.5	37	377	1,097	25.1	3	10	6
1972	1.0	62	398	1,093	25.3	6	16	4

[a]The information does not represent precise estimates of "excess capacity" in U.S. agriculture, but rather a summary of some relevant magnitudes. These do, of course, have implications for excess capacity analysis. [b]Government market diversions include the sum of net change in Government crop inventories (CCCD), Government crop exports (GCX), and assisted commercial crop exports (ASCX). [c]Includes acres of cropland harvested, crop failure acreage, cultivated summer fallow acres, plus acreage diverted by farm programs (AD). [d]Not available or not yet estimated.

cropland. The acreage idled under annual diversion and long-term land retirement programs (AD) is included as an explanatory variable in the equation for the use of cropland. The associated Government payments (GP) are included as part of gross and net farm income. In the free-market simulation, both of these variables have a value of zero. The percentage of total cropland not idled (PCT) is used in the analysis; its free-market value is, of course, 1.0 (100 percent).

Cropland planted with hybrid seed. The increased use of high-yielding corn and sorghum grain seed has been an important technological advance on American farms. The percentage of total cropland planted with hybrid seed (PCTHB) is used as an exogenous explanatory variable in the fertilizer and crop productivity behavioral equations. It was assumed that the upward trend in PCTHB was retarded in 1956 because acreage-idling programs began that year and they affected the relative importance of corn and sorghum acreage. Therefore, in the free-market simulation, PCTHB was assumed to increase a little faster from 1956 to 1959 than in actual history. The record level of PCTHB for 1971 (0.297) was assumed to have been achieved throughout 1961-72, after the high level achieved in 1960 (0.291.)[5]

[5] Following the theoretical ideas of Griliches (*7*), one could argue that the percentage of cropland planted with hybrid seed should be endogenous because the corn price level affects the profitability of adopting more expensive, higher yielding seed. An adequate consideration of this question will have to wait until commodity specific extensions are made. The percentage for all cropland depends on the relative importance and geographic location of corn and sorghum acreage as well as on prices received for corn and sorghum.

Special Features

Current input and asset adjustment. Behavioral equations representing the demand for assets were specified assuming asset adjustments occur in response to changes in (1) longrun profit expectations and (2) the extent of risk and uncertainty. Separate equations were included for the quantity of land and buildings, machinery and equipment, and livestock number inventories. The stock of an asset is determined by its level in the previous year, with adjustments for depreciation and for investments. A partial resource adjustment assumption was used in specifying demand equations for assets based on the Nerlovian distributed lag procedure. Longrun demand was explained by including as variables current and recent factor-factor price ratios, relative rates of return to farm real estate, and risk and uncertainty proxy indexes.

Current input expenditures depend on current and recent factor-product price ratios, asset levels, other input levels, and risk and uncertainty proxy indexes. The model contains behavioral demand equations for the following current inputs to agriculture: repair and operation of machinery, repair and operation of buildings, acres of cropland used for crops, fertilizer and lime, crop labor, livestock labor, hired labor, and miscellaneous inputs. The use of "other" input and asset levels as explanatory variables in current input demand functions is consistent with traditional profit-maximizing theory, because the marginal product of one factor depends on the quantity used of other factors. In the short run, current inputs adjust toward longrun levels as asset adjustments occur. Use of other current inputs as explanatory variables in the input demand functions resulted in a set of simultaneous equations.

Price and income expectations, and risk and uncertainty. Price and income expectations were represented by including current or lagged values of prices and income in input and asset adjustment equations. Simple averages of up to 5 years were sometimes used if more than one observed value was assumed relevant.

A major assumption was that an increase in commodity price variability specifically, and the elimination of farm programs generally, would increase the risk of investing in agriculture. Therefore the level of investment and current input expenditures for any given level of average price and income expectations would be reduced. The idea behind the assumption is that farmers will adjust to situations involving varying degrees of price and income uncertainty by sacrificing some potential profits to reduce the probability of financial disaster. Such adjustments depend on a farmer's psychological makeup and capital position, and they can take several forms:

- Adjusting the planned product mix to favor products with relatively low price and income variability
- Diversifying in a way that reduces net farm income variability
- Minimizing the probability that farm losses will lead to financial disaster by reducing the total amount of investment in the farm business which reduces the potential size of both profits and losses
- Increasing the firm's ability to survive loss experiences by increasing the share of total farm business investment held as financial reserves and operating with smaller amounts of borrowed capital.

(Elements of the first two adjustments may be involved when farmers choose to participate in specific voluntary price support-acreage diversion programs.) Because of the desire for financial reserves, an important interrelationship probably exists between annual investments, savings, family consumption, and risk and uncertainty. A realistic appraisal of the economic consequences of eliminating price stabilizing programs must consider this factor of farmers' risk aversion.[6]

Proxy indexes of the extent of risk and uncertainty were computed in the model as 5-year averages of the absolute annual percentage change in prices and in incomes. These indexes were included as explanatory variables in the behavioral equations for assets and inputs. Proxy indexes were computed for the following variables: (1) aggregate crop price index, (2) aggregate agricultural price index, (3) net income available for investment (net income plus depreciation allowances), and (4) the livestock-crop price ratio. Direct Government program payments to farmers (GP) were also used to explain resource adjustments; GP was assumed to represent a relatively certain source of net income for the coming year, once the annual program details had been announced by USDA.

Behavioral equations for the following variables contain one of the several risk and uncertainty proxy variables: repair and operation of machinery, fertilizer and lime, acres of cropland, repair and operation of buildings, miscellaneous inputs, buildings, land in farms, livestock number inventory, and farmland prices. Demand equations for machinery, labor, and onfarm crop inventories contain no risk proxies.

Crop input and productivity. Crop output is the product of three variables:

- Sum of four inputs (measured in 1957-59 dollar values) used primarily for crop production—fertilizer and lime, machinery inputs, acres of cropland for crops, and man-hours of crop labor
- Percentage of cropland harvested (exogenous)
- Output per unit of crop input

In specifying an output per unit of crop input equation,

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[6] This explanation follows Heady's (*11*, pp. 439-583). Support also appears in (*6, 9, 15,* and *16*). And see the recent quantitative analysis of farmer investment and consumption behavior reported in (*5*), also an empirical test of the hypothesis that farmers' cropping patterns and total outputs are influenced by a consideration of risk as well as expected income in (*18*).

crop productivity increases specifically, and farm technological advances generally, were assumed to have occurred along with, or partly because of, the greater use of nonfarm produced inputs relative to the traditional inputs of land and labor.

Farm technological change can be seen as the longrun result of specialization of labor and the associated highly successful innovative effort and research investment by persons in both the public and private sectors. The farm input and public sectors of the economy have become specialized producers of a continuous stream of new improved products and technologies that are used by farmers. Farmers, in turn, have become specialists in organizing and using these products so that inputs of land and human capital have become more productive. These changes have resulted mainly in response to economic incentives and they involve dynamic adjustments in the demand and supply of technology. Farmers have demanded improved inputs and techniques to maximize profits. And suppliers have developed the new products and techniques desired. Farm technological change depends on resource substitutions and capital outlays by farmers in response to:

- Changes in factor and product price relationships
- Cost and availability of new inputs and techniques
- Expected benefit from adoption of new inputs and methods
- Farmers' liquid and capital assets position
- Extent and importance to farmers of risk and uncertainty[7]

The output per unit of crop input index was estimated as a linear function of several variables:

- Percentage of cropland planted with hybrid seed
- Ratio of nonfarm produced fertilizer and machinery inputs to crop labor and cropland inputs
- Crop inputs subtotal
- Squared interaction term between the first two items in this list.

(Input and output measures used are value aggregates based on 1957-59 average prices.) The hybrid percentage was assumed to increase productivity because of the tremendous yield-increasing effect of shifts to hybrid corn and sorghum seed. Productivity was assumed to decline as total inputs increased, because, for example, greater land use would likely extend to less productive cropland. The ratio of nonfarm inputs to land plus labor was assumed to increase productivity. In the analysis of farm program impacts, this crop productivity equation significantly helped to explain longrun price trends and cycles. Because of the method used to specify the crop productivity equation, financial losses and business disasters simulated in the free market were ultimately reflected in a reduced level of nonfarm purchased inputs relative to land and labor. As a result, aggregate crop resource productivity went down and crop and livestock prices increased over time. Further, as prices rose in the model, additional cropland and other crop inputs were pulled into the system. But average crop input productivity was further decreased, which tended to dampen the supply response and retard the expected downward pressure on prices. This illustrates the advantage of endogenously simulating productivity in preference to using a simple extension of past trends.

Supply, demand, and prices. Total supplies of crops and livestock were set as identically equal to current production, plus beginning-of-year private stocks, and imports (for livestock, minus exports). The associated demand components include feed, seed, domestic human consumption, commercial exports, exogenous exports assisted by export subsidies or other specified Government programs, exogenous CCC net inventory changes, and end-of-year private stocks. Measures of "open-market," or "commercial," supply were defined as total supply minus Government market diversions (CCC net inventory changes plus Government-aided exports). Given the level of crop production, the supply and demand equations are used to simultaneously determine livestock production, livestock and crop prices, and the endogenous components of demand. Each such component is, directly or indirectly, a function of beginning-of-year private stocks, population, disposable personal income per capita, a nonfood price index, the various exogenous Government market diversion variables, exogenous crop exports and crop imports, crop production, and a time trend.

Alternative simulation sets, or runs, discussed below, were based on the use of alternative demand equations for domestic human consumption (because these could not be successfully estimated by usual regression analysis) and the use, in one simulation, of a synthesized equation for the foreign demand for crops.[8]

Aggregate prices, incomes, and other equations. Detailed results from preceding components of the model are used to compute an index of agricultural prices, various measures of income (including gross and net farm income and the rate of return in agriculture relative to the market interest rate), and several measures of price and income variability assumed to reflect the extent of risk and uncertainty. The quantity of hired farm labor and the hired farm wage rate are determined simultaneously. From these results, farm production expenses for labor and a residually computed family labor input are derived. Farm prices and the nonfarm

[7] These ideas are based on concepts in (*1, 10, 27,* and *6*). The quantitative procedure used was influenced by the work in (*17, 21,* and *32*).

[8] One set of domestic demand equations is based on the elasticity matrix of (*4*). Another set is derived using simple analysis of the relationship between income-deflated price and consumption, used in (*33*). Shortrun and longrun foreign demand elasticities for crops are based on (*28*).

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wage rate are two of the explanatory variables determining the wage rate for hired labor. Farm land values and the number of land transfers per 1,000 farms are determined simultaneously. Farm prices, aggregate agricultural productivity, and nonfarm price levels are three of the variables used to explain land values.[9]

Output per unit of input for the total agricultural sector is derived from estimates of crop and livestock production and from the inputs previously estimated.

Other equations included in the model compute (1) the number of farms, based on an estimate of average farm size, (2) gross farm capital expenditures, (3) farm debt, and (4) total quantity and current value of assets.

Simulation Procedures and Alternatives

Results for three alternative simulation sets are discussed below.[10] Each set includes a simulation of a free market situation and the actual historical situation. These alternatives were developed because of the difficulty of estimating theoretically correct demand equations for domestic human consumption and crop exports by usual procedures. The three sets appear in table 3, and its footnotes describe the procedure and sources briefly.[11]

[9] Equation specifications were influenced by (*31*) for hired labor and (*14*) for land prices.

[10] The computer simulation procedure uses the Gauss-Seidel algorithm to obtain a solution of this nonlinear system by an iterative technique (*13*). Bob Hoffman and Hyman Weingarten, ERS, made programming revisions needed to facilitate use of the Gauss-Seidel procedure.

[11] Six additional simulation alternatives appear in (*19*, p. 232, table 19). These are based on arbitrary revisions in the resource adjustment equations made to allow for possible additional effects of increased risk and uncertainty in a free market.

Table 3.—Simulation alternatives

Demand assumption	Number for[a]	
	Historical simulation	Free-market simulation
Least inelastic demand assumption[b]	13	14
Moderately inelastic demand assumption[c]	18	19
Most inelastic demand assumption[d]	9	10

[a] These numbers identify the alternative simulations in the text, table, and charts of this article. [b] Domestic demand equations were based on domestic demand for human consumption elasticities shown in (*4*, pp. 64-66 and 46-51). Own elasticities for domestic consumption of crops and livestock are -0.274 and -0.259 respectively. Commercial crop exports were made endogenous by using foreign demand elasticities based on those reported in (*28*). The foreign demand elasticities are -1.0 in the short run and -6.0 in the long run. [c] Same domestic demand parameters discussed in previous footnote, but commercial crop exports were made exogenous and equal actual historical levels. [d] Crop exports were considered exogenous, as in footnote three, but domestic demand functions were derived by graphic analysis of the relationship between income deflated price and per capita consumption during the period. (See (*33*, pp. 11-18), for example). Here, own elasticities are -0.11 or -0.15 for livestock and -0.07 or -0.13 for crops.

EFFECTS OF ELIMINATING FARM COMMODITY PROGRAMS IN 1953

What would have happened in American agriculture had farm programs been eliminated in 1953? Some possible answers to this question are provided by the results in table 4 and figures 1-8. One measure of the

Table 4.—Effects on selected variables of eliminating farm programs in 1953, five-year averages, 1953-72[a]

Item	Percentage change from historical value			
	1953-57	1958-62	1963-67	1968-72
Crop supply to open market (CSPLY)[b]	8.4	2.6	-4.3	-9.5
Livestock supply to open market (LSPLY)[b]	3.8	4.8	3.4	-3.9
Price index for crops (PC)	-28.2	-22.6	-8.1	31.7
Price index for livestock (PL)	-19.5	-25.8	-18.5	25.2
Price index for agriculture (PA)	-23.2	-24.4	-14.9	27.7
Total net income (TNI)	-42.0	-37.7	-19.7	40.3
Total agricultural productivity index (TLB)	1.5	3.7	2.4	-5.1
Price index for land and buildings (PLD)	-4.6	-12.4	-16.8	-16.5
Gross farm capital expenditures (GCE)	-20.9	-54.3	-47.3	-12.7
Total production assets at end of year (ASSET)	-1.7	-7.0	-10.0	-10.0
Agricultural price variability index (SPA)	52.7	7.2	36.1	150.0

[a] Based on results of simulations 18 and 19, which use demand parameters derived from demand matrix in (*4*). Exports are assumed to be exogenous. [b] Supply includes production minus Government market diversions plus beginning-year private stocks plus net private imports for livestock and gross imports for crops.

PERCENTAGE CHANGE IN AGRICULTURAL PRICE INDEX: HISTORICAL TO FREE-MARKET LEVEL

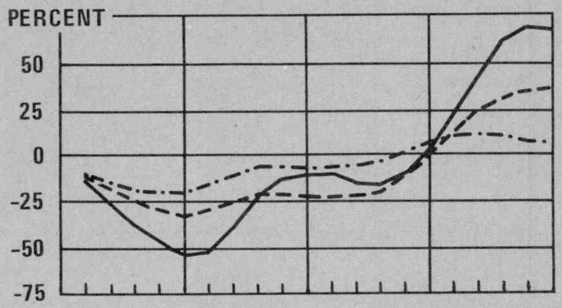

FIGURE 1

1952 '57 '62 '67 '72

SIMULATION	COMPARED WITH SIMULATION	INELASTIC DEMAND
—— 10	9	Most
– – 19	18	Moderately
–·– 14	13	Least

Note: See Table 3 for explanation of alternative simulations.

impact of farm programs on a variable is the difference between the simulated historical level and the simulated free-market level. Such differences are shown in figure 1 and table 4 as percentage changes from the historical to the free-market levels.

Alternative Impacts on Prices

The impacts of eliminating farm programs, on agricultural prices, for the three alternative simulation sets discussed in table 3, are shown in figure 1. The patterns of percentage impacts on prices for each demand alternative resemble one another to some extent. Each is initially negative and each grows over time until the largest negative impact occurs in 1957. Afterwards, the magnitude reduces gradually as the free-market price level becomes equal to and greater than the historical level by 1967. The largest positive impact occurs in 1969-71. However, the degree of impact differs importantly among the alternatives in most years, a behavior that highlights the important interrelationship between the assumed elasticity of demand and the estimated impacts of the farm programs.

Under all three demand alternatives, it is estimated that prices in the free market would have been lower than in actuality during 1953-65. By 1957, the reduction would have been 20 percent for the least inelastic demand assumption, 33 percent for the moderately inelastic demand assumption, and 54 percent for the

FERTILIZER AND LIME INPUTS: ACTUAL AND SIMULATED VALUES

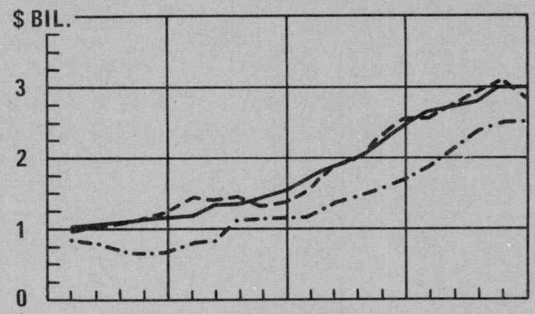

FIGURE 2

MACHINERY INPUTS: ACTUAL AND SIMULATED VALUES

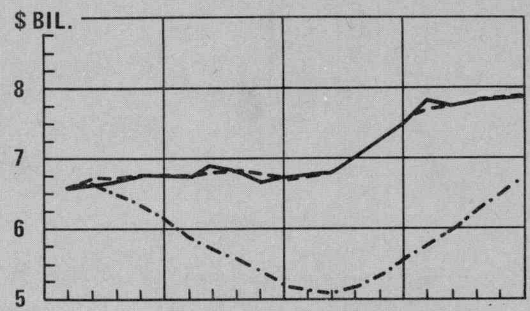

FIGURE 3

CROPLAND INPUT INDEX: ACTUAL AND SIMULATED VALUES

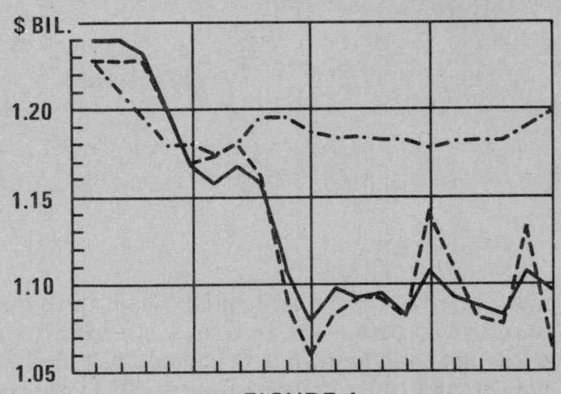

FIGURE 4

1952 '57 '62 '67 '72

—— ACTUAL
– – HISTORICAL*
–·– FREE-MARKET*

**Historical simulation 18 : free-market simulation 19.*

TOTAL AGRICULTURE PRODUCTIVITY INDEX: ACTUAL AND SIMULATED VALUES

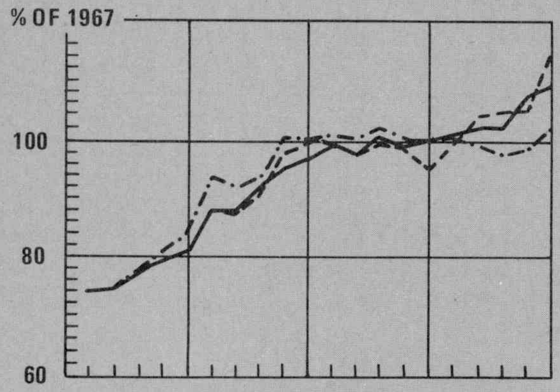

FIGURE 5

TOTAL NET INCOME INCLUDING NET RENT: ACTUAL AND SIMULATED VALUES

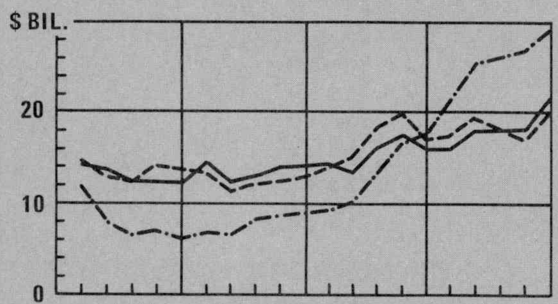

FIGURE 7

1952 '57 '62 '67 '72

— ACTUAL
— — HISTORICAL*
—·— FREE-MARKET*

**Historical simulation 18 : free-market simulation 19.*

PRICE INDEX FOR AGRICULTURAL PRODUCTS: ACTUAL AND SIMULATED VALUES

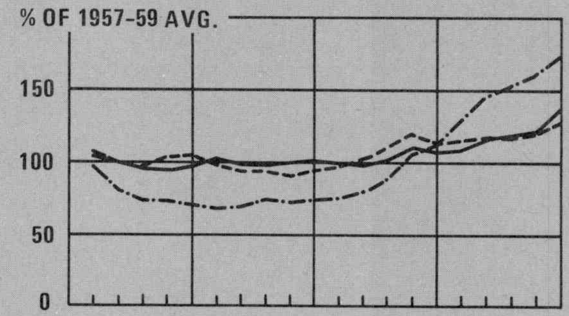

FIGURE 6

RELATIVE RATE OF RETURN TO FARM REAL ESTATE: ACTUAL AND SIMULATED VALUES

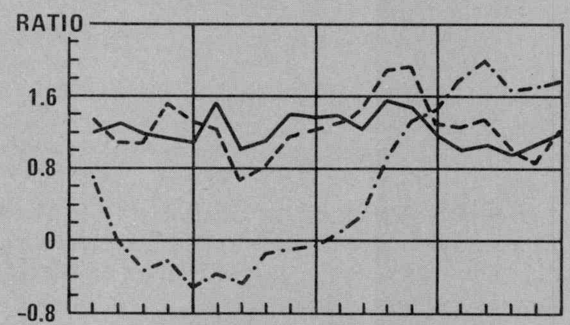

FIGURE 8

1952 '57 '62 '67 '72

— ACTUAL
— — HISTORICAL*
—·— FREE-MARKET*

**Historical simulation 18 : free-market simulation 19.*

most inelastic demand assumption. In all three cases, prices would have begun to recover after 1957, but would not have returned to their actual historical levels until around 1967, 10 years after the 1957 low and 14 years after the programs had been eliminated. Prices would have continued to increase, relative to the historical situation, until they peaked during 1969-71. Eliminating farm programs in 1953 would have raised 1972 farm prices 6 percent under the least inelastic demand assumption, 35 percent under the moderately inelastic demand assumption, and 68 percent under the most inelastic demand alternative. Thus, farm programs kept farm prices higher than they otherwise would have been during 1953-65, but the cumulative effect was to keep them lower than otherwise during 1968-72.

This latter result differs importantly from those in other historical free-market studies. For example, Ray and Heady report that low free-market prices would have depressed income and increased supplies throughout their period of analysis—1932-67 (*25*, p. 40). In Tyner and Tweeten's study, prices are lower in the free-market simulation than in the historical simulation for all periods reported—1930-40, 1941-50, and 1951-60 (*30*, p. 78). In both studies, the supply response in agriculture is never enough for free-market farm prices to recover fully. One explanation is that the rate of technological advance was exogenous in the previous models while in this model, such change is endogenous.

Results For Moderately Inelastic Demand Alternative

Effects of eliminating farm programs in 1953 are also presented in table 4 and figures 2-8. These results are based on a comparison of historical simulation 18 and free-market simulation 19.[12] This set of results is not necessarily the "best," or "most correct." It was selected primarily because the results represent a kind of mid-range between the alternatives, as indicated in figure 1. Presenting only one set of results facilitates understanding the dramatic and interrelated effects that would have occurred in the absence of the programs.

Supplies and prices. Changes in the aggregate farm price level for the free-market situation, compared to actual history, resulted primarily from changes in crop supply and price. As one might reasonably expect, crop price adjustments also determined eventual livestock price adjustments. Over time, livestock producers adjust their inventory and production levels in response to changes in the livestock-crop price ratio. Crop price changes were determined mainly by changes in open market crop supplies tempered by simultaneous adjustments in feed use and private end-of-year inventory levels.

Actual crop prices were significantly affected by large Government market diversions equal to over 10 percent of actual production in 1953-55. With price-supporting activities eliminated in 1953, crop prices would have fallen sharply as stocks increased in the short run. In a free-market situation, private crop stocks would have been 17 percent higher than the historical level in 1955, and crop prices, 36 percent lower. Open market crop supplies would have continued to exceed historical supply levels throughout 1955-64, because crop production decreases would not have been large enough to offset the effect of elimination of Government market diversions. Actual diversions, substantial in this period, ranged from 7 to 16 percent of actual crop production, though 4-16 percent of the cropland was idled by existing programs. After 1964, however, crop production decreases in a free market would have become larger than actual Government market diversions under the program. Thus, free-market crop supplies would have fallen below historical levels in 1965; and, by 1972, they would have been down 11 percent. Crop prices would have been 36 percent higher in 1972 than they actually were in that year.

The relative decrease in crop production after 1964 would have dramatically affected farm prices throughout 1964-72 (fig. 6). As a result, 8 percent more crop related inputs would have been used by 1972, in the free market. *But crop productivity would have dropped 19 percent below the actual historical level, cutting crop production 13 percent.*

Farm income. Total net farm income, in the free market, would have averaged 42 percent below historical levels in 1953-57. Such income would have been 20 percent below the actual level in 1953. By 1957, income would have dropped $8 billion, to equal 55 percent of actual income that year. Further, though net farm income would have remained more than $3 billion lower through 1966, it would have finally risen to a level nearly $10 billion higher than historical levels in 1971 and 1972. Such income would have climbed 58 percent above the historical level in 1971, to average 40 percent higher during 1968-72 (fig. 7).

Figure 8 shows the impact of eliminating farm programs on the rate of return to farm real estate (relative to market interest rates). Residual returns to real estate in a free market would have been negative in 1954-62, making estimated losses comparable to those in the depression years, 1930-33. As with price and net income, the rate of return in a free market would have been higher than its historical level after 1967. However, the highest free-market rate of return ratio (RATO=2.0 in 1969) would not have been as high as that for the war-influenced period of 1942-48, when the ratio varied from 2.1 to 3.8.

Assets, investments, and land prices. Assets, value of capital expenditures, and land prices would all have been lower in a free market than historically for 1953-72 (table 4). Low prices and incomes and increased risk and uncertainty would have immediately and subsequently affected the amount of assets farmers would have been willing and able to buy. Gross farm capital expenditures would have declined dramatically. Reaching a level 59 percent below actual historical levels by 1960, they would not have returned to a point near actual levels until 1971 and 1972. Total productive assets in a free market would have averaged 10 percent below actual historical levels during 1963-72, and farm land prices would have averaged 17 percent below actual values.

Agricultural productivity. The agricultural productivity index would have been somewhat higher in a free market than it actually was from 1955 to 1968, reaching a high of 7 percent more in 1958. However, the longer term effect of eliminating farm programs would have been to reduce the productivity index to a level 11 percent below the historical level by 1972. In 1961, the index would have been 101 (1967 = 100), never to exceed 102 in subsequent years of the free-market simulation (fig. 5).

Crop productivity in a free market would have fallen below actual historical levels for all years after 1958, and would have been down 19 percent by 1972. Most of this 19-percent decrease would have been attributable to the decline in use of nonfarm inputs (such as fertilizer

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[12] Historical simulation 18 can also be compared with the actual variable values plotted in figures 2-8. However, some equations have been adjusted to reproduce history more accurately than otherwise through use of regression error ratios. Such adjustment was considered desirable because the model is nonlinear. Thus, important disturbances in the equations could affect accuracy of the estimated program impacts.

and machinery) relative to cropland (figs. 2-4). The ratio of machinery and fertilizer to land and labor would have been 52 percent lower in the free market situation.[13] Also, the increased use of lower quality land would have reduced crop productivity; but an increase in the relative use of hybrid seed would have raised productivity. Decreased machinery inputs and increased use of cropland would have substantially raised labor inputs for 1957-72 in a free market.

Agricultural price variability. Absolute annual percentage changes in the agricultural price index would have averaged substantially above historical levels in a free-market situation. For the initial 5-year period, 1953-58, this index of variability would have averaged 53 percent higher. It would have continued above historical levels for all but 2 years. By 1968-72, the index would have averaged 150 percent higher.

Organization and structure. Several organizational and structural changes in agriculture would have occurred had farm programs been eliminated in 1953. Number of farms would have risen while the average size dropped. Land in farms relative to other assets would have increased, and cropland and labor would have been substituted for machinery and fertilizer inputs.

In the free market, the number of farms would have declined, but not as fast as it actually did. In historical simulation 18, number of farms declined at the average annual rate of 3.0 percent per year to a 1972 level of 2.7 million. In free-market simulation 19, the number of farms declined at the rate of 1.9 percent per year to 3.3 million in 1972. (The simulated number of farms was 4.7 million for 1953.) In 1972, there would have been 24 percent more farms than in actual history because the average size would have been 19 percent lower while total land in farms remained essentially unchanged. (Elimination of farm programs did affect land in farms prior to 1972.)

Average farm size in 1972 would have been much lower in a free market because agriculture would have been less mechanized, with more labor used per acre. A free market from 1953 on would have slowed the rate at which machinery and fertilizer and other nonfarm produced inputs were substituted for land and labor. Thus, farmers would have had less inducement to reorganize operations into larger sized units. In the historical simulation, the average size of farm increased at the average rate of 2.5 percent per year from 1953 to 1972. In the free market, this figure would have been 1.4 percent.

The share of total assets made up by land would have increased from 55 percent to 60 percent with a free market while shares for all other assets would have declined. Crop labor requirements would have risen from 7 to 15 percent of total current inputs. Cropland would have changed from 3 to 4 percent; livestock labor, from 4 to 5 percent. Other input shares would have declined.

Agricultural employment would have risen, with labor requirements 73 percent higher in 1972 than with farm programs. Most of the increased labor would have come from farm operators or their families. Family labor would have gone up 120 percent but hired labor inputs would have gained only 19 percent.

ASSESSMENT

The following summarizes results from simulations using demand relationships implying an aggregate domestic demand elasticity of around -.25 and assuming commercial crop exports are fixed at their actual historical levels in the free-market case (simulations 18 and 19). These results suggest that at least seven different impacts on the agricultural economy would have occurred had farm commodity programs of the Federal Government been eliminated in 1953:

- Farm prices would have dropped for several consecutive years until they averaged 33 percent below actual levels by 1957
- Aggregate farm prices would have been stable but low until after 1964, when they would have risen to a level averaging 35 percent above the actual figure in 1972
- Net farm income would have fallen 55 percent below the actual level by 1957 but it would have reached 58 percent above the actual level in 1971
- Residual returns to owners of farm real estate would have been negative in 1954-62
- Quantity of assets, value of capital expenditures, and farmland prices all would have been lower than actual levels throughout 1953-72, as a result of farmers' response to the initial and subsequently lower price and income experiences, lower expectations, and increased risk and uncertainty
- Land and labor inputs would have increased relative to other inputs, and the rate of decline in agricultural employment and number of farms during 1953-72 would have been reduced
- Crop resource productivity would have dropped under historical levels in all years after 1958, to be down 17 percent in 1972
- Agricultural productivity (crops and livestock combined) would have been 11 percent under actual levels in 1972.

Thus, farm programs had substantial and important effects on the developments in the agricultural sector during the period studied. In particular, the programs apparently worked to promote both long- and short-

[13] A net decrease in crop productivity in this free-market simulation results mostly from the effect of reduced machinery relative to cropland and labor. The effect of less use of machinery offsets a technically inappropriate positive effect of reduced fertilizer. The fertilizer sign comes from a negative partial derivative of productivity with respect to fertilizer of -0.1 obtained for the crop productivity equation.

term price and income stability. Apparently, the potential exists for continuous long-term food and fiber price cycling because of the nature of agricultural supply responses in a free-market situation. This cycling would occur, as the domestic and world economies grow, because domestic agricultural supply cannot grow at exactly the same rate as demand. The growth rate for supply is affected by complex interrelationships that exist between (1) adjustments in agricultural assets and inputs, in response to price and income experiences, and (2) adjustments in crop productivity and livestock production. During 1953-72, farm commodity programs were operated in a way that mitigated aggregate farm price and income cycling over extended periods.

This study suggests that farm programs supported farm prices and incomes at levels substantially higher than they would have been otherwise during 1953-65. Feed and other crop prices were supported by programs that idled productive land and diverted marketable supplies into Government storage or that subsidized domestic and foreign use. This resulted in reduced livestock production and consumption, and higher livestock prices. Farmers responded to these developments by mechanizing, fertilizing, increasing farm size on the average, and generally adopting technologies that reduced costs, boosted resource productivity, and expanded productive capacity. Elimination of farm programs in 1953 would have slowed the rate at which these advancements took place, or reversed the trend temporarily. The result: in recent years (1968-72), farm price levels would have been higher in a free market than in actuality.

Farm prices in the free-market simulation eventually recovered, and finally exceeded actual historical levels, because elimination of farm programs in 1953 put agriculture through the "longrun wringer."[14] With free-market prices 10 to 30 percent below actual levels throughout 1953-66, and a negative rate of return to real estate for a number of years, gross capital expenditures and current input expenditures were greatly reduced, and agricultural productivity and output growth retarded. The eventual result in the free-market simulation was that farm prices increased dramatically as aggregate demand grew faster than aggregate supply. Farm commodity programs held farm prices and incomes *higher* than would have been true otherwise for 1953-65, which apparently provided the economic incentives to growth in output sufficient to hold farm prices *lower* than they otherwise would have been for 1968-72.

These results suggest that the national agricultural plant can and does respond to changes in economic incentives, given sufficient time. But because substantial time is required to change agricultural capacity, long periods of substantial disequilibrium and disruption can result in a free market. Without farm commodity programs, consumers would have enjoyed low farm product prices through 1964. Farmers, at the same time, would have suffered their worst financial crisis since the Depression. But these low prices would have been replaced by high farm prices, following a long period of rapid farm price increases after 1964. At the same time, farm incomes would have been improved greatly.

[14] Cochrane discussed how the "longrun wringer" could "correct" the surplus condition in agriculture in (*1*, pp. 134-136).

REFERENCES

(1) Cochrane, Willard. *Farm Prices Myth and Reality.* Univ. Minnesota Press, Minneapolis, Minn., 1958.

(2) Daly, Rex F. "Agriculture: Projected Demand, Output and Resource Structure." *Implications of Changes (Structural and Market) on Farm Management and Marketing Research.* CAED Rpt. 29, Ctr. for Agr. and Econ. Adjustment, Iowa St. Univ. Science and Technol., Ames, Iowa, 1967, pp. 82-119.

(3) Egbert, Alvin C. "An Aggregate Model of Agriculture-Empirical Estimates and Some Policy Implications." *Amer. J. Agr. Econ. 51:* 71-86, February 1969.

(4) George, P. S. and G. A. King. *Consumer Demand for Food Commodities in the United States with Projections for 1980.* Giannini Foundation Monograph 26, Univ. Calif., Davis, Calif., 1971.

(5) Girao, J. A., Tomek, W. G., and T. D. Mount. "Effect of Income Instability on Farmers' Consumption and Investment Behavior: An Econometric Analysis." *Search*, Vol. 3, No. 1, Agr. Econ. 5, Cornell Univ., Ithaca, N.Y., 1973.

(6) Gray, Roger W., Vernon L. Sorenson, and Willard W. Cochrane. *The Impact of Government Programs on the Potato Industry.* Tech. Bul. 211, Minn. Agr. Expt. Sta., Minneapolis, Minn. 1954.

(7) Griliches, Zvi. "Hybrid Corn: An Exploration in the Economics of Technological Change." *Econometrica*. Vol. 25, No. 4, October 1957, pp. 501-522.

(8) Guebert, Steven R. "Farm Policy Analysis Within a Farm-Sector Model." Unpublished Ph. D. thesis, Univ. Wisc., Madison, Wisc., 1973.

(9) Hathaway, Dale E. *Effect of Price Support Program on the Dry Bean Industry in Michigan.* Tech. Bul. 250, Mich. St. Univ. Agr. Expt. Sta., East Lansing, Mich., 1955.

(10) Hayami, Yujiro and Vernon Ruttan. *Agricultural Development: An International Perspective.* John Hopkins Press, Baltimire, Md., 1971.

(11) Heady, Earl O. *Economics of Agricultural Production and Resource Use*. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1952.

(12) Heady, Earl O., and Luther G. Tweeten. *Resource Demand and Structure of the Agricultural Industry.* Iowa St. Univ. Press, Ames, Iowa, 1963.

(13) Helen, Dale, Jim Matthews, and Abner Womack. "A Methods Note on the Gauss-Seidel Algorithm for Solving Econometric Models." *Agr. Econ. Res.* Vol. 25, No. 3, July 1973, pp. 71-75.

(14) Herdt, Robert W. and Willard W. Cochrane. "Farm Land Prices and Farm Technological Advance." *J. Farm Econ.* Vol. 48, No. 2, May 1966, pp. 243-263.

(15) Johnson, D. Gale. *Forward Prices for Agriculture.* Univ. Chicago Press, Chicago, Ill., 1947.

(16) Johnson, Glenn L. *Burley Tobacco Control Programs.* Bul. 580, Ky. Agr. Expt. Sta., Lexington, Ky., 1952.

(17) Lambert, L. Don. "The Role of Major Technologies in Shifting Agricultural Productivity." Unpublished paper presented at joint meeting of Amer. Agr. Econ. Assoc., Canadian Agr. Econ. Soc. and Western Agr. Econ. Assoc., Edmonton, Alberta, Aug. 8-11, 1973.

(18) Lin, William, G. W. Dean, and C. V. Moore. "An Empirical Test of Utility vs. Profit Maximization in Agricultural Production." *Amer. J. Agr. Econ.* Vol. 56, No. 3, August 1974, pp. 497-508.

(19) Nelson, Frederick J. "An Economic Analysis of the Impact of Past Farm Programs on Livestock and Crop Prices, Production, and Resource Adjustments." Unpublished Ph.D. thesis, Univ. Minn., Minneapolis, Minn., 1975.

(20) Penson, John B., Jr., David A. Lins, and C. B. Baker. "The Aggregative Income and Wealth Simulator for the U.S. Farm Sector-Properties of the Model." Unpublished ms., National Econ. Analysis Div., Econ. Res. Serv., U.S. Dept. Agr., Washington, D.C., November 1974.

(21) Quance, C. Leroy. "Elasticities of Production and Resource Earnings." *J. Farm Econ.* Vol. 49, No. 5, December 1967, pp. 1505-1510.

(22) Quance, Leroy. "Introduction To The Economic Research Service's Economic Projections Program." Paper prepared for 1975 Amer. Agr. Econ. Assoc. annual meeting, Ohio St. Univ., Columbus, Ohio, Aug. 10-13, 1975.

(23) Quance, C. Leroy and Luther Tweeten. "Excess Capacity and Adjustment Potential in U.S. Agriculture." *Agr. Econ. Res.* Vol. 24, No. 3, July 1972.

(24) Ray, Daryll E. and Earl O. Heady. "Government Farm Programs and Commodity Interaction: A Simulation Analysis." *Amer. J. Agr. Econ.* Vol. 54. No. 4, November 1972, pp. 578,590.

(25) ____________. *Simulated Effects of Alternative Policy and Economic Environments on U.S. Agriculture.* Ctr. for Agr. and Rural Devlpt., Iowa St. Univ., Card Rpt. 46T, Ames, Iowa, 1974.

(26) Rosine, John and Peter Helmberger. "A Neoclassical Analysis of the U.S. Farm Sector, 1948-70." *Amer. J. Agr. Econ.* Vol. 56, No. 4, November 1974, pp. 717-729.

(27) Ruttan, Vernon W. "Agricultural Policy in an Affluent Society." *J. Farm Econ.* Vol. 48, No. 5, December 1966, pp. 1100-1120.

(28) Tweeten, Luther G. "The Demand for United States Farm Output." *Stanford Food Res. Inst. Studies*, Vol. 7, No. 3, 1967, pp. 347-369.

(29) Tyner, Fred H. and Luther G. Tweeten. "Excess Capacity in U.S. Agriculture." *Agr. Econ. Res.*, Vol. 16, No. 1, January 1964, pp. 23-31.

(30) ____________. "Simulation As a Method of Appraising Farm Programs." *Amer. J. Agr. Econ.* Vol. 50, No. 1, February 1968.

(31) Tyrchniewicz, Edward W., and Edward G. Schuh. "Econometric Analysis of the Agricultural Labor Market." *Amer. J. Agr. Econ.* Vol. 51, No. 4, November 1969, pp. 770-787.

(32) Ulveling, Edwin F., and Lehman B. Fletcher. "A Cobb-Douglas Production Function with Variable Returns to Scale." *Amer. J. Agr. Econ.* Vol. 52, No. 2, May 1970, pp. 322-326.

(33) Waugh, Frederick V. *Demand and Price Analysis: Some Examples from Agriculture.* Tech. Bul. 1316, Econ. Res. Serv., U.S. Dept. Agr., Washington, D.C., 1964.

(34) Yeh, Chung-Jeh. "Simulating Farm Outputs, Prices, and Incomes Under Alternative Sets of Demand and Supply Parameters." Paper prepared for 1975 Amer. Agr. Econ. Assoc. annual meeting, Ohio St. Univ., Columbus, Ohio, Aug. 10-13, 1975.