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Alternative Futures for American Agricultural Structure, Policies, Income, Employment, and Exports: A Recursive Simulation

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ALTERNATIVE FUTURES FOR AMERICAN AGRICULTURAL STRUCTURE, POLICIES, INCOME, EMPLOYMENT, AND EXPORTS: A RECURSIVE SIMULATION

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Preface

American agriculture has undergone dramatic changes over the last few years. During the 1960s and early 1970s, it struggled along under surplus capacity relative to demand and prices that were not acceptable to farmers. Farm prices and income were supported by a complex of federal programs emphasizing direct payments for withholding land from production, nonrecourse commodity loans, and heavily subsidized international food aid. This situation of surplus capacity and depressed prices and incomes was quickly inverted, however, as poor weather and crop shortfalls in Eastern Europe and other world regions, along with changes in certain other variables, translated into a huge increase in demand for U.S. grain exports. This demand increment soon threaded through the agribusiness sector and rapidly translated into much higher farm prices and income, consumer food costs, and land values.

With these two contrasting situations both prevailing over the past half dozen years, the question arises as to the future for American agriculture and the appropriate direction for future farm policies. At the request of the Office of Planning and Evaluation, Office of the Secretary of Agriculture, U.S. Department of Agriculture, an existing simulation model developed by the Center for Agricultural and Rural Development (CARD) was extended and adopted to project alternative outcomes which could fall on American agriculture, depending on the policies, markets, and other economic environment that surrounds it. Seven

alternative futures have been simulated and are statistically expressed in all major variables relating to agriculture. The model used is national in scope and incorporates submodels for livestock, feed grain, wheat, soybeans, cotton, tobacco, and all other crops. Simulations are made for a period from 1975 to 2000.

Several seminars were held between the CARD staff and personnel of the Office of Planning and Evaluation. One seminar was held with these persons and the assistant secreatries of agriculture. Hence, we are indebted to numerous persons from the U.S. Department of Agriculture in the formulation and implementation of the project. However, the final decision on methods to be used, the interpretation of the quantitative outputs, and the policy implications of the results are solely the expressions of the authors.

We are particularly indebted to Dr. William A. Carlson, Dr. Burl Back, Dr. Barry Carr, and others of their USDA staff for ideas and stimulating thoughts during seminar sessions. We are indebted to Dr. Steven T. Sonka, Iowa State University, for his helpful comments and critique of the analysis and manuscript, and to Craig V. Fulton, Iowa State University, for his research assistance.

The Authors

SUMMARY

Recent increases in the foreign demand for agricultural products has caused a great deal of uncertainty as to the direction American farm policy should take. Past agricultural policies of supply restriction and price supports are inconsistent with the low commodity inventories and high prices we have experienced during the last several years. If the high export levels of the 1973-74 period indicate the beginning of further growth in the export market, then a program of supply expansion would be desirable. However, such a policy may result in severe economic hardship for the farming industry if the growth in exports does not continue.

Farm policies of the 1960s and early 1970s were characterized by programs of land diversion and price supports in order to maintain a reasonable return to agriculture relative to the nonfarm sector. During the period from 1961-72, farm programs diverted an average of 54.6 million acres of cropland each year. This represents approximately 27 percent of the total cropland planted to feed grains, wheat, soybeans, and cotton [38]. A series of unexpected events, such as crop failures in major importing countries, a decline in the anchovy harvest, and a devaluation of the dollar, combined to expand the foreign demand to almost double previous levels. Agricultural policies of the 1960s were not prepared for such an abrupt change of direction. The result was a drastic depletion of American inventories of agricultural products and rapidly rising prices. Consumer groups were vocal in demanding lower food prices, elimination of acreage restrictions, and new agricultural policies to increase food production.

A number of questions have been raised by the events of the last three years: Is the productive capacity of American agriculture sufficient to meet domestic and foreign demands of recent years at lower crop prices? Are agricultural policies needed to increase the productive capacity of American agriculture through increases in research and development? How much confidence do we have that export levels of the last few years will prevail in the future? What are the consequences of expanding the productive effort of agriculture if exports revert back to their historical growth paths?

This study attempts to provide insight into the long-range consequences of alternative export levels, government agricultural policies, and levels of productive efficiency. The productive capability of American agriculture is assessed in terms of its ability to satisfy foreign as well as domestic needs. Prices of agricultural products, resource requirements, and consumer food expenditures are estimated for various situations.

These types of issues are explored in this study through the application of a simulation model of U.S. agriculture, which statistically describes the behavioral patterns of the agricultural production sector. The simulation model is a national model with submodels for livestock, feed grains, wheat, soybeans, cotton, tobacco, and all other crops. The simulation model estimates 235 agricultural variables for each year from 1975 to 2000.

Seven variations of the basic model analyze the impact of alternative farm policies and export levels on American agriculture.

These variations can be dicotomized into a trend future and a maximum efficiency future. The trend future examines present farm programs under the assumption of continuation of historical trends in farm size, technology, resource use, and export demands. The maximum efficiency future examines policies designed to increase total output and efficiency of agriculture to meet an expanded world market. From each policy set and assumption about the future, time paths of farm prices, farm income, production, resource demand, etc. are generated.

The trend future explores agriculture under its presently evolving structure of farm size, technology, resource use, and export demands. The trend future examines the effects of the 1973 farm program which has provisions for subsidy payments, acreage diversion, and acreage allotments dependent upon the levels of market prices. Two simulation alternatives analyze the effect of current farm programs with the trend future. Simulation 1 includes the 1973 farm program, while Simulation 2 estimates the impact of removing farm programs and returning to a free market structure.

Growing export demand and an assumed U.S. population of 300 million by the year 2000 cause total demand for all commodities to increase steadily from 1975 to 2000 in the trend futures. Soybean and feed grain demands show the largest increase because of substantial growth in exports and higher per capita consumption of livestock. Acreage requirements for feed grain increase to 121.4 million acres of feed grain and 70.1 million acres of soybeans by the year 2000 in Simulation 1. Wheat and cotton acreage requirements decrease to 47.7 million acres and 10.8 million acres,

respectively, by the year 2000 because of greater increases in yields relative to the growth in wheat and cotton demands. By 1995 the growth in soybean and feed grain acres expands the total acres planted to wheat, feed grains, soybeans, and cotton to 250 million acres, the historical cropland base for the four crops.

Farm programs in the trend future maintains stable prices during the period from 1975-94 through price supports and acreage control programs. Stable crop prices average $1.89 per bushel for wheat, $1.31 per bushel for feed grains, $3.33 per bushel for soybeans, and $.35 per pound for cotton in constant 1972 dollars. Crop prices increase after 1995 as demand continues to grow, while cropland available for wheat, feed grains, and cotton is constrained to the historical base of 250 million acres.

The initial response of farmers to removal of farm programs in Simulation 2 is to increase production. This depresses crop prices to $1.32 per bushel for wheat, $1.01 per bushel for feed grains, $3.06 per bushel of soybeans, and $.18 per pound of cotton during the period 1975-89. By 1994 crop prices begin to increase as crop demand begins to reach the supply capacity of the trend future.

Gross farm income grows steadily under the farm program in Simulation 1 with a growing demand for agricultural commodities. Gross farm income reaches $83.3 billion in 1985 and $112.2 billion in 2000. Total net farm income under Simulation 1 increases to $29.6 billion in 1985 and $42.1 billion in 2000. Without farm programs (Simulation 2) total net farm income is lower at $21.9 billion in 1985 and $37.8 billion in 2000.

In both of the trend futures, the number of commercial farms (sales greater than $2,500) is assumed to decline to 1.3 million by the year 2000. Declining farm numbers combined with growing farm income increases net income per commercial farm from $11,036 in 1969-72 to $18,789 in 1985 in Simulation 1 and to $13,902 in Simulation 2. By the year 2000, net income per commercial farm in the Simulation 1 grows to $31,801.

Farm programs are necessary to support farm prices and incomes in the years 1975-95 because the productive capacity of agriculture exceeds commodity demands at legislated target prices. After 1995 growing domestic and foreign demand require U.S. agriculture to produce at full capacity. Growing soybean and feed grain acreage requirements eliminate the need for feed grain acreage diversion by 1994, thus significantly reducing farm program payments.

Consumer food expenditures increase under Simulation 1 as consumers increase consumption of meat and poultry products. Total per capita food expenditures increase from $557 in 1969-72 to $641 in the year 2000. Projected increases in per capita disposable income reduce the proportion of disposable income spent on food from 15 percent in 1969-72 to 8 percent in the year 2000. Lower per capita food expenditures occur in Simulation 2 because of lower crop prices under the free market.

Policies of the maximum efficiency future are designed to increase farm productive efficiency to meet domestic and foreign demands at reasonable prices. These policies include: a change in farm structure to a larger more efficient farm size; increases in research expenditures to increase

crop yields 15 percent above the trend projections; and elimination of production controls to allow greater efficiency in the geographic location of crop production. This study assumes that a price support program would be implemented by the government to encourage the adoption of new technology and to prevent a severe drop in farm prices and incomes. A direct government purchase is used to prevent farm prices from falling below minimum levels of $1.20 per bushel for wheat, $.90 per bushel for feed grains, and $.18 per pound for cotton. This program could involve government purchases of surplus commodities for non-market export either under subsidy or as part of an aid program to needy nations.

A wide range of crop exports are examined under the maximum efficiency future, since export demands plays such a key role in absorbing the increased productive capacity of the maximum efficiency futures. Simulation 3 determines the export levels needed to maintain market prices of wheat, feed grains, and cotton at the 1973 legislated target levels. Simulations 4 through 7 estimate the impacts of increased productive capacity and efficiency in the maximum efficiency future under the assumption of: trend exports (Simulation 4); 30 percent above trend exports (Simulation 5); exports 50 percent above trend exports (Simulation 6); and exports twice the level of trend exports (Simulation 7).

Increases in production in the maximum efficiency futures are absorbed by substantial increases in crop exports. The gap between production and domestic demand decreases from 1980 to 2000 as the growth of domestic demands, especially livestock feed demands, increases faster

than the growth of output. In Simulation 3 market exports in the years 1975-85 needed to absorb production in excess of domestic demand with prices at the 1973 target levels are substantially higher than 1972-73 levels, averaging 77.6 million tons of feed grains, 1430.1 million bushels of wheat, 656.8 million bushels of soybeans, and 14.7 million bales of cotton.

In Simulations 4, 5, and 6, market export demands are assumed to be at trend levels, 30 percent above trend, and 50 percent above trend, respectively. Excess production is purchased and exported through government programs to support prices at $1.20 per bushel for wheat, $.90 per bushel of feed grains and $.18 per pound of cotton. With exports at trend levels, Simulation 4, excess production averages 676.6 million bushel of wheat, 44.1 million tons of feed grains, and 5.4 million bales of cotton from 1980 to 2000, totaling $1.3 billion annually for government purchases. A 50 percent increase in trend exports, Simulation 6, is required before the government export disposable programs are eliminated.

Exports in Simulation 3 are at levels sufficient to maintain farm prices at target levels averaging $2.06 per bushel for wheat, $1.42 per bushel for feed grains, $3.38 per bushel for soybeans, and $.38 per pound for cotton. Neither the export levels of Simulation 4 (trend levels) nor exports in Simulation 5 (30 percent above trend levels) increase total demand enough to match the growth of crop production. As a result crop prices stabilize at minimum support levels in Simulations 4 and 5 through the years 1975 to 2000. The impact of a 30 percent increase in trend than the growth of output. In Simulation 3 market exports in the years 1975-85 needed to absorb production in excess of domestic demand with prices at the 1973 target levels are substantially higher than 1972-73 levels, averaging 77.6 million tons of feed grains, 1039.1 million bushels of wheat, 695.8 million bushels of soybeans, and 10.7 million bales of cotton.

In Simulations 4, 5, and 6, market export demands are assumed to be at trend levels, 30 percent above trend, and 70 percent above trend, respectively. Excess production is purchased and exported through government programs to support prices at $1.20 per bushel for wheat, $.90 per bushel of feed grains and $.18 per pound of cotton. With exports at trend levels, Simulation 4, excess production averages 435.5 million bushel of wheat, 44.1 million tons of feed grains, and 3.6 million bales of cotton from 1980 to 2000, totaling $1.3 billion annually for government purchases. A 30 percent increase in trend exports, Simulation 6, is required before the government export disposable program are eliminated.

Exports in Simulation 3 are at levels sufficient to maintain farm prices at target levels averaging $2.05 per bushel for wheat, $1.42 per bushel for feed grains, $3.38 per bushel for soybeans, and $.38 per pound for cotton. Neither the export levels of Simulation 4 (trend levels) nor exports in Simulation 5 (30 percent above trend levels) increase quick enough to match the growth of crop production. As a result crop prices stabilize at minimum support levels in Simulations 4 and 5 through the years 1975 to 2000. The impact of a 30 percent increase in trend exports in Simulation 5 merely reduces the level of government support required to maintain minimum prices. Even a 50 percent increase in trend exports demand in Simulation 6 is not sufficient to raise prices above minimum levels in the years 1980-94.

After 1994 growing domestic and export demands in Simulation 6 (50 percent increase in trend exports) of the maximum efficiency future exceed the growth in crop production. This causes crop prices to rise to $1.81 per bushel for wheat, $1.72 per bushel for feed grains, $4.48 per bushel for soybeans, and $.18 per pound for cotton in the year 2000. The high export demand levels in Simulation 7 increase crop prices each year from 1975 to 2000 as domestic and export demands grow faster than increases in production. By 2000 crop prices increase to $2.99 per bushel for wheat, $2.45 per bushel for feed grains, $7.06 per bushel for soybeans, and $.63 per pound for cotton.

Increased crop production and input efficiencies in the maximum efficiency future at target prices (Simulation 3) increases net farm income an average 22 percent above the farm program trend (Simulation 1). In the maximum efficiency futures with exports growing at trend (Simulation 4) and 30 percent above trend levels (Simulation 5), market demand is not sufficient to maintain prices above minimum support levels. As a result, net farm income averages 46 to 42 percent lower than in Simulation 3. A 50 percent increase in trend exports (Simulation 6) does not raise net farm income significantly until after 1995 when domestic and export demands have grown enough to reduce the excess capacity of agriculture. The maximum efficiency future under high export levels (Simulation 7)

shows the largest increase in net farm income due to rising crop prices. In Simulation 7 net farm income grows to $77.5 billion by 2000 compared with the $42.7 billion under the maximum efficiency future at target prices (Simulation 3).

Farm policies in the maximum efficiency futures promote large efficient farms (sales greater than $40,000) and reduce the number of commercial farms from 1.796 million in 1969-72 to 1.032 million in 1985 and .983 million in the year 2000. Growth in net farm income combined with the reduction in farm numbers increases net income per commercial farm in the maximum efficiency future at target prices (Simulation 3) to $43,457 by the year 2000, higher than net farm income per commercial farm under the trend future with farm programs (Simulation 1). Net income per commercial farm in the year 2000 ranges from $23,806 in Simulation 4, (trend export maximum efficiency future) to $78,794 in Simulation 7 (double trend exports maximum efficiency future).

Food costs in the maximum efficiency future vary directly with increases in crop exports. Total food expenditures in the maximum efficiency future at target prices (Simulation 3) reach $624 in 2000, which is nearly equal expenditures in the trend future under farm programs (Simulation 1). Food expenditure in the year 2000 under the maximum efficiency future range from $594 per capita to $691 per capita under high crop exports. The primary source of increases in per capita food expenditures is the increase in meat and poultry expenditures.

Clearly, the policy needed for agriculture in the future depends upon future export levels. The farm policy adopted will have long-run impacts on agriculture and the rest of society. If exports grow at trend

projections, then government support policies will be needed, even under trend technology. Results indicate that the export supply capacity of the maximum efficiency future is large, especially from 1980-95. If exports expand more than 50 percent above trend projections, then both consumers and the farm sector can gain from productivity increases. At lower export levels, policies of increased efficiency worsens the problem of excess capacity in agriculture experienced in recent decades and would require higher treasury costs to support farm prices and incomes.

It should be emphasized that all of the effects of the policies discussed in this report are not detailed here. For example, moving to a structure of all large farms in the maximum efficiency future has an impact on the rural community. Under similar production levels, Sonka and Heady [35] have shown that income generated in the rural community from agriculture is significantly lower under the large farm structure than in the typical farm size. Thus, a change in farm programs not only affects farmers and consumers but also will have an impact on the rural community.

The path of future farm exports plays a big role in determining the appropriate policy of the future. Our conclusion for each alternative depends on a set of assumptions about future growth paths of population, trend yields, and per capita demand levels. The effects on each alternative from changes in these parameters can be examined in the context of the impact each parameter change will have on the export capacity presented. For example, assuming a lower population growth rate or assuming higher trend yields would increase the excess capacity in each alternative.

INTRODUCTION

World food uncertainty along with domestic food shortages are causing a re-evaluation of the future of American agriculture. Larger agricultural exports and greater domestic demand for our agricultural output have prompted some persons to predict that problems of over production and low returns to agriculture are a thing of the past. These persons predict that U.S. agriculture's capacity to produce has become more closely aligned with the domestic and foreign demand for our agricultural output, and agriculture will enjoy a higher level of return than it has known in recent decades.

The primary factor creating this optimistic outlook for agriculture is the tremendous increase in 1973 exports of agricultural commodities. The value of 1973 exports, a record 17.7 billion dollars worth, was 88 percent greater than the previous record exports of 1972 [14]. A combination of factors, including a growing world-wide demand for feed grains and other foods, a realignment of the monetary unit, and crop failures in several areas of the world [44] contributed to these record export levels. There also appears to be a greater willingness of Communist countries to obtain the commodities they need from the world market. Future exports also may expand as the standard of living improves in the developing nations and these people exhibit a protein preference such as the more highly developed countries now have. The combination of events which created the high agricultural exports of the last several years are not likely to reoccur in precisely the same form. However, higher long-term exports do appear to be in store for American agriculture.

If the climate for American agriculture has changed, then a critical juncture is being approached in agricultural policy. Our past government programs of price supports and acreage restrictions should be replaced by programs to stimulate production and encourage the development and adoption of new technology. Acreage restrictions should be removed from all crops, and expenditures of public funds for agricultural research and extension should be increased. In addition, agricultural exports should be encouraged and the export "food aid" programs of the past could be replaced by cash sales. In contrast, however, if an all-out production effort is made, and the domestic and foreign demands are not sufficient to absorb the increased production, then this policy would have undesirable effects on agriculture. A glut of agricultural output would develop which would depress prices and create the need for large government assistance programs. A policy which is not suited to the needs of agriculture and society will create a period of price instability and resource realignment.

Historically the farm problem has been a complex, multidimensional problem of unstable farm prices, low farm incomes, costly farm programs, and a consuming society expecting and demanding low food costs. Programs designed to alleviate one facet of the problem often irritate another. In recent years farm prices have been high and farm incomes have been good for most farmers. However, high farm prices have caused consumer food costs to rise to levels which the consuming society considers unacceptable. The result has been pressure from consumers to reduce food costs through reduced exports, expanded output, or a combination of the two. The goals of farmers and consumers are in direct conflict in these respects. Perhaps the most difficult task ahead for agricultural policy is to pursue a farm program which seeks to balance the goals between farmers and consumers.

The orderly evolution of agriculture requires a clear understanding of the path which lies ahead. We must try to understand the alternatives which we face and consider as many of these as possible. Various alternatives provide different levels and distributions of benefits and costs to farmers, consumers, and other groups. From the alternatives that are open to us, we can select the course of action which appears to be most consistent with agricultural and national objectives.

PURPOSE OF STUDY

In this study we explore alternative futures for American agriculture. A number of domestic and foreign demand requirements along with a range of productivity developments are considered and the consequences for agriculture examined. In many cases these consequences can be altered by adjustments in government policies. Through careful evaluation and policy planning, a smooth evolution thus can take place in agriculture.

The major purpose of this study is to estimate, using an econometric simulation model, outcomes for American agriculture under various alternatives of the future. Estimates are made of production, price, farm income, employment, food prices, and other important agricultural variables under alternative environments of exports, support programs, technological change or efficiency, and trend variables to the year 2000. These outcomes are estimated in order that an enlightened basis may exist for the selection of future farm policies.

SIMULATION MODEL

The model used in this analysis is a recursive econometric simulation model. Its initial framework was the CARD simulation model developed (but broadly respecified for this study) in Ray's thesis [29], reported by Ray and Heady [31,32]. Certain sections of this initial CARD model have been extended rather extensively for the current forecasting purposes. The model depicts the sequential nature of the agricultural production cycle for one year at a time. This allows the time path for each endogenous variable, such as production or net income, to be generated by iterating the model for each year in the projection period, subject to a set of assumptions on the exogenous variables. Selecting alternative sets of exogenous variables permits comparison between different futures for agriculture.

The recursive structure of the simulation model refers to the sequential nature in which its equations are solved. A model which exhibits the property of recursiveness can be solved a single equation at a time rather than by solving all equations simultaneously. In a recursive model, the current values for the dependent variables are determined from combinations of past and current values of variables previously determined. Recursiveness has economic significance because it permits a sequential ordering of events rather than a simultaneous ordering. The sequential ordering provides a way of depicting the events which occur in the agricultural production cycle. Linkages between variables in current and past time periods allows for partial adjustments from one time period to the next.

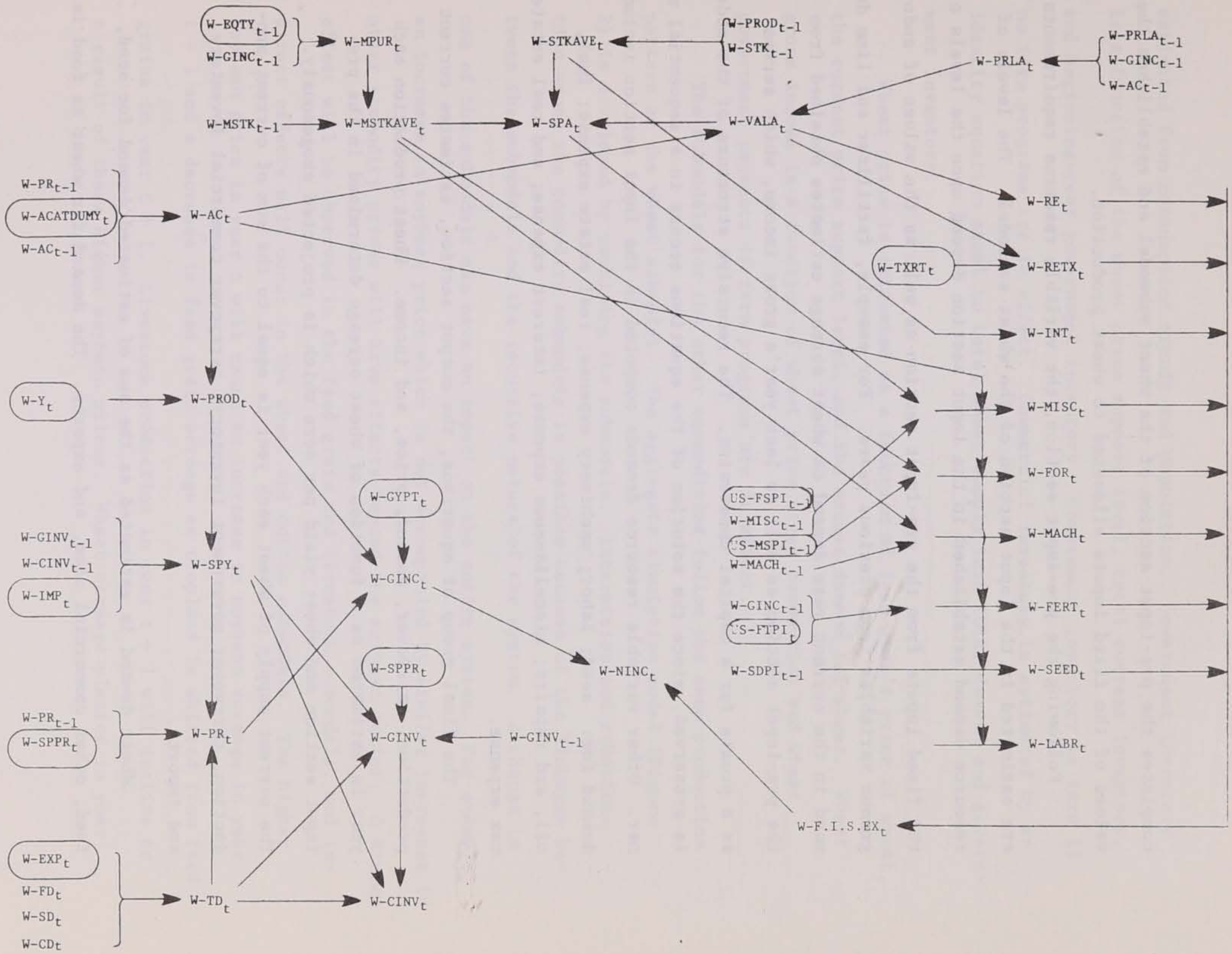
The simulation model is composed of five commodity submodels representing the major categories of agricultural production. The commodity submodels are used to capture the production activity in the livestock, feed grains, wheat, soybeans, and cotton sectors at the national level. Other commodities are included in an exogenous category. Within each commodity submodel, agricultural production is represented by equations to capture the decision-making process at each stage of the production cycle. The output and income responses resulting from the firm's decisions also are represented by econometric equations. Estimation of the econometric equations was based on yearly aggregate U.S. time series data covering the period from 1930-67.

Each commodity submodel is divided into three categories corresponding to the planning, planting, and harvesting decisions in the production cycle. These three categories are referred to as the pre-input, input, and output sections of each commodity submodel. The pre-input section determines the levels of such fixed resources as machinery available, new machinery to be purchased, stock of productive assets, and the number of acres intended for harvest. Levels of the variable inputs such as fertilizer, seed, machinery, and labor requirements are determined in the input section based on information from the pre-input section and from previously determined variables. The output section provides the production, commodity price, and income estimates resulting from the resource levels committed in the pre-input and input sections.

The workings of the simulation model can best be understood by observing the operation of a typical commodity submodel such as the wheat submodel. Figure 1 is a schematic illustration of the wheat submodel, where exogenous variables are enclosed by ovals and all other variables are either predetermined or endogenous. Variables used in the wheat submodel are defined in Appendix A. Within the wheat submodel, the first category of equations is the pre-input section. The initial decisions which the wheat producer will make include the number of acres which will be devoted to wheat production. Wheat acreage in this model is estimated as a function of last year's wheat price and last year's wheat acreage. Machinery purchases for use in wheat production are estimated as a function of last year's gross income and the ratio of last year's value of real estate to last year's mortgage debt. The total machinery stock to be used for wheat production is a function of the carryover stock of machinery and the purchase of machinery in the current year. Commodity stocks on farms at calendar year end is estimated from last year's wheat production and last year's stock of wheat.

An index of the price of land and buildings is estimated as a function of last year's price and per acre gross income from last year. The value of farmland and buildings in the current year are then estimated as a function of the current price of land and current acres. The stock of physical assets is estimated as the sum of the average commodity stock in the farm, the average machinery stock, and the value of farmland and buildings. This

Figure 1. Wheat submodel.



completes the pre-input section of the wheat submodel and establishes the values of the fixed inputs allocated to wheat production.

Following the pre-input section, the variable resource requirements are estimated in the input section of the wheat submodel. The levels of resource demand established in the input section depend upon the levels of the fixed inputs from the pre-input section as well as the values of endogenous variables from previous years. For example, fertilizer and lime demand in the current year depend on wheat acreage estimates obtained from the pre-input section as well as last year's gross income, which serves as a proxie for a capital constraint. The recursive structure of the model is preserved, since the solution of the equations occurs in a sequential manner. Other variable resource demands computed in the input section include demand for: seed; labor; machinery expense; real estate expense; fuel, oil, and repairs; miscellaneous expense; interest expense; and real estate tax expense.

The final group of equations, the output section, estimates current production, carryover, demand, price, and income. Wheat production each year is estimated as a function of wheat acreage determined in the pre-input section and wheat yield per acre which is projected exogenously. The current supply of wheat each year is equal to the sum of current production, carryover government inventory, carryover commercial inventory, and imports.

Wheat demand is estimated as the sum of estimated demand for seed, feed, other commercial uses, and exports. The demand for wheat as food is estimated from consumption trends and population. Government inventory is a function of the wheat price support level, total current inventory, and beginning-year government inventory. Government inventory is zero if no farm programs are in effect. Commercial inventory is estimated by an identity equation equal to total wheat supply less total demand and government inventory.

Wheat price is estimated as a function of last year's price of wheat, the current price support level, and the excess demand for wheat. Wheat gross income is a function of wheat price times production and wheat government payments if farm programs are in effect.

The submodels for the other commodities follow the same production pattern as the wheat submodel. The aggregate simulation model (Figure 2) is developed by combining the submodels. Interaction and substitution among the commodity submodels is possible because of the linkages between the submodels and the recursive nature of the system. A change in one of the submodels can have an impact on the entire system. For example, an increase in soybean price which is not accompanied by similar increases in other commodity prices will have effects beyond the soybean sector. A direct effect will be observed in the feed grain and livestock submodels, and indirect effects will occur in the wheat and cotton submodels. The higher soybean price in year t will cause an increase in soybean acreage in year t + 1 and a decrease in feed grain acreage as cropland is shifted from feed grains in year t + 1. Livestock production in year t + 1 will decline as a result of these higher soybean prices. Wheat acreage planted in year

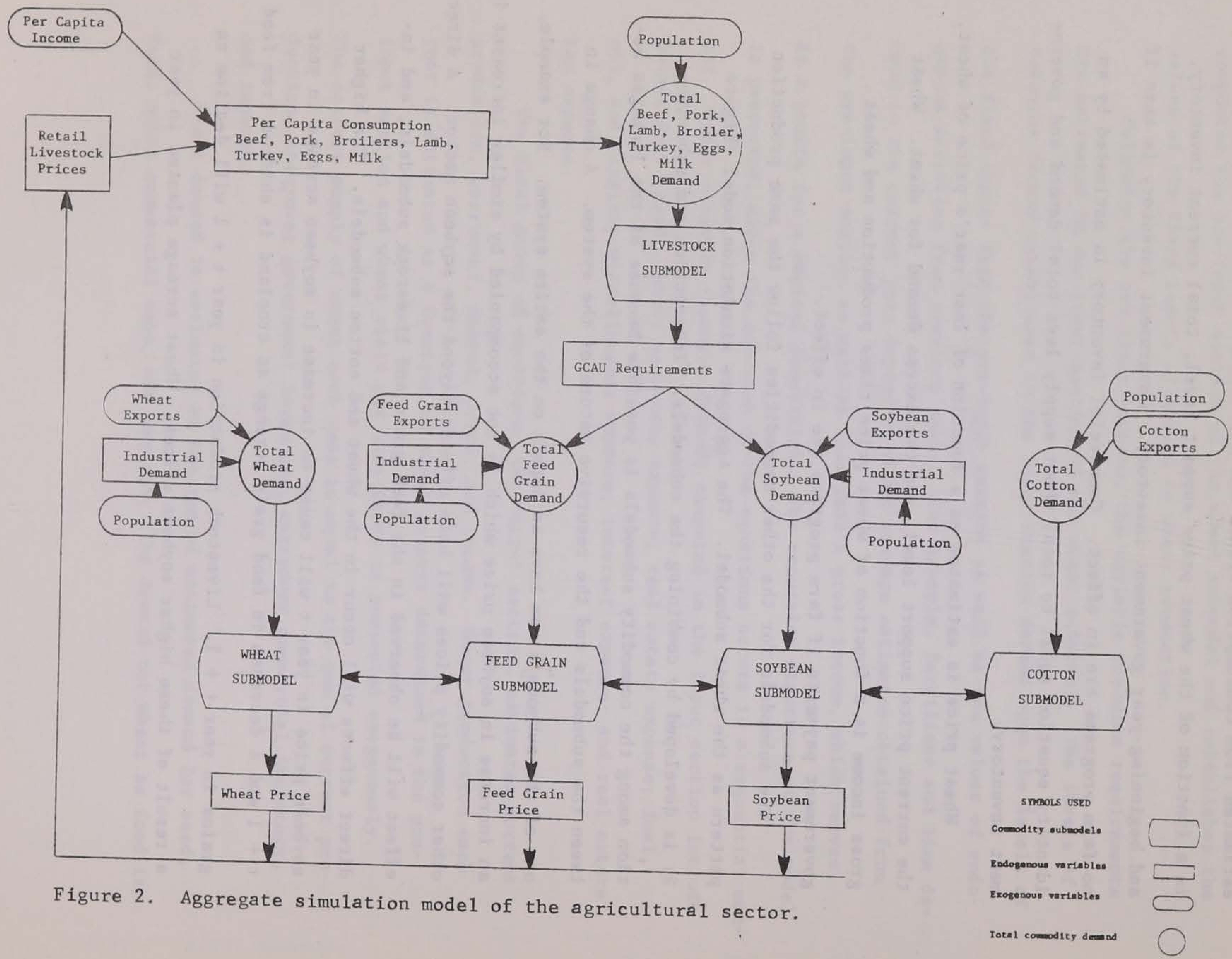


Figure 2. Aggregate simulation model of the agricultural sector.

t + 2 will decline as acreage shifts from wheat to the more profitable soybean production. Continuing effects will work through the system creating additional interactions. The feed grain, livestock, soybean, cotton, and wheat sectors form a network of recursive equations with interaction and feedbacks among the submodels.

The U.S. sector is a set of identity equations summing the commodity submodels and exogenously determined values for other crops to form national totals for acres, stocks, input use, and gross income.

Production expenses as calculated in the simulation model correspond to the definition of production expenses reported in the Farm Income Situation [10]. One category of Farm Income Situation expenses not included in our calculation of production expenses is the value of owner-supplied labor. The cost of hired labor, however, is included as a production expense in our calculations. Net farm income is equal to U.S. gross income minus production expenses, or the cost of the variable resources computed in the U.S. production expenses, or the cost of the variable resources computed in the U.S. input section.

Situations Analyzed

Seven variations of the basic model are analyzed in this study to explore the sensitivity of agriculture to alternative policies and assumptions. These variations can be dicotomized into a trend future scenario and an maximum efficiency scenario. The trend future assumes a continuation to the year 2000 of historical trends in farm size, technology, and export demands. The maximum efficiency future assumes increased crop yields, increased efficiency due to larger farming units, and increased efficiency due to shifts in the location of production. Comparison of these two basic scenarios provide insight into the need for technological advances and a timetable of when these advances are needed.

The trend future scenario is analyzed under two sets of assumptions. The first variation assumes a continuation of a government support program equivalent to the Agriculture and Consumer Protection Act of 1973 [2], along with historical trends in farm size, technology, and export levels. Crops in the model are supported at legislated target prices, and acreage restrictions are used if needed.[1/] The costs of support payments and acreage diversions are estimated in the model. The second variation of the trend future scenario assumes the same historical trends in farm size, technology, and export levels as variation one; however, the government support program is eliminated. This variation is equivalent to a free market agriculture in which production levels are determined solely by crop prices which prevail on the open market. No government purchase programs or subsidies are used to support crop prices.

The second scenario consists of five model variations which examine the future of agriculture under a maximum efficiency farm structure. This maximum efficiency scenario assumes that trends in productivity increases are accelerated through increased funding of agricultural research. In addition, it is assumed that structural changes are implemented to

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[1/] The Agricultural Act amended in August 1973 establishes the target price concept to encourage agricultural production and to provide a fair return to farmers through subsidies when market prices fall below legislated target levels at $1.38 per bushel for corn, $2.05 per bushel for wheat, and $0.38 per pound for cotton.

reorganize agriculture into larger, more efficient farms having gross sales of $40,000 or more. All constraints on the location of crop production are eliminated so that crops will be grown where they have a comparative advantage. The maximum efficiency future includes three types of advances in efficiency above the trend: increased productivity, farm size efficiencies, and more efficient production because of changes in the location of crop production.[2/]

The maximum efficiency future incorporates a greater productive capacity at a lower per unit cost than the trend future. With increased yields and no idle land, production levels for the maximum efficiency future are significantly higher than for the trend future. Nearly all of the increased production will have to be utilized by higher levels of market exports. The first variation of the maximum efficiency future determines the level of exports needed each year, with full production, to support farm prices at their 1973 legislated target levels. This variation of the maximum efficiency future serves as a base situation to compare to other variations of the maximum efficiency future. The remaining variations of the maximum efficiency future examine the impact of export levels which grow at four rates: historical trends, 30 percent above trend levels, 50 percent above trend levels, and 100 percent above trend levels.

In order to encourage rapid adoption of increased capital inputs and maintain structural efficiency, a minimum price of 90 cents per bushel for feed grain, $1.20 per bushel for wheat, and 18 cents per pound

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[2/] Estimates of farm size efficiency and efficiency gains from shifts in the location of production are obtained from the linear programming model developed by Sonka and Heady [35].

of cotton is assumed to be maintained by government purchase programs. This excess production could then be disposed of by foreign aid programs or export subsidy. An alternative to export disposal would be taking land out of production. Total exports in this scenario include market exports and government supported exports. The level of government supported exports indicates how successful a policy of increased efficiency and structural changes will be under various hypotheses about market export levels.

Exogenous Variables and Parameters

When a simulation model is used to make projections, values for a number of its parameters must be projected exogenously. These estimated values are important to the results of the simulation model. For example, one exogenous variable is the level of exports for each crop. This projection is a major determinant of the production quantity demanded for each commodity. Substantially different results are observed when different export levels are assumed. It is important to develop projections for the exogenous variables, using statistical methods and current information affecting the variable, which reflect the most likely time path they will take. This study's simulation model required projections to the year 2000 for 68 exogenous variables. These exogenous variables and parameters include: trend level exports and imports, aggregated cropland acreage restrictions, trend level yields for the crop submodels, and domestic demand levels for commodities.

Exports and Imports

Projected export and import levels are needed to determine the aggregate commodity demand for each year in the simulation projection. A factor which complicates projections is the record export levels reached in 1973. The dramatic increase, 88 percent above the previous high, seems to be partly a shift in the entire export market rather than a one-year aberration in the trend of exports. Of course, part of the supply short fall in other world regions over the last two years also has been translated into a transitory increase in demand for U.S. farm products. The more permanent elements of the changing export climate could be attributed to changes in world food demand resulting from a realignment in world monetary exchange values and institutional changes, such as an apparent U.S.S.R. commitment to consumer welfare even in years of domestic crop short falls. Export projections adopted for this analysis are based on a combination of time series analyses, published projections, and researcher's opinions about a changing export climate. The projections estimated for this study, Table 1, are not offered as definitive future export levels, but instead represent reasonable export levels which can be used as a base or trend level for exports.

Feed grain exports (FGEXP) are projected using the autoregressive model.[3/]

3/ Standard errors of the coefficient are presented in parentheses below the coefficient.

$$FGEXP_t = -1.5674 + \underset{(.11067)}{.79416} * FGEXP_{t-1} + \underset{(.07656)}{.18383} * (t-1)$$

$$R^2 = .922 \qquad D = 2.29 \qquad U = .897 \qquad \text{data - 1930-72}$$

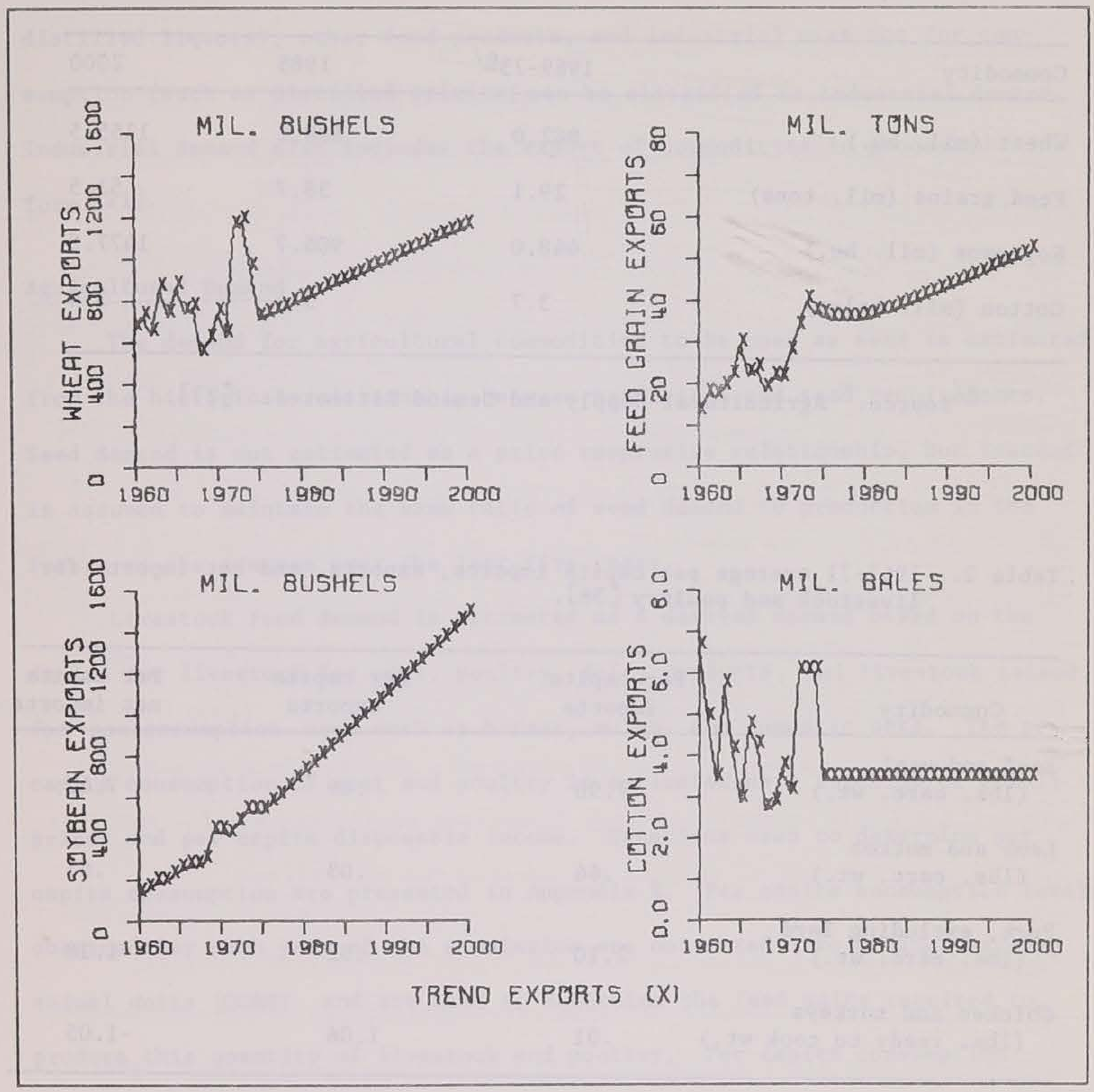
Soybean exports and soybean meal export projections are available through 1985 in an ERS Situation report [24]. These figures are extended to the year 2000 at the same yearly rate as stated in the report. Soybean exports are projected to increase 38.07 million bushels per year from 1972 to 2000, and soybean meal exports are assumed to increase at the rate of 2.26 million bushels per year from 1972 to 2000. Wheat exports are projected to increase at the rate of 17.817 million bushels per year based on time series data from 1949 to 1971. Cotton exports are assumed to remain constant at their 1971 value [38]. Figure 3 presents historical and projected exports for wheat, feed grains, soybeans, and cotton.

Import projections for the major agricultural commodities are also needed for each year between the current time period and the year 2000. For beef, lamb, pork, broilers, and turkeys, net per capita imports are assumed equal to the average net imports of the five-year period from 1967-71, see Table 2. Total net imports of milk are projected to be constant, and net exports of eggs are assumed to be equal to the 1967-71 average of 36.4 million dozen eggs.

Domestic Demand Requirements

The domestic demand for agricultural commodities can be classified into agricultural demand and industrial demand. Commodities used for

Figure 3. Historical and projected trend level exports for the model crops, 1960-2000.[a]



[a]1960-73 are actual exports [38].
1974-2000 are projections from the simulation study.

Table 1. Projected trend level exports of wheat, feed grains, soybeans, and cotton for 1985 and 2000, with actual 1969-73 exports for comparison.

Commodity	1969-73[a]	1985	2000
Wheat (mil. bu.)	862.0	888.2	1155.5
Feed grains (mil. tons)	29.1	38.7	51.5
Soybeans (mil. bu.)	448.0	906.7	1477.8
Cotton (mil. bales)	3.7	3.4	3.4

[a]Source: Agricultural Supply and Demand Estimates. [27].

Table 2. 1967-71 average per capita imports, exports, and net imports for livestock and poultry [38].

Commodity	Per capita imports	Per capita exports	Per capita net imports
Beef and veal (lbs. carc. wt.)	7.96	.49	7.47
Lamb and mutton (lbs. carc. wt.)	.64	.03	.61
Pork, excluding lard (lbs. carc. wt.)	2.10	.92	1.18
Chicken and turkeys (lbs. ready to cook wt.)	.01	1.06	-1.05

livestock feed and seed represent agricultural demand, and commodities used as inputs into industrial processes for cereals, flours, beverages (malt and distilled liquors), other food products, and industrial uses not for consumption (such as distilled spirits) can be classified as industrial demand. Industrial demand also includes the export of commodities in processed form [21].

Agricultural Demand

The demand for agricultural commodities to be used as seed is estimated from the historical relationship between production and seed requirements. Seed demand is not estimated as a price responsive relationship, but instead is assumed to maintain the same ratio of seed demand to production in the future as the average over the last five years.

Livestock feed demand is estimated as a derived demand based on the demand for livestock for meat, poultry, dairy products, and livestock raised for nonconsumption uses such as horses, mules, and domestic pets. The per capita consumption of meat and poultry is estimated as a function of retail prices and per capita disposable income. Equations used to determine per capita consumption are presented in Appendix B. Per capita consumption levels obtained for each year of the simulation are converted into grain-consuming animal units (GCAU) and are used to determine the feed units required to produce this quantity of livestock and poultry. Per capita consumption levels for dairy products (in milk-equivalent form) and eggs are also projected for each time period, and the feed units required to support their production is estimated. Finally, the feed units required to maintain livestock not raised for consumptive purposes are also projected. The feed unit requirements of each of these livestock categories are summed to form an estimate of livestock feed demand.

Per capita consumption levels, Table 3, of beef, pork, poultry, lamb, and mutton are functions of both per capita disposable income and commodity retail prices. Estimates of per capita disposable income are obtained from the OBERS projections up to 1985 and are presented in Appendix B. Beyond 1985 a constant $4,000 per capita income is used in the demand estimates, assuming that the income elasticity of demand for these products is zero after an income of $4,000. Retail livestock prices are calculated as a function of farm price. These farm prices are determined from the grain costs estimated in the simulation model. The livestock finishing feed price developed by Rahn [28] is used to develop a relationship between feed costs, livestock farm prices, and retail livestock prices. The livestock demand equations presented in Appendix B use these retail prices, along with disposable income, to determine consumption of livestock. Using this system as the estimated price of grain rises, the farm price of livestock also increases, causing retail prices to advance and consumption to decline.

Industrial Demand

Industrial demands for feed grains, wheat, soybeans, and cotton are estimated on the basis of historical trends and averages. Demand for industrial uses consists of corn for cereal, dry processing, wet processing, and alcohol; oats for cereal; barley for malt and food products; wheat for flour and other uses; soybeans for soybean meal; and cottonseed for cottonseed

Table 3. Per capita consumption levels for selected agricultural products in 1972 and projected to 2000.

Commodity	Actual[a/] 1972	Trend Future Simulation 1 2000	Max. Efficiency Simulation 3 2000
Beef and veal (lbs. carc. wt.)	118.30	163.63	167.98
Pork (lbs. carc. wt.)	67.4	71.05	72.12
Broilers (lbs. ready to cook wt.)	43.0	38.77	38.66
Turkeys (lbs. ready to cook wts.)	9.10	9.57	9.37
Lamb and mutton (lbs. carc. wt.)	3.30	3.25	3.51
Dairy Products (lbs. milk equiv.)	560.00	491.00	491.00
Eggs (number)	307.00	318.50	318.50
Wheat (bushels)	2.50	2.22	2.22
Cotton (lbs.)	18.68	20.00	20.00

[a/] Sources: Food Consumption [39]; Agricultural Statistics [38].

meal. Appendix B presents a complete list of equations and methods used to estimate the industrial demand for these agricultural commodities.

Crop Yields

In our analysis crop yields are defined as the average crop production per crop acre planted and intended for harvest. Acres intended for harvest include estimates for harvested acreage plus an adjustment to include acreage abandoned due to flood, drought, and other natural disasters [29]. Planted acres intended for harvest are used to represent the planting decisions of farmers and are closely tied to their input decisions.

Per acre yields for the model crops are projected using time series data. Yield equations for feed grains, wheat, and soybeans were estimated using data from 1930-72 and cotton yields were estimated from 1930-71 data. All yield equations were estimated with an autoregressive model on time. The yield projections obtained from these equations, Table 4, are denoted as trend yield projections. These projections represent the yields expected if we assume that historical trends in technology, weather, and input use continue.

Yield for the maximum efficiency future assumes accelerated technology and increases in efficiency due to changes in location of production. Accelerated technological development is incorporated into the model by assuming a 15 percent increase in crop yields over trend levels. This increase is introduced at the rate of 3 percent per year from 1976 to 1980. After 1980 yields are held 15 percent above trend levels. Increased yields are intended to represent the impact of expanded agricultural research efforts. As incorporated in this analysis, the results of these efforts would begin to be felt in 1976 and level off at 15 percent above trend yields by 1980. An additional increase in yields is incorporated in the maximum efficiency yields because of an assumed shift in the location of production of the model commodities. The magnitude of this increase in efficiency was determined from results of a linear programming model of these crop sectors which allowed future production locations to be determined with no regard for past production locations [35]. Table 5 compares the trend yields with the maximum efficiency yields, the sum of trend yields plus the 15 percent increase plus the yield increase due to a shift in production location.

Table 4. Crop yield equations and trend level predictions for 1980 and 2000.[a]

	Intercept	Time	ρ	D	R^2	Actual[c] 1969-72	Estimated 1980	Estimated 2000
Feed grains[b] (tons/acre)	.06211	.76425 (.11091)	.00951 (.00364)	2.636	.941	1.844	2.162	2.956
Wheat[b] (bu./acre)	4.21213	.56811 (.12866)	.20502 (.06078)	2.338	.896	30.99	32.895	42.358
Soybeans[b] (bu./acre)	11.07452	.19358 (.15551)	.25711 (.05282)	1.970	.871	27.04	29.598	35.974
Cotton[b] (bales/acre)	.14163	.59155 (.13547)	.00653 (.00249)	2.052	.890	.851	1.122	1.443

[a] Equations are estimated using autoregressive least squares where the first order autoregressive coefficient is ρ. Coefficient standard errors are in parentheses, and the Durbin-Watson statistic is D.

[b] Values for cotton are estimated from data from 1930-71. Values for the other commodities are estimated from dates between 1930-72.

[c] Actual value for cotton is 1969-71.

Table 5. Crop yields per acre projected to the year 2000.[a]

	Actual 1969-72[b]	Estimated 1985	Estimated 2000
Trend yields			
Feed grains (tons/acre)	1.84	2.35	2.96
Wheat (bu./acre)	31.0	35.2	42.4
Soybeans (bu./acre)	27.0	31.2	36.0
Cotton (bales/acre)	.851	1.20	1.44
Trend yields plus increased efficiency plus locational efficiency			
Food grains (tons/acre)	1.84	2.78	3.47
Wheat (bu./acre)	31.0	42.1	50.3
Soybeans (bu./acre)	27.0	35.6	41.1
Cotton (bales/acre)	.851	1.48	1.76

[a] Crop yields per acre are calculated by dividing total production by acreage. Acreage figures are adjusted to exclude land used for forage, silage, or hay; but they do include crop acreages that are abandoned due to damage caused by floods, drought, insects, etc. [29;38]. The actual yield figures for 1969-72 will be lower than figures which are calculated using unadjusted yield figures.

[b] Actual value for cotton is for 1969-71.

Cropland Base

The total land available in the simulation model for the production of wheat, feed grains, soybeans, and cotton is constrained to 250 million acres. This land base is consistent with the linear programming model used in the companion study done for the Office of Planning and Evaluation [35]. Since 1949 the maximum acreage planted to the above crops was 241 million acres, and in 1972 total acres planted to wheat, feed grains, soybeans, and cotton was 206 million acres.

As land becomes a limiting factor, relative crop prices of wheat, feed grains, soybeans, and cotton will change because of differing growth rates for yields and demands for each crop. In the absence of idle land, farmers must cut back in production of one crop to increase production of the crop with the increased relative price. When planted acres of the model crops reach the land base, changes in crop acreage for each crop are based on the acreage equations and the historical price ratios between crops. The land base did not become a major factor in any of the models until 1995, at which time it is likely that several years of adjustment would be needed before the cropland base could be expanded.

Input Efficiencies

Part of the increased efficiency in the maximum efficiency future comes from assuming a large farm structure (farms with gross sales greater than $40,000) and removal of restriction on location of production. The change in input use due to these factors is estimated by a linear program model which calculates input use in 1980 for each crop under a trend farm size with locational restrictions and a large farm structure with no restriction on location of production.[4/] The ratio of input use for the large farm case to input use in the trend farm size was used to estimate the input savings for each crops in the maximum efficiency future for 1980 (see Table 6). The change in input use due to the large farm structure and locational efficiency is interpolated between the adoption period, 1975 to 1980, reaching full potential in 1980 and then maintained at a constant level after 1980 in the maximum efficiency future.

Table 6. Ratios of input use in the large farm structure as compared with the trend farm structure in 1980 [35].

	Feed Grains	Wheat	Soybeans	Cotton	Livestock[a]
Fertilizer	1.010	1.035	.988	.973	--
Seed	1.016	.983	1.007	1.000	--
Labor	.857	.763	.820	.796	.857
Machinery	.762	.762	.832	.618	.762
Fuel, oil, repairs	.762	.762	.832	.618	.762
Miscellaneous	1.021	.856	.954	.815	1.0

[a]Livestock coefficients assumed to follow input reductions of feed grain production.

[4/]Input use for trend farm size with location restrictions and the unrestricted large farm case from Sonka and Heady [35].

RESULTS OF SIMULATIONS

Simulation analysis permits policy makers to examine directly the results of alternative policy scenarios given the assumptions of the structural model and exogenous variables previously outlined. Results of these "experiments" provide insights on the direct and indirect effects of a particular policy. Information about the sensitivities of each policy to changes in the agricultural environment, such as shifts in export demand, can also be examined. This information can be used to assess each policy scenario and can serve as a basis for reformulating policies to meet the requirements of a changing agricultural environment.

The seven simulation alternatives used in this study can be categorized under two basic policy scenarios. The first contains two simulation alternatives and explores the future of U.S. agriculture assuming continuation of current trends in farm size, technology, export demands, and resource demands. This "trend" future examines performance of our current farm policies in which the growth of commodity supply and commodity demand follow historical growth trends. The second scenario, containing five simulation alternatives, is concerned with the future of agriculture under the assumptions of substantial advances in production efficiency. This latter situation, referred to as the maximum efficiency future, examines the effect of policies which increase productivity in anticipation of increases in export demand.

From each policy set and hypothesis of the future, time paths of production, resource demand, farm prices, farm income, and other agricultural variables are generated. These time paths can be examined to determine the results of each policy set on key variables such as farm income, food costs, and government program costs.

In each simulation alternative, time paths are generated for all variables for each of the years from 1975 to 2000. In this report, however, results are summarized into five-year averages from 1975 to 1999 and single-year results for 1985 and 2000. The entire time path of data for a variable should be examined, rather than focusing on a single year, since fluctuations occur for many of the variables. It is also desirable to compare variables both within the simulation alternative and between alternative simulations. The policy alternatives and farm future assumptions cause variables to show significantly different patterns over time. Comparisons of variables in different time periods and alternative simulations indicate that as demand and supply situations change over time, a policy which is appropriate in an earlier time period may become less effective in a later time period and vice versa.

Tables 7 through 17 include national results for farm income, assets, and input use along with commodity prices and demands. Additional results for individual commodities are presented in Appendix C. Each table contains data in five-year averages for 1975 to 1999 with single-year results for 1985 and 2000. Throughout this analysis, figures presented in dollars units are in real 1972 dollars with no adjustment for inflation that might occur after 1972.

Table 7. Estimates of gross farm income, farm production expenses, and net returns to agriculture for each simulation alternative, with the 1969-72 average for comparison.

Years	Actual[a] 1969-72	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				GROSS FARM INCOME (MILLIONS OF 1972 DOLLARS)[b]				
SIM 1	64935.[c]	73478.1	80020.1	83282.1	86117.8	92105.8	102724.8	112239.8
SIM 2		65173.3	69266.3	73907.4	75514.4	85224.4	97299.3	107526.6
SIM 3		77833.4	87081.1	92167.4	94009.6	100369.2	106314.4	111429.7
SIM 4		66015.5	70597.8	74784.8	75918.1	80558.0	84773.3	89046.6
SIM 5		69840.3	70906.5	74500.4	75974.6	80358.8	86206.4	93530.5
SIM 6		75142.1	74047.9	73981.9	75650.9	82136.8	99309.5	114388.3
SIM 7		89317.3	102771.9	107571.0	112617.3	128267.1	141732.8	152900.4
				PRODUCTION EXPENSES (MILLIONS OF 1972 DOLLARS)				
SIM 1	49388.[d]	50434.0	54710.4	58038.8	59494.7	64590.5	70159.0	74310.9
SIM 2		50313.4	53625.8	56366.6	58161.8	63120.2	69008.4	73911.2
SIM 3		50862.3	54854.6	57828.9	59743.0	64559.5	69497.2	72877.2
SIM 4		49578.7	52553.3	55568.3	57489.4	62047.7	66657.4	69815.7
SIM 5		49928.3	52585.2	55164.6	56984.8	61288.4	66114.5	69786.6
SIM 6		50217.2	53072.9	55410.1	57041.9	61862.5	67512.9	72152.3
SIM 7		51335.0	55942.3	59432.2	61784.0	68438.9	75555.3	79603.9
				NET FARM INCOME (MILLIONS OF 1972 DOLLARS)				
SIM 1	15547.	23044.1	25309.7	25243.4	26623.1	27515.3	32565.7	37928.8
SIM 2		14859.9	15640.6	17540.8	17352.7	22104.3	28290.9	33615.4
SIM 3		26971.2	32226.5	34338.5	34266.7	35809.7	36817.2	38552.5
SIM 4		16436.8	18044.5	19216.6	18428.7	18510.4	18115.9	19230.9
SIM 5		19912.1	18381.3	19335.8	18989.9	19070.4	20091.9	23743.8
SIM 6		24924.9	20975.0	18571.8	18609.1	20274.3	31796.5	42236.0
SIM 7		37982.2	46829.6	48238.8	50833.3	59828.2	66177.5	73296.4
				NON-MONEY INCOME (MILLIONS OF 1972 DOLLARS)[e]				
	4273.	4507.3	4416.8	4368.4	4338.9	4270.3	4209.2	4175.2
				TOTAL NET FARM INCOME (MILLIONS OF 1972 DOLLARS)				
SIM 1	19820.	27551.4	29726.5	29611.8	30962.0	31785.6	36774.9	42104.0
SIM 2		19367.2	20057.4	21909.2	21691.6	26374.6	32500.1	37790.6
SIM 3		31478.5	36643.3	38706.9	38605.6	40080.0	41026.4	42727.7
SIM 4		20944.1	22461.3	23585.0	22767.6	22780.7	22325.1	23406.1
SIM 5		24419.4	22798.1	23704.2	23328.8	23340.7	24301.1	27919.0
SIM 6		29432.2	25391.8	22940.2	22948.0	24544.6	36005.7	46411.2
SIM 7		42489.5	51246.4	52607.2	55172.2	54098.5	70386.7	77471.6

[a] Source: (28).

[b] Includes government payments for Simulation 1.

[c] Actual 1972 = \$69,949 million.

[d] Actual 1972 = \$52,428 million.

[e] Estimated exogenously.

Table 8. Estimates of commercial farm numbers, gross income per commercial farm, and net farm income per commercial farm for each simulation alternative, with the 1969-72 average for comparison.

Year	Actual 1969-72	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
	NUMBER OF COMMERCIAL FARMS (THOUSANDS)[a]							
SIM 1	1796.[b]	1730.0	1632.0	1576.0	1540.0	1453.0	1358.0	1324.0
SIM 2		1730.0	1632.0	1576.0	1540.0	1453.0	1358.0	1324.0
SIM 3		1491.5	1047.3	1036.0	1028.7	1010.7	993.4	983.2
SIM 4		1459.2	1028.6	1032.2	1027.9	1010.7	993.4	983.2
SIM 5		1491.5	1047.3	1036.0	1028.7	1010.7	993.4	983.2
SIM 6		1488.4	1047.3	1036.0	1028.7	1010.7	993.4	983.2
SIM 7		1487.2	1047.3	1036.0	1028.7	1010.7	993.4	983.2
	GROSS FARM INCOME PER COMMERCIAL FARM (1972 DOLLARS)							
SIM 1	36155.	42472.9	49031.9	52844.0	55920.7	63390.1	75644.1	84773.2
SIM 2		37672.5	42442.6	46895.5	49035.3	58654.1	71648.9	81213.4
SIM 3		52184.7	83150.5	88964.8	91390.3	99306.4	107025.1	113332.2
SIM 4		45240.2	68633.9	72449.1	73856.8	79705.0	85340.1	90566.8
SIM 5		46825.6	67763.3	71911.7	73857.9	79507.9	86782.6	95127.3
SIM 6		50486.6	70705.6	71411.1	73543.1	81267.0	99973.4	116341.2
SIM 7		60058.6	98133.1	103929.7	109479.5	126908.8	142680.3	155510.8
	NET FARM INCOME PER COMMERCIAL FARM (1972 DOLLARS)							
SIM 1	11036.	15925.7	18214.8	18789.2	20105.2	21875.8	27080.2	31800.6
SIM 2		11194.9	12290.1	13901.8	14085.4	18151.8	23932.3	28542.7
SIM 3		21105.3	34989.3	37362.0	37529.9	39655.6	41300.7	43457.2
SIM 4		14352.9	21836.5	22848.4	22149.4	22539.5	22474.3	23805.7
SIM 5		16372.4	21769.1	22880.5	22678.8	23093.6	24463.5	28395.7
SIM 6		19775.0	24245.7	22143.1	22308.6	24284.7	36246.5	47203.6
SIM 7		28570.7	48933.3	50779.2	53635.0	63419.8	70857.2	78794.3

[a] Farms with gross sales greater than $2,500.

[b] Source: Farm Income Situation [10].

Table 9. Estimated value of commodity stock, machinery stock, land values, and total assets per commercial farm for each simulation alternative in 1972 dollars with the 1965-67 average for comparison.[a]

Year	Actual 1965-67[b]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
			AVERAGE VALUE OF COMMODITY STOCKS PER COMMERCIAL FARM					
SIM 1	28412.	37840.3	43417.8	47047.1	49257.3	55915.7	63427.1	66802.7
SIM 2		38858.8	43969.8	47548.0	49806.8	55871.8	63606.2	66665.6
SIM 3		45774.3	76090.3	80853.5	83003.8	88385.1	93676.3	96751.4
SIM 4		46800.7	76993.7	81680.8	84444.4	90839.6	96549.4	100006.4
SIM 5		45746.7	75232.2	80052.5	82485.2	88022.1	93378.4	97134.1
SIM 6		45576.4	74066.8	78958.3	81522.8	87348.7	93144.8	96695.8
SIM 7		45595.9	73108.6	77273.1	79414.8	83989.7	88726.4	91709.8
			AVERAGE VALUE OF MACHINE STOCKS PER COMMERCIAL FARM					
SIM 1	14341.	15442.1	17638.9	19182.5	20307.4	23371.0	27158.4	29456.3
SIM 2		15185.5	16865.7	18183.7	19232.9	22120.2	26044.5	28497.2
SIM 3		18063.6	28505.3	30621.3	32006.9	35441.8	39000.5	41193.9
SIM 4		18041.9	27141.9	28296.4	29333.9	32113.9	34987.0	36760.6
SIM 5		17806.8	27082.4	28567.8	29672.4	32485.7	35500.5	37533.2
SIM 6		18029.0	27871.2	29285.4	30296.9	33064.2	36764.8	39970.0
SIM 7		18557.4	30934.3	34175.7	36344.7	42170.1	48634.1	52789.8
			AVERAGE VALUE OF LAND PER COMMERCIAL FARM					
SIM 1	118957.	166441.8	192126.7	210345.9	222019.6	255719.6	296821.3	324124.6
SIM 2		163584.6	180891.6	195987.9	206439.1	236438.4	277454.5	310149.5
SIM 3		199583.3	313751.9	339401.4	354723.5	392691.9	429663.0	458206.9
SIM 4		195352.4	291557.4	306410.1	316791.0	345274.6	374099.3	398839.8
SIM 5		194145.4	290685.9	306679.6	317345.8	344105.0	373388.1	400613.7
SIM 6		196528.0	304657.2	313489.9	321818.8	353455.5	388463.8	421509.5
SIM 7		203472.6	340468.4	367842.8	388254.2	450106.2	509727.5	551575.3
			AVERAGE STOCK OF PRODUCTIVE ASSETS PER COMMERCIAL FARM					
SIM 1	165317.	220034.1	253453.6	277521.8	291963.6	335355.4	387683.2	421233.7
SIM 2		218002.8	242033.6	262062.6	275827.1	314726.0	367284.1	406659.1
SIM 3		264186.1	419261.3	451222.4	470122.9	516893.6	562690.0	596613.3
SIM 4		260900.4	396712.8	416970.7	431133.9	458656.9	506057.3	535893.2
SIM 5		258401.3	393869.6	415714.4	429973.8	464916.1	502730.0	535784.8
SIM 6		260860.6	407355.8	422318.3	434117.8	474292.8	518748.3	559118.8
SIM 7		268301.5	445190.9	479760.3	504409.5	576466.9	647576.3	695718.4

a/ Commercial farms defined as farms with gross sales greater than $2,500.

b/ Source: An Econometric Simulation Model [29].

Table 10. Estimated crop prices in 1972 dollars for Simulations 1 through 7, with the 1969-72 average for comparison.

Years	Actual 1969-72[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT ($ PER BU.)				
SIM 1	1.42	1.89	1.87	1.89	1.89	1.91	1.94	2.00
SIM 2		1.32	1.40	1.24	1.24	1.37	1.49	1.64
SIM 3		2.08	2.06	2.05	2.06	2.06	2.05	2.05
SIM 4		1.51	1.21	1.22	1.21	1.21	1.21	1.20
SIM 5		1.73	1.22	1.20	1.21	1.22	1.21	1.22
SIM 6		1.98	1.36	1.21	1.21	1.30	1.56	1.81
SIM 7		2.59	2.60	2.62	2.67	2.80	2.91	2.99
				FEED GRAINS ($ PER BU.)				
SIM 1	1.21	1.32	1.30	1.16	1.31	1.33	1.57	1.67
SIM 2		1.01	0.98	1.07	1.04	1.25	1.51	1.58
SIM 3		1.40	1.41	1.42	1.41	1.41	1.39	1.40
SIM 4		0.95	0.92	0.94	0.92	0.92	0.92	0.93
SIM 5		1.10	0.91	0.92	0.92	0.92	1.00	1.14
SIM 6		1.36	0.96	0.94	0.92	0.95	1.35	1.72
SIM 7		1.99	2.02	2.07	2.12	2.32	2.50	2.45
				SOYBEANS ($ PER BU.)				
SIM 1	3.12	3.25	3.34	3.43	3.39	3.41	3.73	4.26
SIM 2		3.16	3.06	3.03	3.02	3.18	3.54	4.21
SIM 3		3.41	3.54	3.70	3.73	3.90	4.03	4.12
SIM 4		3.06	2.88	2.82	2.80	2.77	2.74	2.73
SIM 5		3.18	2.87	2.80	2.78	2.74	2.71	2.70
SIM 6		3.72	3.04	2.85	2.80	2.85	3.86	4.48
SIM 7		5.36	3.33	5.70	5.71	6.16	6.57	7.06
				COTTON (PER POUND)				
SIM 1	25.1	35.01	35.04	34.99	35.03	35.11	35.14	35.19
SIM 2		17.96	17.82	20.58	17.86	18.24	18.63	15.87
SIM 3		38.27	33.38	38.06	38.32	38.21	38.45	38.44
SIM 4		18.71	18.16	18.16	18.14	18.13	18.16	18.24
SIM 5		19.02	18.21	18.16	18.11	18.11	18.12	18.73
SIM 6		19.41	13.13	18.19	18.14	19.08	18.86	18.37
SIM 7		26.38	26.95	23.51	31.83	48.82	59.33	63.28

[a]Source: Demand and Price Situation [9].

Table 11. Estimated livestock prices in 1972 dollars per 100 pounds for Simulations 1 through 7 with the 1969-72 average for comparison.

Year	Actual 1969-72[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				BEEF				
SIM 1	29.15	34.90	35.03	34.76	35.05	35.07	37.73	41.72
SIM 2		29.35	27.79	27.51	28.74	31.81	36.13	40.12
SIM 3		36.30	35.80	36.27	36.11	36.18	35.98	35.79
SIM 4		28.42	26.53	26.64	26.54	26.56	26.39	26.46
SIM 5		31.38	26.47	26.47	26.57	26.40	27.26	29.19
SIM 6		35.59	28.50	26.46	26.54	27.04	32.77	38.60
SIM 7		45.96	48.14	48.80	49.89	53.69	56.57	61.05
				PORK				
SIM 1	21.88	25.80	25.96	25.80	26.00	26.01	27.59	29.82
SIM 2		22.94	22.03	21.85	22.48	24.13	26.61	28.92
SIM 3		26.75	26.45	26.86	26.79	26.94	26.94	26.90
SIM 4		22.42	21.25	21.26	21.19	21.17	21.06	21.09
SIM 5		24.03	21.23	21.16	21.19	21.06	21.49	22.48
SIM 6		26.57	22.46	21.20	21.20	21.41	25.00	28.59
SIM 7		32.74	34.16	34.72	35.31	37.61	39.41	41.84
				BROILERS				
SIM 1	14.00	18.73	18.85	18.73	18.88	18.88	20.03	21.64
SIM 2		16.66	15.99	15.86	16.32	17.52	19.33	20.99
SIM 3		19.42	19.20	19.49	19.45	19.55	19.56	19.53
SIM 4		16.28	15.43	15.43	15.38	15.37	15.29	15.31
SIM 5		17.45	15.41	15.36	15.38	15.29	15.60	16.32
SIM 6		19.29	16.32	15.39	15.39	15.54	18.16	20.75
SIM 7		23.81	24.80	25.21	25.63	27.31	28.62	30.37
				SHEEP AND LAMBS				
SIM 1	27.15	32.18	32.37	32.18	32.42	32.43	34.36	37.18
SIM 2		28.56	27.47	27.25	28.02	30.01	33.06	36.06
SIM 3		33.32	32.97	33.49	33.41	33.59	33.60	33.54
SIM 4		27.87	26.50	26.51	26.42	26.40	26.26	26.30
SIM 5		29.91	26.47	26.38	26.42	26.27	26.79	28.03
SIM 6		33.12	27.93	26.44	26.44	26.69	31.01	35.65
SIM 7		40.62	42.59	43.30	44.02	46.87	49.11	52.17

[a] Source: Livestock and Meat Statistics [16].

Table 12. Estimated domestic demands for model crops for Simulations 1 through 7 with 1969-72 average for comparison.[a/]

Years	Actual 1969-72[b/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT (MIL. BU.)				
SIM 1	898.2	806.9	825.1	843.4	855.7	887.8	922.1	943.1
SIM 2		807.6	823.9	854.0	853.2	889.3	921.7	939.8
SIM 3		819.7	855.4	873.3	885.8	918.9	954.8	977.6
SIM 4		818.3	851.2	868.8	881.2	912.7	948.1	968.9
SIM 5		819.0	850.6	867.0	877.2	909.0	941.0	960.2
SIM 6		818.7	849.7	863.6	874.3	904.0	940.1	962.4
SIM 7		821.5	854.2	872.5	882.3	911.2	944.7	964.9
				FEED GRAINS (MIL. TONS)				
SIM 1	164.3	203.2	226.3	238.5	246.6	268.9	291.3	304.1
SIM 2		205.9	230.3	242.6	250.4	271.0	292.4	305.2
SIM 3		202.4	226.1	237.6	246.0	268.0	292.3	307.9
SIM 4		206.5	231.3	243.5	252.1	274.6	299.5	315.3
SIM 5		205.0	231.3	243.5	252.0	274.7	298.8	313.4
SIM 6		202.6	230.0	243.4	252.0	274.3	294.6	305.7
SIM 7		196.8	218.3	229.4	236.9	255.8	277.1	289.1
				SOYBEANS (MIL. BU.)				
SIM 1	807.0	925.6	1047.3	1096.4	1132.3	1222.3	1307.9	1348.2
SIM 2		937.8	1065.3	1117.3	1149.9	1231.5	1313.5	1352.3
SIM 3		923.5	1043.1	1092.2	1127.0	1215.4	1310.5	1370.1
SIM 4		941.2	1069.0	1120.0	1155.8	1247.7	1345.6	1406.5
SIM 5		1000.1	1140.5	1195.4	1233.1	1331.5	1432.7	1492.0
SIM 6		983.3	1132.9	1192.4	1230.7	1325.3	1406.3	1452.1
SIM 7		957.5	1087.3	1137.9	1174.1	1260.2	1352.8	1395.9
				COTTON (MIL. BALES)				
SIM 1	8.1[c/]	9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 2		9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 3		9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 4		9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 5		9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 6		9.3	9.9	10.3	10.6	11.3	12.0	12.5
SIM 7		9.3	9.9	10.3	10.6	11.3	12.0	12.5

[a/] Includes commercial, feed, seed, and food demand for wheat, feed grains and soybeans.

[b/] Sources: [7;11;12;20].

[c/] Cotton actual 1969-71.

Table 13. Estimated total crop exports for each simulation alternative and government supported exports for Simulations 4 through 6 with 1969-72 average.

Year	Actual 1969-72[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
TOTAL EXPORTS: MARKET AND NON-MARKET[b/]								
WHEAT (MIL. BU.)								
SIM 1	781.5	745.7	834.8	888.2	923.9	1012.9	1102.0	1155.5
SIM 2		745.7	834.8	888.2	923.9	1012.9	1102.0	1155.5
SIM 3		1173.8	1620.7	1758.6	1758.8	1855.2	1959.6	2075.1
SIM 4		1007.7	1500.1	1595.1	1627.5	1683.0	1777.4	1792.5
SIM 5		969.4	1542.2	1473.7	1503.7	1601.6	1579.5	1577.2
SIM 6		1118.5	1363.6	1399.0	1426.6	1519.4	1653.0	1733.2
SIM 7		1355.5	1595.1	1682.4	1652.5	1649.9	1688.7	1680.4
FEED GRAINS (MIL. TONS)								
SIM 1	25.7	35.4	36.8	38.7	40.3	44.5	48.8	51.5
SIM 2		35.4	36.8	38.7	40.3	44.5	48.8	51.5
SIM 3		60.9	92.1	88.8	87.1	82.2	72.9	69.0
SIM 4		50.7	86.0	93.2	92.3	89.7	81.9	79.9
SIM 5		46.5	76.4	74.4	75.1	66.9	64.1	66.9
SIM 6		53.1	61.8	70.6	67.9	67.3	73.2	74.0
SIM 7		65.9	70.2	69.3	67.2	57.4	48.9	59.5
SOYBEANS (MIL. BU.)								
SIM 1	439.4	570.2	755.9	813.3	930.0	1116.9	1244.5	1172.6
SIM 2		602.1	792.5	906.7	982.8	1129.6	1265.5	1160.2
SIM 3		582.6	649.0	816.8	885.7	1048.1	1225.2	1325.1
SIM 4		602.1	792.5	906.7	982.8	1173.2	1363.6	1477.8
SIM 5		769.2	1030.2	1178.7	1277.7	1525.2	1772.6	1921.1
SIM 6		818.8	1138.7	1360.1	1474.3	1759.8	1847.9	2006.5
SIM 7		775.3	1269.2	1423.5	1582.5	1911.6	2242.7	2271.3
COTTON (MIL. BALES)								
SIM 1	3.8	3.4	3.4	3.4	3.4	3.4	3.4	3.4
SIM 2		3.4	3.4	3.4	3.4	3.4	3.4	3.4
SIM 3		12.8	16.2	16.2	16.7	16.7	17.2	16.2
SIM 4		6.3	9.1	9.5	9.4	8.8	8.1	7.8
SIM 5		5.7	8.2	7.6	7.1	6.1	4.8	4.4
SIM 6		5.0	7.0	6.8	6.0	5.1	5.3	5.1
SIM 7		6.8	6.8	6.8	6.8	5.9	2.3	1.7
GOVERNMENT SUPPORTED: NON-MARKET EXPORTS[c/]								
WHEAT (MIL. BU.)								
SIM 4		262.0	665.4	706.9	703.7	670.0	675.4	637.1
SIM 5		0.0	457.0	319.0	302.7	284.7	146.9	75.1
SIM 6		0.0	111.4	66.6	40.8	0.0	0.0	0.0
FEED GRAINS (MIL. TONS)								
SIM 4		15.3	49.2	54.5	52.0	45.3	33.1	28.4
SIM 5		2.5	28.6	24.0	22.8	9.2	0.6	0.0
SIM 6		0.0	6.6	12.5	7.5	0.6	0.0	0.0
COTTON (MIL. BALES)								
SIM 4		2.9	5.7	6.1	6.0	5.4	4.7	4.4
SIM 5		1.3	3.8	3.1	2.7	1.6	0.4	0.0
SIM 6		0.9	1.9	1.7	0.9	0.0	0.2	0.0

a/ Sources: [7;11;12;20].

b/ Total exports are market exports in Simulations 1-3 and 7. In Simulations 4-6, total exports include market exports and non-market exports of government disposable programs.

c/ Non-market exports in simulations 4-6 are government purchases to support crop prices.

Table 14. Estimates of acres intended for harvest for model crops and U.S. cropland for each simulation alternative in millions of acres with 1969-72 average, for comparison.[a]

Year	Actual 1969-72[b]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	148.0	54.4	47.8	48.9	49.0	49.0	48.6	47.7
SIM 2		55.1	46.5	57.5	47.2	50.2	48.2	45.5
SIM 3		61.0	61.2	61.2	60.9	60.5	60.0	59.7
SIM 4		59.9	58.3	58.1	57.9	56.6	56.1	54.8
SIM 5		60.5	57.9	56.9	55.3	54.3	51.9	49.9
SIM 6		60.2	57.3	54.6	53.4	51.2	51.4	51.1
SIM 7		62.5	60.4	60.6	58.6	55.7	54.1	52.5
				FEED GRAINS				
SIM 1	101.0	115.2	117.6	121.7	117.5	118.2	117.5	121.4
SIM 2		119.7	119.3	115.4	119.1	117.9	117.0	122.3
SIM 3		121.0	120.1	117.4	116.0	112.9	109.6	108.1
SIM 4		119.6	119.8	120.6	119.9	117.5	114.3	113.5
SIM 5		117.9	116.3	114.3	113.9	110.0	108.0	107.7
SIM 6		116.8	112.5	112.3	111.3	110.0	107.0	105.0
SIM 7		116.2	109.0	107.3	105.8	100.9	97.8	100.3
				SOYBEANS				
SIM 1	43.6	51.6	59.5	51.2	64.9	69.9	72.9	70.1
SIM 2		53.1	61.4	64.9	67.0	70.5	73.7	69.8
SIM 3		49.7	50.4	53.6	55.3	59.2	63.3	65.5
SIM 4		51.4	54.3	57.1	59.0	63.5	67.8	70.3
SIM 5		58.9	63.3	66.8	69.2	75.0	80.2	83.2
SIM 6		60.0	68.3	71.8	74.5	79.0	81.3	84.1
SIM 7		56.9	68.2	71.9	75.8	83.0	89.8	89.1
				COTTON				
SIM 1	12.6	12.3	11.7	11.2	11.1	10.9	11.0	10.8
SIM 2		10.9	11.7	12.2	11.5	11.3	11.1	12.4
SIM 3		18.3	18.3	17.9	17.8	17.4	17.0	16.7
SIM 4		13.3	13.2	13.3	13.1	12.4	11.8	11.4
SIM 5		12.7	12.6	12.0	11.6	10.7	9.8	9.2
SIM 6		12.6	11.9	11.3	10.8	9.9	10.4	9.8
SIM 7		13.8	12.4	10.2	9.8	10.4	8.4	8.0
				UNITED STATES				
SIM 1	335.2	362.4	363.7	369.2	367.9	371.7	372.0	371.1
SIM 2		367.6	366.0	376.4	370.4	373.7	371.9	371.5
SIM 3		378.8	377.0	376.4	375.6	373.8	371.9	371.5
SIM 4		373.0	372.6	375.4	375.5	373.8	371.9	371.5
SIM 5		378.8	377.0	376.4	375.6	373.8	371.9	371.5
SIM 6		378.3	378.1	376.5	375.6	374.7	372.7	371.7
SIM 7		378.0	378.1	376.5	375.6	374.7	372.7	371.7

[a] Crop acreage figures do not include land used for forage, silage or hay but do include crop acres abandoned due to damage caused by floods, drought, insects, etc. See Ray [29] for detail.

[b] Source: Agricultural Statistics, 1973 [38].

Table 15. Estimated production of selected commodities for each simulation alternative with the 1969-72 average for comparison.

Year		Actual 1969-72 a/	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
					WHEAT (MIL. BU.)				
SIM	1	1489.2	1722.1	1615.6	1723.1	1772.5	1889.6	1988.1	2020.1
SIM	2		1741.7	1579.9	2026.2	1702.8	1933.6	1974.4	1925.7
SIM	3		2087.4	2481.2	2577.4	2633.2	2778.1	2921.0	3005.7
SIM	4		2048.7	2360.6	2449.5	2501.5	2600.4	2731.0	2757.5
SIM	5		2068.9	2343.6	2396.5	2388.4	2496.2	2526.7	2511.0
SIM	6		2060.7	2319.0	2300.3	2305.8	2352.3	2501.7	2572.4
SIM	7		2140.7	2448.3	2553.9	2533.8	2560.1	2632.4	2644.3
					FEED GRAINS (MIL. TONS)				
SIM	1	186.3	237.1	263.2	286.5	286.0	311.4	333.3	359.0
SIM	2		246.3	267.0	271.7	290.0	310.7	331.8	361.6
SIM	3		266.6	317.4	326.1	332.7	350.1	365.2	375.2
SIM	4		263.4	316.8	335.1	344.1	364.2	380.8	394.0
SIM	5		259.5	307.4	317.5	326.9	340.9	359.8	374.0
SIM	6		256.9	297.6	311.9	319.3	341.0	356.5	364.4
SIM	7		255.4	288.1	298.3	303.7	312.8	325.6	348.2
					SOYBEANS (MIL. BU.)				
SIM	1	1179.8	1478.0	1799.2	1909.6	2065.5	2336.1	2552.3	2520.8
SIM	2		1521.1	1857.8	2024.0	2132.7	2357.1	2579.0	2512.5
SIM	3		1506.1	1742.1	1909.0	2012.7	2263.5	2535.7	2695.2
SIM	4		1558.4	1875.0	2033.3	2145.4	2427.9	2716.3	2891.4
SIM	5		1790.1	2186.5	2382.3	2519.1	2865.1	3213.8	3421.6
SIM	6		1823.9	2360.4	2559.4	2712.1	3017.4	3254.2	3458.6
SIM	7		1732.8	2356.5	2561.4	2756.6	3171.8	3595.5	3667.3
					COTTON (MIL. BALES)				
SIM	1	11.1	13.0	13.5	13.5	13.7	14.3	15.4	15.6
SIM	2		11.5	13.4	14.7	14.2	14.9	15.5	17.9
SIM	3		21.3	26.1	26.5	27.0	28.0	29.0	29.3
SIM	4		15.3	18.9	19.7	19.9	20.0	20.0	20.1
SIM	5		14.7	17.9	17.8	17.6	17.3	16.7	16.1
SIM	6		14.6	16.9	16.8	16.4	15.9	17.6	17.3
SIM	7		15.8	17.7	15.1	14.8	16.7	14.3	14.1
					LIVESTOCK (MIL. GRAIN CONSUMING ANIMAL UNITS)				
SIM	1	117.0	141.2	156.2	153.7	168.7	182.2	195.2	202.1
SIM	2		143.3	159.3	166.9	171.6	183.8	196.1	203.0
SIM	3		140.5	155.8	162.9	168.1	181.4	195.8	205.0
SIM	4		143.7	159.9	167.4	172.7	186.5	201.3	210.7
SIM	5		142.5	159.9	167.5	172.7	186.6	200.9	209.3
SIM	6		140.7	158.9	167.5	172.7	186.2	197.6	203.4
SIM	7		136.2	149.9	156.6	161.1	172.0	184.2	190.5

a/ Sources: [7,11,12,16,20].

Table 16. Estimated input expenses for U.S. agriculture for each simulation alternative with 1970-72 average for comparison.

Year	Actual 1970-72 a/	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
FERTILIZER AND LIME (MIL. 1972 DOLLARS)								
SIM 1	2441.3	2933.4	3223.5	3455.6	3522.6	3823.7	4209.1	4657.8
SIM 2		2735.3	2833.7	2970.7	3113.1	3495.9	3977.4	4485.3
SIM 3		3261.2	3800.3	3982.8	4052.8	4241.6	4376.2	4459.9
SIM 4		2790.1	3074.2	3299.5	3388.9	3573.1	3718.7	3845.2
SIM 5		2903.4	3026.7	3151.4	3237.0	3364.7	3585.7	3841.6
SIM 6		3058.1	3062.3	3123.7	3187.7	3406.4	3875.4	4298.9
SIM 7		3518.4	3968.5	4176.3	4306.1	4526.0	4947.7	5283.1
SEED (MIL. 1972 DOLLARS)								
SIM 1	1027.1	982.2	1051.7	1098.2	1125.5	1196.0	1252.2	1267.5
SIM 2		1000.0	1062.8	1132.7	1135.5	1202.3	1254.7	1265.4
SIM 3		1024.5	1079.2	1115.2	1136.5	1188.9	1241.6	1272.0
SIM 4		1013.7	1071.0	1113.6	1138.9	1194.6	1248.1	1277.9
SIM 5		1046.0	1104.5	1140.8	1162.6	1220.4	1273.4	1304.6
SIM 6		1046.5	1116.5	1149.5	1173.6	1226.5	1276.6	1309.5
SIM 7		1041.9	1118.3	1153.4	1178.1	1238.7	1296.0	1316.2
LABOR (MIL. MANHOURS)								
SIM 1	6364.0	6903.7	6621.2	6432.1	6347.8	6079.3	5835.6	5746.0
SIM 2		6893.3	6619.4	6625.1	6477.4	6148.2	5797.8	5955.1
SIM 3		6719.5	5987.9	5939.9	5814.4	5484.6	5160.4	5337.5
SIM 4		6687.4	5987.8	5967.5	5845.3	5521.9	5202.4	5383.8
SIM 5		6678.1	5997.2	5959.9	5834.1	5515.0	5191.9	5359.8
SIM 6		6571.3	6467.5	6010.0	5796.6	5946.8	5540.4	5378.3
SIM 7		6496.8	6317.1	5806.7	5591.1	5744.3	5349.6	5205.7
MACHINERY (MIL. 1972 DOLLARS)								
SIM 1	8270.5	8317.2	8873.0	9271.9	9564.7	10324.2	11163.3	11795.2
SIM 2		8166.0	8428.9	8720.2	8990.4	9708.5	10663.8	11382.5
SIM 3		7917.0	8012.0	8581.8	8929.7	9762.9	10585.3	11077.1
SIM 4		7731.5	7457.9	7824.0	8090.1	8743.3	9381.1	9765.8
SIM 5		7801.3	7562.9	7900.3	8154.4	8794.4	9468.6	9938.3
SIM 6		7884.4	7771.3	8062.5	8284.8	8898.5	9802.7	10656.3
SIM 7		8119.8	8713.1	9614.1	10201.4	11740.6	13406.4	14457.9
REAL ESTATE (MIL. 1972 DOLLARS)								
SIM 1	15073.1	19807.2	21448.5	22599.8	23267.6	25152.5	27179.8	28877.9
SIM 2		19476.7	20235.1	21128.0	21707.4	23337.4	25450.2	27700.7
SIM 3		20438.7	22423.7	23934.7	24785.8	26829.3	28721.3	30302.1
SIM 4		19611.2	20548.3	21630.3	22228.2	23713.6	25139.1	26518.6
SIM 5		19905.8	20840.6	21717.5	22275.2	23628.3	25086.3	26627.5
SIM 6		20089.6	21861.3	22171.9	22554.7	24294.4	26103.5	27943.1
SIM 7		20752.7	24314.8	25847.7	27010.8	30648.8	33924.8	36245.9
FUEL, OIL and REPAIRS (MIL. 1972 DOLLARS)								
SIM 1	4618.5	5004.7	5280.1	5478.6	5617.7	5975.2	6355.9	6613.3
SIM 2		4959.4	5160.2	5353.7	5459.6	5801.8	6192.9	6460.2
SIM 3		4735.8	4641.2	4874.9	5031.0	5412.1	5804.1	6041.3
SIM 4		4681.3	4486.3	4664.9	4793.9	5103.7	5418.0	5603.3
SIM 5		4699.8	4522.4	4702.7	4831.1	5152.3	5482.1	5690.6
SIM 6		4720.5	4584.5	4768.9	4890.3	5209.7	5611.4	5932.1
SIM 7		4785.3	4844.9	5223.9	5468.8	6139.1	6874.9	7332.2

Table 16. (cont'd.)

Year	Actual 1970-72[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
			MISCELLANEOUS EXPENSE (MIL. 1972 DOLLARS)					
SIM 1	5712.0	6387.0	7066.5	7486.9	7811.4	8583.3	9371.3	9834.6
SIM 2		6338.9	6930.3	7430.9	7662.8	8351.6	9099.3	9739.0
SIM 3		6605.3	7250.4	7751.6	8073.8	8790.0	9515.1	10153.3
SIM 4		6379.7	6895.3	7354.3	7647.3	8280.2	8906.4	9493.0
SIM 5		6494.0	7069.9	7508.5	7800.5	8471.8	9154.1	9802.2
SIM 6		6493.9	7499.3	7770.5	7973.6	8932.9	9658.2	10229.7
SIM 7		6587.4	7889.0	8363.0	8770.9	10339.7	11696.8	12459.7
			INTEREST ON STOCKS (MIL. 1972 DOLLARS)					
SIM 1	2435.1	2499.7	2698.6	2820.9	2883.4	[illegible]	3263.7	3348.4
SIM 2		2566.1	2732.2	2850.0	2915.4	[illegible]	3272.9	3342.2
SIM 3		2606.0	3030.8	3180.4	3240.0	[illegible]	3523.1	3599.4
SIM 4		2606.6	3012.5	3201.5	3293.4	3478.3	3629.5	3718.7
SIM 5		2604.4	2997.4	3149.8	3220.5	3372.1	3512.4	3613.8
SIM 6		2589.5	2951.4	3108.0	3183.9	3346.8	3503.6	3597.6
SIM 7		2588.5	2913.8	3042.8	3103.1	3220.2	3340.2	3415.1
			REAL ESTATE TAX (MIL. 1972 DOLLARS)					
SIM 1	3193.6	2954.1	3214.8	3401.3	3502.8	3806.5	4128.4	4397.0
SIM 2		2910.0	3027.3	3153.6	3248.3	3514.0	3866.5	4201.5
SIM 3		3042.4	3360.8	3588.2	3723.7	4052.4	4360.8	4580.8
SIM 4		2925.4	3076.1	3234.8	3330.4	3571.0	3806.5	3994.8
SIM 5		2973.6	3123.5	3248.9	3338.0	3555.9	3796.9	4013.2
SIM 6		3009.6	3254.3	3325.0	3392.7	3637.9	3940.4	4241.6
SIM 7		3115.4	3658.1	3937.8	4133.8	4679.3	5220.4	5596.1
			LIVESTOCK FEED (MIL. 1972 DOLLARS)[b/]					
SIM 1	7907.7	10276.7	11994.4	13072.5	13846.4	15908.4	18317.7	19988.1
SIM 2		10174.2	11859.4	12975.9	13788.3	15984.2	18489.9	20261.6
SIM 3		9734.7	10424.7	11551.1	12356.3	14487.4	16848.3	18392.1
SIM 4		9525.9	10154.9	11254.6	12046.1	14152.6	16482.3	17995.0
SIM 5		9598.6	10154.1	11244.7	12042.0	14142.8	16502.9	18085.6
SIM 6		9693.7	10215.1	11231.5	12021.7	14133.8	16668.1	18458.3
SIM 7		9935.1	10729.7	11880.4	12720.7	14986.2	17520.1	19081.5
			LIVESTOCK PURCHASES (MIL. 1972 DOLLARS)[c/]					
SIM 1	5216.9	7334.9	8213.9	9253.0	9163.1	10074.4	10903.8	11593.6
SIM 2		7742.0	8402.1	8948.2	9256.7	9984.5	10861.8	11832.1
SIM 3		8181.5	10243.8	10662.4	10914.3	11562.5	12140.9	12528.7
SIM 4		8117.5	10134.8	10882.0	11285.5	12071.8	12722.3	13088.4
SIM 5		8018.3	9848.7	10348.9	10669.7	11243.7	11902.0	12408.3
SIM 6		7941.3	9457.7	10107.1	10405.6	11104.4	11828.2	12531.9
SIM 7		7930.7	9182.0	9661.7	9848.2	10201.3	10786.2	10685.5

a/ Sources: Agricultural Statistics, 1973 [38]; Farm Income Situation [10].

b/ Livestock feed expenditures = $13,078 in 1973.

c/ Livestock procedures = $8,152 in 1973.

Table 17. Per capita consumer food expenditures for each simulation alternative in 1972 dollars with actual 1969-72 average.

Year	Actual 1969-72[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				MEAT PRODUCTS				
SIM 1	164.7	207.2	220.2	222.4	225.0	229.8	241.7	255.2
SIM 2		194.4	201.6	203.3	208.3	221.0	237.4	251.1
SIM 3		210.3	222.1	226.3	227.8	232.9	237.2	239.6
SIM 4		192.1	198.1	200.8	202.1	206.1	209.5	212.1
SIM 5		199.2	198.0	200.4	202.2	205.6	212.1	220.2
SIM 6		208.9	203.4	200.4	202.1	207.5	228.3	247.4
SIM 7		230.6	250.5	255.5	260.3	274.6	287.2	300.5
				POULTRY AND EGGS				
SIM 1	42.2	37.5	38.1	38.2	38.4	38.7	39.6	40.7
SIM 2		36.3	36.4	36.5	36.9	37.9	39.2	40.3
SIM 3		37.9	38.3	38.6	38.7	39.0	39.2	39.4
SIM 4		36.1	36.1	36.3	36.4	36.6	36.8	37.0
SIM 5		36.8	36.1	36.3	36.4	36.6	37.0	37.6
SIM 6		37.8	36.6	36.3	36.4	36.7	38.4	40.1
SIM 7		40.2	41.3	41.7	42.1	43.3	44.3	45.5
				DAIRY PRODUCTS[b/]				
	85.0	71.3	69.7	68.7	68.1	65.4	64.8	63.8
				OTHER FOOD[c/]				
	265.0	272.7	275.3	276.6	277.3	279.0	280.5	281.3
				TOTAL PER CAPITA FOOD EXPENDITURE				
SIM 1	556.9	588.7	603.2	605.9	608.8	613.8	626.6	641.0
SIM 2		574.7	583.0	585.1	590.6	604.2	621.8	636.4
SIM 3		592.2	605.4	610.2	611.9	617.3	621.8	624.1
SIM 4		572.2	579.3	582.4	583.9	588.1	591.6	594.1
SIM 5		579.9	579.1	581.9	584.0	587.6	594.4	602.9
SIM 6		590.7	585.1	581.9	583.9	589.6	612.0	632.5
SIM 7		614.8	636.8	642.6	647.8	663.3	676.8	691.1

[a/] Source: Food Consumption [39].

[b/] Estimated exogenously.

[c/] Includes bakery products, fruits and vegetables, grain mill products and miscellaneous items.

Trend Future

The trend future scenario examines agriculture under its presently evolving structure of farm size, technology, and resource demand. Export quantities are projected to return from the high export levels of 1973-74 to levels indicated by historical growth trends, and the 1973 legislated farm programs become a policy variable. The trend future examines the effect of the current farm programs by comparing an alternative which continues farm programs in their present form to one in which they are removed and agriculture operates with a free market structure. The provisions of the 1973 Agriculture and Consumer Protection Act [1] include: subsidy payments to farmers when market prices fall below legislated target prices for wheat, corn, and cotton; and acreage restrictions, comprised of diverted acreage for feed grains and allotment programs for wheat and cotton.

Two simulation alternatives are examined in the trend future. Simulation 1 traces out farm income, farm prices, resource demands, and other key agricultural variables when the 1973 farm programs are continued to the year 2000. The amount of support from government subsidies and acreage restrictions is estimated to the year 2000. To compare the trend future without government support and control programs, Simulation 2 examines the trend future under a free market structure. In the free market situation, all crop price supports, subsidies, and acreage control programs are removed. Comparison of the free market and farm program alternatives allows us to focus on both the direct and indirect effects of farm programs and evaluate the trade-offs involved.

Trend Future - Farm Programs (Simulation 1)

The trend future with farm programs estimates the future of U.S. agriculture under the 1973 legislated farm programs with a continuation of historical trends in farm size, resource demand, yields, and exports. Simulation 1 evaluates the trend future under present farm programs and throughout the rest of this report will serve as a "bench mark" to compare with other policies and expected futures.

Future acreage requirements for each crop depend upon the growth of commodity demands and the rate of increase in crop yields. Table 18 compares the estimated growth in commodity demand and crop yields from the years 1969-72 to the year 2000 under the farm program trend. Estimated increases in per capita meat consumption and population growth combine to increase livestock production 74 percent in that time period. Steady growth in livestock feed demands and exports increase feed grain demand by 88 percent and soybean demands by 101 percent by the year 2000. Total demand for wheat increases only 32 percent from the years 1969-72 to the year 2000, due to a lower growth rate of wheat exports and a projected decline in per capita consumption of wheat in the United States. In recent years the domestic per capita consumption of cotton and cotton exports has been declining due to increased use of synthetic materials. Per capita consumption of cotton is projected to remain constant at 20 pounds of cotton lint per person. Thus, the 18 percent increase in cotton demand is due to population increases.

Estimated crop yields for all crops in the year 2000 are substantially higher than actual 1969-72 yields. Soybeans, which show a 101 percent

Table 18. Comparison of 1969-72 actual commodity demand and crop yields to the year 2000 in the farm program trend future.

	Actual 1969-72	2000	Percentage Increases
Total demand[a/]			
Wheat (mil. bu.)	1,586.7	2,095.2	32
Feed grains (mil. tons)	189.9	356.7	88
Soybeans (mil. bu.)	1,246.6	2,512.5	101
Cotton (mil. bales)	12.0	14.1	18
Livestock (mil. grain consuming animal units)	117.0	203.0	74
Yields[b/]			
Wheat (bu./acre)	30.7	42.4	38
Feed grains (bu./acre)	65.7	105.6	61
Soybeans (bu./acre)	27.0	36.0	33
Cotton (lbs./acre)	421.9	692.5	64

[a/] Total demand is the sum of commercial demands based on a 300 million population in the year 2000 and export demands based on trend exports [39].

[b/] Yields are based on acres planted and intended for harvest [29;38].

increase in demand, have only a 33 percent increase in yields. As a result projected soybean acreage increases from 43.6 million acres in 1969-72 to 70.1 million acres in 2000. Feed grain demand also increases faster than the growth in feed grain yields, resulting in an increase in feed grain acreage from 101.0 million acres in 1969-72 to 121.4 million acres in 2000. In contrast the growth in wheat yields is slightly higher than the growth of wheat demand resulting in a small reduction in wheat acreage by the year 2000. The projected 64 percent increase in cotton yields, coupled with the 18 percent increase in demand, leads to a reduction in cotton acreage from 12.6 million acres planted in 1969-72 to 10.8 million in 2000. The increase in feed grain and soybean acreage comes from land previously in feed grain diversion or land formerly in cotton production.

The trend future simulation alternative incorporates provisions of the 1973 farm program as the policy tool to support farm prices and incomes. Included in the farm program: subsidy payments to farmers when market prices are below the legislated target prices of $2.05 per bushel of wheat, $1.38 per bushel of corn, and 38 cents per pound of cotton. If a buildup of stocks occurs at target prices, production controls also can be implemented. These controls include voluntary allotment programs for wheat and cotton and an acreage diversion program for feed grains.

Farm program costs and acres diverted from feed grain production decline significantly over the period 1975-2000 because of rapidly increasing crop demands. Table 19 presents estimates of government payments for wheat, feed grains, and cotton and acres diverted from feed grains under Simulation 1. Rapid growth in both soybean exports and domestic livestock demand reduce feed grain diverted acres, eliminating acreage diversion by 1994. Feed grain program payments include target subsidy payments for corn and payments for diverting acres. Program payments to the cotton and wheat sectors include only target subsidy payments. In this alternative wheat and cotton acreage is restrained by voluntary allotment programs which limit the acres eligible for price subsidies. If voluntary allotments are unsuccessful, diversion of wheat and cotton acres would become necessary. This would increase government payments for wheat and cotton. However, as feed grain and soybean demands

Table 19 . Government payments and feed grain acreage diversion for Simulation 1, the farm program trend.

	Actual 1969-72[a]	1975-79	1980-85	1985	1985-89	1990-94	1995-99	2000
			Payments for land diversion and price subsidy[b] (millions of 1972 dollars)					
Wheat	922.6	273.5	289.2	269.0	269.7	262.2	208.2	88.5
Feed grains	1,614.1	682.1	710.3	1,366.4	712.2	407.9	0.0	0.0
Cotton	907.8	181.7	188.7	197.5	198.6	202.9	211.4	213.8
			Feed grain acreage diversion[c] (million acres)					
Diverted acres	33.0	11.2	7.9	2.4	6.3	2.0	0.0	0.0

[a] Actual payments [38] are under a different set of farm programs than Simulation 1.

[b] Price subsidies are estimated as the difference between the market price and the target price for wheat, corn, and cotton with the maximum payment being the difference between the target price and the 1973 price support levels. The proportion of corn making up feed grain production is estimated as the 1969-72 average. Estimated feed grain acreage diversion payments are the product of estimated feed grain acreage diversion and the national average 1969-72 payment per acre.

[c] Feed grain acreage diversion is estimated as the calculated feed grain acreage reduction needed to reduce government inventory stocks to the 1968-71 average.

increases, wheat and cotton farmers can limit production to their allotments and gradually increase their acres devoted to feed grain and soybean production. Under Simulation 1 acreage allotments for wheat and cotton are maintained to the year 2000 to keep production in line with demand at target prices.

Farm programs in the trend future maintain stable prices through price supports and acreage control programs. For the years 1975-94, market prices under support programs average $1.89 per bushel of wheat, $1.31 per bushel of feed grains, $3.35 per bushel of soybeans, and 35 cents per pound of cotton. Subsidy payments are made to farmers if market prices are below target prices for wheat, corn, and cotton. Expansion of feed grain and soybean acreage in the trend future under farm programs is achieved through release of diverted acres for the period prior to 1994. However, after 1994 no diverted acres are available for expansion of feed grain and soybean acreage, and the growing soybean and feed grain demand causes the price of feed grains and soybeans to rise. This induces farmers to shift from wheat and cotton production to the more profitable soybean and feed grain production. Prices reach $4.26 per bushel of soybeans and $1.67 per bushel of feed grains by the year 2000.

The acreage required to meet wheat and cotton demands declines throughout the period from 1975 to 2000 because of the small projected growth in wheat and cotton demands relative to their projected growth in yields. Acreage planted to wheat and cotton is reduced through acreage allotment programs rather than through a decrease in price. The simulation results in the trend future under farm programs indicate that allotment programs for wheat and cotton are still needed after 1995 to balance supply and demand at target prices. The continuing rise in the relative price of feed grains and soybeans after 2000 will eventually reduce the supply response of wheat and cotton enough to allow elimination of allotment programs.

National gross farm income in the trend future grows steadily with the stable prices and growing demand for agricultural commodities. U.S. gross farm income increases $1.3 billion annually from 1975-95. After 1995 rising livestock, soybean, and feed grain prices combine with growing commodity demands to accelerate the increase in U.S. gross farm income to an average of $3.0 billion per year. By the year 2000, U.S. gross farm income reaches $112 billion. This represents a 60 percent increase above the 1972 value of $69.9 billion. Throughout the time period, the livestock, soybean, and feed grain sectors show the largest increases in gross income as a result of the projected growth in domestic population, per capita meat consumption, and crop exports.

Production expenses also increase steadily as farmers increase both acres in production and total inputs used per acre. Production expenses are estimated to increase from $49.2 billion in 1972 to $58.0 billion in 1985 and $74.3 billion in the year 2000. The major sources of increased input expense are livestock purchases, feed expenses, and fertilizer expenditures.

Total net farm income is estimated to increase from $19.8 billion in the years 1969-72 to $29.6 billion in 1985 and $42.1 billion in the year 2000. The rapid growth in total net farm income is a result of the rapid growth of livestock production and soybean exports, along with the steady growth of domestic and export demands for other agricultural products.

After 1995 price increases for livestock, feed grains, and soybeans contribute to the growth in net farm income.

Net income per commercial farm increases even more rapidly than total net farm income as a result of declining farm numbers. The number of commercial farms (gross sales of $2,500 or more) is assumed to decline from 1.8 million commercial farms in 1969-72 to 1.3 million in 2000.[5/] Net income per commercial farm increases from $11,036 in the years 1969-72 to $15,924 in 1975-79 and $21,876 in 1990-94. By the year 2000 price increases raise net income per farm to $31,801. Growing farm income and higher production levels increase the value of farm assets 50 percent from 1975 to 2000. During the years 1975 to 2000, the value of commodity stocks increases 34 percent as production of all commodities increase. Higher gross incomes which encourage further mechanization in agriculture increases the value of machinery stocks 51 percent from 1975 to 2000.

Total assets per commercial farm increase from $220,034 in 1975-79 to $387,683 in 1995-99 in the farm program trend because of declining farm numbers and greater values of farm assets. The average value of machinery stocks per commercial farm increase from $15,442 in 1975-79 to $27,158 in 1995-99. The value of land and buildings increases from $166,422 per commercial farm in 1975-79 to $296,821 per commercial farm in 1995-99 because of increasing land values and a decline in the number of commercial farms.

In the trend future, increased production, stable farm prices, and higher farm incomes contribute to the steady growth in agricultural input

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[5/] This assumption is based on the belief that the rate of decline in farm numbers will decrease over the next several decades. Various projections suggest farm numbers will decline to the range of .9 to 1.3 million farms by 2000.

usage. Shown in Table 20 are the estimated input expenditures and man-hour requirements for 1985 and the year 2000, with actual 1970-72 values for comparison. Rapid increases in the production of livestock, feed grains, and soybean increases total input use in those sectors substantially. Growing farm assets values, which expands farmers' borrowing base, and favorable crop prices encourage farmers to increase purchased input use per acre for all crops from 1975 to 2000.

Table 20. Estimated U.S. input expenditures in millions of 1972 dollars and labor requirements in millions of man-hours for 1985 and 2000 in Simulation 1, the trend future under farm programs, with 1970-72 actual for comparison.[a]

Input	Actual 1970-72	1985	2000
Fertilizer and lime expense	2,441	3,456	4,658
Seed expense	1,027	1,098	1,268
Labor man-hours[b]	6,490	6,432	5,746
Machinery expense	8,270	9,272	11,795
Real estate expense	15,073	22,600	28,878
Fuel, oil and repairs	4,618	5,479	6,613
Miscellaneous expenses	5,712	7,487	9,835
Interest expense	2,435	2,821	3,348
Real estate tax expense	3,194	3,401	4,397
Livestock feed	8,470	13,072	19,988
Livestock purchases	5,536	9,253	11,594

[a] All expenses are in millions of 1972 dollars except labor which is in millions of man-hours [10].

[b] Actual 1970-72 [38].

Fertilizer and lime expenditures have increased rapidly in the past decade. In the period 1965-67, fertilizer expenditures in the United States were $1,493 million. By 1970-72 the annual expenditure was $2,441 million, a 63 percent increase in five years. The trend future with farm programs projects fertilizer expenditures to increase to $3,455 million in 1985 and reach $4,658 million in the year 2000. The increase in fertilizer and lime expenditures is due to increases in the application rate per fertilized acre, the proportion of acres fertilized, and acreage in production. Feed grains and soybeans show the largest increases in fertilizer and lime expenditures.

Labor requirements in agriculture have been declining rapidly over the last three decades. Total manhour requirements declined from 16.2 billion manhours in 1949 to 7.6 billion in 1970-72. The decline in labor demand is projected to continue to the year 2000 but at a slower rate. The estimated labor requirement in the year 2000 is 5.4 billion man-hours under the trend future. A principal factor responsible for slowing the decline of labor requirements is the increased production of livestock and soybeans. Labor requirements for livestock remain stable at 3.1 billion man-hours in 1975-79 and 3.0 billion man-hours in 1995-99. The man-hour requirements for soybean production increase from 223 million manhours in 1975-79 to 288 million man-hours in 1995-99.

Both livestock feed expenditures and livestock purchases grow rapidly as livestock production increases 78 percent from the years 1969-72 to the year 2000. In the trend future under farm programs, livestock feed purchases reach $20.0 billion and livestock purchases are $11.6 billion in the year 2000.

Estimated expenditures for all other inputs show an increase at the national level from 1970-72 to the year 2000. During that period expenses are expected to increase: 23 percent for seed; 43 percent for machinery; 92 percent for real estate; 43 percent for fuel, oil, and repairs; 72 percent for miscellaneous expenses; 38 percent for interest; and 38 percent for real estate taxes.

Per capita food expenditures in the trend future under farm programs are projected to increase from $556.8 in 1969-72 to $641.0 in the year 2000 (Table 17). Expenditures on meat products are the major source of increased food expenditures due to a rise in per capita meat consumption from 189 pounds in 1970-72 to 238 pounds in 2000. Although per capita food expenditures are rising, projected increases in per capita disposable income reduce the percent of per capita income spent on food from 15 percent in 1970-72 to 8 percent in the year 2000.

Results of Simulation 1, trend future under farm programs, indicates a steady growth in farm incomes over the simulation period because of growing domestic and export demands and because of stable farm prices under government farm programs. Net farm income grows to $42.1 billion, and net income per commercial farm grows to $31,801 in 2000. Although domestic and export demands are increasing, the supply capacity of agriculture under trend technology exceeds crop demands from 1975-95, requiring government acreage restrictions to support farm prices. The rapid growth of feed grain and soybean demands eliminates idle land by 1995. After 1995 new programs may be needed to increase the growth rate of yields or expand total cropland to meet growing domestic and export demand levels.

Trend Future-Free Market (Simulation 2)

Simulation 2 examines the trend future under a free market structure without a farm program to restrict production and support farm prices. In this situation yields, farm size, and export levels are the same as the farm program trend future (Simulation 1). The free market trend future assumes exports increase at trend levels. The results of the free market trend, when compared with the results of the farm program trend future, estimate the effect removal of farm programs have on variables such as farm prices, farm income, and consumer food costs. The indirect effects of farm programs on capital accumulation and resource use are also examined.

The initial response of farmers to removal of farm programs is to increase production, which depresses market prices. The estimated demand for commodities at lower prices, however, is only slightly higher than in the trend future; thus, only a slight increase in crop production and acreage is required to meet commodity demands. Production increases in the free market situation for the years 1975-85 are three percent for soybeans, two percent for livestock and feed grains, and one percent for wheat over the trend future under farm programs.

Because of inelastic demand for farm products, significant price reduction must occur to balance production and demand. Cotton and wheat experience the largest price adjustment in the free market trend because of the slow growth of wheat and cotton demands relative to crop yields. At target prices, the supply response of cotton and wheat is high, relative to demand, requiring allotment programs in the trend future with farm programs.

Removal of these allotments requires large reductions in cotton and wheat prices to maintain acreage at levels consistent with demand requirements. From 1975-89 the large supply capacity in the free market reduces prices to 18 cents per pound of cotton and \$1.32 per bushel of wheat.

Increases in livestock feed demand and feed grain and soybean export demands reduce the price effect for these commodities. Although soybean production is not directly restricted in the farm program trend future, lower prices of substitute crops and increased available land in the free market trend increase the supply response of soybeans. In the years 1975-89 free market prices average \$1.01 per bushel for feed grains and \$3.06 per bushel for soybeans.

In the years 1975-89, crop prices are low because supply capacity under the free market trend exceeds the demand for agricultural products. However, feed grain and soybean acreage is expanding to meet their growing domestic and export demands. By 1990 the cropland base for wheat, feed grains, soybeans, and cotton is fully utilized. The lack of excess land after 1995 reduces the supply response of soybeans and feed grains, causing an increase in soybean and feed grain prices relative to other crop prices. After 1995 as domestic and export demand for soybeans and feed grains continues to expand, the higher prices of soybeans and feed grains bid land away from the wheat and cotton sectors. By 2000 crop prices are \$4.21 per bushel for soybeans, \$1.58 per bushel for feed grains, \$1.64 per bushel for wheat, and 16 cents per pound for cotton.

As would be expected, gross income is significantly lower under the free market trend than under the trend future which incorporates farm support programs. Gross income under the free market assumption falls below that attained with farm programs by: 33 percent for wheat, 18 percent for feed grains, 5 percent for soybeans, 48 percent for cotton, and 7 percent for livestock. Nationally, gross farm income increases over time, even under free market conditions, with production increases offsetting lower crop prices in the free market trend. In the years 1975-95, however, U.S. gross farm income averages 12 percent lower under the free market structure than under the trend future with price supports. In 1985 gross farm income is $73.9 billion in the free market trend as compared to $83.3 billion in the trend under farm programs. After 1995, as commodity demands increase sufficiently to utilize the existing land base, crop prices increase, raising gross farm income to $107.5 billion in 2000, only 4 percent lower than the $112.2 billion in the trend future under farm programs. Production expenses under the free market simulation average 2 percent lower than under the trend future with farm programs. In the free market, the demand for livestock, soybeans, and feed grain is slightly higher than under the farm program trend because of lower crop prices. In spite of these higher production levels, input use is lower under the free market trend because of lower farm prices and gross incomes in the free market.

Net farm income under the free market trend is substantially lower than under the farm program trend because of lower farm prices. From

1985-89 net farm income under the free market trend averages $17.3 billion, a slight increase over the $15.5 billion net farm income of 1969-72, but substantially lower than the $26.6 billion for the trend future under farm programs. By 1995 demands are approaching supply capacities and as a result crop prices increase from 1995 to 2000. Net farm income raises to $37.8 billion in 2000 which is still below the $42.1 billion net farm income of the farm program trend future.

The growth of total farm assets under free market conditions averages 5 percent lower than under the farm program trend because of the lower farm incomes in the free market. The value of commodity stocks averages 1 percent higher in the free market, however, because of larger commodity inventories than in the farm program trend. Lower farm prices in the free market trend result in a 4 percent reduction in the growth of machinery stock and a 6 percent reduction in the value of land and buildings as compared to the trend future incorporating farm programs.

The rate of increase in resource use estimated in the farm program trend future is reduced in the free market trend, partially in response to lower commodity prices and partially because of the reduction in the growth of farm assets. Reduced farm asset values have the effect of reducing farmers' borrowing base, causing them to shift away from purchased capital inputs such as fertilizer to non-purchased inputs such as seed and labor. Fertilizer and lime expenditures are 8 percent lower in the free market trend while fuel, oil, and repairs, and miscellaneous expenses average 2 percent lower than when prices are supported by farm programs. Expenses related to the durable capital stock (machinery expense, real estate expense, interest expense, and real estate taxes) are reduced 5 percent under the free market trend.

Under the free market trend, individual commodities also show a significant reduction in input usage compared to the farm program trend future. Capital input expenses are 11 percent lower for feed grains, 8 percent lower for wheat, 14 percent lower for cotton, and 2 percent lower for livestock than the trend future. With the exception of soybeans, all commodities show significant reductions in the growth path of expenditures for fertilizer and lime; machinery interest and depreciation; interest on real estate; real estate taxes; and machinery operating expenses.

Per capita food costs in the free market trend increase slowly through the years 1975-94. Estimated food expenditures in 1985, $585 per capita, under the free market trend is a slight increase over the $556 spent in 1969-72. Increases in food costs are a result of increases in per capita consumption of meat and other food products. These consumption increases are partially offset by lower farm prices in the free market in 1975-94, compared to the 1969-72 farm prices. After 1995 the rise in crop prices in the free market raises food costs to levels near the trend future which supports prices through farm programs.

In the trend future, capacity to produce exceeds demands for agricultural products in the years 1975-95. As a result, elimination of farm programs results in a substantial decrease in farm prices and incomes in this time period. Net farm income averages 36 percent lower in the free market compared to the trend future incorporating price supports and supply controls. After 1995 the growth in domestic and export demands reduces excess capacity in agriculture, increasing crop prices and farm income to levels near farm prices and income in the farm program trend. The growth of farm assets and input usage in the trend future is reduced when farm programs are removed, due to lower farm prices and farm income under free market conditions. Consumers benefit from removal of farm programs in the trend future through lower food costs and elimination of treasury costs for price support and supply control programs.

Maximum Efficiency Future

Policies of the maximum efficiency future are designed to increase farm efficiency and productivity to meet domestic and foreign demands at reasonable prices. These policies include a change in farm structure to a larger, more efficient farm; additional research expenditure to increase crop yields 15 percent above projected trend yields; elimination of farm programs which restrict crop production; and a return to free market pricing. To promote adoption of new technology and support crop prices at production costs, it is assumed that farm prices are supported at $.90 per bushel for feed grains, $1.20 per bushel for wheat, and $.18 per pound of cotton. This set of support prices is assumed to represent production costs under maximum efficiency. A government support program will maintain prices at support levels if market exports are not large enough to "clear the market" at these levels. Through the support program, supported crops would be purchased by the government. Rather than accumulate large stocks, these purchases would be non-market exports taking the form of subsidized exports or foreign aid programs.

The maximum efficiency future expects that the high export levels of 1973-74 are indications of a new international agricultural environment. In this scenario American agriculture produces at full capacity to meet world demands while satisfying domestic demands at reasonable prices. In the event that temporary farm surpluses develop, export disposal programs can prevent reductions in farm prices below production costs.

Expanded exports are the key to the success of the maximum efficiency future. However, the extent of the needed increases in exports needs to be clearly determined. Five export alternatives (Simulations 3 through 7) are examined in the maximum efficiency future to appraise the full range of effects from variations in crop exports. Simulation 3 estimates the export levels sufficient to maintain market prices at the 1973 legislated target levels for wheat, feed grains, and cotton. Simulation 4 examines the impact on farm income, prices, and other key variables when market exports are at trend levels, based on the 1949-71 growth rate of exports. Simulations 5 and 6 estimate the effects on key agricultural variables when market exports increase 30 percent and 50 percent above trend export levels. Trend exports are doubled in Simulation 7 to estimate the effect on agriculture of exports which increase total demand above the supply capacity of the maximum efficiency future.

Maximum Efficiency-- Target Prices (Simulation 3)

Simulation 3 estimates the level of exports needed to maintain stable prices at the 1973 legislated target levels through the years 1975 to 2000. The objective of this alternative is to determine the minimum export levels needed each year to balance supply and demand in the free market and provide a fair return to farmers (using the 1973 target prices as a basis). Exports of wheat, feed grains, and cotton are at levels which will absorb production above domestic demands and maintain target prices. Soybean exports grow at trend levels. Simulation 3 also shows the production mix under target prices in the absence of acreage controls and increased productivity of the maximum efficiency future.

The maximum efficiency future at target prices achieves both full production and prices maintained at legislated target levels. Therefore, comparing this alternative with the trend future under farm programs, which also maintains target prices to farmers, reveals the effects of a full production agriculture with advances in farm efficiency. In addition, Simulation 3 serves as a basis for comparison with the other maximum efficiency futures which examine the impacts of various export levels. As in previous simulations, all dollar amounts are in 1972 real dollars and are not adjusted for inflation that occurs after 1972.

In the maximum efficiency futures, production is not restricted by farm programs and the immediate effect of dropping acreage restrictions is an increase in crop acreage. With expanded exports stabilizing price at target levels in Simulation 3, acreage expands to 61.0 million acres for wheat, 121.0 million acres for feed grains, 49.7 million acres for soybeans, and 18.3 million acres for cotton in the years 1975-79.

If demand and yields do not grow at the same rate, crop acreage requirements will change. Crop surpluses bid down crop prices and reduce acreage while shortages have the opposite effect. In Simulation 3 prices for wheat, feed grain, and cotton are stabilized by exports which absorb production in excess of domestic needs. Rapid growth in the demand for soybeans, however, causes an increase in soybean price and soybean acres. This relative price change has the largest effect on feed grain acreage. Between the years 1975-79 and the year 2000, soybean acreage increases from 49.7 million to 65.5 million acres, and feed grain acreage decreases from 121.0 million to

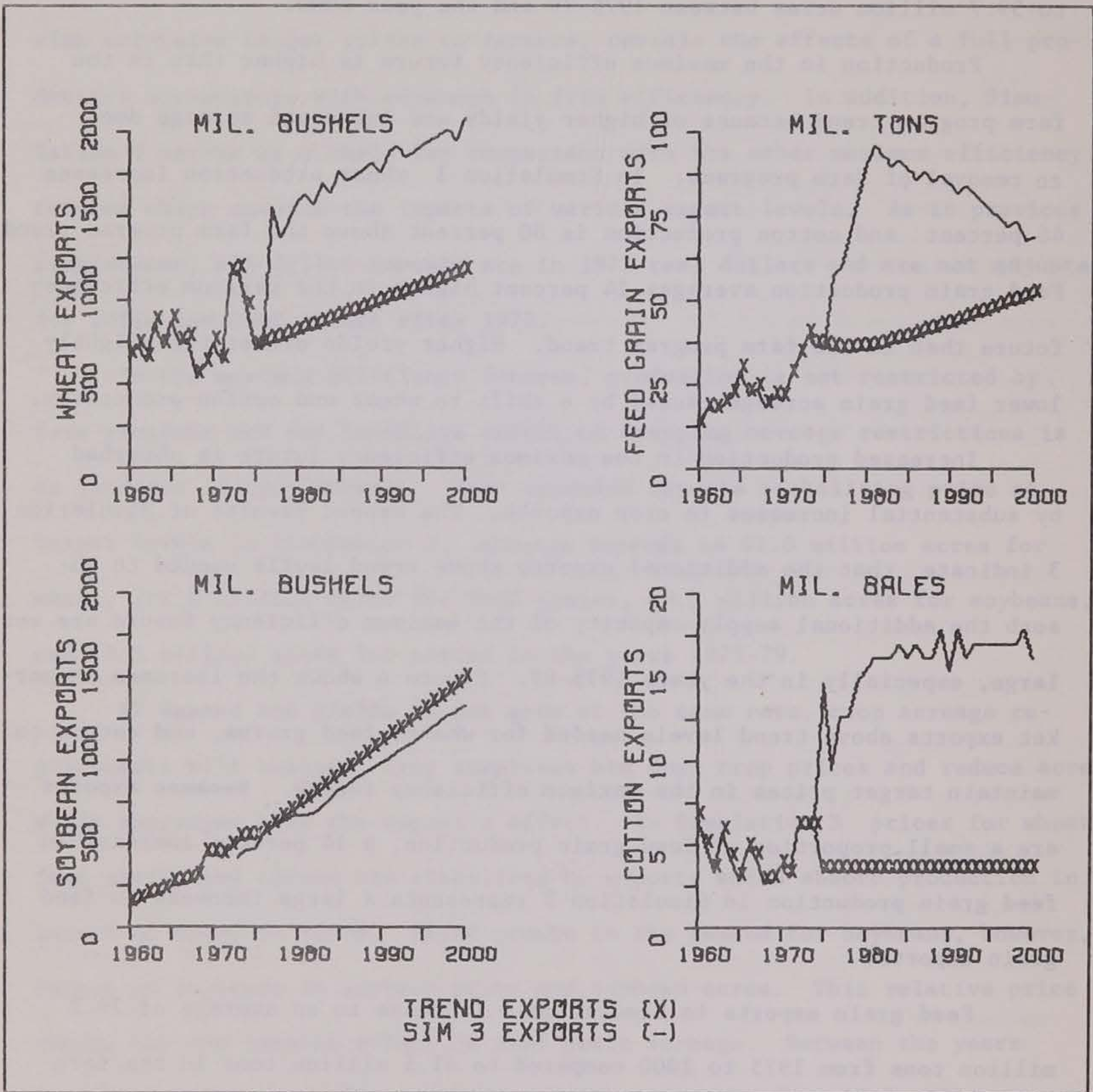
108.1 million acres. In addition, cotton acreage decreases from 18.3 million to 16.7 million acres and wheat acreage decreases from 61.0 million to 59.7 million acres between 1975-79 and the year 2000.

Production in the maximum efficiency future is higher than in the farm program trend because of higher yields and increased acreage due to removal of farm programs. In Simulation 3 wheat production increases 46 percent and cotton production is 80 percent above the farm program trend. Feed grain production averages 14 percent higher in the maximum efficiency future than in the farm program trend. Higher yields offset the slightly lower feed grain acreage caused by a shift to wheat and cotton production.

Increased production in the maximum efficiency future is absorbed by substantial increases in crop exports. The export results of Simulation 3 indicate that the additional exports above trend levels needed to absorb the additional supply capacity of the maximum efficiency future are very large, especially in the years 1975-89. Figure 4 shows the increase in market exports above trend levels needed for wheat, feed grains, and cotton to maintain target prices in the maximum efficiency future. Because exports are a small proportion of feed grain production, a 14 percent increase in feed grain production in Simulation 3 represents a large increase in feed grain exports.

Feed grain exports in Simulation 3 increase to an average of 79.2 million tons from 1975 to 2000 compared to 41.5 million tons in the farm program trend. In the absence of acreage controls, increased cotton acreage and higher cotton yields cause cotton exports in Simulation 3 to average

Figure 4. Estimated exports needed in Simulation 3 to maintain farm prices at target levels in the maximum efficiency future with trend export levels for comparison.[a/]



a/ Actual and projected 1960-74 exports from [7;11;12;20].

14.8 million bales from 1975 to 2000. Wheat exports are an average 77 percent higher than trend exports.

Market prices in Simulation 3 reach target levels through increased exports. Average crop prices are: $2.06 per bushel for wheat, $1.42 per bushel for feed grains, $3.38 per bushel for soybeans, and 38¢ per pound for cotton. Farm prices of livestock, on a liveweight basis, average: 35.9¢ per pound for beef, 26.5¢ per pound for pork, and 19.2¢ per pound for broilers.

Gross income estimates for wheat, feed grains, and cotton are substantially higher than for the farm program trend future due to higher exports in Simulation 3. For the entire simulation period, average gross incomes are 45 percent higher for wheat, 87 percent higher for cotton, 18 percent higher for feed grains, and 7 percent higher for soybeans. Gross income in the livestock sector is nearly unchanged from the trend future, with increases in prices offsetting lower production. Nationally, total gross income averages 6 percent higher in the maximum efficiency future at target prices than under the trend future with farm programs.

Although production increases significantly in Simulation 3, production expenses are slightly lower than in the trend future under farm programs. The reduction in production expenses is due to greater efficiencies in input use caused by the larger farm size and shifts in location of production. As a result, net farm income averages 23 percent above net farm income in the trend future under farm programs. In 1985-89 net farm income averages $34.3 billion which is 25 percent higher than the $27.5 billion in the farm program trend. By 1995-99 net farm income averages $37.1 billion in the maximum efficiency future at target prices. This is 14 percent above the $32.6 billion in the trend future under farm programs.

Net income per commercial farm in the maximum efficiency future at target prices is higher than in the farm program trend future because of increased net income and a reduction in the number of commercial farms. In the maximum efficiency future, all farms are assumed to have gross sales of $40,000 or more, which causes a decline in the number of commercial farms to 1.036 million in 1985 and 983 thousand in the year 2000.[6/] This rapid growth in farm size, combined with rising gross farm income gross farm income, increases gross income per commercial farm to $113,332 in 2000. Net income per commercial farm increases to $37,362 in 1985 and $43,452 in 2000 because of a larger farm size and net farm income in Simulation 3.

The increased production of the maximum efficiency future at target prices stimulates growth in farm assets to 6 percent above the level in the trend future under farm programs. Commodity stocks average 9 percent higher, machinery stocks are 4 percent higher, and the value of land and buildings is 6 percent higher than the farm program trend. Higher production levels and gross farm income in the maximum efficiency future at target prices accounts for these higher values. The rapid growth in farm income in this situation increases total farm assets to $467.5 billion in 1985 and $586.6 billion in 2000.

[6/] Average farm size in acres for the large farm structure without locational bounds is estimated to be 1,093 acres in 1980, see Sonka and Heady [35]. The average farm size in acres is assumed to increase at the rate of 4.4 acres per year from 1980 to 2000, which is the growth of commercial farms from the 1964 to 1969 census. To estimate farm numbers from average farm size, see Sonka and Heady [35].

Asset requirements per commercial farm are substantially higher in Simulation 3 than in the trend future with farm programs because of higher asset values and a smaller number of commercial farms. Total assets per commercial farm in the maximum efficiency future at target prices increases sharply to $451,222 in 1985 and $596,613 in the year 2000.

Greater efficiency in input use, because of larger, more efficient farms and locational efficiencies, tends to decrease the inputs used in the maximum efficiency futures as compared to the trend futures. However, the maximum efficiency future at target prices operates at higher production levels than the trend future under farm programs which offsets some of the reduction in input use.

Fertilizer and lime, seed, and miscellaneous expenses are higher in Simulation 3 than in the trend future under farm programs because of the higher production levels in the maximum efficiency case at target prices (Table 21). The production effect on input usage in the maximum efficiency future at target prices is greatest in the years 1975-89, when the farm program trend future is operating at less than full capacity. Fertilizer and lime expenditures average 15 percent higher and seed and miscellaneous expenses average 3 percent higher than for the trend future under farm programs in the years 1975-89. By 2000, however, production reaches full capacity in the trend future under farm programs raising fertilizer and lime, and seed expenses slightly above those of Simulation 3. Miscellaneous expenses are 3 percent higher in Simulation 3 in the year 2000.

Table 21. Estimated U.S. input expenditures in millions of 1972 dollars and labor requirements in millions of man-hours for 1985 and 2000 in Simulation 3, the maximum efficiency future at target prices, with 1970-72 actual for comparison.

Input	Actual 1970-72[a/]	1985	2000
Fertilizer and lime expense	2,441	3,983	4,460
Seed expense	1,027	1,115	1,272
Labor man-hours[b/]	6,490	5,940	5,358
Machinery expenses	8,270	8,582	11,077
Real estate expense	15,073	23,935	30,302
Fuel, oil and repairs	4,618	4,875	6,041
Miscellaneous expense	5,712	7,752	10,153
Interest expense	2,435	3,180	3,599
Real estate tax expense	3,194	3,588	4,581
Livestock feed	8,470	11,551	18,392
Livestock purchases	5,536	10,662	12,528

[a/] Source: Farm Income Situation [10].

[b/] Actual 1970-72; [38].

Increased efficiency for the maximum efficiency future has a major impact on labor requirements and machinery expense. National labor requirements in the maximum efficiency future are 5.9 billion man-hours in 1985 and 5.3 billion man-hours in 2000, averaging 8 percent below man-hour requirements of the trend future with farm programs. Increased farm size in the maximum efficiency future reduces the growth in machinery operating expenses by 9 percent in the maximum efficiency future, compared to the trend future under farm programs.

Consumer food costs are slightly higher in Simulation 3 than in the farm program trend future, where market prices are generally lower than target prices. In Simulation 1, however, farmers receive a cash subsidy to equal the difference between the farm price and target prices. After 1995 per capita food costs in the trend future under farm programs are higher than the maximum efficiency case at target prices because of price increases in the former alternative. Total per capita food costs for Simulation 3 increase from $557 in 1970-72 to $610 in 1985 and $639 in the year 2000. Most of the increase in per capita food costs is due to increases in meat consumption resulting from higher per capita incomes.

Results of Simulation 3 indicate that a substantial increase in net farm income, over levels of the trend future under farm programs, occurs because of higher production levels combined with farm size and locational cost efficiencies in the maximum efficiency future. The largest cost reductions are in labor requirements and machinery expenses. The gains in farm income of the maximum efficiency future at target prices rely on major increases in crop exports. Compared to the record export levels of 1973, wheat, feed grain, and cotton export levels will have to increase an average of 43 percent, 91 percent, and 215 percent, respectively, above 1973 levels in the years 1980-85 to attain both maximum efficiency and target prices.

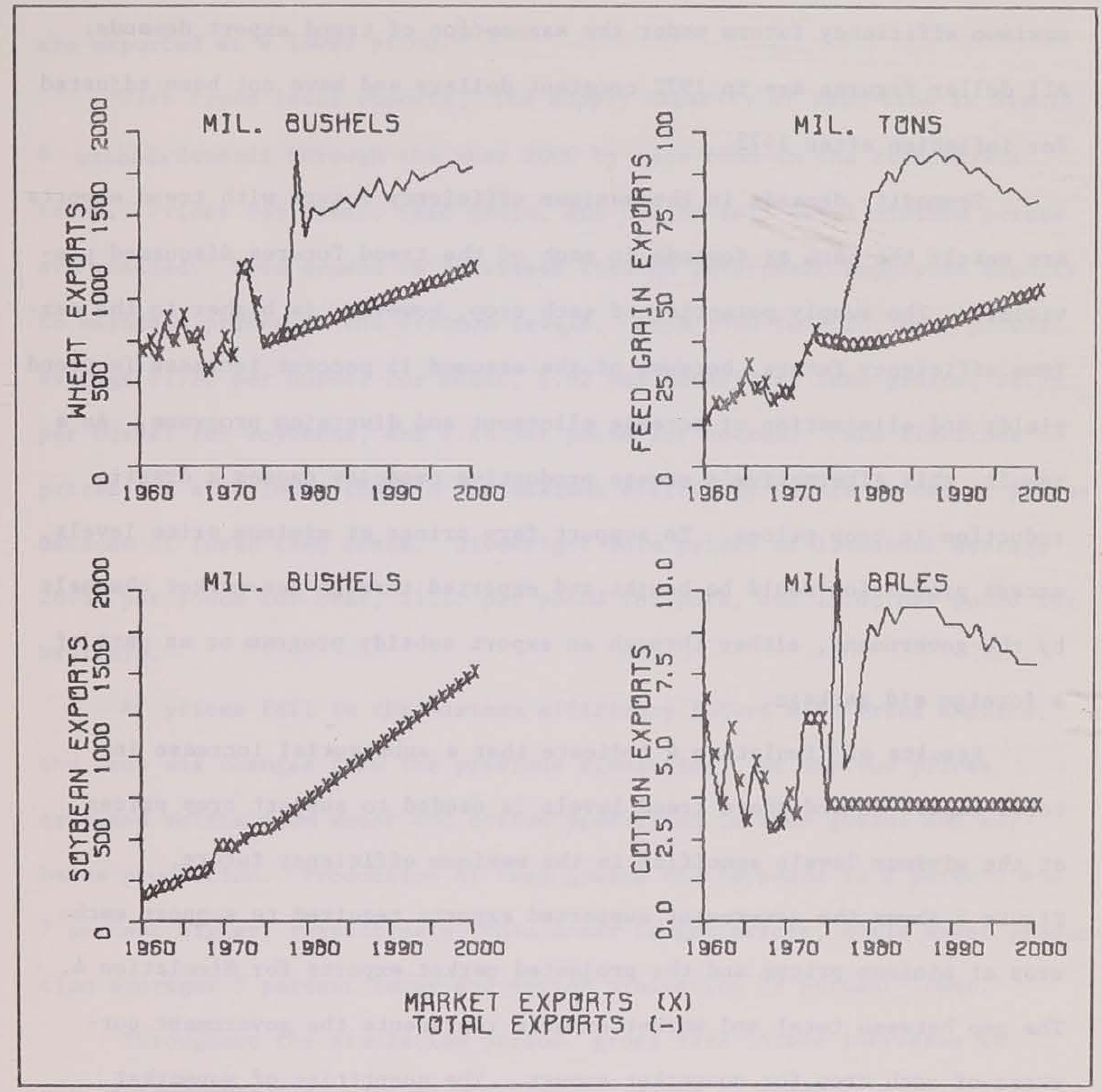
If export goals are achieved, the increased demand and savings from greater input efficiency will substantially increase farm income. Consumers will also benefit, since higher productivity levels keep food costs lower than under trend technology with high market exports.

Maximum Efficiency--Trend Exports (Simulation 4)

Policies in the maximum efficiency future are aimed at increasing production in American agriculture to meet domestic and foreign food demands through increased crop yields and removal of acreage control programs. Simulation 3 examined the maximum efficiency future when exports are sufficient to utilize the additional production and maintain farm prices at target levels. If recent export levels are not indicative of future agricultural exports, but merely a temporary phenomena caused by a shortage of fertilizer, poor weather, and other conditions, a critical concern would be the impact of the maximum efficiency future on farm prices and income.

Simulation 4 examines the maximum efficiency future when exports follow past historical growth trends. When a temporary crop surplus occurs in this alternative, the government would implement an export disposal program to prevent market prices from falling below $1.20 per bushel

Figure 5. Estimated total and market exports in Simulation 4, the maximum efficiency future with market exports at trend levels.[a]



Source: Actual and projected 1960-74 [7;11;12;20].

[a] Total exports include market exports and nonmarket exports by the government to support crop prices.

for wheat, \$.90 per bushel for feed grains, and 18¢ per pound for cotton.[7/] Comparisons are made with the maximum efficiency future at target prices (Simulation 3) to measure the impact of increased productive capacity of the maximum efficiency future under the assumption of trend export demands. All dollar figures are in 1972 constant dollars and have not been adjusted for inflation after 1972.

Commodity demands in the maximum efficiency future with trend exports are nearly the same as demands in each of the trend futures discussed previously. The supply potential of each crop, however, is higher in the maximum efficiency future, because of the assumed 15 percent increase in trend yields and elimination of acreage allotment and diversion programs. As a result, this alternative's excess productive capacity causes a drastic reduction in crop prices. To support farm prices at minimum price levels, excess production would be bought and exported through non-market channels by the government, either through an export subsidy program or as part of a foreign aid package.

Results of Simulation 4 indicate that a substantial increase in total export demand above trend levels is needed to support crop prices at the minimum levels specified in the maximum efficiency future. Figure 5 shows the government supported exports required to support each crop at minimum prices and the projected market exports for Simulation 4. The gap between total and market exports represents the government purchase of each crop for nonmarket export. The quantities of nonmarket exports required to support market prices at minimum levels averages

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[7/] This study assumes that a price support program would be implemented by the government to prevent a severe drop in farm prices, disturbing the goals of increased productive efficiency. Also, estimates of the government purchases needed to support prices present the excess supply for each crop in agriculture for each year.

676.6 million bushels of wheat, 44.1 million tons of feed grains, and 5.4 million bales of cotton for the years 1980 to 2000. The total value of government purchases averages $1.355 billion per year in this time period, some of which could be recovered if government purchases are exported at a lower price.[8/]

With trend level exports, the supply capacity of each crop in Simulation 4 exceeds demands through the year 2000 by more than in the free market trend. Prices for wheat, feed grain, and cotton fall until minimum prices are reached. Then demand is increased through government supported exports to maintain prices at the minimum levels. From 1980 to 2000, crop prices average $1.22 per bushel for wheat, $.92 per bushel for feed grains, $2.79 per bushel for soybeans, and $.18 per pound for cotton. Farm livestock prices are also lower than in the maximum efficiency future at target prices because of lower feed costs. Liveweight farm prices of livestock average 26.5¢ per pound for beef, 21.2¢ per pound for pork, and 15.4¢ per pound for broilers.

As prices fall in the maximum efficiency future with trend exports, the crop mix changes from the previous simulation. At minimum prices cropland shifts from wheat and cotton production to feed grains and soybeans production. Production of feed grains and soybeans is 2 percent and 7 percent higher, respectively, than under target prices, while wheat production averages 5 percent lower and cotton production 28 percent lower.

Throughout the simulation period, gross farm income increases in the maximum efficiency future with trend exports as production increases and crop prices are supported at minimum levels. However, gross farm income

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[8/] If government export levels are not feasible, then acreage diversion required for each crop can be calculated from the annual yield for each crop. If government exports were replaced by land set aside, it would require an average of 34.7 million acres for the period 1980-89 and average 27.2 million acres for the period 1975-2000.

averages 19 percent below that in the maximum efficiency future at target prices because of lower crop and livestock prices. Gross farm income in 1985 is estimated at $74.8 billion in Simulation 4, which is lower than the $92.1 billion estimated for the maximum efficiency future at target prices. In the year 2000, gross farm income is $89.0 billion, 20 percent lower than in the previous alternative. Lower prices and lower production levels for wheat and cotton reduce gross income an average of 42 percent for wheat and 64 percent for cotton, compared to the maximum efficiency future at target prices. Although production of livestock, feed grain, and soybeans is higher in Simulation 4 than in the previous simulation, gross sector income is reduced 15 percent for livestock, 33 percent for feed grains, and 20 percent for soybeans because of lower commodity prices in Simulation 4.

National production expenses average 3.8 percent lower in Simulation 4 than in the maximum efficiency future at target prices because of reduced capital input usage at lower crop prices and a change in the crop mix. The reduction in input use is small, however, compared to the reduction in crop prices.

Net farm income increases slightly in Simulation 4, because of growing production, from $16.4 billion in 1975-79 to $18.4 billion in 1985-89 and $18.1 billion in 1995-99. However, because of lower crop and livestock prices under trend export levels, net farm income averages 46 percent lower than in the maximum efficiency future at target prices. Compared to the trend future under farm programs (Simulation 1), net farm income averages 34 percent lower because of lower crop prices. Thus, if exports fail to increase above trend levels in the maximum efficiency future, cost efficiencies from larger farms and shifts in production location are offset by lower crop prices.

Because of lower farm prices and incomes, farm assets in the maximum efficiency future with trend exports average 8 percent lower than in the maximum efficiency case at target prices. Larger crop inventories increase the value of commodity stocks 2 percent above the target price future. Lower gross incomes with trend exports reduce machinery purchases 13 percent, thereby reducing machinery stock 11 percent below stocks in the maximum efficiency case at target prices. Low farm prices reduce growth in the value of land and buildings 13 percent below values in Simulation 3. By 2000 total farm assets grow to $526.9 billion compared to $586.6 billion in the maximum efficiency future with target prices.

Growth in resource use in the maximum efficiency future at trend exports is lower than in the target price case, because of lower farm prices and reduced farm assets. Fertilizer and lime expenditures show the largest reduction, falling 16 percent below expenditures in the maximum efficiency future at target prices. Machinery operating expenses and miscellaneous expenses average 4.6 percent and 5.3 percent lower than in the previous future due to lower machinery stocks and farm prices under trend exports in the maximum efficiency future. Expenses of durable inputs average 8 percent lower for machinery stocks and 10 percent lower for real estate expenses in Simulation 4.

Lower crop prices in Simulation 4 and a change in the production mix significantly change resource use within the commodity sectors. Total resource use in the wheat and cotton sectors averages 14 percent and 41 percent lower, respectively because of reduced production and lower prices, than in the previous maximum efficiency future. Total resource use devoted to feed grain and soybean production averages 18 percent and 2 percent lower due to lower crop prices in the maximum efficiency future with trend exports. Production increases in the livestock sector offset the reduction in input use caused by lower livestock prices in the trend export case.

Consumer food costs in the maximum efficiency future with trend exports are significantly lower than the maximum efficiency future which maintains target prices. Estimates for total per capita food costs increase from $557 in 1969-72 to $594 in the year 2000. The impact of lower crop and livestock prices is reduced as per capita meat consumption rises from 189 pounds in 1970-72 to 254 pounds in 2000. Thus, consumers are expected to use a portion of the gains from lower livestock prices to consume more meat.

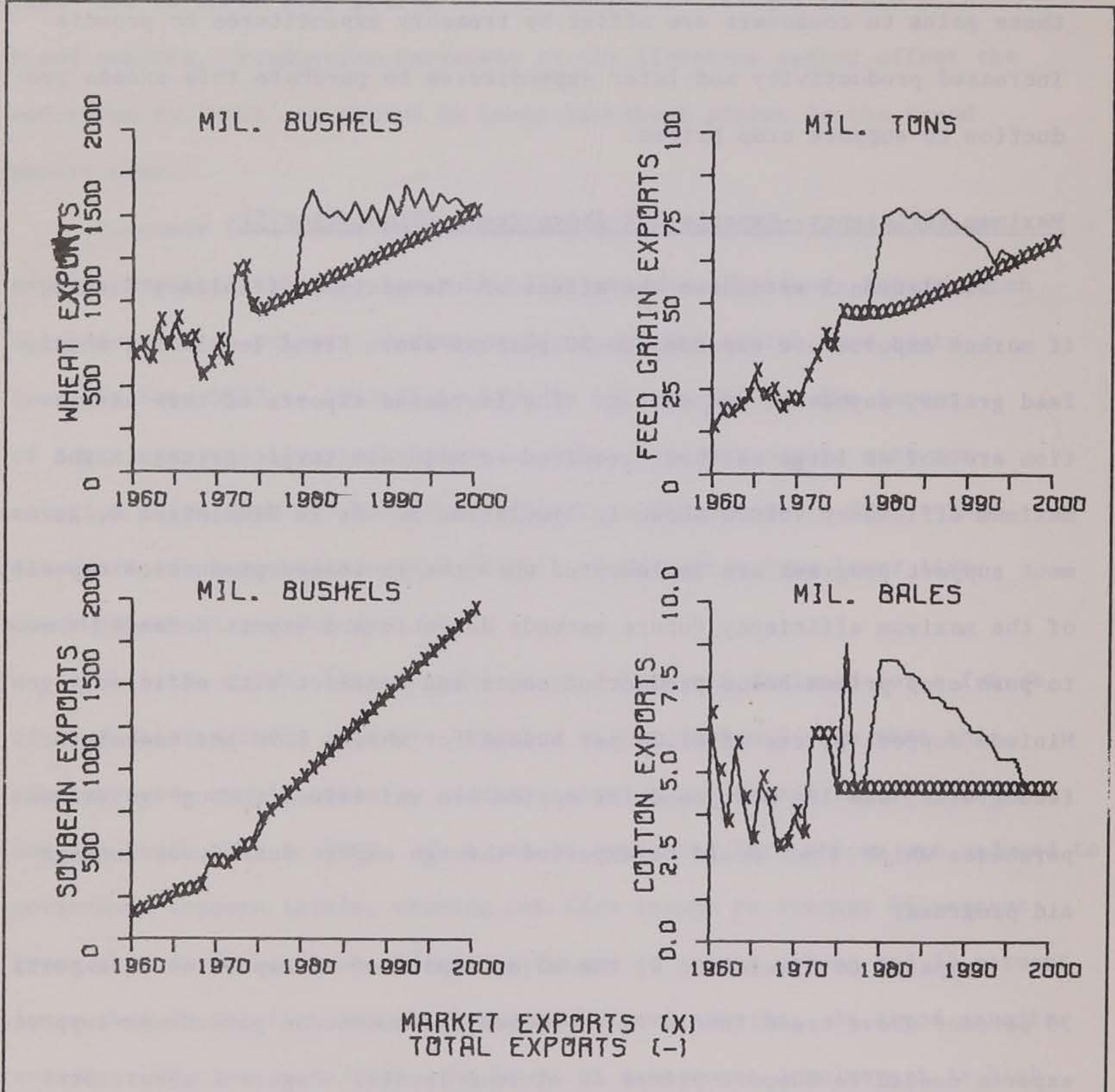
Policies in the maximum efficiency future are designed for a future of large agricultural exports. Results of Simulation 4 show that this alternative's supply capacity exceeds trend export demand levels throughout the years 1975 to 2000. As a result estimated farm prices are reduced to government support levels, causing net farm income to average 46 percent lower than in the maximum efficiency future at target prices and 34 percent lower than in the farm program trend with trend exports. At trend exports and no production restraints, the level of government involvement is high in terms of government-supported exports, even at relatively low levels of price support. The higher crop yields of the maximum efficiency future merely aggrevate the oversupply problem experienced in the trend futures (Simulation 1 and 2) when exports grow at trend levels. Although consumer food costs are lower in Simulation 4 because of lower crop prices, some of these gains to consumers are offset by treasury expenditures to promote increased productivity and later expenditures to purchase this excess production to support crop prices.

Maximum Efficiency--Exports 30% Above Trend (Simulation 5)

Simulation 5 estimates the effect of the maximum efficiency future if market exports are expanded to 30 percent above trend levels for wheat, feed grains, soybeans, and cotton. The increased exports of this simulation are not as large as those required to maintain target prices in the maximum efficiency future shown in Simulation 3. As in Simulation 4, government support programs are implemented when the increased production capacity of the maximum efficiency future exceeds domestic and export demands threatening to push crop prices below production costs and conflict with efficiency goals. Minimum support prices of $1.20 per bushel for wheat, $.90 per bushel for feed grains, and 18¢ per pound for cotton are maintained through government purchases which then could be exported through export subsidy or foreign aid programs.

Compared to Simulation 4, the major impact of an expansion of exports 30 percent above trend levels is to reduce the amount of government-supported exports needed to support prices at minimum levels. Figure 6 shows total crop exports and market exports for wheat, feed grains, soybeans, and cotton for Simulation 5. The gap between total and market export represents the government exports needed to support prices at minimum levels. Supported

Figure 6. Estimated total and market exports in Simulation 5, the maximum efficiency future with market exports 30 percent above trend levels.[a]



Source: Actual and projected 1960-74 exports [7;11;12;20].

[a] Total exports include market exports and nonmarket exports by the government to support crop prices.

export levels are sharply reduced for each crop because of increased market exports. The 30 percent increase in market exports reduces government-supported export levels to less than 40 percent of support levels in the maximum efficiency future with trend exports. Support levels in Simulation 5 average 348 million bushels of wheat, 20.2 million tons of feed grains, and 2.7 million bales of cotton in the years 1980 to 1994.[9/]

The higher soybean demand of Simulation 5 increases soybean acreage 17 percent, an average of 10.3 million acres, above soybean acres in the previous simulation. In response to the increase in soybean acres, acreage of other crops declines an average of 3.3 million acres for wheat, 5.0 million acres of feed grains, and 1.3 million acres of cotton, compared to the maximum efficiency future with trend export levels. Cropland not in production in the trend export case is reduced by .7 million acres in Simulation 5. In the year 2000, planted acres for this alternative are 49.9 million acres of wheat, 107.7 million acres of feed grains, 83.2 million acres of soybeans, and 9.2 million acres of cotton.

Although a 30 percent expansion in trend exports in the maximum efficiency future reduces levels of government support, commodity prices are nearly the same as for the maximum efficiency future with trend exports. Crop prices average \$1.31 per bushel of wheat, \$1.00 per bushel of feed grains, \$2.85 per bushel of soybeans, and 18.3¢ per pound of cotton. Commodity prices increase slightly after 1995 as growing market demands catch up with production levels.

Until 1995 gross farm income under Simulation 5 is approximately the same as in the trend export maximum efficiency future. Then prices increase

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[9/] Converting this into set-aside acreage requires an average 18.6 million acres from 1980-89 with an average 10.1 million acres each year from 1975-2000.

slightly in Simulation 5, as the 30 percent increase in crop exports utilize the production capacity of the maximum efficiency future. Estimated gross farm income is 2000 is $93.5 billion, a slight increase above the $89.0 billion in the maximum efficiency future with trend exports, but significantly lower than the $111.4 billion in the maximum efficiency case at target prices. Although crop prices in Simulation 5 are nearly the same as in the case with trend exports, the crop mix shifts to increased soybean production. Lower soybean prices offset the increased soybean production, resulting in only a one percent increase in gross income in the soybean sector in Simulation 5. Compared to the maximum efficiency future where exports maintain target prices, gross sector income averages 42 percent less for wheat, 35 percent less for feed grains, 67 percent less for cotton, and 14 percent less for livestock when export grew only 30 percent above trend levels.

Production expenses in Simulation 5 are approximately the same as in Simulation 4, averaging 4.2 percent below production expenses in the maximum efficiency future at target prices. As a result, the impact of lower gross income is felt primarily by lower net farm income. Estimated net farm income in Simulation 5 averages 42 percent lower than in the maximum efficiency future, where exports maintain target prices. Farm income increases throughout the period as domestic and export demands expand. Net farm income in Simulation 5 increases to $19.3 billion in 1985 and to $23.7 billion in the year 2000.

Estimated capital stocks in the maximum efficiency future with a 30 percent increase in trend exports are approximately the same as in the trend export case (Simulation 4) although they are 8 percent lower than under the maximum efficiency future at target prices (Simulation 3). Increased soybean exports reduce crop inventories which lowers the value of commodity stocks compared to the trend export case. Changing the crop mix toward soybeans in Simulation 5 increases machinery purchases and machinery stocks when compared to the maximum efficiency future with trend exports.

Input usage in the maximum efficiency future with a 30 percent increase in trend exports is lower than in the maximum efficiency case with target prices because of lower farm prices and incomes in Simulation 5. Compared to the target price case, expenditures are 18 percent lower for fertilizer and lime, 4 percent lower for machinery operating expenses, and 3 percent lower for miscellaneous expenses. Expenses for durable stocks average 8 percent lower for machinery expenses and 9 percent lower for real estate expenses as machinery stocks and land values increase at a slower rate in Simulation 5 than under the target price case.

Compared to the maximum efficiency future with trend exports, total input use changes very little. However, the resource mix and distribution does show some change in Simulation 5 compared to the trend export case. The increase in soybean production reduces the production of other crops. Fertilizer expenditures are 2.5 percent lower and seed expense 2.5 percent higher than in the trend export case. Resources shift from the wheat, feed grains, and cotton production to soybean production because of the 17 percent increase in soybean acreage and the decline in the acreage of wheat, feed grains, and cotton.

Consumer food expenditures with 30 percent expanded exports are nearly the same as in the maximum efficiency future with trend exports. A slight rise in commdity prices, however, increases per capita food cost to $603 in 2000, slightly above expenditures in the trend export case.

A 30 percent increase in trend exports of wheat, feed grains, soybeans, and cotton has little effect on increasing net income to the farming sector above that in the trend export, maximum efficiency future (Simulation 4). Estimated net farm income averages 42 percent lower than in the maximum efficiency future, where high exports maintain target prices and 29 percent lower than in the trend future under farm programs. The primary effect of a 30 percent increase in crop exports above trend levels is to significantly reduce the government's role in disposing of surplus commodities. A minor effect is the shifting of resources to the soybean sector from primarily the feed grain sector.

Maximum Efficiency--Exports 50% Above Trend (Simulation 6)

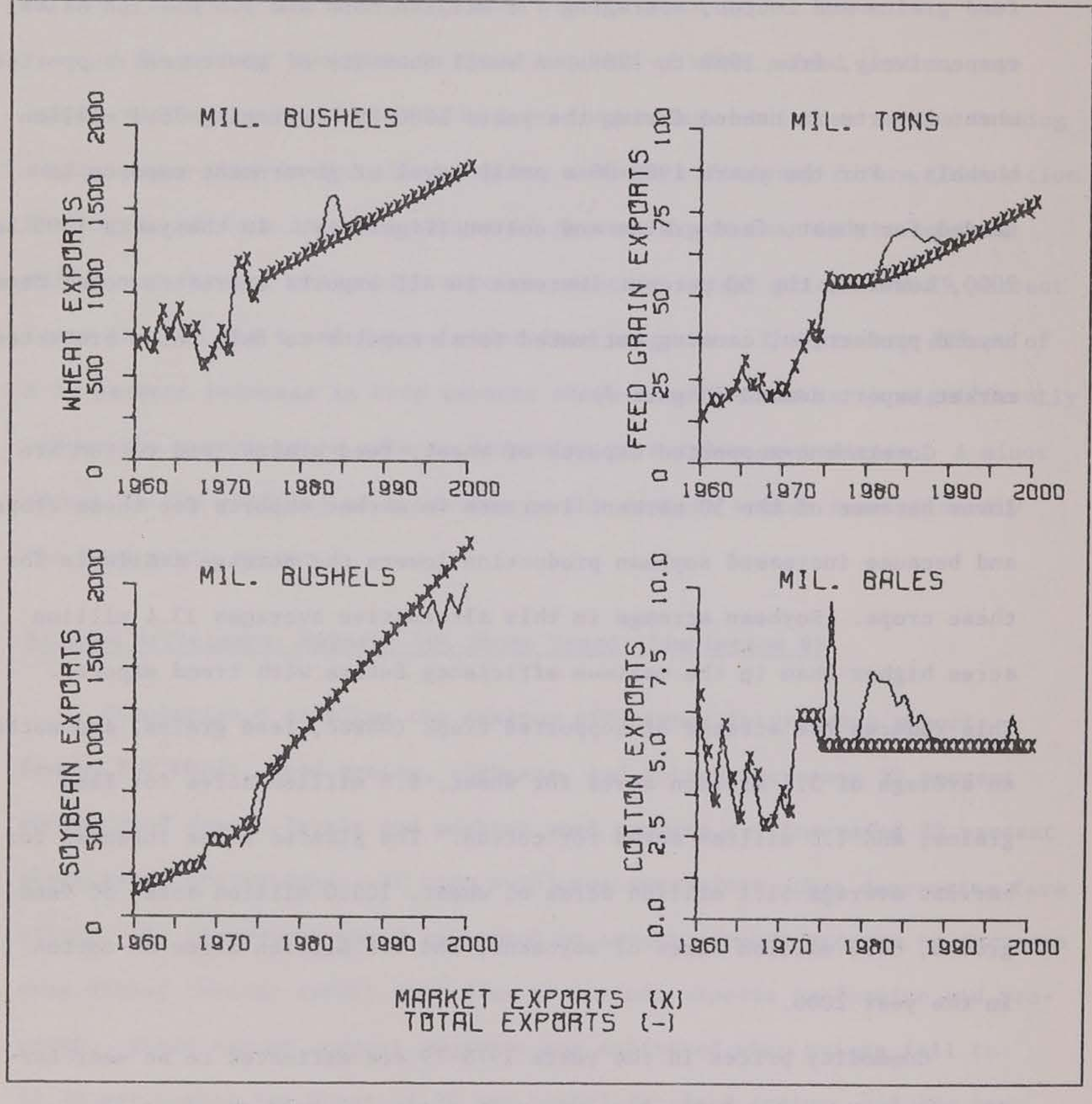
Simulation 6 examines the maximum efficiency future when export demand for wheat, feed grains, soybeans, and cotton increases 50 percent above trend export levels and soybean meal exports are increased 25 percent above trend projections. If crop surpluses accumulate, thus depressing farm prices, the government would implement an export support program to increase crop demand through export subsidies or include exports in foreign aid programs. These export support programs are activated when prices fall to $1.20 per bushel for wheat, $.90 per bushel for feed grains, and 18¢ per pound for cotton.

Increasing crop exports to 50 percent above trend levels sharply reduces the amounts of government-supported exports, compared to the two previous simulations. Supported exports are practically eliminated for feed grains and cotton, averaging 7.1 million tons and 1.4 million bales, respectively, from 1980 to 1989. A small quantity of government-supported wheat exports is needed during the years 1980-89, averaging 76.1 million bushels. For the years 1980-89 a small level of government exports is needed for wheat, feed grains and cotton (Figure 7). In the years 1995 to 2000, however, the 50 percent increase in all exports increases total demand beyond production, causing estimated total exports to fall below projected market export demand (Figure 7).

Government-supported exports of wheat, feed grains, and cotton are lower because of the 50 percent increase in market exports for these crops and because increased soybean production lowers the acreage available for these crops. Soybean acreage in this alternative averages 13.4 million acres higher than in the maximum efficiency future with trend exports. This reduces the acreage of supported crops (wheat, feed grains, and cotton) an average of 3.1 million acres for wheat, 6.8 million acres for feed grains, and 1.6 million acres for cotton. The planted acres intended for harvest average 51.1 million acres of wheat, 105.0 million acres of feed grains, 84.1 million acres of soybeans, and 9.8 million acres of cotton in the year 2000.

Commodity prices in the years 1975-79 are estimated to be near target prices because of the low crop inventories of 1972-74; a 50 percent increase in trend exports from 1975-79; and the assumption that maximum

Figure 7. Estimated total and market exports in Simulation 6, the maximum efficiency future with market exports 50 percent above trend levels.[a]



Source: Actual and projected 1960-74 exports [7;11;12;20].

[a] Total exports include market exports and nonmarket exports by the government to support crop prices.

efficiency yields do not reach full potential until 1980. By 1980, however, yields are a full 15 percent above trend yields. In the years 1980-94, crop prices fall to the minimum levels. Only low levels of government-supported exports are needed because of exports 50 percent above trend levels. Crop prices in the maximum efficiency future with a 50 percent increase in trend exports average 1.29 per bushel of wheat, $.94 per bushel of feed grains, $2.90 per bushel of soybeans, and 18.4¢ per pound of cotton in the years 1980-94. In the years 1990-94, prices increase slightly and continue to increase rapidly from 1995 to 2000 as crop demands increase faster than crop yields. By the year 2000, crop production is unable to meet export demands for feed grains, and the feed grain price increases substantially. Crop prices in the year 2000 reach $1.81 per bushel of wheat, $1.72 per bushel of feed grains, $4.48 per bushel of soybeans, and 18.4¢ per pound of cotton with Simulation 6 export demands. Farm livestock prices on a liveweight basis are 38.6¢ per pound of beef, 28.6¢ per pound of pork, and 20.8¢ per pound of broilers in the year 2000.

As expected, gross farm income follows the same pattern as farm prices. In the years 1975-79, gross farm income is estimated to be $75.1 billion with a 50 percent increase in trend exports. This compares to $77.8 billion in the maximum efficiency future at target prices. For the years 1980-94, however, gross farm income averages $77.3 billion, 18 percent lower than $93.8 gross farm income in the target price case. High export levels, 50 percent above trend levels, and growing domestic demands increase crop prices and gross farm income to an average of $101.8 billion from 1995 to 2000. This is still less than the $107.2 billion estimate in the target price case, however.

Net farm income follows the same pattern as gross income. Production expenses in Simulation 6 are only 5 percent lower in 1980-94 than in the maximum efficiency future at target prices. As a result lower gross income is almost entirely translated into a reduction in net farm income in Simulation 6. In 1980-94 net farm income averages $20.0 billion, compared to $34.1 billion in the target efficiency future. From 1995 to 1999, net farm income averages $31.8 billion, approximately 14 percent lower than net farm income in the target price case. By 2000 a 50 percent increase in trend exports and growing domestic demands increases net farm income in this situation to $42.2 billion.

From 1980-94 total farm assets average 7 percent lower than under the maximum efficiency future at target prices. The primary factor slowing the growth of farm assets values in Simulation 6 is the small growth in the value of land and buildings because of lower crop prices. The value of land and buildings averages 8 percent lower than in the target price case.

Input usage in the maximum efficiency with export levels 50 percent above trend is lower than in the maximum efficiency future at target prices because of lower prices and incomes in the years 1980 to 1995. Fertilizer and lime expenditures averages 15 percent lower than in the target price case. Reduced land values lower real estate expenses and real estate taxes 7 percent in Simulation 6. All other inputs, except seed expenses, show reductions of 1 to 6 percent compared to the target price case. Seed expenses increase an average of 3 percent because of higher levels of soybean production in Simulation 6. Increasing the exports of soybeans 50 percent above trend levels changes the crop mix and generally reduces resource use by wheat, feed grains, and cotton production and increases resource use in the soybean sector.

Consumer food expenditures in 1975-79 and in 1995-2000 are only slightly below food costs in the maximum efficiency future at target prices. However, because of low crop prices in Simulation 6, food costs in the years 1980-94 average 4 percent lower than in the maximum efficiency future at target prices.

In the maximum efficiency future, agricultural policy is aimed at increasing crop yields and resource efficiency above trend levels. Expansion of crop exports 50 percent above trend export growth does not provide sufficient demand to operate at full production and maintain reasonable farm prices before 1994. In the years 1980-94, the capacity to produce exceeds crop demands, even with a large expansion in export trends, and the result is relatively low farm prices and incomes from 1980 until approximately 1995. Exports above a 50 percent increase in trend levels for all crops will have to be maintained in the years 1980-85 to prevent an even further decline in farm prices and incomes in this situation. Expansion of market exports to 50 percent above trend levels transfers benefits of increased farm efficiency to consumers through lower food costs and lower treasury costs until 1994. After 1995 food costs are bid up by higher crop prices as expanded exports reach the supply capacity of agriculture.

Maximum Efficiency--Exports 100% Above Trend (Simulation 7)

A situation in which world food demands exceed American agriculture's capacity to produce, leading to rising food prices (as in 1972-74), is examined in Simulation 7. Although an infinite number of export combinations are possible to represent higher export levels, each having a different impact on crop prices and crop production mix, the high export levels chosen for Simulation 7 result from a doubling in trend export demands. This export level is a major increase for exports of all crops and, as in the trend export projections, emphasizes increases in feed grain and soybean exports.

Although doubling trend exports is a substantial increase in crop exports, the impact on total demand for each crop depends on the proportion of total demand represented by exports. Using the domestic demands of Simulation 1 as a base, a doubling of trend exports increases total demand 55 percent for wheat and 52 percent for soybeans in the year 2000. However, total demand for feed grains and cotton, both of which rely mainly on domestic demand, increases 14 and 21 percent, respectively, when trend exports are doubled.

The major impact of the high export levels in Simulation 7 is higher crop and livestock prices. Crop prices increase to $2.62 per bushel of wheat, $2.02 per bushel of feed grains, $5.70 per bushel of soybeans, and $.23 per pound of cotton in 1985. Total demand increases rapidly in the years 1975 to 2000 due to rapid growth in agricultural exports and a growing U.S. population which is assumed to reach 300 million people by 2000. In the year 2000 demand pressure in the maximum efficiency future under high exports raises crop prices to \$2.99 per bushel for wheat, \$2.45 per bushel for feed grains, \$7.06 per bushel for soybeans, and \$.63 per pound of cotton. Because of the rising feed costs in this situation, liveweight farm prices for livestock increase to 61¢ per pound of beef, 42¢ per pound of pork, 30¢ per pound of broilers, and 52¢ per pound of mutton in the year 2000.

In response to higher prices in Simulation 7, agriculture produces at full capacity under the maximum efficiency future. The resulting production mix is determined by relative crop prices. Compared to the maximum efficiency future at target prices (Simulation 3), farmers reduce planted acres of wheat, feed grains, and cotton to increase soybean production. Growing crop demands constrained by a limited land base increases soybean acreage to 89.1 million acres while reducing acreage of wheat to 52.5 million acres, with 100.3 million acres of feed grains, and 8.0 million acres of cotton in the year 2000.

Because crop demands exceed productive capacity of the maximum efficiency future in Simulation 7, projected crop export demands (double trend levels) are not met. Instead, exports are reduced to production in excess of domestic demands. Higher soybean and wheat prices increase total wheat and soybean production and allow wheat exports to increase to 1,680 million bushels and soybean exports to increase to 2,271 million bushels in the year 2000. Although feed grain prices increase over time, the growth in soybean prices and acreage reduces the growth in feed grain production compared to the target price case. This shift in the acreage mix reduces feed grain exports from 69.3 million tons in 1985 to 59.5 million tons in 2000.

As expected, estimated gross farm income grows substantially under the high export case. Crop prices and total production increase annually, causing gross farm income to increase to $107.7 billion in 1985 and $152.9 billion in 2000. For soybeans, higher prices and production levels increase gross income 114 percent above level of the maximum efficiency future at target prices. Higher prices offset lower production levels in the high export case and raise gross income 23 percent for livestock, 26 percent for wheat, and 39 percent for feed grains, compared to the maximum efficiency future where exports keep prices at the 1973 legislated target levels. Cotton gross income is lower than in the target price case because of lower cotton production in Simulation 7 and lower crop prices in the years 1975-89. The 6.8 million bales of cotton exports was not sufficient to support prices at target levels in Simulation 7.

Production expenses in the high export maximum efficiency future are slightly higher than in the maximum efficiency future at target prices because of a general income in input use resulting from higher crop prices. Because gross farm income averages 24 percent higher than in the target price case and production expenses only 5 percent higher, net farm income is 59 percent higher in Simulation 7. Growing production levels and rising prices increase net farm income to $48.2 billion in 1985 and $73.3 billion in 2000.

The value of farm assets increases rapidly in the maximum efficiency future under high exports because of rising land values and increases in machinery stock. Estimated total farm assets increase to $497 billion in

1985 and $684 billion in the year 2000. This is more than double the $306 billion of 1965-67. The value of land and buildings, a major portion of total farm assets, increases from $220 billion in 1965-67 to $542 billion in 2000 because of increasing land prices following the rise in crop prices. This increase is 20 percent higher than the $450.5 billion reached in the target price case. Machinery stocks also respond to higher crop prices by increasing to $51.9 billion in 2000. This is double the 1965-67 average of $26.5 billion. Total machinery stocks increase 30 percent above the target price case in the year 2000 because of the higher crop prices in the high export case.

Crop prices increase from 1975 to 2000 causing a growth in demand for farm inputs above the growth in the maximum efficiency future at target prices. The growing farm asset values in the high export maximum efficiency future expands the farmer's borrowing base and, combined with the rise in farm prices, encourages increased input use per acre from 1975 to 2000.

Increases in crop prices from 1975 to 2000 under the high export case encourage higher application rates of fertilizer for all crops. Fertilizer and lime expenditures increase to $5.3 billion, 13 percent higher than the $4.4 billion in Simulation 3, and double the $2.4 billion applied in 1970-72. Higher prices in the high export case increase the growth of input expenditures over that of the maximum efficiency future at target prices by an average of 16 percent for machinery depreciation, 10 percent for machinery operating expenses, 10 percent for real estate expenses, 11 percent for miscellaneous expenses, and 12 percent for real estate taxes. Seed expenditures increases in the high exports case from $1,027 million in 1970-72 to $1,316 million in the year 2000 due primarily to the rapid growth of soybean production.

Livestock purchases reach $10.7 billion in 2000. However, this is lower than the $12.5 billion in the target price case because of lower meat consumption caused by higher livestock prices in the high export case. Livestock feed expenditures increase from 1975 to 2000 because of rising feed prices. Livestock feed expenditures increase from $8.5 billion in 1970-72 to $19.2 billion in 2000, compared to $18.4 billion of the target price case.

Labor requirements decline to 5.1 billion man-hours by 2000 in the maximum efficiency future at high export levels. This is lower than any of the other maximum efficiency futures (Simulation 3-6). Reduced meat consumption (217 pounds per capita in 2000) compared to the maximum efficiency future at target prices (244 pounds per capita in 2000) reduces man-hour requirements for livestock 8 percent by the year 2000.

As expected food costs measured in 1972 real dollars are higher in Simulation 7 than in other futures. Per capita food costs increase to $691 in the year 2000. The effects of higher livestock prices is reduced partially by a lowering of per capita meat consumption.

Also expected the effect of high exports in the maximum efficiency future increases crop prices throughout the simulation period as export and domestic demands grow faster than increases in crop yields. High crop prices and increasing production levels for all crops increase the returns to agriculture and raise net farm income from $17.5 billion in 1972 to $73.3

billion in 2000. High prices and increased capital formation increase the growth of farm inputs used in agriculture. Labor requirements in agriculture are reduced, relative to the other futures, by high crop prices which lower livestock demand. Consumers feel the effect of high exports through higher food costs which increases food costs 11 percent above the maximum efficiency future at target prices.

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APPENDIX A--MODEL EQUATIONS

The estimated equations, assumed equations, and identities of the simulation model are presented in this appendix. The names of the variables used in the equations are presented in Tabel A.1. Each equation which is estimated econometrically is accompanied by its summary statistics. The coefficient's standard error is presented in parentheses below the coefficient. The estimation procedure used to estimate each equation is indicated by the following letters: LS for ordinary least squares; ALS for autoregressive least squares; 2SLS for two-stage least squares; and ATS for autoregressive, two-stage least squares. The coefficient of autocorrelation, ρ, the Durbin-Watson d, the R^2, and the mean square error, MSE, are also presented. Equations which do not have summary statistics were obtained by assumption or by modification of an estimated equation.

Livestock Submodel

Pre-Input Section

$$\text{L-LPUR}_t = -884.5171 + \underset{(1.8516)}{24.0218}\ \text{FG-PROD}_{t-1}$$

LS d = 1.69 R^2 = .824 MSE = 98,479.2487

$$\text{L-STK}_t = 3780.9 + \underset{(.2971)}{.8766}\ \text{L-LPUR}_t + \underset{(.1277)}{.6105}\ \text{L-STK}_{t-1}$$

2SLS d = 1.65 R^2 = .901 MSE = 315,211

$$\text{L-STKAVE}_t = (\text{L-STK}_{t-1} + \text{L-STK}_t)/2$$

$$\text{L-MPUR}_t = .3125 + \underset{(15.9188)}{53.5906}\ \text{POSTWARDUMY} + \underset{(.0021)}{.0049}\ \text{L-GINC}_{t-1} + \underset{(.6869)}{2.3647}\ \text{TIME} + \underset{(.1429)}{.2929}\ \text{L-MPUR}_{t-1}$$

LS d = 1.99 R^2 = .907 MSE = 514.43

$$L\text{-}MSTK_t = -37.532 + \underset{(.1947)}{1.2174}\ L\text{-}MPUR_t + \underset{(.0300)}{.8721}\ L\text{-}MSTK_{t-1}$$

2SLS $\quad d = 1.75 \quad R^2 = .989 \quad MSE = 2,356.7$

$$L\text{-}MSTKAVE_t = (L\text{-}MSTK_{t-1} + L\text{-}MSTK_t)/2$$

$$L\text{-}VALA_t = -16.633 + \underset{(.0910)}{.0996}\ L\text{-}GINC_{t-1} + \underset{(63.4461)}{108.0093}\ TIME + \underset{(.0608)}{.9246}\ L\text{-}VALA_{t-1}$$

ALS $\quad \rho = \underset{(.1467)}{-.6032} \quad d = 1.89 \quad R^2 = .971 \quad MSE = 2,869,794.$

$$L\text{-}SPA_t = L\text{-}STKAVE_t + L\text{-}MSTKAVE_t + L\text{-}VALA_t$$

Input Section

$$L\text{-}FEED_t = 112.1565 + \underset{(.0105)}{.0155}\ GCAU_t + \underset{(.0423)}{.0593}\ L\text{-}GINC_{t-1} + \underset{(4.7555)}{7.9041}\ FG\text{-}PR_t$$

ALS $\quad \rho = \underset{(.0267)}{1.0216} \quad d = 2.12 \quad R^2 = .9807 \quad MSE = 88,155.8527$

$$L\text{-}LABR_t/GCAU_t = .0669 - \underset{(.0014)}{.0132}\ LN(TIME)_t$$

LS $\quad d = .221 \quad R^2 = .802 \quad MSE = .00003$

$$L\text{-}LABR_t = L\text{-}LABR/GCAU_t * GCAU_t$$

$$L\text{-}MACH_t = 43.5581 + \underset{(.0148)}{.1467}\ L\text{-}MSTKAVE_t$$

ALS $\quad \rho = \underset{(.1649)}{.3603} \quad d = 2.13 \quad R^2 = .937 \quad MSE = 30.619$

$$L\text{-}RE_t = 366.672 + \underset{(.011)}{.0434}\ L\text{-}VALA_t + \underset{(.8990)}{8.1235}\ TIME$$

ATS $\quad \rho = \underset{(.0844)}{-.3260} \quad d = .619 \quad R^2 = .996 \quad MSE = 999.379$

$$L\text{-}FOR_t = 226.23 + \underset{(.0269)}{.0128}\ L\text{-}MSTKAVE_t - \underset{(.6245)}{1.4906}\ US\text{-}MSPI_{t-1} + \underset{(.1302)}{.7905}\ L\text{-}FOR_{t-1}$$

2SLS $\quad d = 2.38 \quad R^2 = .990 \quad MSE = 251.0$

$$L\text{-}MISC_t = 168.1829 + \underset{(.0020)}{.0169}\ L\text{-}SPA_t - \underset{(1.6277)}{5.3965}\ US\text{-}FSPI_{t-1} + \underset{(7.2887)}{18.1500}\ TM61 + \underset{(.1033)}{.1712}\ L\text{-}MISC_{t-1}$$

ALS $\quad \rho = \underset{(.1715)}{.4253} \quad d = 1.78 \quad R^2 = .993 \quad MSE = 861.53$

$$L\text{-}INT_t = 46.878 + \underset{(.0030)}{.0563}\ L\text{-}STKAVE_t$$

ATS $\rho = \underset{(.1484)}{.3134}$ $d = 1.45$ $R^2 = .958$ MSE = 421.71

$$L\text{-}RETX_t = L\text{-}VALA * L\text{-}TXRT_t$$

Output Section

Livestock demands, prices, and Grain Consuming Animal Units are obtained from the Domestic Demand Section presented in Appendix B. Livestock Gross Income, $L\text{-}GINC_t$, is obtained as the sum of all types of livestock production times their respective prices.

Feed Grain Submodel

Pre-Input Section

$$FG\text{-}AC_t = 114.88 + \underset{(.5279)}{.7897}\ FG\text{-}PR_{t-1} - \underset{(11.7482)}{15.8956}\ S\text{-}PR_{t-1} - \underset{(.1555)}{.6784}\ FG\text{-}ACDIV_t + \underset{(.13014)}{.1316}\ FG\text{-}AC_{t-1}$$

LS $d = 1.98$ $R^2 = .935$ MSE = 20.789.

$$FG\text{-}STK_t = -34.22 + \underset{(2.9274)}{41.7228}\ FG\text{-}PROD_{t-1}$$

ALS $\rho = \underset{(.1515)}{-.4845}$ $d = 2.04$ $R^2 = .723$ MSE = 449,147.

$$FG\text{-}STKAVE_t = (FG\text{-}STK_{t-1} + FG\text{-}STK_t)/2$$

$$FG\text{-}MPUR_t = 88.8782 + \underset{(86.0408)}{284.1584}\ POSTWARDUMY + \underset{(10.5967)}{39.4036}\ FG\text{-}EQTY_{t-1} + \underset{(.0445)}{.1025}\ FG\text{-}GINC_{t-1}$$

ALS $\rho = \underset{(.1624)}{.4242}$ $d = 1.87$ $R^2 = .871$ MSE = 12,344.

$$FG\text{-}MSTK_t = -18.351 + \underset{(17.47)}{.9295}\ FG\text{-}MPUR_t + \underset{(.0450)}{.7980}\ FG\text{-}MSTK_{t-1}$$

2SLS $d = 2.43$ $R^2 = .963$ MSE = 46,436.

$$FG\text{-}MSTKAVE_t = (FG\text{-}MSTK_{t-1} + FG\text{-}MSTK_t)/2$$

$$FG\text{-}PRLA_t = 1.510 + \underset{(.5466)}{1.1519}\ FG\text{-}GINC_{t-1}/FG\text{-}AC_{t-1} + \underset{(.0982)}{.8980}\ FG\text{-}PRLA_{t-1}$$

LS $d = 2.55$ $R^2 = .958$ MSE = 120.541

$$FG\text{-}VALA_t = -.4778 + \underset{(.0002)}{.9194}\ FG\text{-}PRLA_t * FG\text{-}AC_t$$

ATS $d = 1.90$ $R^2 = .999$ MSE = 41.519

$$FG\text{-}SPA_t = FG\text{-}STKAVE_t + FG\text{-}MSTKAVE_t + FG\text{-}VALA_t$$

<u>Input Section</u>

$$FG\text{-}FERT_t/FG\text{-}AC_t = 14.4820 + \underset{(.0641)}{.1194}\ FG\text{-}PR_{t-1} - \underset{(.0849)}{.2546}\ US\text{-}FTPI_t + \underset{(.0007)}{.0030}\ FG\text{-}GINC_{t-1} + \underset{(.0001)}{.0003}\ FG\text{-}SPA_t$$

LS $d = 2.29$ $R^2 = .985$ MSE = .369

$$FG\text{-}PCTAF_t = .0158 + \underset{(.0084)}{.0297}\ TIME$$

ALS $\rho = \underset{(.1003)}{.8725}$ $d = 1.18$ $R^2 = .987$ MSE = .0003

$$FG\text{-}FERT_t = FG\text{-}FERT_t/FG\text{-}AC_t * FG\text{-}PCTAF_t * FG\text{-}AC_t$$

$$FG\text{-}SEED_t = -135.311 + \underset{(.1822)}{.8846}\ FG\text{-}AC_t + \underset{(3.3282)}{14.8038}\ TIME{*}{*}.5 + \underset{(.0940)}{.5739}\ FG\text{-}SEED_{t-1}$$

ALS $\rho = \underset{(.1618)}{-.4754}$ $d = 1.97$ $R^2 = .910$ MSE = 99.314

$$FG\text{-}LABR_t/FG\text{-}AC_t = 13.012 - \underset{(.1277)}{2.7059}\ LN(TIME)$$

LS $d = .5430$ $R^2 = .963$ MSE = .1915

$$FG\text{-}LABR_t = FG\text{-}LABR_t/FG\text{-}AC_t * FG\text{-}AC_t$$

$$FG\text{-}MACH_t = -159.0625 + \underset{(.0250)}{.2966}\ FG\text{-}MSTKAVE_t$$

LS $d = 2.13$ $R^2 = .893$ MSE = 1,345.7

$$FG\text{-}RE_t = 2.820 + \underset{(.0009)}{.0510}\ FG\text{-}VALA_t$$

ALS $\rho = \underset{(.0892)}{.8746}$ $d = 2.01$ $R^2 = .997$ MSE = 108.84

$$FG\text{-}FOR_t = 30.864 + \underset{(.0311)}{.1043}\ FG\text{-}MSTKAVE_t$$

ALS $\rho = \underset{(.0468)}{.9242}$ $d = 2.08$ $R^2 = .977$ MSE = 1,426.0

$$FG\text{-}MISC_t/FG\text{-}AC_t = 1.2504 + \underset{(.00003)}{.00007}\ FG\text{-}SPA_t - \underset{(.0097)}{.0174}\ US\text{-}FSPI_{t-1}$$

ALS $\rho = .3947$ $d = 2.26$ $R^2 = .986$ MSE = .0275

$$FG\text{-}MISC_t = FG\text{-}MISC_t/FG\text{-}AC_t * FG\text{-}AC_t$$

$$FG\text{-}INT_t = -3.6203 + \underset{(.0019)}{.0622}\ FG\text{-}STKAVE_t$$

ALS $\rho = \underset{(.1442)}{-.5441}$ $d = 2.14$ $R^2 = .936$ MSE = 403.15

$$FG\text{-}RETX_t = FG\text{-}VALA_t * FG\text{-}TXRT_t$$

Output Section

$$FG\text{-}Y_t = .0621 + \underset{(.1109)}{.7643}\ TIME$$

ALS $\rho = \underset{(.0036)}{.0095}$ $d = 2.64$ $R^2 = .941$ MSE = .0122

$$FG\text{-}PROD_t = FG\text{-}AC_t * FG\text{-}Y_t$$

$$FG\text{-}SPY_t = FG\text{-}PROD_t + FG\text{-}GINV_{t-1} + FG\text{-}CINV_{t-1} + FG\text{-}IMP_t$$

$$FG\text{-}FOOD_t/POP = .8696 + .0112\ TIME + .0004\ PCDY_t$$

$$FG\text{-}FOOD_t = POP\ (.0159 + .028\ FG\text{-}FOOD_t/POP)$$

$$FG\text{-}FU_t = 1.287\ GCAU - WFU_t$$

$$FG\text{-}SD_t = .00475\ FG\text{-}PROD_t$$

$$FG\text{-}CD_t = FG\text{-}FU_t + FG\text{-}SD_t + FG - FOOD_t$$

$$FG\text{-}TD_t = FG\text{-}CD_t + FG\text{-}EXP_t$$

$$FG\text{-}PR_t = 19.838 + \underset{(3.0248)}{21.8219}\ CN\text{-}SPPR_t - \underset{(.0432)}{.2051}\ (FG\text{-}SPY_t - FG\text{-}TD_t) + \underset{(2.9788)}{9.7044}\ WARDUMY$$

ATS $\rho = \underset{(.1567)}{.0828}$ $d = 1.46$ $R^2 = .852$ MSE = 27.701

$$FG\text{-}GINV_t = -37.8694 + \underset{(2.5070)}{15.4935}\ CN\text{-}SPPR_t + \underset{(.0372)}{1.1876}\ (FG\text{-}SPY_t - FG\text{-}TD_t)$$

LS $d = 2.54$ $R^2 = .985$ MSE = 5.7145

$$FG\text{-}CINV_t = FG\text{-}S_t - (FG\text{-}CD_t + FG\text{-}EXP_t + FG\text{-}GINV_t)$$

$$FG\text{-}GINC_t = .4298 * FG\text{-}CD_t * FG\text{-}PR_t + FG\text{-}EXP_t * FG\text{-}PR_t + FG\text{-}GPYT_t$$

Wheat Submodel

Pre-Input Section

$$W\text{-}AC_t = 27.691 + \underset{(1.8920)}{4.7645}\ W\text{-}PR_{t-1} - \underset{(1.6252)}{6.9285}\ W\text{-}ACATDUMY + \underset{(.0928)}{.4704}\ W\text{-}AC_{t-1}$$

LS $d = 1.78$ $R^2 = .766$ MSE = 20.587

$$W\text{-}STK_t = 155.50 + \underset{(.1853)}{.1911}\ W\text{-}PROD_{t-1} + \underset{(.2226)}{.5444}\ W\text{-}STK_{t-1}$$

LS $d = 2.07$ $R^2 = .524$ MSE = 20,645.

$$W\text{-}STKAVE_t = (W\text{-}STK_{t-1} + W\text{-}STK_t)/2$$

$$W\text{-}MPUR_t = 5.111 + \underset{(24.7713)}{37.2151}\ POSTWARDUMY + \underset{(2.9762)}{7.6931}\ W\text{-}EQTY_{t-1} + \underset{(.0216)}{.0539}\ W\text{-}GINC_{t-1}$$

ALS $\rho = \underset{(.1837)}{.4582}$ $d = 1.99$ $R^2 = .860$ MSE = 1,007.8

$$W\text{-}MSTK_t = 9.849 + \underset{(.3298)}{.8657}\ W\text{-}MPUR_t + \underset{(.0746)}{.8401}\ W\text{-}MSTK_{t-1}$$

ATS $d = 2.37$ $R^2 = .928$ MSE = 9,535.1

$$W\text{-}MSTKAVE_t = (W\text{-}MSTK_{t-1} + W\text{-}MSTK_t)/2$$

$$W\text{-}PRLA_t = 6.641 + \underset{(.3518)}{.3852}\ W\text{-}GINC_{t-1}/W\text{-}AC_{t-1} + \underset{(.0952)}{.8776}\ W\text{-}PRLA_{t-1}$$

LS $d = 2.64$ $R^2 = .832$ MSE = 216.476

$$W\text{-}VALA_t = 2.7804 + \underset{(.0003)}{.6801}\ W\text{-}AC_t * W\text{-}PRLA_t$$

2SLS $d = 2.42$ $R^2 = .999$ MSE = 9.00

$$W\text{-}SPA_t = W\text{-}STKAVE_t + W\text{-}MSTKAVE_t + W\text{-}VALA_t$$

Input Section

$$W\text{-}FERT_t/W\text{-}AC_t = 7.3629 - \underset{(.0270)}{.0460}\ US\text{-}FTPI_t + \underset{(.0006)}{.0008}\ W\text{-}GINC_{t-1} + \underset{(.3350)}{1.3210}\ LN(TIME)$$

LS $d = 1.82$ $R^2 = .920$ MSE = .2259

$$W\text{-}PCTAF_t = .0429 + \underset{(.0021)}{.0209}\ TIME$$

ALS $\rho = \underset{(.1509)}{.6634}$ $d = 1.62$ $R^2 = .983$ MSE = .0003

$W\text{-}FERT_t = W\text{-}FERT_t / W\text{-}AC_t * W\text{-}PCTAF_t * W\text{-}AC_t$

$W\text{-}SEED_t = 17.090 + 2.2897\ W\text{-}AC_t - .0650\ W\text{-}SDPI_{t-1} + .1555\ TIME$
(.1934) (.0939) (.1276)
ATS d = 2.01 R^2 = .889 MSE = 50.37

$W\text{-}LABR_t / W\text{-}AC_t = 5.0517 - .7761\ LN(TIME)$
(.1014)
LS d = .446 R^2 = .775 MSE = .1207

$W\text{-}LABR_t = W\text{-}LABR_t / W\text{-}AC_t * W\text{-}AC_t$

$W\text{-}MACH_t = -69.3051 + .1799\ W\text{-}MSTKAVE_t + .3707\ W\text{-}MACH_{t-1}$
(.0252) (.1123)
ALS ρ = -.5094 d = 2.2032 R^2 = .833 MSE = 206.725
(.2752)

$W\text{-}RE_t = 15.362 + .0495\ W\text{-}VALA_t + 2.9174\ TIME{**}.5$
(.0015) (1.1360)
ATS d = .53 R^2 = .988 MSE = 48.537

$W\text{-}FOR_t = 200.412 - 2.5492\ US\text{-}MSPI_{t-1} + .1225\ W\text{-}MSTKAVE_t + 1.7601\ W\text{-}AC_t$
(.4073) (.0197) (.3508)
ATS ρ = .2435 d = 1.74 R^2 = .976 MSE = 205.62
(.1399)

$W\text{-}MISC_t / W\text{-}AC_t = 4.2588 - .000001\ W\text{-}SPA_t - .0193\ US\text{-}FSPI_{t-1}$
(.000046) (.0117)
$+ .8095\ W\text{-}MISC_{t-1}$
(.1561)
ALS ρ = -.8014 d = 2.25 R^2 = .969 MSE = .0284
(.1887)

$W\text{-}MISC_t = W\text{-}MISC_t / W\text{-}AC_t * W\text{-}AC_t$

$W\text{-}INT_t = -.5146 + .0623\ W\text{-}STKAVE_t$
(.0048)
2SLS d = 2.34 R^2 = .852 MSE = 22.75

$W\text{-}RETX_t = W\text{-}VALA_t * W\text{-}TXRT_t$

<u>Output Section</u>

$W\text{-}Y_t = 4.2121 + .5681\ TIME$
(.1287)
ALS ρ = .2050 d = 2.34 R^2 = .896 MSE = 4.1375
(.0608)

$W\text{-}PROD_t = W\text{-}AC_t * W\text{-}Y_t$

$W\text{-}SPY_t = W\text{-}PROD_t + W\text{-}GINV_{t-1} + W\text{-}CINV_{t-1} + W\text{-}IMP_t$

$W\text{-}FD_t = POP\ (1.7922 + 30.1755\ TIME^{-1})$

$W\text{-}SD_t = .035\ W\text{-}PROD_t$

$W\text{-}CD_t = 207.22 + W\text{-}SD_t$

$W\text{-}TD_t = W\text{-}CD_t + W\text{-}FD_t + W\text{-}EXP_t$

$$W\text{-}PR_t = .4584 + \underset{(.0750)}{.1594}\ W\text{-}SPPR_t - \underset{(.0001)}{.0002}\ (W\text{-}SPY_t - W\text{-}TD_t) + \underset{(.1296)}{.6345}\ W\text{-}PR_{t-1}$$

2SLS $\quad d = 1.52 \quad R^2 = .681 \quad MSE = .057$

$$W\text{-}GINV_t = -326.57 + \underset{(17.7485)}{88.0167}\ W\text{-}SPPR_t + \underset{(.0475)}{1.0525}\ (W\text{-}SPY_t - W\text{-}TD_t) + \underset{(.0403)}{.0744}\ W\text{-}GINV_{t-1}$$

LS $\quad d = 2.25 \quad R^2 = .990 \quad MSE = 1,541.00$

$W\text{-}CINV_t = W\text{-}SPY_t - (W\text{-}TD_t + W\text{-}GINV_t)$

$W\text{-}GINC_t = .981\ W\text{-}PROD_t * W\text{-}PR_t + W\text{-}GYPT_t$

Soybean Submodel

Pre-Input Section

$$S\text{-}AC_t = 3.3094 + \underset{(2.3590)}{9.2696}\ S\text{-}PR_{t-1} - \underset{(.1127)}{.4689}\ FG\text{-}PR_{t-1} + \underset{(.0487)}{.8692}\ S\text{-}AC_{t-1}$$

LS $\quad d = 2.33 \quad R^2 = .991 \quad MSE = 1.257$

$$S\text{-}STK_t = -1.506 + \underset{(.0476)}{1.0923}\ S\text{-}PROD_{t-1}$$

LS $\quad d = 2.18 \quad R^2 = .936 \quad MSE = 5,667.1$

$S\text{-}STKAVE_t = (S\text{-}STK_{t-1} + S\text{-}STK_t)/2$

$$S\text{-}MPUR_t = -1.902 + \underset{(.0269)}{.0658}\ S\text{-}GINC_{t-1} + \underset{(.1617)}{.6743}\ S\text{-}MPUR_{t-1}$$

LS $\quad d = 2.34 \quad R^2 = .967 \quad MSE = 229.78$

$$S\text{-}MSTK_t = 7.2425 + \underset{(.5480)}{.3417}\ S\text{-}MPUR_t + \underset{(.1036)}{1.0048}\ S\text{-}MSTK_{t-1}$$

ATS $\quad d = 2.23 \quad R^2 = .988 \quad MSE = 2,543.3$

$$S\text{-}MSTKAVE_t = (S\text{-}MSTK_{t-1} + S\text{-}MSTK_t)/2$$

$$S\text{-}PRLA_t = -3.0499 + \underset{(.1524)}{.2226}\ S\text{-}GINC_{t-1}/S\text{-}AC_{t-1} + \underset{(.0540)}{.9769}\ S\text{-}PRLA_{t-1}$$

LS d = 2.46 R^2 = .924 MSE = 103.46

$$S\text{-}VALA_t = .573 + \underset{(.0001)}{.8935}\ S\text{-}PRLA_t * S\text{-}AC_t$$

ALS $\rho = \underset{(.0577)}{-.6658}$ d = .980 R^2 = .999 MSE = .915

$$S\text{-}SPA_t = S\text{-}STKAVE_t + S\text{-}MSTKAVE_t + S\text{-}VALA_t$$

<u>Input Section</u>

$$S\text{-}FERT_t/S\text{-}AC_t = 11.1620 - \underset{(.0353)}{.0937}\ S\text{-}PR_{t-1} + \underset{(.4377)}{1.2945}\ US\text{-}FTPI_t$$

LS d = .57 R^2 = .916 MSE = .387

$$S\text{-}PCTAF_t = -.0228 + \underset{(.0263)}{.0236}\ TIME$$

ALS $\rho = \underset{(.0984)}{.9255}$ d = 1.65 R^2 = .924 MSE = .0002

$$S\text{-}FERT_t = S\text{-}FERT_t/S\text{-}AC_t * S\text{-}PCTAF_t * S\text{-}AC_t$$

$$S\text{-}SEED_t = .862 + \underset{(.2830)}{3.3710}\ S\text{-}AC_t + \underset{(.0778)}{.1363}\ S\text{-}SEED_{t-1}$$

ALS $\rho = \underset{(.1991)}{.2188}$ d = 1.87 R^2 = .997 MSE = 5.112

$$S\text{-}LABR_t/S\text{-}AC_t = 6.8004 - \underset{(.0369)}{.7264}\ LN(TIME)$$

LS d = .610 R^2 = .958 MSE = .0159

$$S\text{-}LABR_t = S\text{-}LABR_t/S\text{-}AC_t * S\text{-}AC_t$$

$$S\text{-}MACH_t = 5.4040 + \underset{(.0055)}{.2235}\ S\text{-}MSTKAVE_t$$

LS d = 2.08 R^2 = .990 MSE = 65.434

$$S\text{-}RE_t = -.9873 + \underset{(.0002)}{.0502}\ S\text{-}VALA_t + \underset{(.0273)}{.2593}\ TIME$$

ATS $\rho = \underset{(.0192)}{-.0660}$ d = .98 R^2 = .999 MSE = .521

$$S\text{-}FOR_t = 46.694 - \underset{(.1224)}{.3511}\ US\text{-}MSPI_{t-1} + \underset{(.0242)}{.1240}\ S\text{-}MSTKAVE_t + \underset{(.1487)}{.2974}\ S\text{-}FOR_{t-1}$$

2SLS d = 2.05 R^2 = .995 MSE = 35.296

$$S\text{-}MISC_t/S\text{-}AC_t = 1.8386 + \underset{(.00003)}{.00014}\ S\text{-}SPA_t - \underset{(.0041)}{.0106}\ US\text{-}FSPI_{t-1} + \underset{(.0524)}{.7708}\ S\text{-}MISC_{t-1}$$

ALS $\rho = \underset{(.2169)}{-.6495}$ $d = 2.54$ $R^2 = .995$ MSE = .0084

$$S\text{-}MISC_t = S\text{-}MISC_t/S\text{-}AC_t * S\text{-}AC_t$$

$$S\text{-}INT_t = -.0881 + \underset{(.0014)}{.0597}\ S\text{-}STKAVE_t$$

ATS $\rho = \underset{(.1275)}{-.2187}$ $d = 2.63$ $R^2 = .975$ MSE = 7.7814

$$S\text{-}RETX_t = S\text{-}VALA_t * S\text{-}TXRT_t$$

Output Section

$$S\text{-}Y_t = 11.0745 + \underset{(.1555)}{.1936}\ TIME$$

ALS $\rho = \underset{(.0528)}{.2571}$ $d = 1.97$ $R^2 = .871$ MSE = 2.5089

$$S\text{-}PROD_t = S\text{-}AC_t * S\text{-}Y_t$$

$$S\text{-}SPY_t = S\text{-}PROD_t + S\text{-}CINV_{t-1}$$

$$S\text{-}SD_t = .041\ S\text{-}PROD_t$$

$$S\text{-}CD_t = SM\text{-}EXP_t + S\text{-}SD_t + S\text{-}CDEM_t$$

$$S\text{-}TD_t = S\text{-}CD_t + S\text{-}EXP_t$$

$$S\text{-}PR_t = e^{.2353}\ (S\text{-}SPY_t - S\text{-}TD_t)^{\underset{(.0144)}{-0.0221}}\ S\text{-}PR_{t-1}^{\underset{(.1310)}{0.7200}}$$

LS $d = 1.33$ $R^2 = .811$ MSE = .0053

$$S\text{-}CINV_t = S\text{-}SPY_t - S\text{-}TD_t$$

$$S\text{-}GINC_t = -1.99 + \underset{(.0058)}{.9771}\ S\text{-}PROD_t * S\text{-}PR_t$$

ALS $\rho = \underset{(.0840)}{.8718}$ $d = 2.01$ $R^2 = .999$ MSE = 16.047

Cotton Submodel

Pre-Input Section

$$C\text{-}AC_t = 12.757 + \underset{(.0654)}{.2700}\ C\text{-}PR_{t-1} - \underset{(.9336)}{5.2940}\ C\text{-}ACATDUMY - \underset{(.1985)}{.5293}\ C\text{-}CINV_{t-1} + \underset{(.1953)}{.8000}\ C\text{-}AC_{t-1}$$

LS $d = 1.51$ $R^2 = .963$ MSE = 1.614

$$C\text{-}STK_t = 310.37 - \underset{(15.7396)}{12.9612}\ C\text{-}CD_{t-1} + \underset{(1750)}{.3670}\ C\text{-}STK_{t-1}$$

LS $d = 1.95$ $R^2 = .195$ $MSE = 19{,}399.$

$$C\text{-}STKAVE_t = (C\text{-}STK_{t-1} + C\text{-}STK_t)/2$$

$$C\text{-}MPUR_t = 114.489 + \underset{(15.9818)}{49.1934}\ POSTWARDUMY + \underset{(2.2515)}{4.9609}\ C\text{-}EQTY_{t-1} - \underset{(.4723)}{1.2210}\ US\text{-}MHPI_{t-1} - \underset{(.0161)}{.0175}\ C\text{-}GINC_{t-1}$$

ALS $\rho = \underset{(.2194)}{.1756}$ $d = 1.94$ $R^2 = .816$ $MSE = 466.787$

$$C\text{-}MSTK_t = 54.33 + \underset{(.3522)}{1.1264}\ C\text{-}MPUR_t + \underset{(.1055)}{.6437}\ C\text{-}MSTK_{t-1}$$

2SLS $d = 2.42$ $R^2 = .769$ $MSE = 5{,}005.1$

$$C\text{-}MSTKAVE_t = (C\text{-}MSTK_{t-1} + C\text{-}MSTK_t)/2$$

$$C\text{-}PRLA_t = 2.5325 + \underset{(.0822)}{.1394}\ C\text{-}GINC_{t-1}/C\text{-}AC_{t-1} + \underset{(.0648)}{.8915}\ C\text{-}PRLA_{t-1}$$

LS $d = 1.58$ $R^2 = .938$ $MSE = 131.80$

$$C\text{-}VALA_t = 3.339 + \underset{(.0035)}{2.0569}\ C\text{-}PRLA_t * C\text{-}AC_t$$

2SLS $d = 1.97$ $R^2 = .999$ $MSE = 76.502$

$$C\text{-}SPA_t = C\text{-}STKAVE_t + C\text{-}MSTKAVE_t + C\text{-}VALA_t$$

<u>Input Section</u>

$$C\text{-}FERT_t/C\text{-}AC_t = 43.8889 + \underset{(.1121)}{.2083}\ C\text{-}PR_{t-1} - \underset{(.0698)}{.4888}\ US\text{-}FTPI_t + \underset{(.0003)}{.0011}\ C\text{-}SPA_t$$

LS $d = 1.64$ $R^2 = .906$

$$C\text{-}PCTAF_t = .1906 + \underset{(.0027)}{.0125}\ TIME$$

ALS $\rho = \underset{(.1947)}{.6197}$ $d = 1.67$ $R^2 = .910$ $MSE = .0007$

$$C\text{-}FERT_t = C\text{-}FERT_t/C\text{-}AC_t * C\text{-}PCTAF_t$$

$$C\text{-}SEED_t = .595 + \underset{(.1942)}{1.6375}\ C\text{-}AC_t - \underset{(.0340)}{.1170}\ C\text{-}SDPI_{t-1} + \underset{(.0709)}{.3475}\ C\text{-}SEED_{t-1}$$

2SLS $d = 1.88$ $R^2 = .975$ $MSE = 12.310$

$$C\text{-}LABR_t/C\text{-}AC_t = 25.745 - .39\ TIME$$

$$\text{C-LABR}_t = \text{C-LABR}_t/\text{C-AC}_t * \text{C-AC}_t$$

$$\text{C-MACH}_t = -21.4769 + \underset{(.0159)}{.1909}\ \text{C-MSTKAVE}_t + \underset{(.0677)}{.2749}\ \text{C-MACH}_{t-1}$$

ALS $\rho = \underset{(.1716)}{-.3735}$ $d = 2.11$ $R^2 = .981$ MSE = 22.649

$$\text{C-RE}_t = 14.656 + \underset{(.0010)}{.0498}\ \text{C-VALA}_t$$

ATS $d = .562$ $R^2 = .989$ MSE = 34.292

$$\text{C-FOR}_t = 9.2617 - \underset{(.6768)}{.0251}\ \text{US-MSPI}_{t-1} + \underset{(.0480)}{.2919}\ \text{C-MSTKAVE}_t + \underset{(.1629)}{.0636}\ \text{C-FOR}_{t-1}$$

ALS $\rho = \underset{(.2334)}{-.3833}$ $d = 1.59$ $R^2 = .940$ MSE = 119.122

$$\text{C-MISC}_t/\text{C-AC}_t = 20.8829 + \underset{(.0004)}{.0004}\ \text{C-SPA}_t - \underset{(.2008)}{.2641}\ \text{US-FSPI}_{t-1} + \underset{(.3858)}{.4363}\ \text{C-MISC}_{t-1}$$

ALS $\rho = \underset{(.3791)}{.3326}$ $d = 1.64$ $R^2 = .935$ MSE = 1.858

$$\text{C-MISC}_t = \text{C-MISC}_t/\text{C-AC}_t * \text{C-AC}_t$$

$$\text{C-INT}_t = .0332 + \underset{(.0081)}{.0629}\ \text{C-STKAVE}_t$$

2SLS $d = 2.55$ $R^2 = .705$ MSE = 25.695

$$\text{C-RETX}_t = \text{C-VALA}_t * \text{C-TXRT}_t$$

Output Section

$$\text{C-Y}_t = .1416 + \underset{(.1355)}{.5916}\ \text{TIME}$$

ALS $\rho = \underset{(.0025)}{.0065}$ $d = 2.05$ $R^2 = .890$ MSE = .0057

$$\text{C-PROD}_t = \text{C-AC}_t * \text{C-Y}_t$$

$$\text{C-SPY}_t = \text{C-PROD}_t + \text{C-GINV}_{t-1} + \text{C-CINV}_{t-1} + \text{C-IMP}_t$$

$$\text{C-CD}_t = \text{POP} * .0417$$

$$\text{C-TD}_t = \text{C-CD}_t + \text{C-EXP}_t$$

$$\text{C-GINV}_t = -9.148 + \underset{(.1231)}{.2516}\ \text{C-SPPR}_t + \underset{(.0782)}{.9234}\ (\text{C-SPY}_t - \text{C-TD}_t)$$

LS $d = 1.35$ $R^2 = .882$ MSE = 1.902

$$C\text{-}CINV_t = C\text{-}SPY_t - C\text{-}TD_t - C\text{-}GINV_t$$

$$C\text{-}PR_t = 4.8144 - \underset{(.3549)}{.5003}\,(C\text{-}SPY_t - C\text{-}TD_t - C\text{-}GINV_t) + \underset{(.1006)}{.2130}\,C\text{-}SPPR_t + \underset{(.1031)}{.6744}\,C\text{-}PR_{t-1}$$

LS d = 1.65 R^2 = .747 MSE = 14.649

$$C\text{-}GINC_t = 112.77 + \underset{(.1329)}{5.3876}\,C\text{-}PROD_t * C\text{-}PR_t + \underset{(.0959)}{.8068}\,C\text{-}GPYT_t$$

ATS d = .66 R^2 = .983 MSE = 4,755.8

Tobacco Submodel

Pre-Input Section

$$T\text{-}AC_t = -.6978 + \underset{(.0065)}{.0306}\,T\text{-}PR_{t-1} - \underset{(.00003)}{.00012}\,T\text{-}CINV_{t-1} + \underset{(.0392)}{.8144}\,T\text{-}AC_{t-1}$$

LS d = 1.63 R^2 = .980 MSE = .0022

$$T\text{-}STK_t = 73.822 + \underset{(.0364)}{.0364}\,T\text{-}PROD_{t-1} + \underset{(21.3597)}{61.4897}\,WARDUMY - \underset{(.0491)}{.0792}\,T\text{-}GINC_{t-1} + \underset{(.1049)}{.6412}\,G\text{-}STK_{t-1}$$

ALS $\rho = \underset{(.1676)}{-.5244}$ d = 1.84 R^2 = .547 MSE = 2,360.6

$$T\text{-}STKAVE_t = (T\text{-}STK_{t-1} + T\text{-}STK_t)/2$$

$$T\text{-}MPUR_t = 9.030 + \underset{(.9848)}{2.8563}\,POSTWARDUMY + \underset{(.0011)}{.0099}\,T\text{-}GINC_{t-1} - \underset{(.0305)}{.0877}\,US\text{-}MHPI_{t-1}$$

LS d = 2.33 R^2 = .802 MSE = 2.921

$$T\text{-}MSTK_t = 7.126 + \underset{(1.0269)}{1.8531}\,T\text{-}MPUR_t + \underset{(.0843)}{.8253}\,T\text{-}MSTK_{t-1}$$

2SLS d = 2.18 R^2 = .875 MSE = 225.31

$$T\text{-}MSTKAVE_t = (T\text{-}MSTK_{t-1} + T\text{-}MSTK_t)/2$$

$$T\text{-}PRLA_t = -2.791 + \underset{(.0103)}{.0181}\,T\text{-}GINC_{t-1}/T\text{-}AC_{t-1} + \underset{(.0591)}{.9682}\,T\text{-}PRLA_{t-1}$$

LS d = 2.33 R^2 = .969 MSE = 57.077

$$T\text{-}VALA_t = .980 + \underset{(.0040)}{11.1412}\,T\text{-}PRLA_t * T\text{-}AC_t$$

ATS d = 2.13 R^2 = .999 MSE = .623

$$\text{T-SPA}_t = \text{T-STKAVE}_t + \text{T-MSTKAVE}_t + \text{T-VALA}_t$$

<u>Input Section</u>

$$\text{T-FERT}_t = 29.058 - \underset{(.0450)}{.3651}\ \text{US-FTPI}_{t-1} + \underset{(.0038)}{.0155}\ \text{T-GINC}_{t-1} + \underset{(.0022)}{.0090}\ \text{T-SPA}_t$$

ATS $\quad \rho = \underset{(.1045)}{.3386} \quad d = 2.06 \quad R^2 = .981 \quad MSE = 4.534$

$$\text{T-LABR} = 2.563 + \underset{(15.6740)}{462.1345}\ \text{T-AC}_t$$

ALS $\quad \rho = \underset{(.0500)}{.8704} \quad d = 2.28 \quad R^2 = .977 \quad MSE = 380.88$

$$\text{T-MACH}_t = -3.8596 + \underset{(.0066)}{.0937}\ \text{T-MSTKAVE}_t + \underset{(.054}{.3233}\ \text{T-MACH}_{t-1}$$

ALS $\quad \rho = \underset{(.2406)}{-.5245} \quad d = 2.21 \quad R^2 \quad .959 \quad MSE = .177$

$$\text{T-RE}_t = 7.129 + \underset{(.0059)}{.0586}\ \text{T-VALA}_t + \underset{(1.8718)}{4.2802}\ \text{TIME}^{.5}$$

ATS $\quad \rho = \underset{(.0590)}{.3775} \quad d = 1.15 \quad R^2 = .973 \quad MSE = 28.226$

$$\text{T-FOR}_t = -5.2486 + \underset{(.1662)}{.1862}\ \text{US-MSPI}_{t-1} + \underset{(.0559)}{.2213}\ \text{T-MSTKAVE}_t + \underset{(.1624)}{.2585}\ \text{T-FOR}_{t-1}$$

LS $\quad d = 2.13 \quad R^2 = .774 \quad MSE = 7.775$

$$\text{T-MISC}_t = 78.6754 + \underset{(.0038)}{.0100}\ \text{T-SPA}_t - \underset{(.2468)}{.7614}\ \text{US-FSPI}_{t-1} + \underset{(.1334)}{.6571}\ \text{T-MISC}_{t-1}$$

ALS $\quad \rho = \underset{(.2948)}{-.1671} \quad d = 1.90 \quad R^2 = .975 \quad MSE = 11.259$

$$\text{T-INT}_t = -.193 + \underset{(.0036)}{.0640}\ \text{T-STKAVE}_t$$

ATS $\quad \rho = \underset{(.1335)}{-.3645} \quad d = 2.16 \quad R^2 = .854 \quad MSE = 3.331$

$$\text{T-RETX}_t = \text{T-VALA}_t * \text{T-TXRT}_t$$

<u>Output Section</u>

$$\text{T-PROD}_t = \text{T-AC}_t * \text{T-Y}_t$$

$$\text{T-SPY}_t = \text{T-PROD}_t + \text{T-CINV}_{t-1} + \text{T-IMP}_t$$

$$\text{T-CD}_t = 785.31 - \underset{(.9109)}{2.3746}\ \text{T-IMP}_t + \underset{(.1587)}{.5124}\ \text{US-PCDI}_t + \underset{(.1718)}{.1647}\ \text{T-CD}_{t-1}$$

LS $\quad d = 1.76 \quad R^2 = .474 \quad MSE = 11,948.$

$$\text{T-EXP}_t = 298.052 - \underset{(.0238)}{.0473}\ \text{T-FRPD}_{t-1} + \underset{(3.1350)}{8.7171}\ \text{TIME} + \underset{(.2237)}{.6039}\ \text{T-EXP}_{t-1}$$

ALS $\rho = \underset{(.2671)}{-.0890}$ $d = 2.00$ $R^2 = .527$ MSE = 5,535.1

$$\text{T-TD}_t = \text{T-CD}_t + \text{T-EXP}_t$$

$$\text{T-CINV}_t = \text{T-SPY}_t - \text{T-TD}_t$$

$$\text{T-PR}_t = 22.774 + \underset{(.1308)}{.3495}\ \text{T-SPPR}_t - \underset{(.0016)}{.0038}\ (\text{T-SPY}_t - \text{T-TD}_t) + \underset{(.2327)}{.3850}\ \text{T-PR}_{t-1}$$

ALS $\rho = \underset{(.2970)}{.1812}$ $d = 2.22$ $R^2 = .794$ MSE = 15.668

$$\text{T-GINC}_t = 37.342 + \underset{(.0011)}{.0092}\ \text{T-PROD}_t * \text{T-PR}_t$$

ATS $\rho = \underset{(.1377)}{.4601}$ $d = 1.92$ $R^2 = .902$ MSE = 7,255.4

United States

Pre-Input Section

$$\text{US-AC}_t = \text{FG-AC}_t + \text{W-AC}_t + \text{S-AC}_t + \text{C-AC}_t + \text{T-AC}_t + \text{O-AC}_t$$

$$\text{US-STK}_t = \text{L-STK}_t + \text{FG-STK}_t + \text{W-STK}_t + \text{S-STK}_t + \text{C-STK}_t + \text{T-STK}_t + \text{O-STK}_t$$

$$\text{US-STKAVE}_t = \text{L-STKAVE}_t + \text{FG-STKAVE}_t + \text{W-STKAVE}_t + \text{S-STKAVE}_t + \text{C-STKAVE}_t + \text{T-STKAVE}_t + \text{O-STKAVE}_t$$

$$\text{US-MPUR}_t = \text{L-MPUR}_t + \text{FG-MPUR}_t + \text{W-MPUR}_t + \text{S-MPUR}_t + \text{C-MPUR}_t + \text{T-MPUR}_t + \text{O-MPUR}_t$$

$$\text{US-MSTK}_t = \text{L-MSTK}_t + \text{FG-MSTK}_t + \text{W-MSTK}_t + \text{S-MSTK}_t + \text{C-MSTK}_t + \text{T-MSTK}_t + \text{O-MSTK}_t$$

$$\text{US-MSTKAVE}_t = \text{L-MSTKAVE}_t + \text{FG-MSTKAVE}_t + \text{W-MSTKAVE}_t + \text{S-MSTKAVE}_t + \text{C-MSTKAVE}_t + \text{T-MSTKAVE}_t + \text{O-MSTKAVE}_t$$

$$\text{US-VALA}_t = \text{L-VALA}_t + \text{FG-VALA}_t + \text{W-VALA}_t + \text{S-VALA}_t + \text{C-VALA}_t + \text{T-VALA}_t + \text{O-VALA}_t$$

$$\text{US-SPA}_t = \text{US-STKAVE}_t + \text{US-MSTKAVE}_t + \text{US-VALA}_t$$

Input Section

$$US\text{-}FERT_t = FG\text{-}FERT_t + W\text{-}FERT_t + S\text{-}FERT_t + C\text{-}FERT_t + T\text{-}FERT_t + O\text{-}FERT_t$$

$$US\text{-}SEED_t = FG\text{-}SEED_t + W\text{-}SEED_t + S\text{-}SEED_t + C\text{-}SEED_t + O\text{-}SEED_t$$

$$US\text{-}LABR_t = L\text{-}LABR_t + FG\text{-}LABR_t + W\text{-}LABR_t + S\text{-}LABR_t + C\text{-}LABR_t + T\text{-}LABR_t + O\text{-}LABR_t$$

$$US\text{-}MACH_t = L\text{-}MACH_t + FG\text{-}MACH_t + W\text{-}MACH_t + S\text{-}MACH_t + C\text{-}MACH_t + T\text{-}MACH_t + O\text{-}MACH_t$$

$$US\text{-}RE_t = L\text{-}RE_t + FG\text{-}RE_t + W\text{-}RE_t + S\text{-}RE_t + C\text{-}RE_t + T\text{-}RE_t + O\text{-}RE_t$$

$$US\text{-}FOR_t = L\text{-}FOR_t + FG\text{-}FOR_t + W\text{-}FOR_t + S\text{-}FOR_t + C\text{-}FOR_t + T\text{-}FOR_t + O\text{-}FOR_t$$

$$US\text{-}MISC_t = L\text{-}MISC_t + FG\text{-}MISC_t + W\text{-}MISC_t + S\text{-}MISC_t + C\text{-}MISC_t + T\text{-}MISC_t + O\text{-}MISC_t$$

$$US\text{-}INT_t = L\text{-}INT_t + FG\text{-}INT_t + W\text{-}INT_t + S\text{-}INT_t + C\text{-}INT_t + T\text{-}INT_t + O\text{-}INT_t$$

$$US\text{-}RETX_t = L\text{-}RETX_t + FG\text{-}RETX_t + W\text{-}RETX_t + S\text{-}RETX_t + C\text{-}RETX_t + T\text{-}RETX_t + O\text{-}RETX_t$$

$$US\text{-}F.I.S.\ EX_t = US\text{-}FERT_t * .2906 + US\text{-}SEED_t * .6643 + US\text{-}MACH_t * .9365 + US\text{-}FOR_t * .7960 + US\text{-}RTAX_t + US\text{-}MISC_t * .6595 + L\text{-}FEED_t * .5627 + L\text{-}LPUR_t * .8283 + O\text{-}EX_t$$

Output Section

$$US\text{-}GINC_t = L\text{-}GINC_t + FG\text{-}GINC_t + W\text{-}GINC_t + S\text{-}GINC_t + C\text{-}GINC_t + T\text{-}GINC_t + O\text{-}GINC_t$$

$$US\text{-}NINC_t = US\text{-}GINC_t - US\text{-}F.I.S.\ EX_t$$

Table A1. Definitions of variable code names use in simulator model.[a]

Variable code name	Definition
AC	Acreage (million acres)
LPUR	Livestock purchased by farmers (million 1947-49 dollars)
STK	Ending calendar year commodity stock on farms (million 1947-49 dollars)
STKAVE	Average of beginning and ending calendar year commodity stock on farms (million 1947-49 dollars)
MPUR	Machinery purchases (million 1947-49 dollars)
MSTK	Ending calendar year stock of machinery on farms (million 1947-49 dollars)
MSTKAVE	Average of ending and beginning calendar year machinery stock on farms (million 1947-49)
PRLA	Index of price of land and buildings per acre (index 1947-49 = 100)
VALA	Value of farmland and buildings (million 1947-49 dollars)
SPA	Stock of physical assets defined as the sum of STKAVE, MSTKAVE, and VALA (million 1947-49 dollars)
FERT	Fertilizer and lime expense (million 1947-49 dollars)
PCTAF	Percent of crop acres which are fertilized
SEED	Purchased plus home-grown seed for individual crops (million 1947-49 dollars)
FEED	Purchased livestock feed (million 1947-49 dollars)
LABR	Man-hour requirements (million man-hours)
MACH	Machinery interest and depreciation (million 1947-49 dollars)
RE	Real estate expense including interest on land and farm buildings and depreciation, repairs and maintenance on farm buildings (million 1947-49 dollars)
FOR	Machinery fuel, oil, and repairs expense (million 1947-49 dollars)
MISC	Miscellaneous expenses including pesticides, small hand tools, binding materials, electricity, telephone, etc. (million 1947-49 dollars)

[a]Prescripts on variable code names refer to commodity categories: livestock (L), feed grains (FG), wheat (W), soybeans (S), cotton (C), tobacco (T), other crops (O), and all commodities (US).

Table A1. (cont'd.)

Variable code name	Definition
INT	Interest on farmer-held commodity inventories (million 1947-49 dollars)
RETX	Real Estate taxes (million 1947-49 dollars)
Y	Crop yield per acre
PROD	Crop production (FG, million tons; W and S, million bushels; C million bales; and T, million pounds)
FU	Feed units in corn equivalent (million tons)
GCAU	Grain-consuming animal units (million units)
SPY	Beginning crop year supplies defined as the sum of production, carry-in stocks , and imports
PR	Average crop year price received by farmers deflated by the implicit GNP deflator. (L, index 1947-49 = 100: FG, dollars per ton; W and S, dollars per bushel; C and T, dollars per pound)
POP	Population (million people)
SD	Seed demand (same units as production)
CD	Total domestic crop year demand for all uses, except wheat in which only nonfood demand is included (same units as production)
FD	Crop year demand for wheat as food (million bushels)
FOOD	Crop year demand used for food (same units as production)
TD	Total demand (same units as production)
GINV	Government ending crop year inventory (same units as production
CINV	Commercial ending crop year inventory (same units as production
EXP	Crop year exports (same units as production)
GINC	Cash receipts and government payments deflated by the implicit GNP deflator (million 1947-49 dollars)
F.I.S. EX_t	Production expenses which correspond to the definition used in the Farm Income Situation
TXRT	Tax rate per dollar value of land and buildings
SPPR	Average support price levels deflated by the implicit GNP deflator (same units as price)

Table A.1. (cont'd.)

Variable code name	Definition
GPYT	Government payments deflated by the implicit GNP deflator (million 1947-49 dollars)
ACATDUMY	Acreage allotment dummy with 1.0's in years allotments were in effect
ACDIV	Acreage diverted from production (million acres)
SDPI	Index of seed prices deflated by the implicit GNP deflator (1947-49 = 100)
EQTY	Equity ratio defined as the value of real estate divided by mortgage debt on that real estate
IMP	Crop year imports (same units as production)
MHPI	Index of machinery price deflated by GNP deflator (1947-49 =100)
FTPI	Index of fertilizer price deflated by GNP deflator (1947-49 = 100
MSPI	Index of motor supplies price deflated by GNP deflator (index 1947-49 = 100)
FSPI	Index of farm supplies price deflated by GNP deflator (index 1947-49 = 100)
PCDI	Per capita disposable income deflated by GNP deflator (1947-49 dollars)
TIME	Trend variable with 1930 = 1.0
LN(TIME)	Natural log of TIME variable with 1949 = 1.0
WARDUMY	Dummy variable for World War II with 1.0's for the years 1942-47
POSTWARDUMY	Dummy variable with 1.0's for years 1948-52
FRPD	Calendar year production of tobacco in all countries excluding the United States (million pounds)

APPENDIX B--DOMESTIC DEMANDS

Domestic Agricultural Demand[10/]

Seed Demand

Agricultural commodities used for seed are estimated as constant ratios of seed demand to output. Seed demand for feed grain, wheat, and soybeans is given by the equations:

$$FGSD_t = .00475 * FG\ Production_t$$

$$WSD_t = .035 * W\ Production_t$$

$$SSD_t = .041 * S\ Production_t$$

Livestock Demand

The per capita demand for beef, pork, and broilers was estimated with equations (1), (2), and (3), respectively. These equations were developed from Waugh's price-quantity relationships [42],

$$Q_B = 43.7809 - 0.7697RP_B + 0.2786RP_P + 0.1076RP_{Br} + 0.0386Y \quad (1)$$

$$Q_P = 90.1111 + 0.2786RP_B - 0.9612RP_P + 0.0728RP_{Br} + 0.0032Y \quad (2)$$

$$Q_{BR} = (32.0623 + 0.1076RP_B + 0.0728RP_P - 0.4485RP_{Br} + 0.0023Y)/.955 \quad (3)$$

where:

Q_i = per capita consumption of commodity i in lbs./yrs.

10/ This section on domestic demand for agricultural products relies heavily on work completed by Fedeler, Heady, and Koo: A Summary of Interrelationships of Grain Transportation, Production, and Demand, 1973 [22].

The farm prices of broilers, lambs, turkeys, milk, and eggs are set equal to their 1971-73 averages. The 1971-73 average price of broilers and lambs is multiplied by the percentage change in the farm price of pork from its 1971-73 average to estimate yearly prices of broilers and lambs.

The per capita demand for lamb (lamb and mutton) and turkey was estimated using equations (5) and (6).

$$Q_L = (e^{5.57087} RPI_L^{-1.9916} RPI_B^{0.57397} Y^{0.36813} t^{-0.13775})/1.27 \quad (5)$$

$$Q_T = (e^{2.40871} RPI_T^{-0.43835} RPI_B^{0.19729} t^{0.21801})\ .926 \quad (6)$$

where: RPI = retail price index of commodity i, (1957-59=100),

ie., $RPI_{i,t} = (RP_{i,t}/RP_{i,57-59})\ 100$;

t = time in years, t = 1 is 1948, and t = 1,2,3,...53;

Q_L = pounds of lamb and mutton consumed per capita per year.

Q_T = pounds of turkey consumed per capita per year

Adjustment factors were applied to three of the per capita demand equations--(3), (5), and (6). This adjustment factor was based on the average prediction error of the respective equations over the eleven-year period from 1960 to 1970.

The demand for lamb and turkey are based on the same OBER per capita income figures used to estimate beef, pork, and broilers; however a retail price index was required in the equation. The retail price index for turkeys RPI_t was set equal to the 1967-69 average value of 92.0. The retail prices of beef and lambs were adjusted to obtain the RPI:

RP_i = retail price of commodity i in 1957-59 prices,

Y = disposable consumer income per capita in 1957-59 prices,

i = B (beef), P (pork), or Br (broilers)

The retail prices were obtained from farm prices by using equation (4).

$$RP_i = (FP_i\ CF_i + FRPS_i)/CPI_{57-59} \qquad (4)$$

where: FP_i = current farm price of commodity i

CF_i = factor to convert liveweight prices to carcassweight basis for commodity i

$FRPS_i$ = current farm to retail price spread for commodity i.

CPI_{57-59} = consumer price index, 1957-59 = 100.

Farm prices for beef and pork are determined on the basis of feed and labor costs from [28] and adjusted to 1971-73 farm prices of beef and pork. Lagged feed grain and soybean prices determine livestock prices through the following relationships:

$$\text{SM-PRL} = 2.811 + \underset{(5.38)}{28.15}\ \text{S-PRL} \qquad R^2 = .989$$

$$FP_B = (1.705\ \text{FG-PRL} + .0023\ \text{SM-PRL})\ 10.68 + .5\ \text{FLW} + 6.74$$

$$FP_P = (1.557\ \text{FG-PRL} + .0064\ \text{SM-PRL})\ 6.04 + 1.2\ \text{FLW} + 6.99$$

where:

FP_B = farm price of beef per pound of liveweight

FP_P = farm price of pork per pound of liveweight

FLW = farm labor wage rate

FG-PRL = lagged soybean meal price in dollars per

SM-PRL = lagged soybean meal price in dollars per ton

S-PRL = lagged soybean price in dollars per bushel

$$RPI_B = (RP_{B,t}/RP_{i,\ 57\text{-}59}) \qquad (7)$$

$$RPI_L = (RP_{L,t}/RP_{i\ 57\text{-}59}) \qquad (8)$$

The levels of per capita income were taken from the OBER projections. Per capita disposable income was held constant after it reached $4,000 in 1986. This assumes that the income elasticity of demand is zero after an income of $4,000. Population and per capita incomes are presented in Table B1.

Egg Demand

Per capita egg consumption is projected to remain at the level of the last ten years. No trend is observable over that time period with consumption fluctuating from 314 to 322. The 10-year average of 318.5 is projected for the year 2000 [14].

Milk Demand

Per capita milk consumption for the year 2000 is estimated to be 491 pounds. This represents a decline of 2.5 lbs. per year over the current level of 561 lbs. in 1972 [8]. Milk demand for calves is assumed to be constant at 1.823 million pounds per year.

Grain Demand

Grain-consuming animal units are obtained from the demand for livestock products after adjusting for livestock net imports. The conversion factors to convert pounds of livestock product or dozens of eggs into grain-consuming animal units was obtained from the average over the 1968-70 period. Total pounds of livestock products or dozens of eggs produced

Table B1. Assumed population and OBERS per capita disposable income projections used to estimate livestock demands.

YEAR	POP	PCDY (1957-59 dollars)
	(Millions)	(1954 dollars)
1975	217	$ 3023.
1980	232	3495.
1985	247	3976.
1990	264	4000.
1995	281	4000.
2000	300	4000.

annually was divided into the corresponding number of grain-consuming animal units produced annually. The resulting grain-consuming animal units required per unit of livestock product are given in Table B2. The grain-consuming animal unit requirements for horses and mules is assumed to remain constant at the 1968-70 average of 1.261 million GCAU's. The GCAU's for other livestock such as pets and zoo animals is projected by the equation:

$$OGCU = 1.946 + .155 * TIME$$

Table B2 . Conversion factors to express livestock demands in terms of grain—consuming animal units.

Livestock Class	Unit of Measure	Grain Consuming Animal Units per Unit of Livestock
Dairy	lbs.	.000124
Beef	lbs.	.001629
Pork	lbs.	.002802
Eggs	doz.	.003053
Broilers	lbs.	.001312
Turkeys	lbs.	.002302
Lamb and Mutton	lbs.	.001085

The total numbers of GCAU's is converted into corn-equivalent feed units which is used as the demand for feed grains. The conversion factor to convert GCAU's to feed units is based on the 1960-70 trend between feed units and GCAU's:

$$FU = 1.287 \text{ GCAU's} \tag{9}$$

Feed units for other livestock is obtained from the equation:

$$OFU = 2504.4724 + 199.99353 * TIME \tag{10}$$

$$(11.910839) \qquad R^2 = .932$$

Total feed units demanded are obtained as the sum of FU and OFU.

Industrial Agricultural Demand

The demand for feed grain, wheat, and soybeans for food and industrial uses are estimated from historical averages and trends.

Feed Grain and Wheat Demand

The per capita projections for feed grain and wheat demands were made by using the following equations:

$$C_c = \underset{(.002372)}{0.066847} + \underset{(.000181)}{0.001867TIME} \qquad R^2 = .842 \tag{11}$$

$$C_{dp} = \underset{(.011744)}{0.398122} + \underset{(.000894)}{0.009321TIME} \qquad R^2 = .844 \tag{12}$$

$$C_{wp} = \underset{(.065991)}{0.237624} + \underset{(.000034)}{0.000364Y} \qquad R^2 = .86 \tag{13}$$

$$C_a = 0.1670, \text{ 1966-69 average} \tag{14}$$

$$O_c = 0.2248, \text{ 1966-69 average} \tag{15}$$

$$B_m = 0.5505, \text{ 1966-69 average} \tag{16}$$

$$B_f = 0.0406, \text{ 1966-69 average} \quad (17)$$

$$W_{fi} = 1.7922 + 30.1755TIME^{-1}$$
$$(.7459) \quad d = 1.41 \quad R^2 = .987 \quad (18)$$

where:

C_c = bushels of corn per person demanded for cereal,

C_{dp} = bushels of corn per person demanded for dry processing,

C_{wp} = bushels of corn per person demanded for wet processing,

C_a = bushels of corn per person demanded for alcohol,

O_c = bushels of oats per person demanded for cereal,

B_m = bushels of barley per person demanded for malt,

B_f = bushels of barley per person demanded for food products,

W_{fi} = bushels of wheat per person demanded for flour and other industrial uses,

Y = per capita disposable income.

Soybean Meal Demand

Since soybeans are crushed into meal before they are fed to livestock, demand for soybeans by livestock was included in the industrial demand for soybeans. Preliminary demand for soybean meal is calculated with equation (19).

$$S_m = \left[e^{-3.05949} LS^{\underset{(.2801)}{}} T^{\underset{(.0210)}{}} \right] * GCAU$$
$$d = 1.08 \quad U = .799 \quad R^2 = .918 \quad (19)$$

where: S_m = million tons of soybean equivalent feed units demand annually,

GCAU = millions of grain-consuming animal units fed annually to livestock in the United States.

The value of S_m is taken as the domestic disappearance of soybean cake and meal, given in Fats and Oils Statistics [11]. The estimated demand for soybean meal per grain-consuming animal unit was held constant after 1980.

APPENDIX C - MISCELLANEOUS TABLES

Table C1. Estimated average value of commodity stock for selected commodities and United States in millions of 1972 dollars, with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	1858.3	1955.0	1915.5	1930.6	1976.5	2076.7	2166.8	2204.2
SIM 2		1989.1	1826.2	2000.4	2047.0	2060.2	2144.3	2212.1
SIM 3		2048.2	2447.2	2591.3	2645.0	2762.9	2877.6	2943.6
SIM 4		2037.3	2383.2	2496.3	2546.6	2642.5	2735.7	2787.9
SIM 5		2041.0	2393.1	2478.6	2500.2	2553.2	2621.3	2624.3
SIM 6		2040.2	2381.9	2459.0	2454.3	2465.4	2551.2	2600.1
SIM 7		2060.7	2467.0	2561.9	2596.5	2641.6	2680.2	2715.5
				FEED GRAINS				
SIM 1	11790.8	18046.0	19948.4	21327.3	21784.7	23814.6	25622.6	26254.2
SIM 2		18901.7	20258.4	21419.6	22035.5	23624.1	25616.5	26243.2
SIM 3		19563.6	23979.3	25140.8	25607.6	26951.4	28181.2	28912.7
SIM 4		19489.2	23685.6	25476.7	26315.8	28003.8	29357.0	30249.8
SIM 5		19293.4	23171.4	24428.4	25052.6	26336.8	27612.9	28679.1
SIM 6		19125.8	22412.4	23820.9	24496.9	25973.8	27532.2	28449.8
SIM 7		19156.8	21859.9	22960.1	23369.9	24232.3	25216.1	25805.7
				SOYBEANS				
SIM 1	1794.6	2885.4	3497.8	3911.5	4064.7	4643.6	5076.1	5477.0
SIM 2		2945.6	3623.0	3973.2	4196.5	4703.7	5155.5	5452.0
SIM 3		2872.1	3440.2	3707.8	3954.1	4477.7	5024.4	5358.2
SIM 4		2992.0	3681.9	3993.5	4221.6	4796.4	5384.2	5740.3
SIM 5		3295.1	4287.7	4670.0	4948.7	5653.4	6367.6	6795.3
SIM 6		3246.5	4611.4	5006.7	5319.0	6068.4	6491.9	6798.9
SIM 7		3056.5	4602.7	4960.7	5407.4	6205.2	7080.7	7594.6
				COTTON				
SIM 1	453.1	572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 2		572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 3		572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 4		572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 5		572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 6		572.6	549.4	534.8	524.6	498.2	470.0	452.3
SIM 7		572.6	549.4	534.8	524.6	498.2	470.0	452.3
				LIVESTOCK				
SIM 1	31159.7	36808.9	39582.9	40976.7	41977.1	44511.0	46925.3	48094.4
SIM 2		37601.4	40054.7	41499.4	42298.4	44520.7	47014.1	47884.3
SIM 3		38000.6	43824.0	46281.0	47051.0	48866.1	50524.1	51439.0
SIM 4		37986.2	43449.5	46304.4	47592.2	50096.1	51984.6	53076.0
SIM 5		37813.8	42939.9	45314.2	46222.7	48147.7	49709.7	50931.1
SIM 6		37614.7	42224.8	44428.0	45446.6	47546.3	49537.6	50733.7
SIM 7		37727.9	41697.5	43486.1	44174.6	45579.9	46747.2	47564.3
				UNITED STATES				
SIM 1	52506.3	65463.7	70857.8	74146.3	75856.3	81245.4	86133.9	88446.8
SIM 2		67225.7	71758.8	74935.7	76702.4	81181.7	86377.2	88265.3
SIM 3		68272.3	79687.1	83764.1	85382.8	89330.9	93054.1	95127.3
SIM 4		68292.7	79196.6	84314.1	86801.1	91811.8	95908.2	98327.8
SIM 5		68231.1	78788.4	82934.3	84849.3	88964.1	92758.3	95503.5
SIM 6		67833.9	77567.9	81800.7	83859.3	88283.5	92526.3	95072.6
SIM 7		67808.9	76564.4	80054.8	81690.9	84888.6	88137.1	90170.3

[a] Source: An Econometric Simulation Model [29].

Table C2. Estimated machinery purchases for model commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	420.3	336.3	320.1	330.6	336.3	349.2	361.0	363.8
SIM 2		287.3	249.7	292.8	262.7	286.5	297.7	296.9
SIM 3		369.4	411.9	423.2	430.5	446.8	461.7	468.9
SIM 4		320.2	296.2	302.6	305.7	312.3	320.2	324.3
SIM 5		342.6	299.1	300.6	300.1	305.9	309.0	308.0
SIM 6		358.5	325.7	295.8	294.5	302.8	343.4	378.3
SIM 7		417.1	479.2	494.1	501.0	522.2	547.4	561.4
				FEED GRAINS				
SIM 1	1580.8	1578.2	1626.0	1635.9	1685.4	1734.4	1869.8	2050.6
SIM 2		1401.0	1404.9	1422.9	1476.4	1622.2	1823.5	1994.4
SIM 3		1641.5	1880.4	1926.0	1919.0	1944.3	1940.2	1926.0
SIM 4		1408.8	1528.5	1585.7	1597.3	1625.5	1630.7	1639.3
SIM 5		1484.0	1495.8	1529.6	1543.1	1544.5	1599.0	1704.5
SIM 6		1608.4	1502.9	1502.4	1516.4	561.5	1816.2	2072.3
SIM 7		1927.8	2113.7	2175.0	2216.1	2320.4	2443.2	2490.6
				SOYBEANS				
SIM 1	519.9	841.2	1042.8	1165.6	1241.8	1440.4	1671.2	1870.0
SIM 2		850.3	1008.7	1100.2	1160.7	1328.0	1593.2	1787.0
SIM 3		894.0	1063.8	1210.7	1314.0	1564.2	1834.8	1998.1
SIM 4		846.8	981.1	1045.1	1093.7	1225.3	1366.3	1452.6
SIM 5		931.6	1148.5	1219.9	1275.5	1430.3	1598.4	1700.7
SIM 6		1030.0	1350.3	1380.4	1417.3	1554.0	1992.3	2474.7
SIM 7		1192.1	2093.5	2441.8	2701.9	3380.0	4142.3	4653.5
				COTTON				
SIM 1	128.7	85.4	71.1	66.8	61.7	52.9	46.0	37.1
SIM 2		61.8	48.3	39.2	37.8	27.6	18.2	16.1
SIM 3		110.5	117.5	115.0	111.1	103.7	96.3	91.6
SIM 4		68.4	56.6	51.9	47.9	37.2	26.1	19.8
SIM 5		68.0	55.2	49.4	44.3	32.7	20.7	13.6
SIM 6		67.9	54.0	47.2	42.4	30.8	23.7	15.1
SIM 7		83.2	69.0	56.4	53.7	76.2	71.7	67.4
				LIVESTOCK				
SIM 1	460.3	558.9	623.1	659.7	580.3	737.4	805.0	865.2
SIM 2		544.9	589.6	620.5	646.2	710.0	791.7	867.4
SIM 3		565.9	626.4	661.9	685.7	743.9	803.6	841.4
SIM 4		542.7	583.1	613.5	634.7	588.0	741.1	774.6
SIM 5		552.3	586.1	612.7	634.5	687.2	743.6	785.7
SIM 6		563.1	603.6	614.4	635.2	688.4	767.5	842.7
SIM 7		588.8	681.4	719.7	749.0	827.5	915.6	964.6
				UNITED STATES				
SIM 1	4962.7	5618.9	6123.3	6429.2	6667.4	7196.4	7857.1	8425.9
SIM 2		5358.2	5736.1	6042.3	6244.5	6852.6	7621.4	8204.8
SIM 3		5795.1	6535.0	6903.5	7120.9	7681.2	8233.7	8568.9
SIM 4		5399.7	5880.4	6165.4	6339.8	6766.7	7181.5	7453.5
SIM 5		5591.4	6019.6	6278.8	6458.1	6879.0	7367.7	7755.3
SIM 6		5840.1	6277.8	6408.8	6560.7	7020.1	8043.5	9016.0
SIM 7		6421.1	7878.1	8455.7	8876.5	10008.9	11220.7	11970.5

[a] Source: An Econometric Simulation Model [29].

Table C3. Estimated average machinery stocks for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year		Actual 1965-67[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
					WHEAT				
SIM	1	2430.8	1971.2	1915.8	1895.1	1904.7	1946.7	2003.5	2036.0
SIM	2		1902.3	1651.0	1626.9	1610.0	1594.6	1644.0	1695.8
SIM	3		2025.2	2154.7	2250.2	2302.0	2414.5	2512.1	2564.0
SIM	4		1956.3	1830.4	1789.7	1784.0	1787.9	1812.9	1832.2
SIM	5		1980.8	1896.1	1826.5	1802.7	1774.2	1781.6	1783.6
SIM	6		1997.4	2002.9	1909.7	1855.1	1779.1	1834.0	1922.9
SIM	7		2085.5	2393.4	2539.9	2616.0	2776.3	2916.8	3001.8
					FEED GRAINS				
SIM	1	7293.5	7112.4	7174.3	7285.0	7379.2	7612.2	7943.8	8383.9
SIM	2		6829.2	6426.5	6379.8	6466.2	6778.7	7452.0	8104.2
SIM	3		7224.7	7796.3	8205.4	8353.8	8602.1	8713.9	8738.4
SIM	4		6826.5	6666.7	6826.3	6938.3	7161.2	7267.1	7314.8
SIM	5		6976.7	6744.9	6757.1	6814.8	6909.3	6995.3	7189.6
SIM	6		7161.9	7063.7	6855.6	6840.6	6877.0	7343.4	8081.7
SIM	7		7688.8	8797.3	9256.8	9496.7	10051.4	10576.9	10903.8
					SOYBEANS				
SIM	1	2741.4	3814.1	4382.0	4814.3	5137.2	6010.3	6982.4	7654.7
SIM	2		3818.1	4375.5	4761.1	5039.1	5779.4	6667.2	7309.4
SIM	3		3835.9	4465.3	4907.4	5264.0	6255.9	7405.9	8160.3
SIM	4		3816.4	4354.5	4704.6	4946.7	5582.9	6274.5	6712.5
SIM	5		3859.9	4606.4	5085.2	5404.7	6225.6	7096.5	7641.2
SIM	6		3904.6	4902.4	5520.9	5889.3	6789.8	7858.9	8816.6
SIM	7		3968.7	5668.0	7023.8	8040.9	10810.5	14025.0	16149.1
					COTTON				
SIM	1	676.3	584.9	526.4	510.9	496.5	467.1	440.8	425.6
SIM	2		550.9	457.6	425.3	419.4	385.9	356.7	342.0
SIM	3		637.9	649.0	654.2	646.3	624.6	600.7	587.5
SIM	4		559.8	479.0	462.4	451.0	419.1	384.8	364.0
SIM	5		559.7	475.7	457.4	442.9	406.3	368.9	346.2
SIM	6		563.4	475.7	452.7	437.6	399.7	372.8	353.1
SIM	7		601.0	513.9	500.3	474.8	499.5	520.9	506.7
					LIVESTOCK				
SIM	1	3250.8	4021.1	4561.2	4897.3	5117.0	5666.2	6232.2	6613.8
SIM	2		3998.9	4420.0	4689.0	4881.6	5391.9	6015.2	6439.4
SIM	3		4046.6	4593.1	4931.1	5155.9	5713.8	6274.9	6612.4
SIM	4		3996.5	4393.5	4650.1	4830.3	5296.2	5781.3	6080.3
SIM	5		4010.1	4445.2	4684.6	4855.4	5307.8	5788.5	6102.9
SIM	6		4029.5	4545.6	4781.6	4932.7	5348.0	5856.6	6271.4
SIM	7		4077.1	4825.6	5265.9	5548.1	6259.3	7016.5	7488.9
					UNITED STATES				
SIM	1	26501.7	26714.9	28786.8	30231.6	31273.4	33958.1	36881.1	39000.2
SIM	2		26271.0	27524.9	28657.5	29618.7	32140.7	35369.0	37730.3
SIM	3		26941.9	29652.8	31723.7	32924.2	35821.1	38741.5	40502.3
SIM	4		26327.2	27918.5	29208.6	30152.5	32457.5	34754.6	36143.5
SIM	5		26558.9	28362.6	29596.2	30522.8	32833.4	35264.8	36903.2
SIM	6		26833.6	29188.6	30339.6	31165.2	33418.1	36520.7	39299.0
SIM	7		27598.0	32396.6	35405.9	37386.4	42621.4	48311.1	51903.6

[a/] Source: An Econometric Simulation Model [29].

Table C4. Estimated price of land indexes for model crops with base 1947-49=100 with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	178.1	172.0	168.3	168.7	170.0	174.8	181.1	185.3
SIM 2		164.1	143.4	140.3	136.8	136.4	141.1	146.2
SIM 3		175.1	178.2	183.1	186.6	195.4	204.4	209.7
SIM 4		168.7	152.0	146.7	145.2	144.0	146.1	148.1
SIM 5		171.0	156.9	150.0	147.7	145.5	147.0	148.7
SIM 6		172.7	166.1	157.4	153.5	149.1	156.2	165.9
SIM 7		180.3	196.7	207.8	215.0	233.7	254.0	266.4
				FEED GRAINS				
SIM 1	245.1	335.8	345.0	352.8	361.8	382.0	412.0	448.1
SIM 2		311.0	283.7	276.0	279.9	299.5	349.6	400.9
SIM 3		339.7	382.3	415.5	433.7	474.6	506.4	521.6
SIM 4		311.1	300.7	308.0	314.4	332.2	348.2	357.8
SIM 5		322.2	310.4	311.7	315.4	326.0	341.3	361.3
SIM 6		337.0	338.2	329.4	329.1	334.3	375.7	436.4
SIM 7		375.0	476.6	533.6	569.7	659.9	752.6	810.0
				SOYBEANS				
SIM 1	180.0	220.4	235.0	244.7	251.8	270.2	291.8	308.7
SIM 2		220.4	231.8	238.6	243.4	256.5	276.1	291.8
SIM 3		226.1	247.1	263.9	276.2	308.9	345.4	368.5
SIM 4		220.4	234.6	243.5	249.4	264.3	279.8	289.4
SIM 5		221.7	236.7	245.4	251.0	265.2	280.0	289.1
SIM 6		228.4	249.7	259.0	264.3	277.5	301.3	327.4
SIM 7		237.3	292.0	327.2	352.2	419.7	495.2	544.0
				COTTON				
SIM 1	191.5	177.0	181.8	185.9	189.5	198.8	209.0	215.3
SIM 2		158.8	138.9	132.3	129.3	125.8	126.7	128.8
SIM 3		180.3	196.0	207.7	214.7	231.0	246.0	254.6
SIM 4		160.8	144.0	140.0	139.0	139.1	142.0	144.7
SIM 5		161.1	144.7	140.8	139.8	140.2	143.5	146.4
SIM 6		161.8	146.2	141.9	140.9	141.7	148.0	150.0
SIM 7		171.5	168.2	169.4	173.7	215.2	281.7	325.1

[a] Source: An Econometric Simulation Model [29].

Table C5. Estimated value of land and buildings for selected commodities and United States in millions of 1972 dollars with 1965-57 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	12520.4	11958.6	10256.5	10529.4	10629.7	10931.2	11225.5	11276.8
SIM 2		11583.9	8493.4	10296.4	8254.2	8738.1	8685.4	8484.3
SIM 3		13625.9	13926.3	14291.8	14502.7	15073.2	15652.3	15982.0
SIM 4		12896.8	11307.4	10883.9	10722.0	10403.1	10461.4	10357.1
SIM 5		13197.1	11587.1	10890.4	10422.4	10090.2	9741.4	9471.3
SIM 6		13279.4	12139.3	10966.1	10453.5	9742.8	10244.4	10825.5
SIM 7		14384.6	15169.7	16075.3	16077.8	16614.9	17521.2	17859.7
				FEED GRAINS				
SIM 1	42388.6	66707.5	69961.3	74029.4	73297.9	77878.6	83508.4	93812.9
SIM 2		64245.3	58349.8	54909.1	57504.1	60947.4	70580.4	84538.3
SIM 3		70912.9	79103.1	84088.1	86709.0	92414.1	95735.3	97217.8
SIM 4		64210.9	62114.4	64055.9	64999.9	67294.8	68635.9	70028.6
SIM 5		65501.1	62225.7	61406.5	61954.5	61819.2	63561.6	67123.9
SIM 6		67844.6	65633.6	63762.8	63145.7	63394.5	69342.8	78999.2
SIM 7		74933.9	89512.8	98769.4	103952.3	114814.9	126825.7	140107.9
				SOYBEANS				
SIM 1	11281.4	19059.5	23442.3	25108.1	27385.5	31650.1	35655.3	36253.5
SIM 2		19615.6	23874.3	25951.8	27331.7	30323.2	34074.8	34153.0
SIM 3		18834.6	20891.8	23688.9	25623.1	30682.6	36669.6	40458.1
SIM 4		18987.9	21343.0	23280.6	24651.0	28149.4	31813.5	34082.5
SIM 5		21920.8	25118.3	27492.5	29138.0	33336.5	37664.7	40295.2
SIM 6		23004.2	28593.7	31166.7	33023.0	36726.1	41043.3	46125.0
SIM 7		22762.5	33397.8	39415.4	44751.0	58414.8	74582.6	81263.7
				COTTON				
SIM 1	8492.7	8376.3	8198.8	8065.9	8118.2	8347.9	8886.0	8990.1
SIM 2		6813.9	6321.2	6248.9	5767.5	5494.2	5427.8	6165.0
SIM 3		12716.7	13833.9	14361.3	14749.3	15490.6	16173.7	16389.6
SIM 4		8279.7	7363.6	7187.4	7023.1	6660.5	6446.7	6379.3
SIM 5		7979.5	7029.5	6533.9	6258.0	5809.1	5448.6	5193.3
SIM 6		7938.1	6701.4	6215.3	5893.5	5397.5	5918.7	5693.0
SIM 7		9189.3	8044.8	6658.9	6555.6	8596.8	9088.5	10039.2
				LIVESTOCK				
SIM 1	105114.8	137910.4	155084.3	165687.2	172746.1	190610.8	208985.4	220825.9
SIM 2		137469.5	152916.4	162489.9	169140.1	186227.4	205126.0	217582.8
SIM 3		138314.7	155567.9	166208.5	173387.6	191419.0	209690.2	220752.7
SIM 4		137414.1	152511.1	161900.0	168317.5	184646.8	201368.4	211582.4
SIM 5		137695.9	153205.9	162415.4	168749.7	184917.7	201603.5	212090.3
SIM 6		138061.9	154677.4	163780.9	169937.1	185744.1	203023.7	215113.6
SIM 7		138952.3	159124.3	171282.0	179455.8	200249.0	222013.9	235368.1
				UNITED STATES				
SIM 1	219832.5	287944.3	313550.8	331505.3	341910.3	371560.8	403083.3	429141.2
SIM 2		283001.5	295215.3	308876.9	317916.1	343545.1	376783.3	410638.2
SIM 3		297678.1	328583.0	351619.3	364890.2	396894.1	426809.6	450514.9
SIM 4		285062.8	299899.6	316288.5	325632.3	348969.5	371614.7	392144.9
SIM 5		289567.6	304426.7	317719.6	326441.2	347787.4	370908.5	393888.8
SIM 6		292504.0	319058.4	324775.4	331042.4	357238.2	385884.0	414434.1
SIM 7		302598.3	356562.4	381084.4	399381.9	454923.3	506342.6	542316.3

[a] Source: An Econometric Simulation Model [29].

Table C6. Estimated stock of physical assets for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	16688.2	15884.8	14087.8	14355.0	14510.9	14954.5	15395.8	15517.0
SIM 2		15475.3	11970.6	13923.7	11911.2	12392.9	12473.8	12392.1
SIM 3		17699.3	18528.2	19133.3	19449.6	20250.6	21042.1	21489.7
SIM 4		16890.4	15520.9	15169.9	15052.5	14833.6	15010.0	14977.3
SIM 5		17218.9	15876.2	15195.5	14725.3	14417.6	14144.3	13879.2
SIM 6		17317.1	16524.1	15334.8	14762.9	13987.3	14629.6	15348.5
SIM 7		18530.8	20030.0	21177.0	21290.3	22032.8	23118.2	23577.1
				FEED GRAINS				
SIM 1	61185.6	91865.9	97084.0	102641.6	102461.8	109305.5	117074.8	128451.0
SIM 2		89976.2	85034.7	82708.5	86005.9	91350.2	103648.9	118885.8
SIM 3		97701.2	110878.7	117434.3	120670.4	12[illegible]967.6	132630.3	134868.9
SIM 4		90526.6	92466.7	96358.9	98254.1	102459.8	105260.1	107593.1
SIM 5		91771.2	92142.0	92602.0	93821.9	95065.2	98169.7	102992.6
SIM 6		94132.3	95109.6	94439.3	94483.1	96245.4	104218.4	115530.8
SIM 7		101779.6	120170.0	130986.4	136818.8	149098.6	162618.4	176817.3
				SOYBEANS				
SIM 1	15588.3	25759.0	31322.0	33833.9	36587.4	42304.1	47713.8	49385.2
SIM 2		26379.3	31872.7	34686.1	36567.3	40806.3	45897.5	46914.4
SIM 3		25542.6	28797.3	32304.1	34841.1	41416.2	49099.9	53976.6
SIM 4		25796.3	29379.5	31978.7	33819.2	38528.8	43472.2	46535.4
SIM 5		29075.8	34012.4	37247.7	39491.4	45215.5	51128.8	54731.7
SIM 6		30155.3	38107.5	41694.3	44231.3	49584.2	55394.1	61740.5
SIM 7		29787.8	43668.5	51399.9	58199.2	75430.5	95688.3	105007.4
				COTTON				
SIM 1	9812.6	9533.8	9274.6	9111.6	9139.3	9313.3	9796.8	9868.0
SIM 2		7937.4	7328.2	7209.0	6711.5	6378.4	6254.5	6959.3
SIM 3		13927.2	15032.3	15550.3	15920.2	16613.5	17244.4	17429.5
SIM 4		9412.1	8392.0	8184.5	7998.7	7577.8	7301.6	7195.7
SIM 5		9111.8	8054.6	7526.1	7225.6	6713.6	6287.5	5991.8
SIM 6		9074.0	7726.5	7202.7	6855.7	6295.4	6761.5	6498.4
SIM 7		10362.9	9108.1	7694.0	7555.1	9594.5	10079.4	10998.3
				LIVESTOCK				
SIM 1	139105.6	178740.3	199228.4	211561.2	219840.1	240787.8	262142.9	275534.0
SIM 2		179069.8	197391.1	208678.3	216320.1	236140.1	258155.2	271906.5
SIM 3		180361.8	203985.1	217420.6	225594.4	245998.8	266489.1	278804.0
SIM 4		179397.0	200354.1	212854.5	220740.0	240039.1	259134.3	270738.6
SIM 5		179519.9	200591.1	212414.1	219827.8	238373.3	257101.8	269124.2
SIM 6		179706.1	201447.8	212990.4	220316.3	238638.4	258418.1	272118.6
SIM 7		180757.3	205647.3	220034.0	229178.3	252088.1	275777.6	290421.3
				UNITED STATES				
SIM 1	305505.6	380659.1	413636.4	437374.6	449623.9	487271.4	526473.7	557713.6
SIM 2		377144.9	394998.9	413010.9	424773.8	457297.0	498771.8	538416.8
SIM 3		394033.0	439079.8	467465.7	483597.1	522425.0	558953.1	586597.9
SIM 4		380711.8	408063.7	430413.4	443166.3	473672.2	502696.4	526897.6
SIM 5		385405.0	412487.9	430679.4	442297.1	469891.3	499391.6	526790.8
SIM 6		388253.9	426611.5	437521.5	446560.0	479368.7	515303.3	549733.4
SIM 7		399009.8	466235.1	497030.9	518866.3	582636.3	643275.9	684039.8

[a/] Source: An Econometric Simulation Model [29].

Table C7. Estimated fertilizer and lime expenditures for selected crops and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	137.7	238.4	240.4	268.8	278.0	286.7	290.1	286.9
SIM 2		232.2	224.4	307.2	253.1	280.4	275.2	260.6
SIM 3		278.9	340.7	370.4	380.7	389.4	394.7	396.6
SIM 4		263.4	297.5	322.5	330.7	331.8	335.0	330.1
SIM 5		270.8	296.2	315.5	315.1	317.6	308.4	298.2
SIM 6		273.1	299.1	302.3	303.5	299.5	313.1	320.6
SIM 7		296.6	352.4	385.4	384.7	378.1	377.0	371.4
				FEED GRAINS				
SIM 1	751.7	1618.7	1748.5	1871.9	1854.6	1979.5	2190.2	2575.6
SIM 2		1452.5	1388.6	1335.9	1472.9	1673.2	1997.8	2431.0
SIM 3		1830.1	2171.0	2231.2	2227.6	2260.2	2230.6	2199.7
SIM 4		1457.7	1577.9	1684.1	1703.1	1736.5	1719.7	1732.2
SIM 5		1540.6	1497.5	1507.4	1527.2	1486.2	1540.3	1679.2
SIM 6		1692.8	1497.7	1472.9	1474.0	1516.6	1801.9	2110.4
SIM 7		2118.6	2335.9	2453.1	2511.5	2604.0	2744.3	2994.5
				SOYBEANS				
SIM 1	38.6	199.8	283.7	326.3	371.7	470.5	566.0	588.3
SIM 2		205.8	293.1	346.2	384.2	475.1	572.1	586.5
SIM 3		191.0	237.6	282.5	313.8	395.6	488.7	546.9
SIM 4		197.9	256.2	301.7	335.5	425.8	525.6	589.2
SIM 5		227.3	298.8	353.5	394.0	502.6	622.0	697.4
SIM 6		231.2	322.1	379.6	424.1	528.8	627.3	700.9
SIM 7		218.7	319.4	376.7	427.1	550.5	687.8	738.3
				COTTON				
SIM 1	82.4	142.7	144.3	140.2	138.6	136.4	139.8	136.4
SIM 2		115.7	126.3	133.5	123.5	119.4	116.9	131.5
SIM 3		232.0	249.9	250.8	251.2	248.6	246.9	240.9
SIM 4		141.8	141.4	143.2	140.2	131.2	123.2	118.1
SIM 5		135.6	133.1	127.0	121.3	110.4	99.6	91.2
SIM 6		134.1	124.5	118.6	112.1	100.4	107.4	99.4
SIM 7		157.7	141.9	110.8	108.7	132.2	113.0	111.4
				UNITED STATES				
SIM 1	1493.5[b]	2933.4	3223.5	3455.6	3522.6	3823.7	4209.1	4657.8
SIM 2		2735.3	2833.7	2970.7	3113.1	3495.9	3977.4	4485.3
SIM 3		3261.2	3800.3	3982.8	4052.8	4241.6	4376.2	4459.9
SIM 4		2790.1	3074.2	3299.5	3388.9	3573.1	3718.7	3845.2
SIM 5		2903.4	3026.7	3151.4	3237.0	3364.7	3585.7	3841.6
SIM 6		3058.1	3062.3	3123.7	3187.7	3406.4	3875.4	4298.9
SIM 7		3518.4	3968.5	4176.3	4306.1	4626.0	4947.7	5283.1

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72=2441.3 [10].

Table C8. Estimated seed expenditures for selected crops and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	186.1	181.2	163.2	167.0	167.6	168.7	168.4	166.5
SIM 2		183.1	159.7	191.6	162.4	172.1	167.5	160.1
SIM 3		198.6	198.2	198.6	198.2	197.9	197.5	197.3
SIM 4		195.5	189.8	190.0	189.7	187.0	186.5	183.4
SIM 5		197.1	188.6	186.4	182.2	180.5	174.6	169.4
SIM 6		196.5	187.0	179.9	176.8	171.6	173.2	172.9
SIM 7		202.8	195.9	196.9	191.7	184.3	180.6	176.8
				FEED GRAINS				
SIM 1	249.7	288.5	310.2	325.5	324.3	338.6	349.6	360.3
SIM 2		300.1	315.3	319.6	328.0	337.8	349.3	361.3
SIM 3		303.8	323.7	326.8	328.1	332.3	335.9	338.4
SIM 4		301.9	321.1	331.4	335.9	343.5	347.7	351.3
SIM 5		298.5	313.8	318.1	321.5	325.2	330.4	335.9
SIM 6		295.7	304.7	311.1	314.4	322.4	328.3	332.5
SIM 7		295.7	297.2	300.0	301.2	302.0	305.3	311.3
				SOYBEANS				
SIM 1	183.8	251.4	290.0	299.6	316.0	341.1	355.5	344.5
SIM 2		258.6	299.3	316.3	326.5	344.2	359.5	343.1
SIM 3		243.3	248.3	262.9	271.7	290.8	310.7	321.4
SIM 4		251.8	266.9	280.2	289.5	311.8	332.7	344.7
SIM 5		287.3	311.0	327.9	339.6	367.5	393.3	407.5
SIM 6		291.3	335.7	352.2	365.5	388.1	398.7	410.4
SIM 7		276.1	335.0	352.0	371.4	406.4	439.1	440.4
				COTTON				
SIM 1	28.4	25.0	21.4	20.8	20.0	19.3	19.7	18.7
SIM 2		22.1	21.7	20.0	21.0	19.9	19.5	23.4
SIM 3		42.6	42.2	41.6	41.0	39.6	38.5	37.5
SIM 4		28.4	26.3	26.7	26.2	24.1	22.1	21.0
SIM 5		27.0	24.3	23.1	21.7	19.0	16.2	14.3
SIM 6		26.9	22.3	20.9	19.3	16.2	17.4	16.2
SIM 7		31.1	23.3	19.1	16.3	17.6	12.0	10.2
				UNITED STATES				
SIM 1	836.4[b]	982.2	1051.7	1098.2	1125.5	1196.0	1252.2	1267.5
SIM 2		1000.0	1062.8	1132.7	1135.5	1202.3	1254.7	1265.4
SIM 3		1024.5	1079.2	1115.2	1136.5	1188.9	1241.6	1272.0
SIM 4		1013.7	1071.0	1113.6	1138.9	1194.6	1248.1	1277.9
SIM 5		1046.0	1104.5	1140.8	1162.6	1220.4	1273.4	1304.6
SIM 6		1046.5	1116.5	1149.5	1173.6	1226.5	1276.6	1309.5
SIM 7		1041.9	1118.3	1153.4	1178.1	1238.7	1296.0	1316.2

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72=1027.1 [10].

Table C9. Estimated labor requirements for selected commodities and United States in millions of man-hours with 1965-67 average for comparison.

Year	Actual[a/] 1965-67	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	137.3	131.4	109.5	109.0	107.2	102.8	97.9	94.0
SIM 2		133.1	106.4	128.1	103.4	105.4	97.2	89.6
SIM 3		133.3	106.6	102.4	99.5	92.9	87.1	83.8
SIM 4		131.0	101.2	97.1	94.3	86.3	80.7	75.5
SIM 5		132.2	100.0	94.0	88.3	81.2	72.0	65.6
SIM 6		131.7	99.1	89.5	84.6	75.2	71.4	68.5
SIM 7		136.4	104.6	101.0	94.3	82.8	75.0	69.5
				FEED GRAINS				
SIM 1	502.7	438.7	399.0	385.6	356.1	320.7	285.3	275.5
SIM 2		455.6	404.8	365.6	360.9	319.6	284.1	277.5
SIM 3		435.9	346.1	310.4	290.2	245.0	204.8	183.8
SIM 4		431.0	346.1	321.9	303.2	258.4	217.2	197.2
SIM 5		424.7	335.6	303.0	286.3	239.3	203.1	185.4
SIM 6		420.9	325.5	299.3	281.0	241.8	203.1	181.7
SIM 7		419.2	314.0	284.3	265.1	217.9	181.5	171.7
				SOYBEANS				
SIM 1	178.3	223.3	250.8	254.6	267.3	282.0	288.5	274.4
SIM 2		229.7	259.0	269.8	276.0	284.6	291.6	273.5
SIM 3		199.5	174.7	184.7	190.0	201.0	212.7	218.6
SIM 4		206.3	188.2	196.5	202.3	215.6	227.8	234.5
SIM 5		236.1	219.6	230.7	238.0	255.2	270.4	278.5
SIM 6		239.9	235.7	246.2	254.7	266.3	269.3	276.8
SIM 7		227.0	236.3	247.4	260.8	283.5	303.9	297.6
				COTTON				
SIM 1	344.7	263.8	227.7	206.0	194.7	169.8	150.5	135.1
SIM 2		235.6	229.2	224.3	203.0	176.5	151.1	154.7
SIM 3		361.4	281.8	253.7	237.9	196.5	158.0	133.4
SIM 4		264.5	203.8	189.3	175.3	139.2	106.2	88.1
SIM 5		254.5	192.8	167.6	150.9	114.9	81.7	61.9
SIM 6		252.1	181.6	157.9	140.2	103.8	91.4	72.6
SIM 7		278.1	195.1	140.3	124.9	115.6	68.5	53.6
				LIVESTOCK				
SIM 1	2839.0	3115.6	3130.3	3103.7	3084.1	3047.3	2994.3	2945.9
SIM 2		3161.8	3192.4	3165.0	3137.8	3075.5	3008.5	2958.8
SIM 3		2912.8	2651.2	2615.3	2600.7	2562.5	2532.5	2517.0
SIM 4		2978.2	2721.0	2690.5	2674.0	2635.7	2605.3	2587.4
SIM 5		2954.0	2721.6	2692.4	2674.4	2637.6	2599.4	2567.5
SIM 6		2916.8	2710.0	2700.2	2682.6	2641.0	2557.8	2489.9
SIM 7		2826.2	2551.7	2516.7	2492.6	2425.8	2373.5	2324.5
				UNITED STATES				
SIM 1	7607.0[b/]	6903.7	6621.2	6432.1	6347.8	6079.3	5835.6	5746.0
SIM 2		6893.3	6619.4	6625.1	6477.4	6148.2	5797.8	5955.1
SIM 3		6719.5	5987.9	5939.9	5814.4	5484.6	5160.4	5337.5
SIM 4		6687.4	5987.8	5967.5	5845.3	5521.9	5202.4	5383.8
SIM 5		6678.1	5997.2	5959.9	5834.1	5515.0	5191.9	5359.8
SIM 6		6571.3	6467.5	6010.0	5796.6	5946.8	5540.4	5378.3
SIM 7		6496.8	6317.1	5806.7	5591.1	5744.3	5349.6	5205.7

[a/] Source: An Econometric Simulation Model [29].

[b/] Actual 1970-72= 6364.0 [38].

Table C10. Estimated machinery expenses for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	665.5	564.8	545.0	534.9	537.3	551.6	572.6	585.2
SIM 2		544.2	452.2	431.6	428.2	419.5	437.1	455.6
SIM 3		525.9	482.5	518.7	538.9	582.6	620.0	639.9
SIM 4		508.0	388.4	369.9	366.5	366.5	375.0	382.2
SIM 5		513.8	406.8	379.3	369.1	355.9	357.7	358.8
SIM 6		517.7	438.2	408.6	386.6	353.6	368.0	398.2
SIM 7		540.6	551.3	609.7	639.7	702.3	755.7	787.9
				FEED GRAINS				
SIM 1	2369.0	2389.4	2413.7	2457.0	2493.8	2585.0	2714.8	2887.0
SIM 2		2278.6	2121.1	2102.8	2136.6	2258.9	2522.3	2777.5
SIM 3		2201.1	2057.3	2217.4	2275.5	2372.6	2416.3	2426.0
SIM 4		2066.1	1697.5	1759.9	1803.8	1891.0	1932.4	1951.1
SIM 5		2116.6	1711.1	1719.8	1738.5	1775.4	1809.1	1885.1
SIM 6		2178.6	1793.2	1711.8	1705.9	1720.2	1902.7	2191.6
SIM 7		2356.7	2357.9	2537.7	2631.5	2848.6	3054.2	3182.1
				SOYBEANS				
SIM 1	795.9	1137.9	1305.3	1432.7	1527.9	1785.3	2071.9	2270.1
SIM 2		1139.0	1303.3	1417.0	1499.0	1717.3	1979.0	2168.3
SIM 3		1065.0	1119.4	1249.7	1354.8	1647.3	1986.3	2208.7
SIM 4		1060.0	1090.3	1193.5	1264.9	1452.5	1656.3	1785.5
SIM 5		1071.3	1156.6	1297.8	1391.9	1634.0	1890.7	2051.3
SIM 6		1083.0	1235.0	1417.3	1526.0	1791.4	2106.6	2389.0
SIM 7		1099.6	1443.3	1843.0	2142.8	2959.4	3907.1	4533.3
				COTTON				
SIM 1	203.1	151.5	130.6	124.7	119.9	109.6	100.3	95.3
SIM 2		141.5	107.0	96.0	93.2	81.5	71.3	65.9
SIM 3		142.8	107.3	109.6	107.2	99.9	91.6	87.1
SIM 4		123.5	68.6	62.4	58.4	47.5	35.6	28.4
SIM 5		123.5	67.8	61.0	56.1	43.4	30.5	22.6
SIM 6		124.9	67.5	59.1	53.9	40.7	31.0	24.5
SIM 7		134.7	76.3	71.6	62.9	68.7	77.7	73.3
				LIVESTOCK				
SIM 1	767.6	946.6	1051.1	1116.1	1158.6	1264.9	1374.4	1448.2
SIM 2		942.3	1023.7	1075.8	1113.1	1211.8	1332.4	1414.5
SIM 3		862.0	824.0	889.4	932.9	1040.8	1149.4	1214.7
SIM 4		853.7	791.6	841.3	876.1	966.3	1060.1	1118.0
SIM 5		855.9	799.1	845.4	878.5	965.0	1059.0	1119.9
SIM 6		859.0	815.4	861.1	890.3	970.7	1069.1	1149.4
SIM 7		867.0	862.4	947.5	1002.2	1139.8	1286.4	1377.8
				UNITED STATES				
SIM 1	7533.4[b]	8317.2	8873.0	9271.9	9564.7	10324.2	11163.3	11795.2
SIM 2		8166.0	8428.9	8720.2	8990.4	9708.6	10663.8	11382.5
SIM 3		7917.0	8012.0	8581.8	8929.7	9762.9	10585.3	11077.1
SIM 4		7731.5	7457.9	7824.0	8090.1	8743.3	9381.1	9765.8
SIM 5		7801.3	7562.9	7900.3	8154.4	8794.4	9468.6	9938.3
SIM 6		7884.4	7771.3	8062.5	8284.8	8898.5	9802.7	10656.3
SIM 7		8119.8	8713.1	9614.1	10201.4	11740.6	13406.4	14457.9

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72=8270.0 [10].

Table C11. Estimated real estate expenses for selected commodities and the United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	887.6	865.0	756.3	776.1	783.5	805.4	826.8	831.4
SIM 2		840.5	642.2	760.9	629.1	662.9	661.7	649.9
SIM 3		973.4	995.4	1020.6	1035.3	1074.7	1114.6	1137.3
SIM 4		926.0	825.2	799.1	789.5	771.1	777.1	771.6
SIM 5		945.5	843.3	799.5	770.0	750.8	730.3	714.0
SIM 6		950.8	879.2	804.4	772.1	728.2	763.0	802.1
SIM 7		1022.7	1076.2	1136.6	1137.7	1174.9	1236.0	1259.3
				FEED GRAINS				
SIM 1	2839.8	4521.2	4739.1	5011.4	4962.5	5269.2	5646.1	6335.9
SIM 2		4356.3	3961.7	3731.4	3905.1	4135.7	4780.6	5715.0
SIM 3		4802.7	5351.1	5684.8	5860.3	6242.3	6464.6	6563.9
SIM 4		4354.0	4213.7	4343.7	4406.9	4560.6	4650.4	4743.6
SIM 5		4440.4	4221.2	4166.4	4203.1	4194.0	4310.7	4549.2
SIM 6		4597.3	4449.3	4324.1	4282.8	4299.5	4697.7	5344.2
SIM 7		5071.9	6048.0	6667.7	7014.7	7742.0	8546.1	9435.3
				SOYBEANS				
SIM 1	766.1	1284.8	1576.9	1688.6	1840.0	2124.3	2391.6	2432.9
SIM 2		1321.4	1605.4	1744.2	1836.5	2036.9	2287.4	2294.4
SIM 3		1270.0	1408.8	1595.1	1723.8	2060.6	2458.4	2710.1
SIM 4		1280.1	1438.5	1568.1	1659.8	1893.6	2138.3	2289.8
SIM 5		1473.4	1687.4	1845.8	1955.6	2235.5	2524.0	2699.3
SIM 6		1544.8	1916.5	2088.0	2211.7	2459.0	2746.7	3083.7
SIM 7		1528.9	2233.2	2631.8	2984.8	3888.7	4957.7	5400.0
				COTTON				
SIM 1	578.1	584.2	572.6	563.9	567.3	582.3	617.5	624.3
SIM 2		481.9	449.7	445.0	413.5	395.6	391.3	439.5
SIM 3		868.2	941.3	975.8	1001.2	1049.7	1094.4	1108.5
SIM 4		577.9	517.9	506.4	495.6	471.9	457.9	453.5
SIM 5		558.2	496.1	463.6	445.6	415.2	392.6	375.9
SIM 6		555.5	474.6	442.8	421.7	389.3	423.4	408.6
SIM 7		637.4	562.5	471.8	465.0	598.6	630.8	693.0
				LIVESTOCK				
SIM 1	7443.0	9495.6	10573.8	11237.7	11679.7	12797.2	13943.7	14678.1
SIM 2		9470.5	10450.3	11055.6	11474.3	12547.6	13723.9	14493.4
SIM 3		9518.7	10601.3	11267.4	11716.3	12843.2	13983.9	14674.0
SIM 4		9467.4	10427.2	11022.0	11427.5	12457.5	13509.9	14151.7
SIM 5		9483.4	10466.8	11051.3	11452.1	12473.0	13523.3	14180.6
SIM 6		9504.3	10550.6	11129.1	11519.7	12520.0	13604.2	14352.8
SIM 7		9555.0	10803.9	11556.3	12061.9	13346.2	14685.8	15506.4
				UNITED STATES				
SIM 1	13540.3[b]	19807.2	21448.5	22599.8	23267.6	25162.5	27179.8	28877.9
SIM 2		19476.7	20235.1	21128.0	21707.4	23337.4	25450.2	27700.7
SIM 3		20438.7	22423.7	23934.7	24785.8	26829.3	28721.3	30302.1
SIM 4		19611.2	20548.3	21630.3	22228.2	23713.6	25139.1	26518.6
SIM 5		19906.8	20840.6	21717.6	22275.2	23628.3	25086.3	26627.5
SIM 6		20089.6	21861.3	22171.9	22554.7	24294.4	26103.5	27943.1
SIM 7		20752.7	24314.8	25847.7	27010.8	30648.8	33924.8	36245.9

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72 = 15073.1 [10].

Table C12. Estimated fuel, oil, and repairs expense for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	408.1	427.6	404.7	405.7	406.8	411.0	415.4	416.2
SIM 2		422.6	375.7	402.1	373.3	379.8	379.5	377.2
SIM 3		407.2	354.9	364.0	368.4	378.2	386.5	390.9
SIM 4		398.9	322.0	317.7	316.5	313.5	314.6	313.1
SIM 5		402.1	325.1	315.7	309.2	303.9	298.3	293.2
SIM 6		403.0	332.7	316.6	308.1	295.0	300.8	308.8
SIM 7		415.5	371.5	386.2	388.4	396.4	405.8	410.0
				FEED GRAINS				
SIM 1	1110.7	1183.4	1193.4	1204.7	1213.6	1235.1	1264.1	1301.3
SIM 2		1159.9	1131.3	1129.6	1137.8	1165.9	1223.3	1278.1
SIM 3		1079.1	956.3	992.4	1005.8	1028.6	1039.4	1042.1
SIM 4		1050.4	880.0	895.4	905.8	926.5	936.7	941.3
SIM 5		1061.1	882.9	886.9	891.9	902.0	910.6	927.4
SIM 6		1074.3	900.3	885.2	885.0	890.2	930.4	992.4
SIM 7		1112.1	1020.1	1060.4	1081.4	1129.6	1174.7	1202.5
				SOYBEANS				
SIM 1	391.6	569.9	647.7	707.0	751.8	873.2	1008.3	1100.8
SIM 2		570.3	647.2	700.6	739.3	842.4	964.8	1053.0
SIM 3		532.6	554.4	615.1	664.1	801.4	961.0	1066.0
SIM 4		530.8	541.5	590.5	624.3	713.0	809.5	870.6
SIM 5		535.2	570.9	638.1	682.9	797.8	919.5	995.6
SIM 6		539.6	605.5	693.3	745.6	872.5	1018.7	1146.8
SIM 7		545.8	694.6	881.5	1022.3	1406.5	1852.5	2147.6
				COTTON				
SIM 1	174.3	152.9	138.3	134.4	130.8	123.5	117.0	113.2
SIM 2		144.7	121.2	113.2	111.7	103.4	96.1	92.4
SIM 3		140.6	105.1	106.4	104.5	99.2	93.2	90.0
SIM 4		125.5	77.0	72.8	70.0	62.1	53.6	48.5
SIM 5		125.5	76.4	71.9	68.3	59.2	49.9	44.3
SIM 6		126.3	76.1	70.4	66.6	57.2	50.5	45.6
SIM 7		133.9	82.8	79.5	73.1	78.9	84.4	80.9
				LIVESTOCK				
SIM 1	741.1	928.8	964.6	983.0	994.4	1022.2	1049.6	1066.8
SIM 2		928.4	961.1	976.5	986.2	1010.7	1038.0	1056.3
SIM 3		843.0	746.7	765.2	776.8	805.0	832.6	849.1
SIM 4		842.3	742.0	756.9	766.1	789.0	812.3	826.5
SIM 5		842.4	743.3	758.5	767.5	789.8	812.6	826.9
SIM 6		842.7	745.7	762.1	771.1	792.3	814.9	831.0
SIM 7		843.4	751.8	775.1	789.7	825.3	861.4	883.7
				UNITED STATES				
SIM 1	4206.5[b]	5004.7	5280.1	5478.6	5617.7	5975.2	6355.9	6613.3
SIM 2		4959.4	5160.2	5353.7	5459.6	5801.8	6192.9	6460.2
SIM 3		4735.8	4641.2	4874.9	5031.0	5412.1	5804.1	6041.3
SIM 4		4681.3	4486.3	4664.9	4793.9	5103.7	5418.0	5603.3
SIM 5		4699.8	4522.4	4702.7	4831.1	5152.3	5482.1	5690.6
SIM 6		4720.5	4584.5	4768.9	4890.3	5209.7	5611.4	5932.1
SIM 7		4785.3	4844.9	5223.9	5468.8	6139.1	6874.9	7332.2

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72 = 4618.5 [10].

Table C13. Estimated miscellaneous expenses for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	255.4	332.4	297.2	305.9	306.8	307.6	305.1	299.5
SIM 2		336.3	290.0	359.9	295.6	315.5	303.4	286.0
SIM 3		351.0	326.1	327.4	326.2	323.9	321.2	319.5
SIM 4		344.8	310.2	311.2	310.1	302.9	300.1	292.0
SIM 5		347.9	307.1	302.9	293.4	288.3	273.5	260.9
SIM 6		346.7	304.2	289.4	282.2	269.5	271.1	269.3
SIM 7		359.4	320.6	323.3	311.4	293.7	283.5	273.9
				FEED GRAINS				
SIM 1	714.2	1069.1	1117.7	1167.3	1167.9	1231.4	1301.7	1395.3
SIM 2		1059.0	1010.9	993.2	1015.7	1060.8	1173.0	1302.2
SIM 3		1130.0	1264.0	1329.4	1360.6	1430.3	1476.2	1497.7
SIM 4		1071.6	1095.8	1131.9	1150.8	1191.0	1218.3	1238.5
SIM 5		1081.5	1096.6	1102.0	1111.9	1124.8	1150.6	1191.8
SIM 6		1099.7	1126.3	1120.8	1120.9	1133.8	1201.6	1305.4
SIM 7		1163.2	1348.3	1452.3	1507.4	1624.9	1752.6	1862.1
				SOYBEANS				
SIM 1	220.8	561.7	761.1	854.9	962.8	1189.1	1394.4	1421.2
SIM 2		584.1	799.9	920.5	1001.5	1180.5	1368.0	1363.6
SIM 3		520.3	588.6	681.0	753.1	947.6	1188.1	1346.8
SIM 4		549.7	644.8	731.6	797.4	973.1	1167.4	1291.7
SIM 5		666.0	838.2	969.7	1065.9	1321.0	1598.2	1772.2
SIM 6		678.5	968.4	1137.0	1260.2	1526.6	1745.1	1946.6
SIM 7		634.0	1036.8	1297.3	1548.5	2202.9	3028.1	3401.6
				COTTON				
SIM 1	315.8	393.7	369.5	355.7	350.8	344.8	351.9	345.5
SIM 2		349.4	360.6	370.7	350.3	340.7	333.6	376.8
SIM 3		578.1	517.0	510.7	509.8	501.3	494.9	483.7
SIM 4		399.5	337.3	337.5	329.9	306.0	284.2	273.2
SIM 5		383.2	317.3	297.1	281.9	252.4	223.0	202.0
SIM 6		379.9	297.4	278.1	260.4	227.6	244.4	227.8
SIM 7		428.4	325.9	252.7	236.8	263.9	204.4	194.7
				LIVESTOCK				
SIM 1	1792.8	2443.8	2719.9	2885.5	2997.7	3279.8	3567.3	3747.3
SIM 2		2448.2	2696.4	2848.2	2950.9	3217.7	3513.3	3697.3
SIM 3		2464.0	2782.3	2964.9	3075.3	3350.5	3626.7	3792.5
SIM 4		2452.1	2734.6	2903.8	3010.4	3270.8	3528.3	3684.5
SIM 5		2453.5	2738.2	2898.7	2998.7	3248.8	3500.8	3662.1
SIM 6		2455.6	2749.7	2906.6	3005.4	3252.3	3517.6	3700.5
SIM 7		2468.8	2804.1	2998.8	3122.3	3431.2	3749.8	3947.2
				UNITED STATES				
SIM 1	4493.4[b]	6387.0	7066.5	7486.9	7811.4	8583.3	9371.3	9834.6
SIM 2		6338.9	6930.3	7430.9	7662.8	8351.6	9099.3	9739.0
SIM 3		6605.3	7250.4	7751.6	8073.8	8790.0	9515.1	10153.3
SIM 4		6379.7	6895.3	7354.3	7647.3	8280.2	8906.4	9493.0
SIM 5		6494.0	7069.9	7508.6	7800.5	8471.8	9154.1	9802.2
SIM 6		6493.9	7499.3	7770.5	7973.6	8932.9	9658.2	10229.7
SIM 7		6587.4	7889.0	8363.0	8770.9	10339.7	11696.8	12459.7

[a]Source: An Econometric Simulation Model [29].

[b]Actual 1970-72 = 5712.0 [10].

Table C14. Estimated interest expense on commodity stocks for selected commodities and United States in millions of 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a/]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	67.0	76.5	75.0	75.5	77.4	81.3	84.9	86.3
SIM 2		77.9	71.4	78.3	80.1	80.7	84.0	86.7
SIM 3		80.2	95.9	101.6	103.7	108.4	112.9	115.5
SIM 4		79.8	93.4	97.9	99.8	103.6	107.3	109.4
SIM 5		79.9	93.8	97.2	98.0	100.1	102.8	102.9
SIM 6		79.9	93.4	96.4	96.2	96.6	100.0	102.0
SIM 7		80.7	96.7	100.5	101.8	103.6	105.1	106.5
				FEED GRAINS				
SIM 1	445.4	708.0	782.9	837.2	855.2	935.2	1006.4	1031.3
SIM 2		741.7	795.1	840.8	865.1	927.7	1006.1	1030.8
SIM 3		767.7	941.7	987.4	1005.8	1058.7	1107.2	1136.0
SIM 4		764.8	930.1	1000.6	1033.7	1100.2	1153.5	1188.6
SIM 5		757.1	909.8	959.3	983.9	1034.5	1084.8	1126.8
SIM 6		750.5	879.9	935.4	962.0	1020.2	1081.6	1117.7
SIM 7		751.7	858.2	901.5	917.7	951.6	990.4	1013.6
				SOYBEANS				
SIM 1	59.3	109.0	132.2	147.9	153.7	175.6	191.9	207.1
SIM 2		111.3	136.9	150.2	158.6	177.8	194.9	206.1
SIM 3		108.5	130.0	140.2	149.5	169.3	190.0	202.6
SIM 4		113.1	139.2	151.0	159.6	181.3	203.6	217.0
SIM 5		124.5	162.1	176.5	187.1	213.7	240.8	256.9
SIM 6		122.7	174.3	189.3	201.1	229.4	245.5	257.1
SIM 7		115.5	174.0	187.5	204.4	234.6	267.7	287.2
				COTTON				
SIM 1	31.2	22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 2		22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 3		22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 4		22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 5		22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 6		22.8	21.9	21.3	20.9	19.9	18.8	18.0
SIM 7		22.8	21.9	21.3	20.9	19.9	18.8	18.0
				LIVESTOCK				
SIM 1	1151.9	1393.7	1492.6	1542.3	1578.0	1668.4	1754.5	1796.2
SIM 2		1422.0	1509.5	1561.0	1589.5	1668.7	1757.6	1788.7
SIM 3		1436.2	1643.9	1731.5	1759.0	1823.7	1882.8	1915.4
SIM 4		1435.7	1630.5	1732.3	1778.3	1867.5	1934.9	1973.8
SIM 5		1429.6	1612.4	1697.0	1729.4	1798.1	1853.8	1897.3
SIM 6		1422.5	1586.9	1665.4	1701.7	1776.6	1847.6	1890.3
SIM 7		1426.5	1568.1	1631.8	1656.4	1706.5	1748.1	1777.3
				UNITED STATES				
SIM 1	2015.4[b/]	2499.7	2698.6	2820.9	2883.4	3083.1	3263.7	3348.4
SIM 2		2566.1	2732.2	2850.0	2915.4	3080.5	3272.9	3342.2
SIM 3		2606.0	3030.8	3180.4	3240.0	3385.7	3523.1	3599.4
SIM 4		2606.6	3012.5	3201.5	3293.4	3478.3	3629.5	3718.7
SIM 5		2604.4	2997.4	3149.8	3220.5	3372.1	3512.4	3613.8
SIM 6		2589.6	2951.4	3108.0	3183.9	3346.8	3503.6	3597.6
SIM 7		2588.5	2913.8	3042.8	3103.1	3220.2	3340.2	3415.1

[a/] Source: An Econometric Simulation Model [29].

[b/] Actual 1970-72 = 2435.13 [10].

Table C15. Estimated real estate tax expense for selected commodities and United States in 1972 dollars with 1965-67 average for comparison.

Year	Actual 1965-67[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	134.3	128.4	110.1	113.0	114.1	117.4	120.5	121.1
SIM 2		124.4	91.2	110.5	88.6	93.8	93.3	91.1
SIM 3		146.3	149.5	153.4	155.7	161.8	168.1	171.6
SIM 4		138.5	121.4	116.9	115.1	111.7	112.3	111.2
SIM 5		141.7	124.4	116.9	111.9	108.3	104.6	101.7
SIM 6		142.6	130.3	117.7	112.2	104.6	110.0	116.2
SIM 7		154.4	162.9	172.6	172.6	178.4	188.1	191.8
				FEED GRAINS				
SIM 1	474.4	746.9	783.4	828.9	820.7	872.0	935.0	1050.4
SIM 2		719.4	653.3	614.8	643.9	682.4	790.3	946.6
SIM 3		794.0	885.7	941.5	970.9	1034.8	1071.9	1088.5
SIM 4		719.0	695.5	717.2	727.8	753.5	768.5	784.1
SIM 5		733.4	696.7	687.6	693.7	692.2	711.7	751.6
SIM 6		759.7	734.9	714.0	707.0	709.8	776.4	884.6
SIM 7		839.0	1002.3	1105.9	1164.0	1285.6	1420.1	1568.8
				SOYBEANS				
SIM 1	112.2	189.8	233.5	250.1	272.8	315.2	355.1	361.1
SIM 2		195.4	237.8	258.5	272.2	302.0	339.4	340.2
SIM 3		187.6	208.1	235.9	255.2	305.6	365.2	403.0
SIM 4		189.1	212.6	231.9	245.5	280.4	316.9	339.5
SIM 5		218.3	250.2	273.8	290.2	332.0	375.1	401.3
SIM 6		229.1	284.8	310.4	328.9	365.8	408.8	459.4
SIM 7		226.7	332.6	392.6	445.7	581.8	742.8	809.4
				COTTON				
SIM 1	49.3	48.8	47.8	47.0	47.3	48.7	51.8	52.4
SIM 2		39.7	36.9	36.4	33.6	32.0	31.6	35.9
SIM 3		74.1	80.7	83.7	86.0	90.3	94.3	95.6
SIM 4		48.3	42.9	41.9	40.9	38.8	37.6	37.2
SIM 5		46.5	41.0	38.1	36.5	33.9	31.8	30.3
SIM 6		46.3	39.1	36.2	34.4	31.5	34.5	33.2
SIM 7		53.6	46.9	38.8	38.2	50.1	53.0	58.5
				LIVESTOCK				
SIM 1	1141.7	1494.0	1680.1	1794.9	1871.4	2064.9	2264.0	2392.3
SIM 2		1489.2	1656.6	1760.3	1832.3	2017.5	2222.2	2357.1
SIM 3		1498.4	1685.3	1800.5	1878.4	2073.7	2271.6	2391.5
SIM 4		1488.6	1652.2	1753.9	1823.4	2000.3	2181.5	2292.1
SIM 5		1491.7	1659.7	1759.5	1828.1	2003.3	2184.0	2297.6
SIM 6		1495.7	1675.7	1774.3	1841.0	2012.2	2199.4	2330.4
SIM 7		1505.3	1723.8	1855.5	1944.1	2169.4	2405.1	2549.8
				UNITED STATES				
SIM 1	2695.3[b]	2954.1	3214.8	3401.3	3502.8	3806.5	4128.4	4397.0
SIM 2		2910.0	3027.3	3153.6	3248.3	3514.0	3866.5	4201.6
SIM 3		3042.4	3360.8	3588.2	3723.7	4052.4	4360.8	4580.8
SIM 4		2925.4	3076.1	3234.8	3330.4	3571.0	3806.5	3994.8
SIM 5		2973.6	3123.5	3248.9	3338.0	3555.9	3796.9	4013.2
SIM 6		3009.6	3254.3	3325.0	3392.7	3637.9	3940.4	4241.6
SIM 7		3115.4	3658.1	3937.8	4133.8	4579.3	5220.4	5596.1

[a] Source: An Econometric Simulation Model [29].

[b] Actual 1970-72 = 3194.6 [10].

Table C16. Estimated beginning crop year supplies for model crops with 1969-72 average for comparison.[a]

Year	Actual 1969-72[b]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT (MIL. BU.)				
SIM 1	2314.9	2344.1	2481.1	2484.3	2520.8	2603.2	2627.6	2525.0
SIM 2		2542.8	2166.7	2776.2	2576.3	2549.7	2445.0	2229.8
SIM 3		2680.8	3126.3	3260.5	3286.2	3420.5	3578.2	3700.0
SIM 4		3048.5	3740.7	3827.2	3894.8	3985.4	4119.6	4165.1
SIM 5		2691.4	3806.6	3770.5	3772.2	3886.9	3913.5	3896.8
SIM 6		2388.2	3582.0	3663.5	3695.7	3629.3	3422.3	3162.5
SIM 7		2177.1	2449.3	2554.9	2534.8	2561.1	2633.4	2645.3
				FEED GRAINS (MIL. TONS)				
SIM 1	231.8	284.8	310.8	337.9	334.2	357.7	362.1	367.9
SIM 2		304.1	332.7	338.7	350.7	356.2	358.0	367.0
SIM 3		317.2	370.9	378.0	385.5	403.0	419.7	430.9
SIM 4		325.3	388.3	405.9	415.2	435.1	452.6	465.3
SIM 5		307.1	379.3	389.0	397.9	412.6	427.1	431.2
SIM 6		285.4	359.5	383.8	390.6	409.5	399.0	379.7
SIM 7		266.7	288.6	298.7	304.1	313.2	326.0	348.6
				SOYBEANS (MIL. BU.)				
SIM 1	1361.7	1551.1	1815.9	1919.6	2078.3	2349.6	2565.1	2530.8
SIM 2		1595.3	1837.8	2054.0	2162.7	2379.1	2597.0	2522.5
SIM 3		1513.5	1752.1	1919.0	2022.7	2273.5	2545.7	2705.2
SIM 4		1680.8	2115.6	2300.2	2425.7	2742.4	3065.9	3262.5
SIM 5		1883.9	2462.1	2589.3	2842.7	3230.6	3621.9	3855.2
SIM 6		1833.9	2614.4	2872.0	3038.9	3331.1	3264.2	3468.6
SIM 7		1742.8	2366.5	2571.4	2766.6	3181.8	3605.5	3677.3
				COTTON (MIL. BALES)				
SIM 1	15.7	20.6	20.7	22.0	21.5	21.5	22.0	22.1
SIM 2		24.6	23.7	21.1	24.0	23.8	24.2	28.0
SIM 3		28.1	32.1	32.7	33.2	34.1	35.1	34.8
SIM 4		26.9	28.5	29.2	29.4	29.6	29.6	29.7
SIM 5		26.0	27.5	27.3	27.2	26.9	26.4	25.7
SIM 6		25.6	26.5	26.6	26.1	24.9	26.5	26.8
SIM 7		29.3	27.9	29.2	23.3	17.3	14.4	14.2

[a] Included year production, carryover, and imports.

[b] Cotton actual average 1969-71 [7;11;12;20].

Table C17. Estimated end-of-year government inventories for selected crops with 1969-71 average for comparison.

Year	Actual 1969-71[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT (MIL. BU.)				
SIM 1	665.2	597.4	648.2	567.1	554.1	510.3	400.1	202.5
SIM 2		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 3		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 4		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 5		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 6		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 7		0.0	0.0	0.0	0.0	0.0	0.0	0.0
				FEED GRAINS (MIL. TONS)				
SIM 1	25.8	26.1	27.9	43.3	27.3	24.0	4.3	0.0
SIM 2		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 3		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 4		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 5		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 6		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 7		0.0	0.0	0.0	0.0	0.0	0.0	0.0
				COTTON (MIL. BALES)				
SIM 1	1.2	1.5	1.1	1.9	1.2	0.5	0.4	0.0
SIM 2		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 3		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 4		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 5		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 6		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIM 7		0.0	0.0	0.0	0.0	0.0	0.0	0.0

[a] Sources: [7;12;20].

Table C18. Estimated end-of-year commercial inventories for selected crops with 1969-71 average for comparison.

Year	Actual 1969-71[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT (MIL. BU.)				
SIM 1	161.3	194.1	172.9	185.5	187.2	192.2	203.6	224.0
SIM 2		989.5	508.1	1034.0	799.3	647.4	421.3	134.6
SIM 3		687.3	650.3	628.6	641.5	646.4	663.7	647.4
SIM 4		1222.5	1389.4	1363.2	1386.1	1389.8	1394.0	1403.7
SIM 5		902.9	1413.8	1429.8	1391.3	1376.3	1393.1	1359.3
SIM 6		450.9	1368.7	1400.9	1394.8	1205.9	829.2	466.9
SIM 7		0.0	0.0	0.0	0.0	0.0	0.0	0.0
				FEED GRAINS (MIL. TONS)				
SIM 1	17.4	20.1	19.8	17.4	19.9	20.4	17.7	12.4
SIM 2		62.8	65.5	57.4	60.0	40.8	18.1	10.3
SIM 3		53.9	52.7	51.6	52.4	52.8	54.5	54.0
SIM 4		68.1	71.0	69.2	70.8	70.7	71.2	70.2
SIM 5		53.6	71.6	71.1	70.7	71.0	64.2	51.0
SIM 6		29.8	67.7	69.7	70.7	68.0	31.2	0.0
SIM 7		4.0	0.0	0.0	0.0	0.0	0.0	0.0
				SOYBEANS (MIL. BU.)				
SIM 1	133.5	55.3	12.7	10.0	16.0	10.3	12.7	10.0
SIM 2		55.4	30.0	30.0	30.0	17.9	18.0	10.0
SIM 3		7.4	10.0	10.0	10.0	10.0	10.0	10.0
SIM 4		137.5	254.1	273.4	287.1	321.5	356.8	378.2
SIM 5		114.6	291.4	315.2	331.8	374.0	416.6	442.0
SIM 6		31.8	292.7	319.5	334.0	246.0	10.0	10.0
SIM 7		10.0	10.0	10.0	10.0	10.0	10.0	10.0
				COTTON (MIL. BALES)				
SIM 1	3.2	6.4	6.4	6.4	6.4	6.3	6.2	6.2
SIM 2		11.9	10.4	7.4	10.0	9.2	8.8	12.1
SIM 3		6.0	6.0	6.2	5.9	6.1	5.9	6.1
SIM 4		11.3	9.5	9.5	9.5	9.5	9.5	9.4
SIM 5		11.1	9.4	9.5	9.5	9.5	9.5	8.7
SIM 6		10.3	9.6	9.4	9.5	8.5	9.2	9.2
SIM 7		13.2	11.2	12.1	5.9	0.2	0.0	0.0

[a] Sources: [10;11;12;20].

Table C19. Estimated per capita consumption of livestock in pounds of meat with 1969-73 average for comparison.

Year		Actual 1969-73[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
					BEEF				
SIM	1	115.4	137.75	150.69	153.89	155.65	160.50	163.55	163.63
SIM	2		141.65	155.85	159.05	150.11	152.81	164.65	164.76
SIM	3		136.74	150.16	152.90	154.97	159.83	164.89	167.98
SIM	4		142.27	156.71	159.62	161.64	166.49	171.48	174.35
SIM	5		140.20	150.76	159.74	161.62	166.60	170.85	172.36
SIM	6		137.38	153.28	159.77	161.54	166.15	167.14	166.03
SIM	7		130.33	141.75	144.37	145.55	147.81	150.71	150.43
					PORK				
SIM	1	66.7	70.43	71.38	71.71	71.76	72.17	71.81	71.05
SIM	2		71.58	73.09	73.43	73.34	73.05	72.30	71.45
SIM	3		69.91	71.14	71.11	71.29	71.56	71.89	72.12
SIM	4		71.82	73.47	73.76	73.96	74.39	74.85	75.08
SIM	5		71.12	73.48	73.80	73.97	74.44	74.69	74.54
SIM	6		69.86	72.86	73.75	73.94	74.30	72.86	71.29
SIM	7		66.82	67.18	67.06	66.98	66.24	65.72	64.91
					BROILERS				
SIM	1	38.9	36.88	37.67	37.86	37.98	38.28	38.57	38.77
SIM	2		36.82	37.63	37.82	37.96	38.29	38.59	38.76
SIM	3		36.85	37.66	37.82	37.93	38.21	38.49	38.66
SIM	4		36.82	37.64	37.84	37.97	38.28	38.58	38.77
SIM	5		36.84	37.64	37.84	37.97	38.28	38.60	38.81
SIM	6		36.80	37.62	37.83	37.96	38.29	38.51	38.63
SIM	7		36.72	37.50	37.65	37.78	38.05	38.32	38.53
					SHEEP AND LAMBS				
SIM	1	3.2	3.65	3.69	3.69	3.66	3.65	3.47	3.25
SIM	2		3.97	4.15	4.16	4.08	3.87	3.58	3.33
SIM	3		3.54	3.63	3.56	3.56	3.53	3.51	3.51
SIM	4		4.04	4.27	4.25	4.26	4.25	4.25	4.25
SIM	5		3.84	4.27	4.27	4.26	4.26	4.20	4.07
SIM	6		3.54	4.10	4.26	4.26	4.22	3.74	3.33
SIM	7		2.97	2.90	2.84	2.79	2.62	2.50	2.36
					TURKEYS				
SIM	1	8.6	8.24	8.53	8.68	8.78	9.01	9.31	9.57
SIM	2		8.06	8.28	8.42	8.56	8.89	9.26	9.51
SIM	3		8.29	8.56	8.73	8.82	9.05	9.25	9.37
SIM	4		8.03	8.23	8.39	8.48	8.70	8.89	9.01
SIM	5		8.13	8.23	8.38	8.48	8.69	8.93	9.12
SIM	6		8.27	8.31	8.38	8.48	8.72	9.14	9.46
SIM	7		8.56	8.92	9.10	9.23	9.58	9.88	10.12

[a] Sources: [15;18].

Table C20. Projected yield per planted acre of model crops for each alternative with 1969-72 average for comparison.

Year	Actual 1969-72[a]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT (BUSHELS)				
SIM 1	31.0	31.7	33.8	35.2	36.2	38.6	40.9	42.4
SIM 2		31.7	33.8	35.2	36.2	38.6	40.9	42.4
SIM 3		34.2	40.5	42.1	43.2	46.0	48.7	50.3
SIM 4		34.2	40.5	42.1	43.2	46.0	48.7	50.3
SIM 5		34.2	40.5	42.1	43.2	46.0	48.7	50.3
SIM 6		34.2	40.5	42.1	43.2	46.0	48.7	50.3
SIM 7		34.2	40.5	42.1	43.2	46.0	48.7	50.3
				FEED GRAINS (BUSHELS)				
SIM 1	65.7	73.5	79.9	84.1	86.9	94.1	101.3	105.6
SIM 2		73.5	79.9	84.1	86.9	94.1	101.3	105.6
SIM 3		78.7	94.4	99.2	102.5	110.7	119.0	123.9
SIM 4		78.7	94.4	99.2	102.5	110.7	119.0	123.9
SIM 5		78.7	94.4	99.2	102.5	110.7	119.0	123.9
SIM 6		78.7	94.4	99.2	102.5	110.7	119.0	123.9
SIM 7		78.7	94.4	99.2	102.5	110.7	119.0	123.9
				SOYBEANS (BUSHELS)				
SIM 1	27.0	28.6	30.2	31.2	31.8	33.4	35.0	36.0
SIM 2		28.6	30.2	31.2	31.8	33.4	35.0	36.0
SIM 3		30.3	34.5	35.6	36.4	38.2	40.0	41.1
SIM 4		30.3	34.5	35.6	36.4	38.2	40.0	41.1
SIM 5		30.3	34.5	35.6	36.4	38.2	40.0	41.1
SIM 6		30.3	34.5	35.6	36.4	38.2	40.0	41.1
SIM 7		30.3	34.5	35.6	36.4	38.2	40.0	41.1
				COTTON (POUNDS)				
SIM 1	408.4	512.5	554.1	577.3	592.7	631.1	669.5	692.5
SIM 2		512.5	554.1	577.3	592.7	631.1	669.5	692.5
SIM 3		561.7	684.4	711.1	728.8	772.9	817.0	843.5
SIM 4		561.7	684.4	711.1	728.8	772.9	817.0	843.5
SIM 5		561.7	684.4	711.1	728.8	772.9	817.0	843.5
SIM 6		561.7	684.4	711.1	728.8	772.9	817.0	843.5
SIM 7		561.7	684.4	711.1	728.8	772.9	817.0	843.5

[a] Sources: [7;11;12;20]

Table C21. Estimated gross income [a] for model commodities and livestock in 1972 dollars with 1969-72 average for comparison.

Year	Actual 1969-72 [b]	1975-79	1980-84	1985	1985-89	1990-94	1995-99	2000
				WHEAT				
SIM 1	2855.1	3465.0	3248.4	3464.4	3563.8	3799.2	3997.3	4061.6
SIM 2		2246.9	2166.5	2465.8	2067.7	2597.8	2885.6	3089.9
SIM 3		4266.7	5013.4	5211.4	5324.9	5620.0	5882.5	6051.8
SIM 4		3041.8	2811.3	2940.7	2976.2	3090.1	3241.3	3258.6
SIM 5		3513.8	2802.1	2828.8	2841.5	2981.2	3001.8	3010.8
SIM 6		3999.8	3086.0	2733.7	2735.5	3010.2	3834.6	4555.9
SIM 7		5433.5	6242.6	6560.8	6646.4	7033.7	7522.2	7750.6
				FEED GRAINS				
SIM 1	4894.2	6448.0	6937.4	7227.6	7537.9	8023.3	9779.4	10894.4
SIM 2		4464.4	4750.8	5452.6	5487.8	7169.3	9404.2	10275.2
SIM 3		7380.7	9539.7	9702.7	9741.0	9941.3	9863.2	10046.6
SIM 4		4710.6	6104.5	6647.3	6614.4	6857.7	6909.1	7153.0
SIM 5		5379.1	5741.2	5881.4	6055.1	6087.4	6846.4	8187.0
SIM 6		6826.3	5468.4	5852.9	5819.8	6309.9	9655.9	12622.4
SIM 7		10671.9	11805.0	12392.8	12810.7	13841.5	14984.8	16057.8
				SOYBEANS				
SIM 1	3064.2	4665.5	5851.1	6367.8	6817.5	7744.0	9281.4	10467.9
SIM 2		4673.3	5517.8	5958.0	6264.9	7297.4	8883.5	10306.8
SIM 3		4985.6	5992.3	6874.7	7315.4	8593.3	9965.7	10809.9
SIM 4		4627.1	5242.6	5578.8	5846.6	6537.7	7250.5	7682.1
SIM 5		5536.2	6112.4	6491.0	6806.2	7633.0	8480.9	8985.2
SIM 6		6592.1	6978.9	7100.5	7402.3	8383.9	12259.9	15110.1
SIM 7		9041.0	12246.7	14243.2	15345.7	19060.8	23063.6	25281.0
				COTTON				
SIM 1	2168.3	2818.7	2908.9	2918.3	2958.1	3079.7	3289.8	3343.0
SIM 2		1329.0	1499.0	1842.7	1576.4	1671.6	1764.4	1740.3
SIM 3		4613.1	5600.9	5652.7	5792.4	5971.3	6219.1	6277.5
SIM 4		1757.9	2058.8	2137.6	2152.7	2162.3	2169.2	2182.9
SIM 5		1718.9	1970.7	1953.3	1927.8	1897.2	1844.9	1840.0
SIM 6		1737.6	1803.5	1858.7	1817.1	1843.5	2002.3	1920.5
SIM 7		2451.3	2775.2	2121.1	2754.0	4600.1	4771.8	5004.7
				LIVESTOCK				
SIM 1	31067.0	38523.9	43079.1	44958.5	46624.6	50423.4	56906.2	63273.4
SIM 2		35239.0	38015.1	39562.8	41756.9	47680.6	55457.2	61832.3
SIM 3		39366.7	43617.5	46100.5	47475.4	51435.6	55479.5	57961.8
SIM 4		34657.5	37053.4	38855.2	39967.5	43102.6	46298.9	48487.9
SIM 5		36471.8	37023.0	38720.5	39983.6	42952.2	47128.0	51225.5
SIM 6		39022.7	38538.8	38727.9	39971.6	43516.5	52503.3	60635.5
SIM 7		44756.0	51589.2	54644.9	57155.9	64658.3	72337.0	79262.4

[a] Includes estimated government payments for target support payments and land diversion.

[b] Soybeans and livestock are 1969-71 averages, cotton in 1968-70 average [7;11;12;15;20].

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