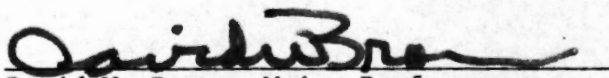
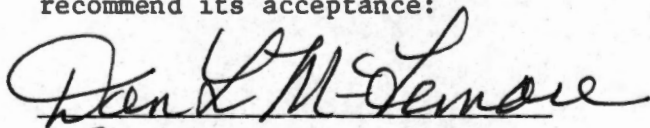
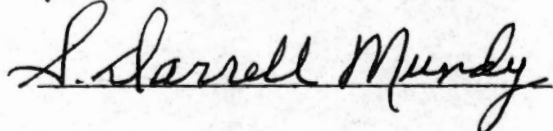


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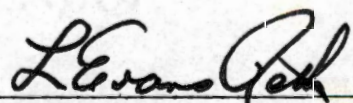
I am submitting herewith a thesis written by John Arrin Gillies III entitled "World Trade and the Tennessee Farmer: An Overview of Trade-Induced Instability and Its Effects on Individual Farms." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.


David W. Brown, Major Professor

We have read this thesis and
recommend its acceptance:

Accepted for the Council:


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WORLD TRADE AND THE TENNESSEE FARMER: AN OVERVIEW OF
TRADE-INDUCED INSTABILITY AND ITS EFFECTS ON
INDIVIDUAL FARMS

A Thesis
Presented for the
Master of Science
Degree
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John Arrin Gillies III

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ABSTRACT

This study was intended to provide diagnostic insight into some of the political and economic factors affecting crop price fluctuations and their effect on decision-making on West Tennessee farms. The primary focus was on the impact of foreign trade on domestic price stability from the farmer's perspective.

The study included an overview of foreign agricultural trade of the United States in recent history, with an emphasis on how the trade and agricultural policies of the U.S. and its major trading partners interact to influence price stability in this country.

The four major cash crops in West Tennessee (soybeans, cotton, corn, and wheat) were analyzed with respect to the characteristics of importance to decision-makers on both the policy and farm levels. These characteristics included price, production and export trends, the international supply and demand situation, market structure, and other factors affecting the long-term prospects for exports.

This information was incorporated into several simulated decision-making situations to illustrate the effect of different degrees of price variability on farm income. Three five-year price scenarios were assumed; one with large price fluctuation, one with low fluctuations, and one with a series of bad (low price) years for soybeans. These scenarios represented domestic farm-level prices for the four major commodities with no interference from the government. These basic prices could then be modified by one of six government programs. Two variations—one with annual cost-of-production adjustments and the other

without—of three types of government programs were assumed. The three types of government programs were a market floor support system, an income support system, and a price band system. A total of eighteen different situations were therefore assumed (each of three scenarios subject to six programs).

This macro-level view was then balanced with a micro-level view. Two illustrative farms were assumed—a medium-sized full-time farm and a small, limited resource, part-time farm. Each farm used four "naive" strategies to attempt to deal with uncertainty. The illustrative model showed the effects on farm income for each farm under every combination of strategy, government program, and scenario.

The income figures were used to assess not only the average income and income variation under each situation but also the effect on the ability of each farm to generate enough income to weather the low income years, survive as a business, and to provide a source of livelihood for the family.

The study found that world trade in agricultural commodities will probably continue to increase in the near future. While some international agreements may reduce domestic price variability to some extent, the potential for major price fluctuations still exists due to the basic structure of the international markets and the continuation of policies which distort market signals.

Of the four crops with which the study is concerned, the most promising was soybeans. Corn also has some potential while both cotton and wheat are subject to greater uncertainty.

While the illustrative model was too general to be used for prescribing certain actions, it did allow for generalizations to be drawn about the interaction of scenarios, programs and farm-level strategies. Implications were also made for directions for future research in this area.

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GLOSSARY OF TERMS AND ABBREVIATIONS

<u>Term</u>	<u>Meaning</u>
CPE	Centrally Planned Economy
EEC	European Economic Community
GATT	General Agreement on Tariffs and Trade
Group of 77	A political bloc of developing countries
LDC	Less Developed Countries (also referred to as developing countries)
MNC	Multinational Corporation
MTN	Multilateral Trade Negotiations (conducted under the auspices of GATT)
OPEC	Organization of Petroleum Exporting Countries
UNCTAD	United Nations Conference on Trade and Development

Strategies used in Illustrative Model

Perfect Information - the optimum solution for each scenario/program situation as shown by the LP solution

Forecast a naive strategy of price prediction using the previous year's prices

Traditional a cropping pattern in which corn, soybeans and cotton are all planted

Diversification a cropping pattern based on the price variation and income correlation statistics found, in which soybeans and wheat are double cropped, cotton is grown, and soybeans are grown alone on the remaining land

Minimum a cropping pattern which assumes a situation in which cotton yields are very low and double-cropping is infeasible or not done for other reasons, therefore only soybeans and corn are grown

CHAPTER I

INTRODUCTION

The technological and economic factors affecting U.S. agricultural production are constantly evolving, requiring changes in the structure of the agricultural sector to adjust to each new environment. One important change in recent years has been the increased role of trade in determining the domestic market prices of agricultural commodities.

World trade has been increasing in recent years at a faster rate than has production; the volume of agricultural commodity exports has increased at an average annual rate of 3.9 percent since 1960 while production increased at a rate of only 2.6 percent in the same period (O.E.C.D., 1975). As the dominant producer and the largest exporter of agricultural commodities in the world, accounting for one-half to two-thirds of the world trade in some commodities, the United States is inevitably affected by any changes in the patterns of international trade. Not only has the total value of U.S. exports been increasing, but as the growth rates indicate, a higher portion of domestic production goes to foreign markets. (See Table 1.)

This increase in trade impacts on all segments of American society: producers of agricultural goods through the influence on domestic market prices, consumers through changes in both the absolute and relative costs of food, and the economy as a whole through the effects on the balance of payments and the strength of the dollar against foreign currencies.

Table 1
Selected U.S. Trade Statistics, 1950-1977

Characteristic	Year			
	1950	1960	1970	1977
Total value of agricultural exports ^a	2.9	4.8	7.3	23.7
Agricultural trade balance ^a	-1.1	1.0	1.5	10.2
Nonagricultural trade balance ^a	2.5	4.4	1.4	-40.2
Exports as a percentage of agricultural production (value)	9%	14%	14%	20%
Agricultural exports as percentage of total exports (value)	23%	24%	16%	20%

^aExpressed in billion dollar units.

Source: U.S. Statistical Abstract, 1978, and Foreign Agricultural Trade of the U.S., Calendar Year 1977.

The instability in domestic prices is caused in part by the nature of the market system and the peculiarities of the agricultural sector. In a market economy, the supply and demand functions of a particular commodity interact to arrive at a price which reflects both of them and indicates the relative scarcity of the commodity in the economy. The agricultural sector is particularly sensitive to changes in either of these functions. An inelastic demand for agricultural products in developed countries means that a small change in supply causes a disproportionately large change in price. In the short run (within a production period), the supply is essentially fixed and a change in the

quantity demanded (a large, unexpected export purchase, for example) can also cause a disproportionate change in price. In a completely closed economy with no foreign trade, the quantity demanded would remain fairly constant overall, with some gradual shifts toward or away from some products as income levels and preferences change, and the supply, affected by technological and climatic variables, would change the market price. In a world with relatively free trade, however, the total demand in any one agricultural surplus market such as the United States becomes a function of world supplies, thus exposing that market to the danger of considerable yearly fluctuations in price as both demand and supply become major variables.

Since the U.S. agricultural sector is by no means isolated from other parts of the economy, these changes influence and are influenced by other developments in the broader economic and political events of the time. For the U.S. in particular, this expansion in trade has come at a crucial time—a time of inflation, caused partly by rising trade deficits (which in turn reflect the increased cost of oil imports) and lopsided trade flows with other industrial nations, as well as a time of increasing doubt about the position of the dollar as the dominant world currency. To an extent, this relative weakness of the dollar has contributed to the rise in exports by making American products more competitive abroad. As the figures in Table 1 show clearly, the agricultural sector's contribution to the overall balance of trade has become increasingly important since 1950.

Many interrelated factors have contributed to the rise in trade—the opening of East-West trade, poor harvests in some countries caused

by drought and other natural disasters, a continued increase in demand arising from world-wide economic growth, and several devaluations of the dollar, both directly and through the floating exchange rate. However, the actual impact on the American agricultural sector has been determined largely by changes in both foreign and domestic trade and agricultural policies.

The United States has officially encouraged freer trade in all commodities since the Trade Expansion Act of 1934 (Tontz, 1977). The movement toward opening the channels for international trade has been facilitated by the Multilateral Trade Negotiations (MTN) conducted through the General Agreement on Trade and Tariffs (GATT), which have continued to the present day. Although GATT and other trade initiatives have been relatively successful in reducing tariff barriers on some commodities, by and large agricultural commodities have not been included in the trade liberalization. In addition, many nations have adopted nontariff barriers to trade to protect domestic industries.

The government has also been encouraging greater agricultural exports for years. The chronic surpluses of the 1950's and 1960's were in part responsible for the establishment and promotion of government food donations, barter, and concessional sales through the Agricultural Trade Development and Assistance Act of 1954 (PL480), commonly known as "Food for Peace," which opened new markets for U.S. agricultural exports.

The U.S. domestic agricultural production and pricing policies, in response to both internal and external forces, have evolved to be more consistent with the principles set forth in the GATT negotiations

as well as the directions pursued in the trade policies. The Agricultural and Consumer Protection Act of 1973 eliminated the system of price supports for most agricultural commodities, making them more directly competitive with foreign products. Federal controls on production were also eased, giving farmers more freedom in making cropping decisions.

This increase in world agricultural trade, combined with the increased freedom for farmers, has allowed the prices and production of some agricultural commodities to fluctuate more than they had in the past. The resultant instability affects farmers in all areas of the country; Tennessee being no exception. About 70 percent of the cropland in Tennessee is devoted to five major cash crops (soybeans, corn, cotton, wheat, and tobacco), all of which have substantial export markets. These five crops account for 48 percent of the farm receipts from agriculture in the State and 87 percent of the receipts from nonlivestock enterprises (Tennessee Agricultural Statistics, 1976). This indicates that Tennessee agriculture is sensitive to large fluctuations in the market prices of these commodities, and by extension, to changes in world production, demand, and relevant policies. A poor grain harvest in Russia or a bumper crop of soybeans in Brazil can to some extent determine the profits and losses of a farmer in Tennessee.

Many farmers in Tennessee are also particularly sensitive to price fluctuations in that they are marginal producers of some of these commodities. Geographically and agriculturally, the State falls between the South and Midwest and can grow the crops of either of these areas. In recent years, the high price of soybeans has made this crop more

profitable. Acreage in soybeans has therefore expanded considerably while the acreages in competing crops and pasture have been reduced. A change in the relative prices of alternative crops can influence these marginal farmers to change the enterprise mix. Of course, all farmers in Tennessee do not fall into this category of "marginal producers"—many farmers with good bottom land are competitive with efficient producers elsewhere.

I. Statement of the Problem

With the situation described in mind, the problem facing farmers in West Tennessee and elsewhere can be readily seen. Although this is essentially the same resource allocation problem that farmers always face, any increase in uncertainty caused by greater price variability would make the penalties for poor decisions much greater.

Most farmers rely on some sort of strategy to hedge against uncertainty. The question is whether traditional strategies work as well in periods of greater price variability. Even the formulation of a strategy requires a considerable degree of understanding of the factors causing instability, the possible directions for the future, and a feeling for political trends. With the new influence of world trade, it is possible that the relative stability of a crop, vis-à-vis the alternative uses of the land, may have changed. This could be an important point for a farmer whose land could support either soybeans, cotton, corn, or wheat.

The other side of the problem reflects the uncertainty facing policy makers. Any change in the structure or performance of

agricultural markets requires adjustments in governmental policies and programs if the latter are to achieve their aims. One problem here is that it is difficult to estimate the impact of old policies in a new environment.

II. Objectives

The primary objective of this study was to provide diagnostic insight into the effects of world crop price fluctuations and uncertainties on Tennessee farmers. The focus was on four of the most important internationally traded crops produced in Tennessee—soybeans, cotton, corn, and wheat. Attention was given not only to the impact of these price movements on the incomes of farmers in West Tennessee, but also to actions which might be taken at both the farm and policy levels to buffer the effects of these fluctuations.

More specifically, four subobjectives were addressed in this study:

1. To examine the relationships among international events, trade policies, domestic agricultural policies, and price stability, and to assess the extent to which recent price instabilities have been caused by long term structural changes as opposed to transitory, extraordinary occurrences. (See Chapter II.)

2. To examine the price movements of the four cash crops in Tennessee and to assess whether the prices are less predictable than they have been in the past. This information, together with trends in the factors affecting supply and demand of each commodity, will be used to estimate the future growth and income potential of each commodity. (See Chapter III.)

3. Using two farm situations illustrative of West Tennessee, to examine alternative farm level strategies which might be used to cope with trade-induced instability, and to test those strategies under alternative scenarios for trade and commodity legislation futures to determine the relative strengths and weaknesses of each. (See Chapters IV and V.)

4. To assess the implications of the findings with respect to farmers, policy makers, and future research in this area. (See Chapter VI.)

III. Approach to the Study

In keeping with the overview nature of this study, the analysis started with a broad view of macro-level policies and events which influence market prices in this country. The view then narrowed to the micro-level view of two individual illustrative farms in West Tennessee.

On the international level, the relationships between trade policies, domestic agricultural policy and supply instability were examined using existing theoretical and empirical research. An effort was made to identify most of the relevant variables which affect price stability and to assess the relative impact of each.

The general price and market attributes of the four major crops in West Tennessee were examined with the use of simple time series analysis and descriptive statistics. Formal forecasts made by several national and international agencies were relied on for the indications of the future potential of each crop.

The illustrative farms, alternative strategies and government agricultural programs used in the simulation model depicted a spectrum

of contrasting situations. They were based on the publications and knowledge of agricultural scientists at The University of Tennessee, and on real and proposed government price-support programs. Linear programming and simple budgeting techniques were used to determine the income effects of different strategies and programs on each illustrative farm.

IV. Limitations and Uses of the Study

This study was not meant to be an exhaustive study of the effects of trade on price stability, or a thorough rendering of the many alternative enterprises in which a farmer in Tennessee can become involved. Nor was it intended to be used as more than a general guideline for cropping decisions in particular situations involving the relative attractiveness of these particular crops.

By concentrating only on the major cash crops, this study neglected by design the other major component of agriculture in the state—livestock enterprises. Earnings from livestock account for more than half of all agricultural earnings in the state (Tennessee Agricultural Statistics, 1977). This sector is also strongly affected by the level of trade, although it tends to be more sensitive to the import side of trade. Certainly future changes in policy as regards imports of foreign beef will be important to farmers in Tennessee. Just as important will be the interrelationships between the feed grains and oilseeds used as inputs into the livestock sector. However, an inquiry into the livestock import and export markets, and the interrelationships of inputs would require more resources and time than is feasible for this study.

The time span used for price analysis, 1950-1977, has inherent limits in terms of the statistical significance of the findings. Particularly in the crucial period from 1972 to 1977, many judgments had to be made as to which events reflected a recurring pattern and which were of a temporary, nonrecurring nature. This time period was chosen because it is the longest period which the author considered relevant to the current agricultural situation; the depression, war years, and immediate post-war years were abnormal in terms of the amount of agricultural production, product mix, and price levels. The post-1972 period was also unusual in that a number of serious disrupting events occurred in a short period of time, including changes in the Russian policy on domestic livestock, the Arab oil embargo, high rates of international inflation, and several droughts in Asia and Africa. Nonetheless, basic changes in the structure of agriculture and the commodity markets as well as in the nature of international commercial relations in general, may have occurred during those years and to await the perspective of time to assess those changes would be of little use to farmers and policy makers today.

At relevant points throughout the study, attention was drawn to specific limiting assumptions and caveats were added whenever necessary.

These limitations notwithstanding, this study can be useful in providing a cohesive framework within which both farmers and policy makers can understand both the macro and micro levels of instability and the relationships between them. People in policy-making positions could find the study useful in seeing the programs and policies through a farmer's eyes and to recognize some potential impacts of proposed

legislation. Farmers could gain a broader perspective of the variables affecting price and income variability and be better able to participate knowledgeably in the democratic process to influence favorable legislation. The study could also be used by consumer groups to put the problem of food prices in a broader perspective.

The study may also be useful in identifying aspects of the problem which better facts and more analysis could help clarify. Being exploratory in nature, this study can raise as many questions as answers and provide a basis for future research.



CHAPTER II

AGRICULTURAL TRADE, POLICIES AND PRICE STABILITY

With agricultural exports taking a greater portion of domestic production and contributing more to the balance of payments, an understanding of the relationships between production policies, trade and price stability is necessary for both farmers and policy makers. This chapter is intended to explore some of the relevant relationships.

I. Factors Affecting Supply and Demand

The two basic requirements for any country wishing to engage in world trade in any commodity are that: (1) it must have sufficient quantities of the product at prices which are competitive with the prices of other producers, and (2) it must have overseas markets willing to buy the product. While this is a vast oversimplification that ignores many other crucial variables, such as an internal willingness to sell the product, it does provide a framework within which to view the trade process.

This study is concerned with the trade—or more specifically, the export potential—of the four major cash crops in West Tennessee: soybeans, corn, wheat and cotton. The prospect for trade of any agricultural good depends on the two sides of the market—supply and demand. The effective world demand for agricultural goods depends on a large number of variables, including: (1) population changes; (2) economic growth rates, both absolute (determining growth in personal

disposable income) and relative (between countries), which will affect each currency's position against the dollar; (3) the distribution of income, which influences the proportion spent on food; (4) relative inflation rates which affect exchange rates and therefore the importing capability of each country; (5) prices; (6) policies; and (7) available supplies. The supply side will depend on, among other things: (1) technological advances; (2) adoption of new technology in the third world allowing for productivity increases; (3) prices of inputs; (4) availability of fertilizer and other inputs; (5) weather; (6) land availability; (7) policies; and (8) price of the product. These factors all interact to determine the actual quantity of exports demanded from the U.S. in any given year.

The general prospects for the immediate future are for continued population growth at a rate of around 1.9 percent and continued rises in the income levels of people around the world (OECD, 1976). The rate of economic progress and changes in income levels at any particular point in time are of course uncertain, allowing for high and low demand years. According to an analysis by the U.S.D.A. (1976), growth of demand in developing countries will be primarily fueled by population increases, with some boost from income changes, while in the developed countries income growth will account for most of the change in demand. Production in the developed countries will most likely continue to exceed demand at prevailing market prices while the opposite will probably be true for most of the developing world. Although some possibility certainly exists for changes in the supply and demand outlook for the developing countries, the likelihood of such changes in the near

future is not large. The changes necessary for improvement of the situation would include more widespread adoption of new technologies, more nearly equal distribution of income, and a reversal of historical policies in some developing countries which discourage agricultural production through artificially low market prices (U.S.D.A., 1976). Some of the other important factors will be considered on a commodity by commodity basis in Chapter III.

In addition to the above, much of the annual uncertainty connected with agriculture deals with meteorological variables and their effects on yields, both domestic and worldwide. These weather related effects on supply are random occurrences and may either dampen or accentuate the fluctuations caused by other factors. The role of price and income stabilization policies is to minimize the impacts of such events on a nation's farmers and economy.

II. Agriculture in International Relations

Before focusing on individual cases, a macro view of international relations is helpful in providing a backdrop for policies. In recent years, the character of international relations has been in a state of flux as foreign economic policy has assumed a greater importance relative to strategic balance considerations. This has been caused primarily by a fragmentation of economic and political power and the evolution of a multipolar world consisting of the U.S., Russia, the European Economic Community (EEC), Japan, the Organization of Petroleum Exporting Countries (OPEC), the "Group of 77" developing nations forming a voting bloc in the United Nations, and even multinational corporations

(MNC). This has had the effect of diminishing the power of the United States to dominate world events, as well as increasing the complexity of world economic problems (Warley, 1976).

The relations among these different power groups are influenced by philosophical differences as well as regional or national interests. The EEC considers domestic agriculture policy and trade policy as components of a set of integrated policies with common social and political goals, one of which is protecting EEC farmers' incomes. Since the EEC farmers are at a comparative disadvantage in grain production, these policies reduce a potential U.S. market. Differences in beliefs about how international economic problems should be resolved accentuate the difficulty.

Japan also has a protected agricultural sector but is much more dependent on imported food and is primarily interested in assured supplies. Japanese confidence in U.S. reliability was undermined by the soybean boycott in 1973 and their main thrust in agricultural policy today is toward self-sufficiency, although they remain a major American customer.

The centrally planned economies (CPE) are in a unique position in that they only enter the world markets when they care to. This free access to western markets, in combination with unequal access to market information, has allowed them to reap most of the economic benefits of trade with the West (Warley, 1976).

The developing nations (LDC), whose interests are represented in international forums by the "Group of 77" and the United Nations Conference on Trade and Development (UNCTAD), have two primary points of

interest in international commodity trade: (1) they tend to receive a disproportionate amount of their export earnings from primary commodities, which encourages support of stabilization plans and wider access to Western markets, and (2) their food production systems are generally less productive and leave the countries vulnerable to the danger of famines. The LDC advocacy of the New International Economic Order reflects their desire to protect themselves from the vagaries of economic fortune (Warley, 1976). These differences in interests and philosophies are reflected in internal agricultural policies, other domestic policies, and trade policies, each of which affects the export demand for U.S. agricultural products.

III. International Trade Considerations

As noted, most countries try to integrate their domestic and foreign policies to some degree. Therefore, the trade policy of a particular nation will reflect national priorities and the structure of domestic agricultural and food programs, making any sharp distinction between the international effects of trade policies and domestic policies a dubious one. Therefore, this thesis considered any policy of another country which affects U.S. trade, whether a domestic agricultural or trade policy, as well as U.S. foreign trade policy, as an international variable. American domestic agricultural policy and its effects on farmers and farm income is examined in the following section.

Since the early 1930's, the dominant trend in international trade has been toward liberalization and reduction of trade barriers. The last major protectionist measure in the United States was the Hawley-Smoot

Tariff Act of 1930, which raised American tariffs to one of the highest levels in history and prompted retaliation from our trading partners. The Reciprocal Trade Agreements Act of 1934, an amendment to the Hawley-Smoot Act, was the first in a long series of trade liberalization legislation. This act, which authorized the President to make step-by-step bilateral tariff reductions, set the stage for continuing Multilateral Trade Negotiations (MTN) conducted under the General Agreement on Tariffs and Trade (GATT), beginning in 1947. (See Figure 1.)

The original meeting of GATT in 1947 involved 22 nations and affected about two-thirds of world trade. Each successive round brought more nations into the agreement and reduced tariffs a little more, with the most recent round involving 99 countries. Although the GATT talks have achieved some success in liberalizing agricultural trade, most of the benefits until the 1973-79 Tokyo Round related to industrial commodities. Agricultural trade has proven to be more difficult to deal with than industrial trade because of virtually universal domestic programs protecting the farm sector and the increasingly widespread use of nontariff barriers.¹

The major importers of agricultural goods, such as the EEC and Japan, maintain high domestic prices to protect comparatively inefficient agricultural industries: the EEC through variable levies to keep imports at competitive prices and Japan by imposing high tariffs on processed products and subsidizing consumers. The United States also

¹For a more comprehensive treatment of U.S. agricultural trade policy and its relationship to domestic agricultural policy, see Robert L. Tontz, Foreign Agricultural Trade Policy of the United States, 1776-1976, U.S. Department of Agriculture, Economic Research Service, (1977).

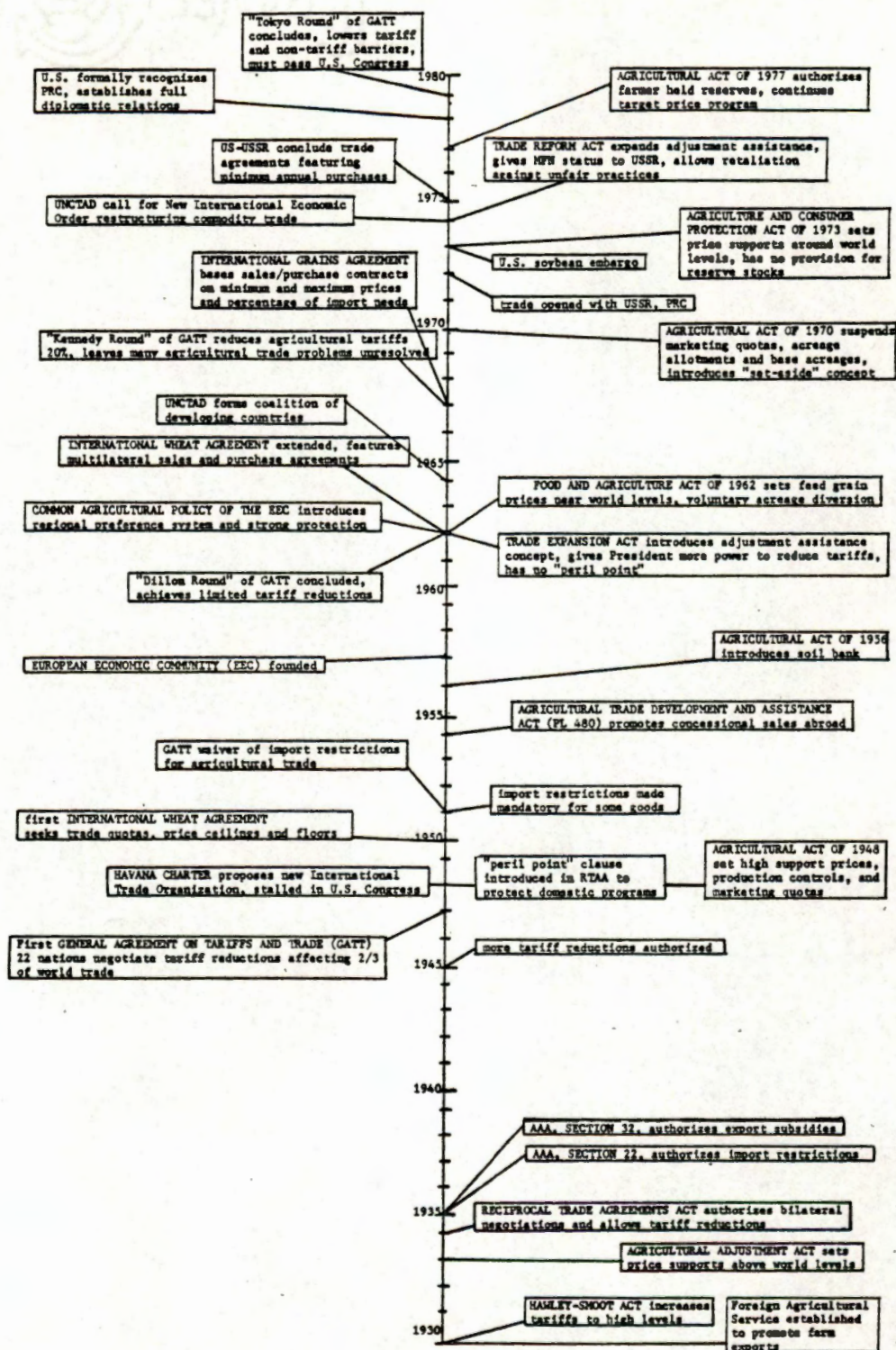


Figure 1. Major programs and policies affecting U.S. agricultural trade, 1930-1979.

Source: Primarily from Robert L. Tontz, Foreign Agricultural Trade Policy of the U.S., 1776-1976 (U.S. Department of Agriculture, Economic Research Service, 1977).

protects its vulnerable industries, such as dairy and beef, through import barriers.

Some trade distortions are also created by the exporters. Various forms of export subsidies, state trading, and marketing boards are used to provide advantages in world markets. The EEC uses export subsidies to sell grain to Japan, a major U.S. customer, and many countries which are heavily dependent on export earnings from agricultural products (i.e., Canada, Australia, New Zealand, Argentina, etc.) have some form of state or bulk trading.

The centrally planned economies, such as the USSR and China, also gain a significant market advantage in both importing and exporting through the use of state trading. This, in combination with the secrecy of the purchases and limited information about their domestic market situation, has been a major cause of both price instability and uncertainty in the past few years.²

Causes of the Price Instability of 1972-1974

An example of how trade policies can affect price stability would be helpful at this point. The dominant example of a trade-induced instability occurred in the period from 1972 to 1974 in the world grain markets. The problem was initially one of supply, caused by poor harvests in Russia, India, Australia and Argentina in 1972. Therefore,

²A distinction should be made at this point between the two related concepts, instability and uncertainty. Instability refers to the degree of variation in prices (i.e., unstable prices might consist of very high and very low prices), while uncertainty refers to the element of predictability in the price movements. If prices are very unstable but also highly predictable (i.e., cyclical), the farm or policy decision-maker is not faced with serious uncertainty.

the amount of grain available for export from Australia and Argentina was limited. Russia, normally a grains exporter, decided to supplement its domestic production with purchases on the world market rather than cutting back on livestock herds as they had done in the past, making them abnormally heavy buyers of American grain in 1972. This was made possible by a change in U.S. policy which encouraged "detente" with the Communist states. The size and makeup of the Russian purchases were unexpected, prices rose rapidly, and stocks were depleted. The following year production controls were still in effect in the U.S. which, in combination with low yields here and elsewhere, exacerbated the imbalance of supply and demand. The oil embargo in that year stunted production in many developing countries as the price of petroleum-based fertilizers rose rapidly.

Demand for American products was also spurred by a devaluation in the dollar, although a recent study indicates that devaluation played a relatively minor role in the price increases compared to policy effects (Johnson, Grennes, and Thursby, 1977).

While these events formed a chain of unusual and unanticipated events, the nature of agricultural (and other commodity) markets is one of such occasional supply problems. The price fluctuations were accentuated by the standard trade policies of many other involved nations. The EEC's system of variable levies, for example, effectively buffered the European farmers and consumers from major price fluctuations. As the world prices rose, the levies decreased and therefore European demand wasn't affected by the changes in world prices. Both Canada and Australia, who are major grain exporters in normal years, imposed export

controls through the state trading agencies to protect domestic supplies and prices, and thereby increased the effective world supply shortage. Japan decreased its tariffs and was in effect subsidizing imports, thus further distorting the market situation by not allowing the price changes to influence quantity demanded. The overall result was a massive increase in demand on the American market, since the situation was one of a seller's market and the U.S. was the only country with available supplies. The average price of wheat on the farm level rose 205 percent from 1971 to 1974 largely as a result of these events.

D. Gale Johnson has explained these phenomena as a result of each region or country attempting to achieve internal price stability, regardless of the effects on the rest of the world (Johnson, 1975). One means of stabilizing internal prices is by controlling the flow of trade, which is the practice in the EEC, Japan, the Centrally Planned Economics and many of the world grain exporters. With controls on imports and exports, the market mechanism is not allowed to work and the price elasticity of demand (in the case of importers) and that of supply (in the case of exporters) is zero. Therefore, the necessary adjustments in price and consumption must be made in the remaining countries without trade controls. Since the EEC, Russia, and China all have this type of price stabilization mechanism, and they collectively consume about one-half of the world grain production, the potential for price instability in the remaining countries is very large.

The consensus of many economists today is that trade distortions and restrictions are the primary cause of price instability and that such variability decreases as more countries allow world price signals

to be reflected in domestic markets (Shei and Thompson, 1977). Many proposed solutions to the international price instability, such as commodity agreements and export contracts are actually movements toward more trade restrictions. While the impact of trade-induced instability in any particular country can be lessened by domestic programs and controlled trade flows, such gains are at the expense of trading partners. The U.S. attempted such a solution with the embargo on soybean exports in the summer of 1973. This move seriously damaged the confidence of the Japanese in American reliability and undermined years of efforts to build up markets for American products.

IV. American Domestic Policies

As was previously noted, domestic policies interact with trade policies and international agreements, although not always in a positive way. American agricultural policies have at various times worked for and against trade policies.

American agricultural policies, like those in most other countries, have attempted to protect farm income, provide food at reasonable prices to the general public, and achieve some stability of prices and incomes. The policies have been implemented through general program types which set a floor on market prices, set a floor on farm incomes, adjust production, adjust both domestic and foreign demand, or some combination of these.

The Agricultural Adjustment Act of 1933 set the pattern for many years with price supports which were above world levels. With the discovery that such a policy attracted imports from other countries as

well as making exports more difficult, the agricultural legislation in 1935 added provisions for export subsidies and nontariff barriers (i.e., quotas and fees) for several key commodities, wheat and cotton among them. This situation, with some adjustments in the types of production controls, continued until the mid-sixties when the price supports on some commodities were lowered to world levels and production controls were made voluntary. The Agricultural Act of 1970 firmly set the new directions by eliminating marketing quotas, acreage allotments, and other production control schemes, set most prices at world levels, and maintained farm income through direct payments to farmers when necessary to achieve target prices. The intervening period, however, was characterized by efforts to allow the market mechanism to work in international trade while restricting the market forces in domestic agricultural programs. This same conflict between the goals of domestic and trade programs occurred in most other countries with a stake in agricultural trade and understandably limited progress in trade liberalization.

In the fifties and early sixties huge surpluses of some commodities were built up in the government storehouses. This prompted efforts to build up demand for these products. The Agricultural Trade Development and Assistance Act of 1954 (commonly known as "Food for Peace" or "P.L. 480") allowed the government to dispose of surplus stocks through concessional sales to needy countries. Some domestic welfare food programs and school lunch programs also grew out of this situation.

The movement toward market orientation of agricultural policies in 1970, and continuing in the Agriculture and Consumer Protection Act of

1973, had two major effects. Domestic programs were made more consistent with the efforts and commitments in the trade arena and allowed more flexibility in negotiations, but at the same time the domestic price equilibrium was exposed to the forces of highly protected markets in other countries. This and the crucial absence of any provisions for stocks in the 1973 legislation, as much as international events, allowed the price changes in the 1970's to reach the magnitude they did.³

During the tight supply situation of 1973 and 1974, the USDA called for maximum production and the utilization of all farm resources. Large production in 1975 led to rapidly falling prices in 1976 and 1977 because export demand could not absorb the increase. Operating with few reserves and assuming that production changes in the U.S. would be compensated for by changes in the exportable supplies elsewhere proved ill-advised in an imperfect market with inelastic demand.

Other than strictly agricultural policies, many other types of domestic policy may influence the degree of price instability and economic uncertainty. As already mentioned, trade policies and international relations can have a profound effect on price stability. While the impact of the general economic policies of the country on agricultural commodity prices is less clear, major distortions of the market such as price ceilings certainly have an effect. The impact of price controls on the livestock sector played an important part in the

³For a more complete overview of U.S. commodity policy, see American Farm Policy, 1948-1973, Willard W. Cochrane and Mary E. Ryan, University of Minnesota Press (1976) or Price Support and Adjustment Programs from 1933 through 1978: A Short History, Wayne D. Rasmussen and Gladys L. Baker, USDA Agricultural Information Bulletin 424, February, 1979.

food price increases of 1973 (Eckstein and Heien, 1978). Policies on inflation (particularly as they affect crucial farm inputs), energy policies, environmental policies (particularly those dealing with erosion and nonpoint pollution), and decisions about research and extension work also have an impact on agriculture.

V. Free Trade and the U.S.

The preceding sections have implied that trade restrictions and market distortions are the root of all evil in international economic relations. Many prominent economists since Ricardo have argued that free trade would have welfare benefits for society as a whole, reduce price instability, and promote efficiency. Whereas this may be true, free international trade also assumes international division of labor and specialization, which in turn implies that adjustments must be made to weed out inefficient producers. While society as a whole may be benefiting from the changes, these particular inefficient producers in the process of being weeded out may have some cause for complaint. In looking at the movement toward freer trade from the farmer's point of view, therefore, it is necessary to assess just how free trade would affect them.

D. Gale Johnson has estimated that the United States has a clear comparative advantage in the production of corn, wheat, soybeans, and tobacco, while its relative position in the production of cotton is unclear. The implications of this are that both production and prices of feed grains and oilseeds would probably increase with freer trade, while production of wheat would increase with relatively steady prices.

Although the impact of free trade on cotton is more difficult to assess because of protection of the industry, both production and prices might decrease somewhat.⁴ Freer trade would also affect the alternative enterprises available to farmers. Dairy farmers would be operating at a clear comparative disadvantage, for example, as would certain kinds of beef farmers. But the higher quality grain-fed beef would probably still have a substantial market (Johnson, 1973).

According to Johnson's assessment, it does not appear that the cash crop farmers with whom this study is concerned would have to make any serious adjustments, although the situation for cotton is unclear. Some losses could occur for those farmers who have diversified into dairy operations or large beef operations, although the expanded "adjustment assistance" provisions of the Trade Act of 1974 could be used to buffer the effects.

VI. The Situation in 1979

The course of trade in the 1980's will be determined in part by decisions and agreements made in 1979. Therefore, the situation facing the decision makers and the factors influencing their decisions are of considerable importance.

In the U.S., high rates of inflation and fears of a recession are a dominant national issue. Mounting trade deficits in recent years,

⁴The prospects for cotton production in Tennessee are dependent on many different factors influencing physical production, export potential, consumer preference, technological changes in textile manufacture, and competition from other U.S. producers. See the section on cotton in Chapter 3 for a more detailed treatment.

exacerbated by the high levels of protection of agriculture in the EEC and of almost everything in Japan, have weakened the dollar and contributed to this inflation. These factors, along with the survival instinct in some American industries have intensified domestic pressure for trade protectionism. In the steel, textile, shoe, dairy and beef industries in particular, the threat of greater trade liberalization has prompted major lobbying efforts (Survey of International Development, 1978). The interrelationships between industrial and agricultural trade preclude the possibility of protecting our vulnerable industries and at the same time seeking greater concessions for agricultural trade.

In addition to the traditional concepts of protections, tariffs and duties, the role of nontariff barriers in restricting trade has become particularly important (Hillman, 1978). These nontariff barriers might be grouped into three general types: (1) measures to restrict imports; (2) assistance to domestic production of import substitutes; and (3) direct assistance to exporters. A major problem with such types of trade restrictions is that, in contrast with the laws themselves, they can become a form of "administrative protectionism" to be implemented at the discretion of bureaucrats. This type of barrier is also extremely difficult to deal with and dismantle in the framework of multilateral trade negotiations since the distinction between outright protectionism and legitimate measures (such as health, safety, or labeling restrictions) is difficult to prove.

In the agricultural sector specifically, the U.S. has continued its domestic policy of reliance on market conditions with one significant change. The Food and Agriculture Act of 1977 provided for grain reserves

to help modify price fluctuations. The trade agreement with the USSR in 1975, which was intended to balance purchases and minimize negative price impacts, has been less effective than expected because of the secrecy of the purchases (Talbot, 1978). Adjustments continue to be made to correct these problems.

Internationally, the reemergence of China into the world economic mainstream may have diverse effects on agricultural exports. The potential for imports of cotton and wheat when Chinese production is low is considerable—in 1978 they imported about \$380 million worth of American farm products. The normalization of relations with the U.S. also makes possible extensive aid and development help. This could enhance China's production capability to compete in production of some crops for export markets.

China, Japan, India, and the EEC are all intensifying their efforts to achieve greater degrees of self-sufficiency in some crops, which will undoubtedly affect U.S. export potential. At the same time, however, rising incomes and population growth in most developing countries will bring about increased need for food imports.

Without a doubt the most important event of the late 1970's influencing international trade is the conclusion of the Tokyo Round of the Multilateral Trade Negotiations. In April 1979, representatives of 99 nations signed the agreement which would establish international codes of conduct regulating export subsidies, standards, import licensing, and other nontariff barriers to trade, as well as reducing tariffs an average of 30 percent over an 8 to 10 year period. This agreement would open up foreign markets for many agricultural items,

including cotton, wheat and soybeans. The tariff reductions need no formal approval, but the nontariff reductions must be approved and implemented by Congress, which will be subjected to pressures by import-sensitive industries. The agreement would also promote participation in international commodity arrangements on coarse grains, meat, and dairy products; greater worldwide participation in food aid; and stockpiling via a wheat agreement.

In the absence of a major trade war, world exports will continue to rise in the near future. The effect of this increased trade on price stability will depend primarily on the policies adopted by the major trading countries.

CHAPTER III

PRICE AND WORLD MARKET CHARACTERISTICS OF THE MAJOR CASH CROPS IN WEST TENNESSEE

I. Introduction

This chapter is devoted to analysis of price and world market characteristics of the four major cash crops in West Tennessee—soybeans, corn, cotton, and wheat—in order to provide a general feeling for the price stability and future potential of each crop. Specifically, the attributes studied are those which a farmer or policy-maker would be concerned with: U.S. price, production, and export trends, price stability and predictability, the international supply and demand situation and market structure, and factors affecting the long-term prospects for each commodity. This chapter deals with relative price stability in Tennessee from a statistical historical viewpoint, using data from secondary sources, and relies on previous studies and publications for assessment of international market structure and future prospects.⁵

The time period used for trend analysis was 1950-1977. For the purpose of identifying whether there have been changes in the stability

⁵The primary sources of information used in this chapter are: Tennessee Agricultural Statistics, Agricultural Statistics (USDA), World Food Production, Demand and Trade (Heady, Blakeslee, and Framingham), Alternative Futures for World Food in 1985 (USDA), The World Food Situation and Prospects to 1985 (USDA), Projections for Agricultural Commodities in 1975 and 1985 (FAO), and Study in Trends of World Supply and Demand of Major Agricultural Commodities (OECD).

of prices (since 1972, especially), the period of study was viewed not only as a continuous whole but also as five separate time periods (1950-56; 1957-61; 1962-66; 1967-71; and 1971-77).

Two commodity price attributes of most immediate concern to farmers are the magnitude and predictability of price fluctuations. These factors create a situation of either risk or uncertainty. By a commonly accepted definition which is used in this study (Heady, 1952), a risk situation is one in which the probability of a particular outcome is known approximately. A situation of uncertainty, on the other hand, is characterized by a lack of knowledge of the likelihood of possible outcomes. This distinction is important because in a risk situation a farmer is able to utilize what information he has to make long-term plans. In an uncertain situation the farmer must still make plans but they are based on ignorance of the environment and allow for the possibility of sustained long-term losses.

Fluctuations in commodity prices were measured according to the three primary components of variation: trends, cycles, and seasonal variation. The analysis was based on the real prices of these commodities. These were calculated by deflating the average annual price paid to farmers in Tennessee for each commodity by the U.S. Department of Agriculture index of prices paid by farmers for production and living expenses (Agricultural Prices, 1978). This index was used to reflect the actual buying power of the farmers.

The trends in prices, production and exports were identified by linear regression techniques, the key indicators being the r^2 statistic, the coefficient of variation, and the beta coefficient. (See Table 2.)

Table 2
Measures of Price Instability used in
This Analysis

Attribute	Measurement Technique	Indicators
Trend	simple linear regression	r^2 statistic coefficient of variation beta coefficients
Cycle	decomposition of time series	visual
Seasonal variation	index of seasonal variation	changes in indices over time variation from the seasonal pattern
Magnitude of fluctuation	mean period prices	coefficient of variation

The price trends were measured for the periods both before and after 1972, to see whether any notable changes in trends have occurred. The slope indicates the direction and degree of the price trend and the magnitude of the fluctuations was measured by the coefficient of variation from the mean price for each period. The cyclical pattern was found by dividing the deflated price series by the trend and the existence of a cycle was assessed visually. Seasonal variation was measured in two ways: (1) the stability of the seasonal patterns themselves through a comparison of the index of seasonal variation for each period, and (2) the reliability of the pattern for each period as measured by the coefficient of variation from these patterns.⁶ Refer to Appendix A for data and detailed results of the regression.

In addition to historical time series analysis, the prospects for foreign trade in these commodities were explored. Among the factors considered in assessing the future export potential of these crops were U.S. production capability, the effects of technological improvements, the capacity of other producers to expand production, the relative market share the U.S. can hope to capture, the economic conditions favoring each crop, which countries are likely to be the major importers of these crops, and what the trade and food policies are likely to be in those countries as well as in the United States.

⁶Time series analysis based on methods found in Statistical Methods Applied to Agriculture, Pearson and Bennett.

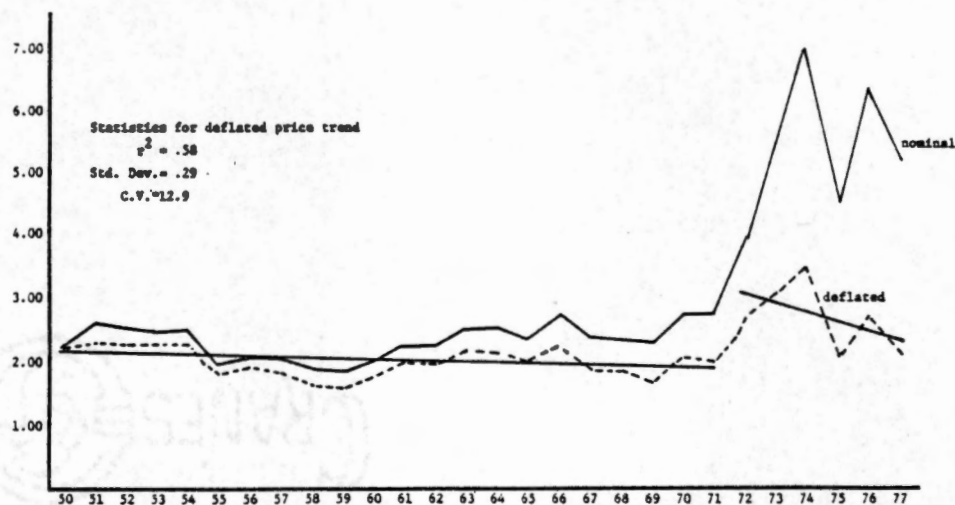
II. Soybeans

The soybean is the major crop in Tennessee today in terms of both acreage harvested and total value of production. Grown primarily in West and Middle Tennessee, soybeans have expanded from a minor crop in 1950 to one contributing over 40 percent of the State's total revenue from crops in the 1970's. The State ranked eighth among the 30 soybean producing states in 1977, and accounted for 3 percent of total production (Tennessee Agricultural Statistics, 1978). The crop competes primarily with corn and cotton for land, although in recent years high soybean prices (relative to beef) have put soybeans on marginal land, replacing some pastures.

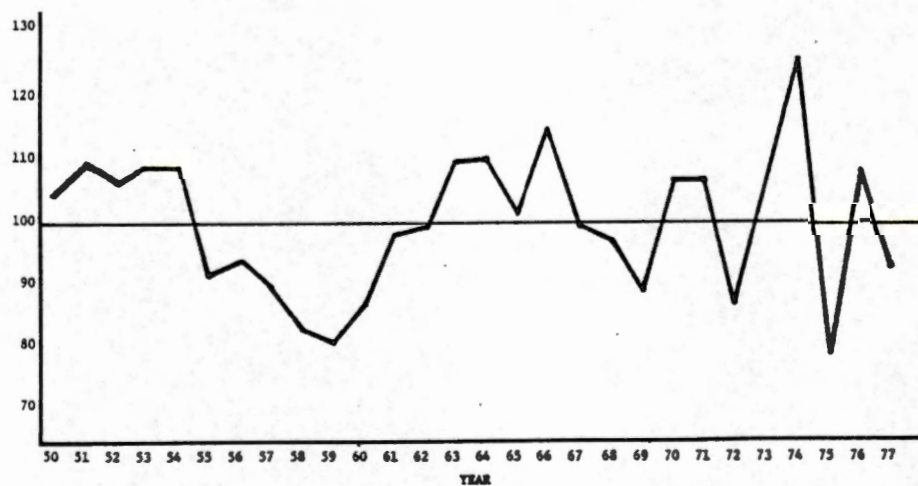
Price Analysis

Although the nominal prices of soybeans generally moved with a slight upward trend from 1950 to 1971, real prices were decreasing. Sharp rises in market prices in 1972, 1973, and 1974 brought about changes in both the intercept and slope of the trend line, but the slope change was not statistically significant. (See Figure 2a.)

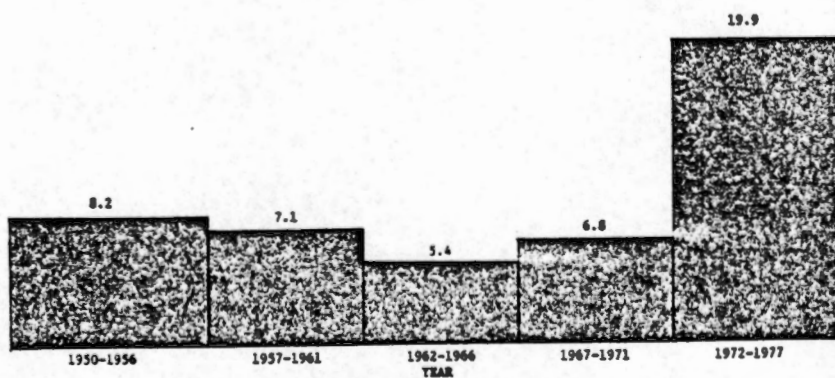
The cyclical movement in the price of soybeans seemed to have a definite pattern in the pre-1972 period, rising for five years or so and then declining for about the same period, but this pattern disappeared after 1972. (See Figure 2b.) The rapid price increases of the 1972-77 period also caused a considerable increase in the amount of variation, disrupting the previous situation of moderate price variation. (See Figure 2c.)



A. Nominal and deflated price movements and deflated trend



B. Deflated price cycle



C. Coefficient of variation of mean deflated price, by period

* Figure 2. Selected price and market characteristics of soybeans.

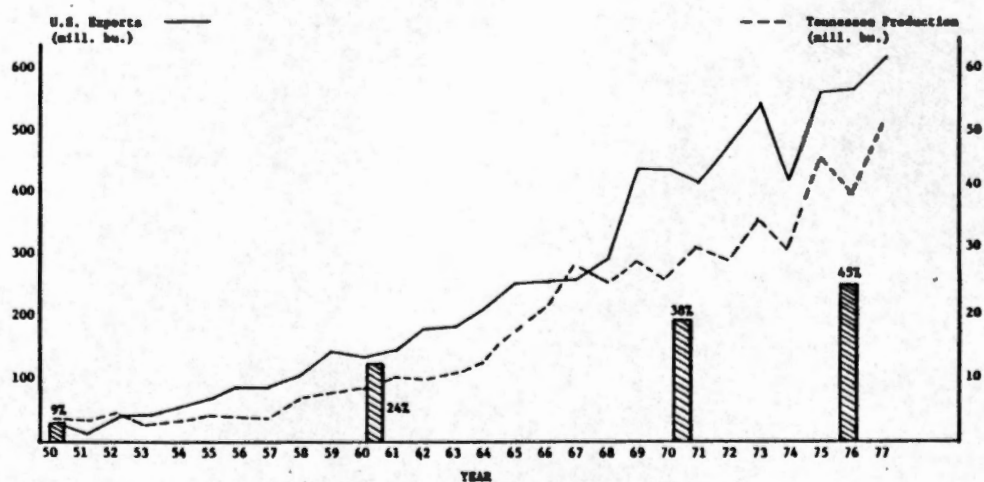
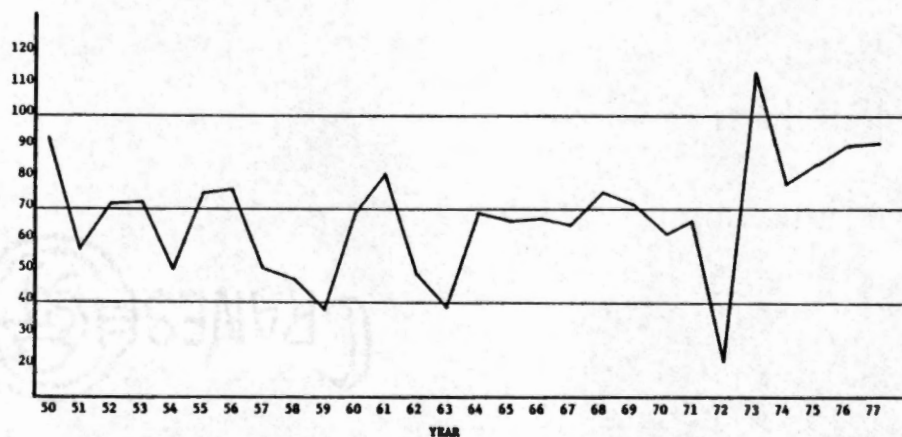
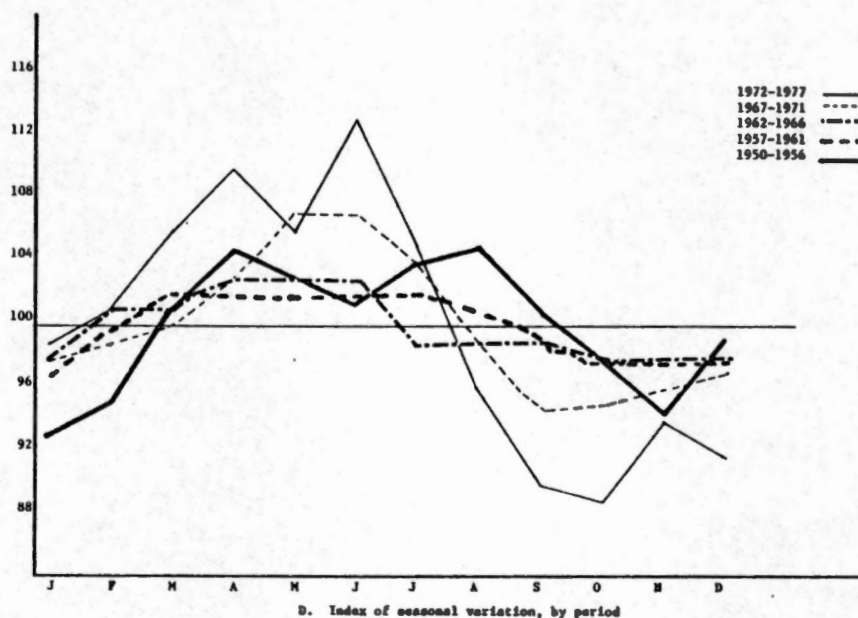


Figure 2. (Continued)

The pattern of seasonal variation held relatively constant throughout the five periods, indicating that the seasonal high and low prices came in about the same months in each period. (See Figure 2d.) The coefficients of variation from these patterns (Figure 2e) show that the patterns for each period were roughly of the same reliability, with somewhat higher variability in the most recent period.

Overall, it might be concluded that the real prices of soybeans were less stable in 1972-1977 than they were before the 1972 period. The trend in real prices continued to be slightly decreasing.

Domestic Concerns

The growth of the soybean industry in the State reflects the national and international trends—production increasing steadily. The United States is the world's largest producer and exporter of soybeans, accounting for over 60 percent of world production and about three-fourths of the exports (Statistical Abstract of the U.S., 1977). An ever larger share of the domestic produce has been going to foreign markets. (See Figure 2f.)

Soybeans are directly affected by two government programs—price supports and the PL 480 programs of exporting soybean oil to developing countries. The loan rate has had little effect on soybeans since the continuing demand has kept the market price well above the loan rate for all but 5 of the 28 years. One domestic policy stimulant to the growth of the soybean industry was indirect—the planting restrictions on other crops which compete with soybeans for land. As land was diverted from corn and cotton, much of it was planted in soybeans.

In West Tennessee particularly, the diversion of land from other crops and pastureland into soybeans has contributed to erosion problems. This problem of erosion has become of increasing concern to policy makers in recent years and steps will probably be taken to reduce it in the near future. This could have real effects on the amount of acreage devoted to soybeans.

International Concerns

The rising prices and growing potential for export earnings from soybeans has also attracted international competition in recent years. Brazil increased soybean production by 682 percent between 1969-71 and 1977 in a bid to capture more of the world market (FAO Production Yearbook, 1978). The People's Republic of China is also a major producer, although its production has remained about the same since 1970. With the new emphasis on development in China, however, this situation could well change and China could increase its share of the soybean export market.

World prices of soybeans also depend on the prices and availability of substitutes. The price increases of 1973-74 were in part caused by a shortage of fishmeal in South America, increasing the demand for soybeans. Palm oil is a partial substitute of increasing importance and cottonseed products also compete in the same market. Feed compounds for cattle can use most of the oilseeds interchangeably, but swine and poultry feed is more dependent on soybeans for an optimal combination of proteins.

Potential

Soybeans are used primarily as an ingredient in feed grain compounds and as such its demand is derived from increased meat consumption. Since people will generally demand more meat as income levels rise, the demand for soybeans also increases with economic growth and higher incomes. The growth of soybean production since 1950 can be explained primarily on the basis of this simple relationship since most of the soybeans grown are consumed in the U.S., Europe, and Japan—all areas which have experienced rapid economic growth in the past 28 years (U.S.D.A., 1971).

The export demand for U.S. soybeans has also been boosted in recent years because a weakened dollar has acted to reduce the real cost in foreign exchange of American soybeans in the industrialized nations (World Agricultural Situation, 1978).

The demand for soybeans will continue to increase in the developed countries with the anticipated continuation of the current trends of economic growth and income growth. In the LDCs, demand for high protein soybean oil will also probably continue to increase.

Soybeans have relatively free access to the EEC market, since the crop is not grown by member countries. If the present GATT negotiations are finalized in all member countries the export market in other countries could become more accessible as well.

III. Corn

Once the biggest crop in Tennessee in terms of harvested acreage, corn had been decreasing in importance relative to the other crops since the beginning of the study period. Although still grown in all parts

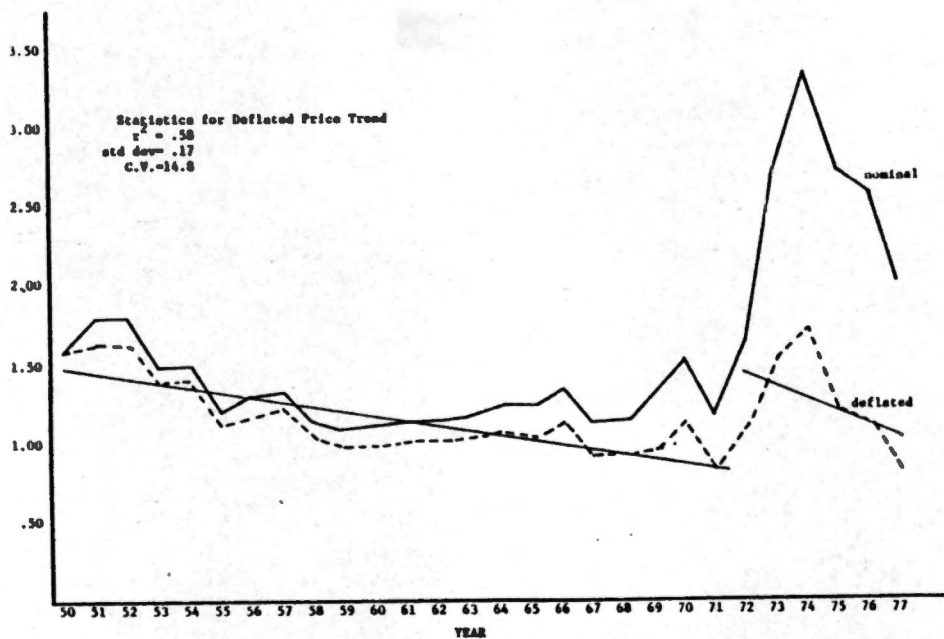
of Tennessee, much of the acreage once devoted to corn has been shifted to other uses. In 1977, roughly 13 percent of the cropland was planted in corn and the crop accounted for 8 percent of the total revenue from crops. Tennessee ranked eighteenth among the 41 corn producing states in the country, producing about 7 percent of the total in 1977 (Tennessee Agricultural Statistics, 1978).

Price Analysis

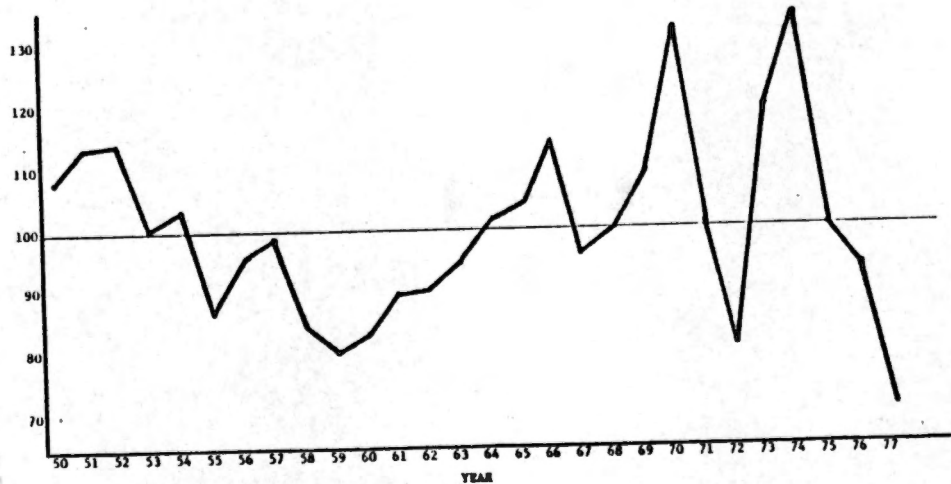
As with soybeans, the trend in real prices of corn has been in a downward direction since 1950. While there was a significant jump in prices in 1972-73-74, the overall trend did not change significantly; real prices continued to decrease. (See Figure 3a.)

Some cyclical pattern for corn did exist before the 1970's, when year to year changes became greater and sharp changes in the direction of price movements became more frequent. Whatever pattern had previously existed disappeared. (See Figure 3b.) As with soybeans, the magnitude of the price fluctuations increased substantially after 1972, reflecting the large annual price changes in that period. The coefficient of variation of the price of corn tended to be greater than those for soybeans in all periods. (See Figure 3c.)

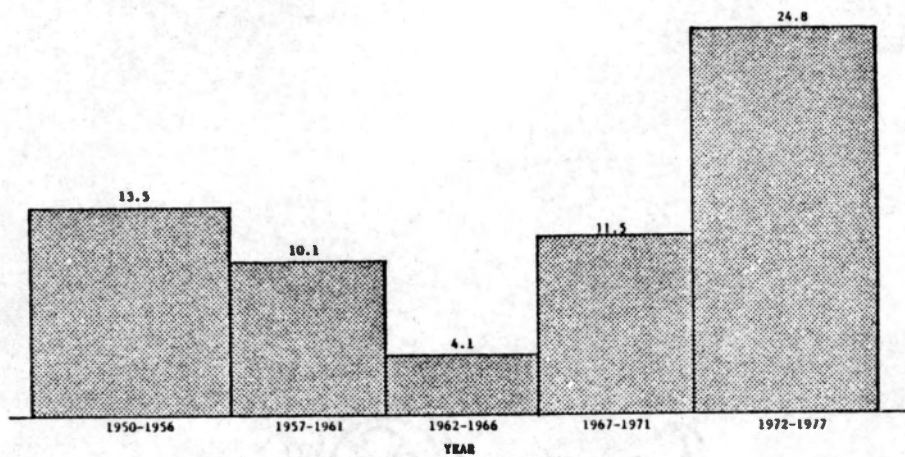
The pattern for seasonal variations in prices remained very stable over the study period. (See Figure 3d.) The pattern itself also appears to be a relatively good indicator of seasonal price movements, since the deviation from the pattern was somewhat less than that for soybeans and did not increase significantly after 1972. (See Figure 3e.) This would possibly be helpful to farmers with storage capacity and the ability to wait for expected higher prices.



A. Nominal and deflated price movements and deflated trend

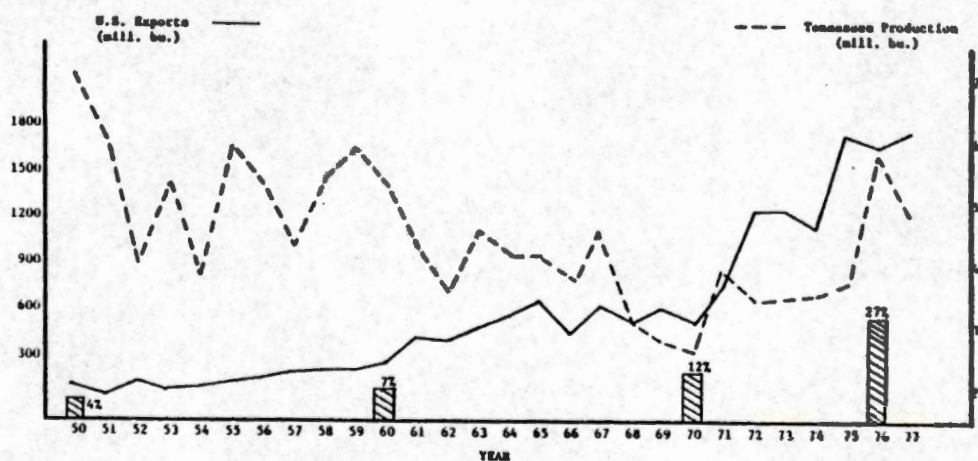
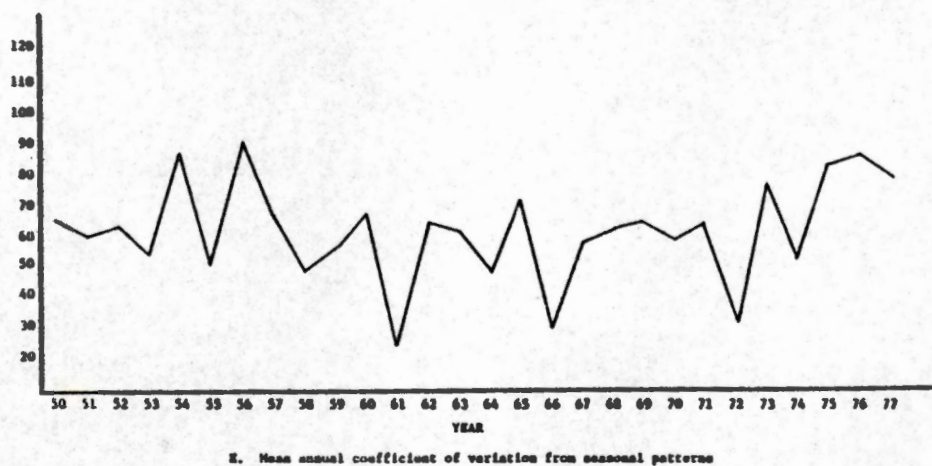
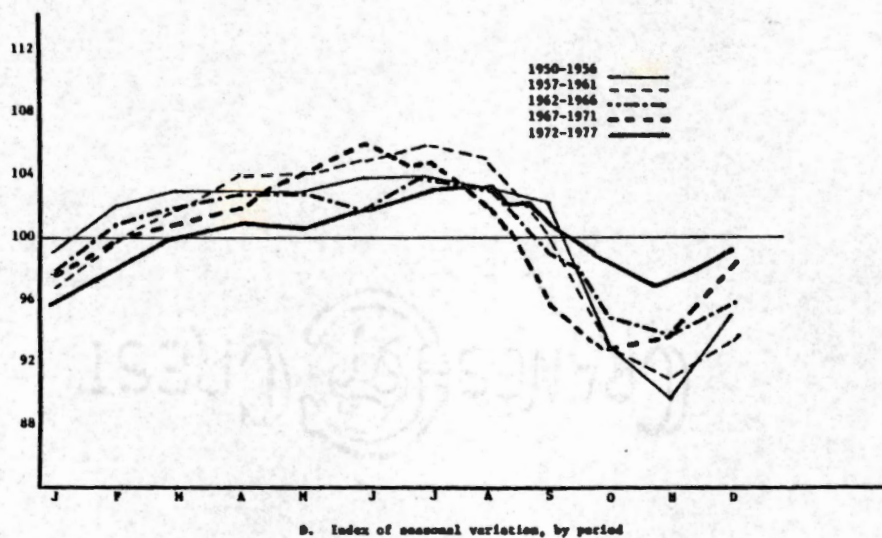


B. Deflated price ratio



C. Coefficient of variation of mean deflated price, by period

Figure 3. Selected price and market characteristics of core.



F. U.S. exports, Tennessee production, and percentage of U.S. production exported

Figure 3. (Continued)

Overall, in the period since 1972, the variation in annual prices of corn has increased considerably relative to previous periods and the annual movements are characterized by large shifts, making prediction difficult. On the other hand, seasonal variation has remained fairly stable and the real price trend has continued to decrease.

Domestic Concerns

Corn is a major U.S. export crop, as are most grains, because of the efficiency of large-scale production in this country. Roughly 45 percent of the world production is grown here and U.S. exports account for over 60 percent of the total world exports (Statistical Abstract of the U.S., 1977). Exports of U.S. corn have generally been increasing since 1950, with particularly strong increases in the years following 1972. In the period from 1971 to 1977, the volume of U.S. exports of corn rose 119 percent. More importantly, this increase in exports also constituted a larger portion of total production, although proportionately much more corn than soybeans is consumed domestically.

In the period of study, increasing efficiency of production, mechanization, and technological improvements in corn strains have increased yields and resulted in more output and lower prices in many years. Government production controls have been in effect most of the last 28 years, except for the high demand years of the Korean War. Price support levels have played an important part in determining the market price of corn.

International Concern

Other than the U.S., the major corn exporters are Argentina, France, Thailand, South Africa and the Netherlands, with some other Asian and

European nations competing to a lesser degree. Mexico is a major producer and a driving force in the development of new varieties, but at this time does not export. A war in South Africa could result in an abrupt supply shift internationally, while more limited use of export subsidies by the EEC resulting from acceptance of the GATT agreements could reduce the volume of French exports.

The importers are predominantly the industrialized nations—Japan and the European countries—and are relatively dependable export outlets.

Prospects

Corn is mainly used as a feed grain in the developed countries and, as was noted with soybeans, the derived demand for feeds will probably continue to rise in the future. The supply situation will largely be determined by yield increases, with changes in land usage playing a more minor role in production changes (U.S.D.A., 1976). Although there is considerable potential for increasing corn production in the developing countries, most of these nations have concentrated on the crops with greater domestic consumer preference for human food—rice and wheat. The devaluation of the dollar relative to other major currencies has benefitted U.S. corn exports by increasing effective demand.

With the ratification of the new GATT treaty, U.S. corn will probably have access to more markets in Europe and face somewhat less competition in other markets.

IV. Cotton

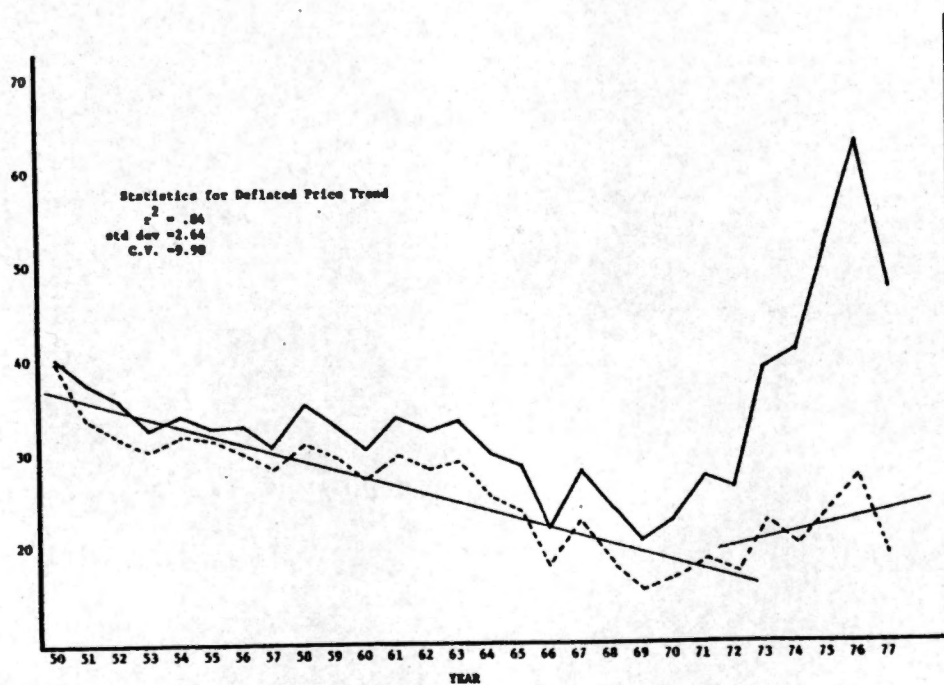
Cotton has historically been an important crop in Tennessee. In the period under study however, the production of cotton has been

steadily declining to the point at which only 6 percent of the cropland is currently being used for cotton. The crop contributes about 10 percent of the total farm revenue from crops. Tennessee was ranked eighth of the 18 cotton producing states in 1977, accounting for 1.8 percent of national cotton production (Tennessee Agricultural Statistics, 1978). Although much of the decreased production in the State has been caused by low prices for cotton, in recent years a number of production problems have affected yields and seriously reduced the profitability of the crop.

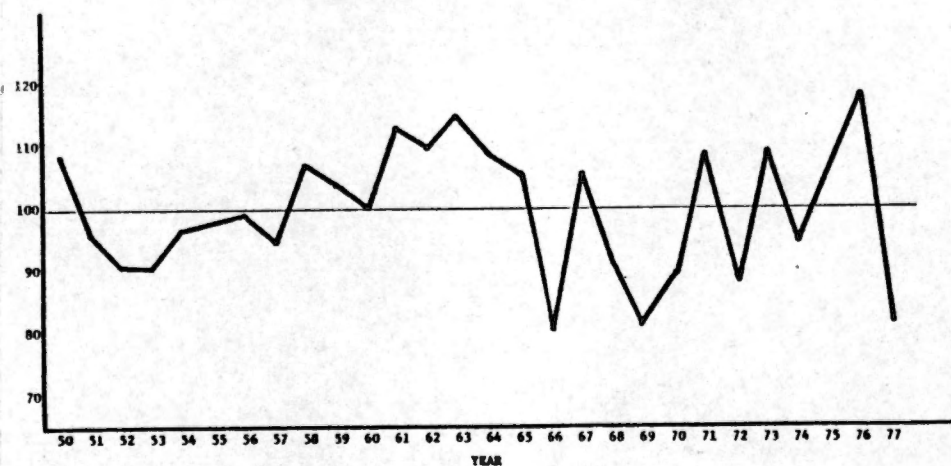
Price Analysis

The real prices of cotton lint had been steadily declining from 1950 to 1971. This reflected the decreasing demand for cotton as a textile because of the appearance of new substitute products made from polyester during this time period. In the post-1972 period, the direction of the trend changed as the prices moved sharply upward—a significant change from the earlier period. (See Figure 4a.)

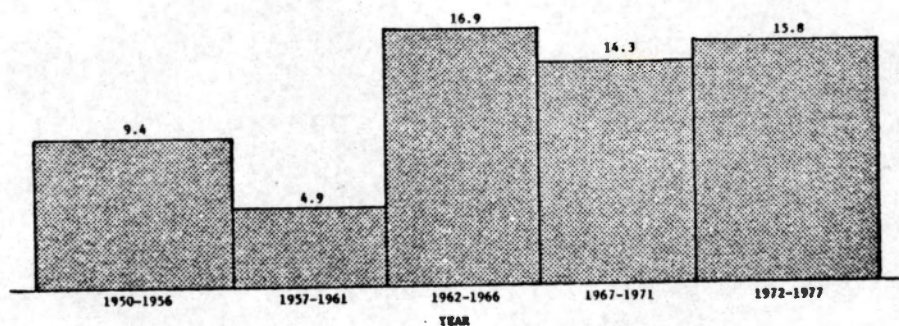
Little can be said about the predictability of cotton prices since the annual price movements did not appear to have any set pattern. Since 1965, the price movements have been characterized by almost yearly reversals in direction, making predictions very risky. (See Figure 4b.) This situation also contributed to the relatively high levels of price variability shown in Figure 4c. Cotton was essentially unaffected by the factors which caused the rapid price increases of the other crops in the early 1970's and the magnitude of fluctuations did not change much after 1972.



A. Nominal and deflated price movements and deflated trend



B. Deflated price cycle



C. Coefficient of variation of mean deflated price, by period

Figure 4. Selected price and market characteristics of cotton.

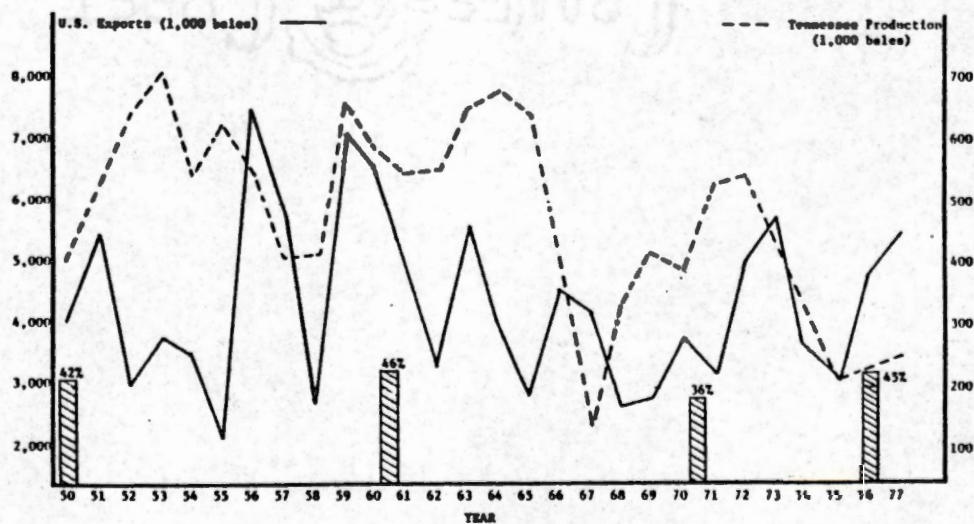
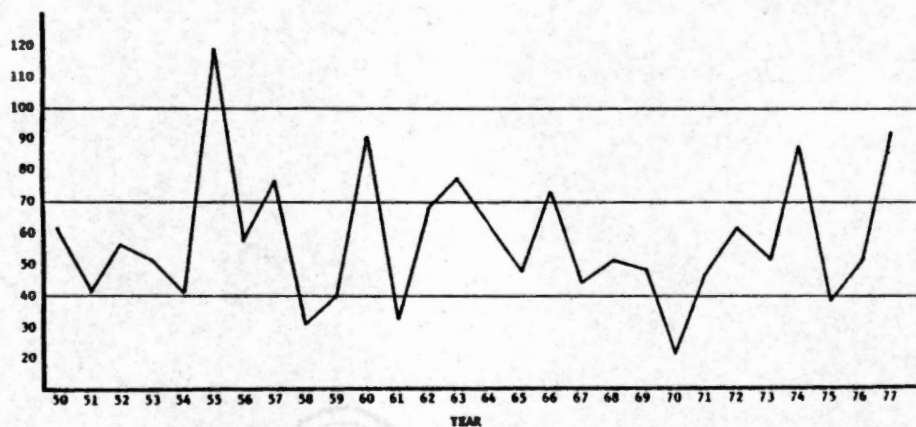
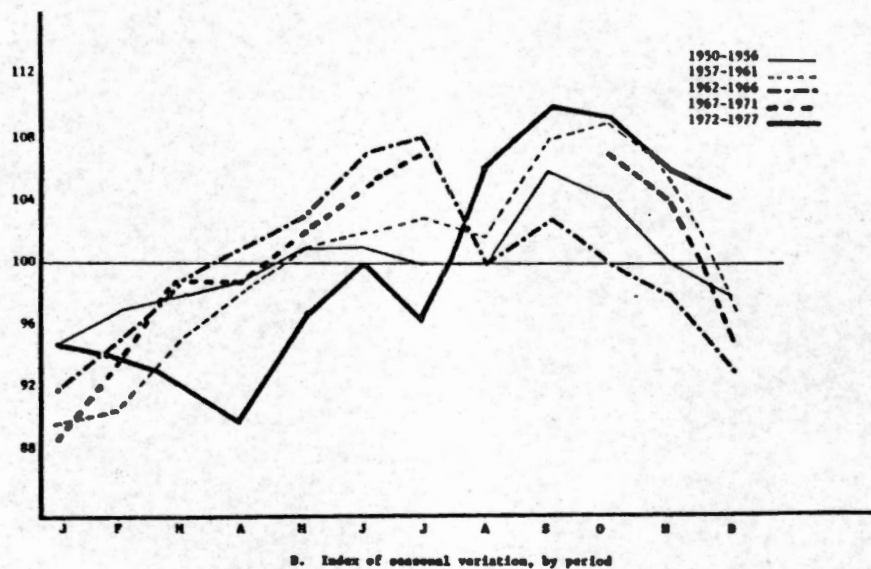


Figure 4. (Continued)

The patterns of seasonal variation were somewhat similar from 1950 to 1971, but the post-1972 period was characterized by a different pattern. The prices remained lower than average until the middle of the year and then rose abruptly. (See Figure 4d.) The deviations from the seasonal patterns were relatively low both before and after 1972. This suggests that the seasonal price pattern for cotton within any one period is fairly consistent. (See Figure 4e.)

Overall the price of cotton has been less predictable than those of the other commodities in terms of all of the indicators of price variability used in this study.

Domestic Concerns

The United States is not the superpower in cotton production that it is in grain production. This country produced about 18 percent of the world production and about 27 percent of the world exports in 1976 (Statistical Abstract of the U.S., 1978). Cotton exports fluctuated so much in the study period that a trend line could explain very little of the movement, although the overall trend was downward. (See Figure 4f.) Exports of cotton as a percentage of domestic production also varied considerably, fluctuating from 32 percent to 47 percent in the 1970's alone (Statistical Abstract of the U.S., 1978).

American agricultural legislation has played a major part in the cotton industry. High price supports, mandatory production controls and marketing quotas, and export subsidies were the rule until 1966 when support prices were lowered and direct payments were made to farmers. As with most other crops, production controls were made voluntary in the 1970's. Until that time, however, the government was the major influence

on domestic (and export) prices. The current target prices reflect the costs of production, which are relatively high, and should encourage cotton production.

International Concerns

The U.S. competes with several other countries for cotton exports, most of which tend to have lower export prices. The USSR, Egypt, the Sudan, Mexico, India, Pakistan, Turkey and Brazil all produce and export cotton. The weakened position of the dollar has helped to make U.S. produce more competitively overseas. Most of the American cotton exports currently go to thriving Asian countries—Korea, Taiwan, Hong Kong, Japan, Singapore—and in recent years, the PRC is also becoming a major importer. The population growth in these countries and the market for inexpensive, ready-made cotton garments in the U.S. should continue to support their demand for cotton.

Prospects

The future prospects for cotton are tied to a number of variables. In general, cotton appears to be making a comeback against the competing synthetic materials because of technological advances which allow the manufacture of all-cotton, permanent-press fabrics. This coupled with a general consumer preference for the more comfortable cotton garments may work to reverse the trends of the past quarter century. The high cost of petroleum has also increased the cost of synthetics, making cotton more competitive. These changes were reflected to some degree in the shift in price trends after 1972.

Demand for cotton is also tied to economic growth. As previously mentioned, economic growth in the developed and developing countries can be expected to continue, although occasional slowdowns may occur.

The situation in Tennessee is somewhat different. In the past few years, cotton yields in the State have been very low (Tennessee Agricultural Statistics, 1978); a phenomenon variously attributed to soil compaction, weather, the cumulative effects of herbicides and insecticides, and insects. Cotton production has been steadily falling in this period (Figure 4F) and could be phased out entirely if the underlying causal factors do not change.

In addition, Tennessee cotton growers are facing greater competition from irrigated cotton fields in some states in the Southwest. These areas have an advantage in growing cotton in that the drier climate discourages insect problems.

V. Wheat

Wheat is a minor but expanding crop in Tennessee. Increasing steadily since the early 1950's, when less than 1 percent of the cropland was planted in wheat, it now covers about 5 percent of the cropland and accounts for roughly 3 percent of the crop revenue (Tennessee Agricultural Statistics, 1978). Ranked nineteenth of the 42 producing states and accounting for only 0.5 percent of the total production, Tennessee will probably not be competing with the big wheat producers in the Great Plains. At this time most of the wheat production in the State is generated through double-cropping schemes with other crops such as soybeans or sorghum.

Price Analysis

The trend in the real price of wheat was downward from 1950 until the early 1970's when increased foreign demand and changes in the domestic policy caused a surge in real prices. The subsequent decline in real prices, however, has brought about a return of the previous trend. (See Figure 5a.)

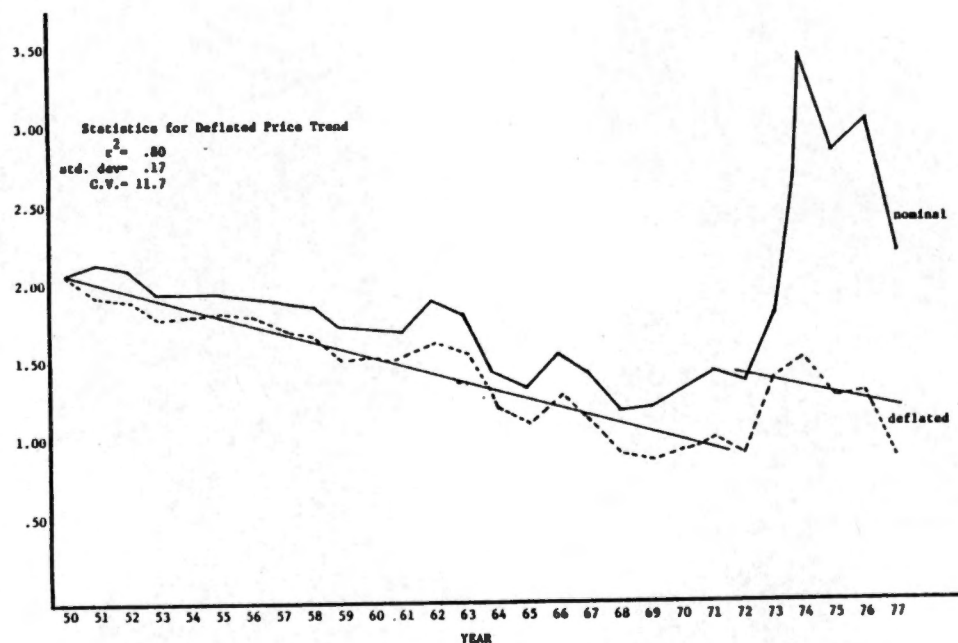
Little can be said as to the predictability of the annual prices of wheat in this period. As Figure 5b shows, no enduring cyclical pattern was established for any length of time. The annual price movements also indicated that price fluctuations have increased considerably since the 1950's. Price variation was lower than for the other crops except cotton from 1950-1961, but it also rose significantly after 1972. (See Figure 5c.)

Seasonal prices have generally followed an identifiable pattern (Figure 5d) although some changes can be noticed in the post-1972 period—specifically that prices tended to fall a month or two earlier and rise earlier than in other periods. The deviation from these patterns has tended to be rather small except for the period from 1967-71. (See Figure 5e.)

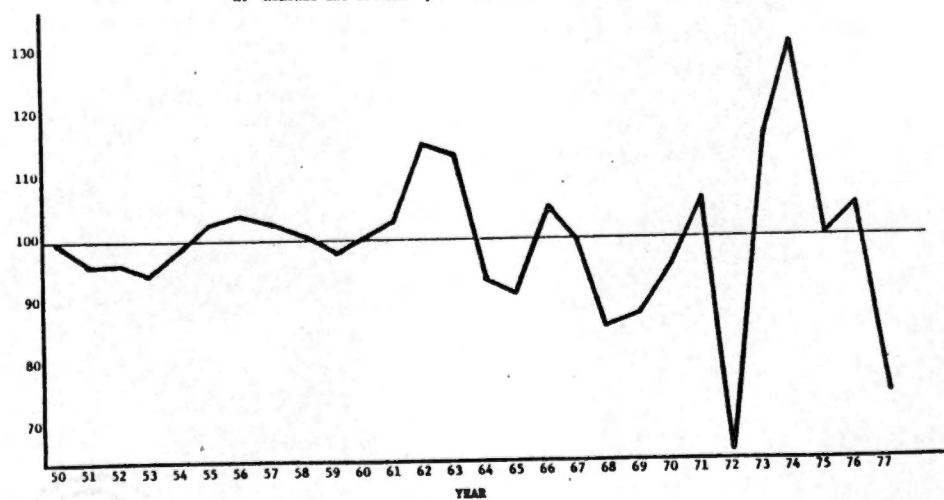
On an annual basis, therefore, wheat prices appear to be less predictable and to fluctuate more than in the periods before 1972, although seasonal price movements are still relatively predictable.

Domestic Concerns

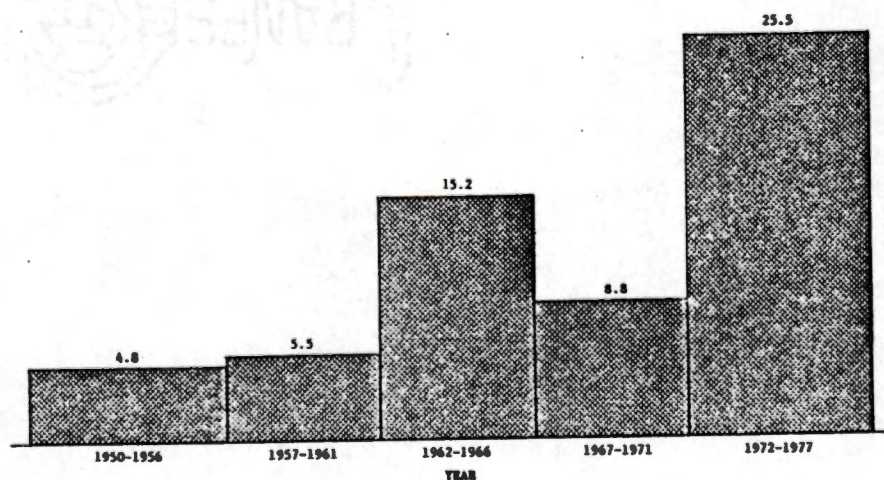
The United States is traditionally a major supplier of wheat and other grains; in 1976, although only 17 percent of the world production came from this country, more than 45 percent of the world exports



A. Nominal and deflated price movements and deflated trend



B. Deflated price cycle



C. Coefficient of variation of mean deflated price, by period

Figure 5. Selected price and market characteristics of wheat.

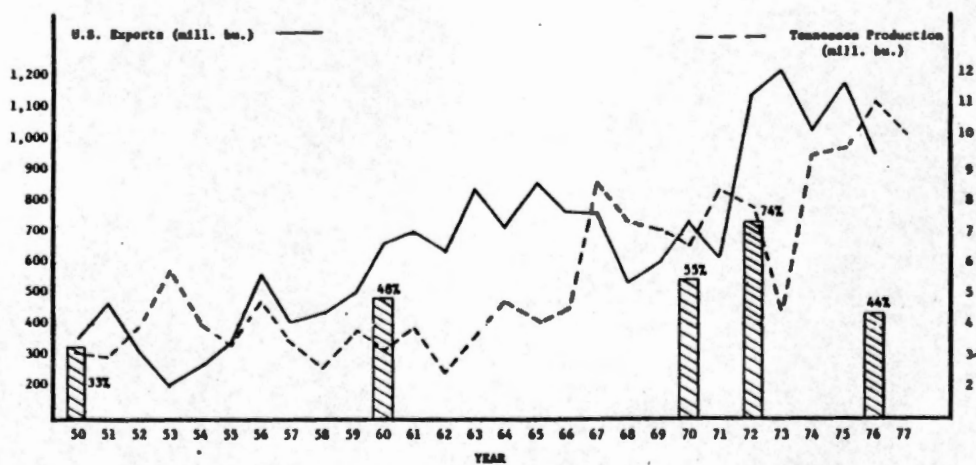
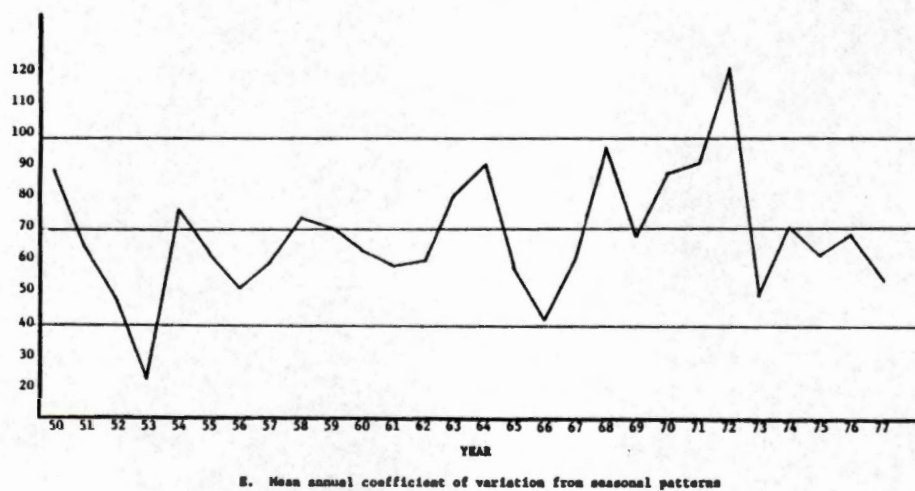
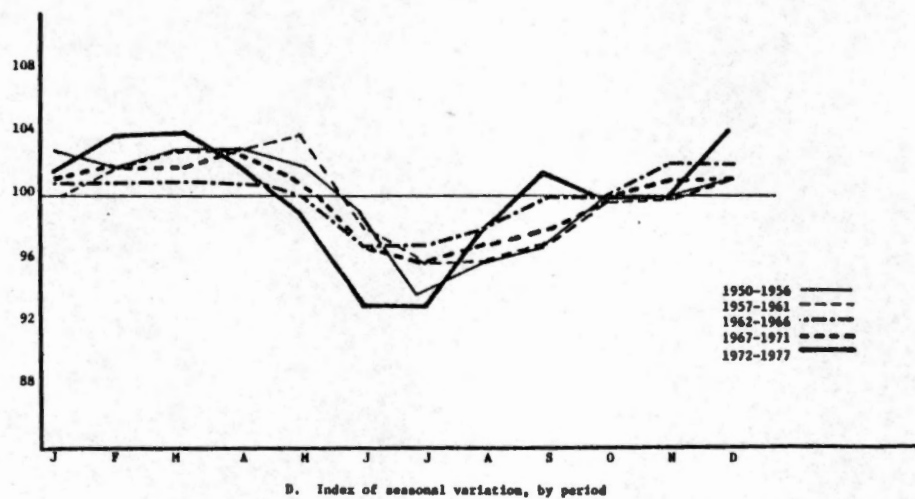


Figure 3. (Continued)

originated here (U.S. Statistical Abstract, 1978). As these figures imply, the U.S. exports a sizeable percentage of domestic production—a portion which usually hovers around 50 percent but has approached 75 percent in exceptional years like 1972. (See Figure 5f.) These figures attest to the crucial role of foreign demand in determining the market price of wheat.

As with corn, technological improvements in farming methods and wheat strains have generated surplus production in many years. Domestic programs have generally aimed at limiting production of this important crop and stimulating demand, particularly through the PL 480 program. Domestic price supports have played an important role in determining the price paid to farmers in most of the 28 years of the study. In 1973, USDA policy-makers continued production controls, and the next year, encouraged all-out production, which contributed to the price fluctuations in the 1970's.

International Concerns

The major wheat producers and exporters other than the U.S. are Canada, Australia, France, and the USSR, although in recent years, Russia has occasionally been a major importer. Production of sufficient quantities of wheat to meet foreign demand should be no problem in the near future except for possibilities of short-run shortages. Most of the increased production will come from further yield increases, although additional land is available in both the U.S. and Australia if the price warrants putting it into production (U.S.D.A., 1976).

The major importers of wheat are the USSR, China, Japan, and some EEC countries. The developing countries also import sizeable quantities

of wheat on both commercial and concessional terms—often as a supplement to domestic rice production.

Prospects

Wheat can be used both as a food for humans and as feed for livestock. In the case of developed countries, there is an inverse relationship between income and demand for wheat as food, a relationship which holds true for rice and coarse grains as well, because people tend to substitute more meat for grain as incomes rise. Therefore, population growth and income growth tend to balance out in their effect on the demand for wheat. As a feed, however, the demand should increase (U.S.D.A., 1976).

In developing countries the situation is the reverse; the demand for wheat increases with income since wheat is more desirable than the coarse grains. Therefore, the combined pressures of population growth and increasing income would create a substantial increase in total demand for wheat. In addition, wheat is imported by some Asian countries to supplement rice production. The shift from use as food to feed would be minimal in those countries. Since much of the world's population is in developing countries and the rate of population growth is higher than that of developed countries, and economic growth is also relatively high, it is evident that much of the potential future growth in demand will originate in the LDCs (U.S.D.A., 1976).

Some of the demand growth in LDCs will be offset to some degree by other factors. Improved production could meet some of the domestic needs, but experience does not presage any major advances in this area. Insufficient amounts of foreign exchange may also hinder efforts to

transform need into effective demand. This problem is exacerbated by the fact that many of these countries have currencies tied to the dollar, or declining relative to the dollar, making wheat imports even more expensive (World Agricultural Situation, 1978). Ironically, the situation is the opposite of that in the industrialized countries, for whom the U.S. exports have become progressively less expensive with currency realignments. On the other hand, many countries could be helped in this regard by increased emphasis in international organizations or in U.S. foreign policy on meeting nutritional needs of the world poor.

Wheat exporters would benefit from the acceptance of the GATT negotiations. Markets in the EEC and Japan particularly would be opened to more U.S. trade. A section on a new wheat agreement would stimulate international stockpiling to reduce price fluctuations and spread the burden of stabilizing measures more equally throughout the world.

The international wheat market will continue to be relatively volatile until the structural problems of large and secret purchases by the centrally planned economies (and others) are solved. The fluctuations caused by the USSR in particular, moving from net exporter to net importer with little notice and in effect using the world markets as a buffer stock, are likely to be somewhat less than those caused in 1973 and 1974 if there is success in establishing international as well as domestic reverse stocks.

VI. Comparison of the Commodities

It may be helpful at this point to bring together the information presented in the preceding sections in order to get a more complete

picture of the relative position of the crops. Most of the relevant data is summarized in Table 3.

Soybeans was the most rapidly expanding crop in Tennessee in the study period—a function of both growing demand and reduced opportunities for planting other crops due to program restrictions. Although annual price movements are somewhat uncertain, the magnitude of price fluctuations has been lower than for most of the other crops in any particular period and seasonal variations are relatively predictable. Prices have also tended to be consistently high over the past 28 years. With an expectation of continuing export demand, some help from the proposed GATT agreements and a dominant share in the world export market, soybeans appear to be the most promising crop in West Tennessee for the near future.

The next best prospect is corn, with some good export potential and with domestic demand projected to continue. The magnitude of price variation tends to be relatively high and cyclical movements are uncertain, but the seasonal patterns are very stable.

Cotton and wheat have conflicting factors affecting growth and the future for these crops is more uncertain. Both have relatively high fluctuations in price and export potentials are only moderate.

The trends in exports of the commodities also provide a certain amount of perspective on the relative importance of these crops to the economy and agricultural sector as a whole. The figures in Table 4 show a dramatic increase in both value and percentage of total agricultural exports that consist of soybeans and corn, while cotton and wheat have become relatively less important. Although the composition has changed,

Table 3

A Brief Summary of the Characteristics of
Four Tennessee Crops

Crop	Price Trend	Predictability	Export Potential	International Considerations	Policies	Overall Outlook
Soybeans	slightly down	cycle-uncertain seasonal variation good	high	competition from Brazil and other producers, and some substitutes	Gatt will help, US policies have no effect	good/ excellent
Corn	slightly down	cycle-uncertain seasonal-good/ very good	medium/high	some competition from other producers	GATT will help, US policies are necessary	good
Cotton	uncertain-strong upward trend in recent years	cycle-poor seasonal uncertain	uncertain/ fair	income change, heavy international competition	US policies important	fair/good uncertain in Tenn. due to yield problems
Wheat	down	cycle-poor seasonal-good	uncertain/ fair	GATT, LDC production USSR, PRC purchases	GATT and US important	uncertain/ fair

Table 4

Composition of U.S. Agricultural Exports in 1950, 1960,
1970 and 1977, Selected Crops of Special
Importance to Tennessee

Commodity	Value (mill.\$)	Percentage total agri- cultural exports	Value (mill.\$)	Percentage total agri- cultural exports	Value (mill.\$)	Percentage total agri- cultural exports	Value (mill.\$)	Percentage total agri- cultural exports
Soybeans and products	150	4%	440	9%	1,520	23%	5,670	24%
Corn and products	210	6%	330	6%	900	13%	4,750	20%
Wheat and products	750	22%	1,080	22%	970	15%	3,050	13%
Cotton	940	28%	940	19%	410	6%	1,520	6%
Total U.S. agr. exports	3,400		4,900		6,700		24,000	
Total percentage agr. exports		60%		56%		57%		62%

Source: Agricultural Statistics and U.S. Foreign Agricultural Trade Statistical Report.

the total contribution of these four crops to U.S. agricultural exports has held constant since 1950.

CHAPTER IV

INTERNATIONAL PRICE MOVEMENTS AND INDIVIDUAL FARMS—AN ILLUSTRATIVE MODEL

As was established in the preceding chapters, the agricultural commodity markets in the 1970's were buffered by numerous events, both common and extraordinary, and prices were less stable than in any other period since 1950. In consequence, farm decision makers were forced to deal with more than usual uncertainty and potential for income variability. Historically, the federal government has attempted to stabilize prices and protect farm income through programs involving some combination of production controls and price supports. On the farm level, cropping decisions and strategies also offer a means of reducing income variability and risk. The increased reliance on foreign markets characterized by trade-distorting mechanisms and policies is bringing in new elements which affect price fluctuations. Accordingly, traditional farm-level strategies may no longer be as effective as they were in a period of relative price stability.

In order to illustrate how international trends and events, trade policies, government agricultural policies and farmer-initiated attempts to buffer price fluctuations might interact and ultimately affect farm income, two farm situations in West Tennessee were depicted to assess the efficacy of several alternative farm management strategies under differing levels of price instability and with different domestic agricultural programs. This was not intended to be an exhaustive study

of all possible policies and programs, nor were the programs indicative of the mass of regulations, provisions and exceptions incorporated in most federal programs. Rather they were merely intended to illustrate the interaction of events.

The general framework used for this illustration was as follows: three overall scenarios reflect possible sets of world and domestic events which could make prices either more unstable or more stable. The market prices projected in the scenarios could be influenced by two variations of three types of U.S. agricultural programs which could be considered for use by the government. On the farm level, four basic strategies were depicted which the individual farmer might employ to help buffer the effects of price variation.

I. Explanation of the Scenarios

The "Stable Prices" Scenario was based on the assumption that the increases in price instability in the post-1972 period were caused primarily by the convergence of a number of extraordinary influences and therefore are not likely to be indicative of the future.

Given this assumption, the degree of fluctuation in prices observed in the period from 1972-1977 was considered abnormal and therefore discarded for future prediction. The magnitude of price fluctuations for this scenario was therefore more consistent with the degree of stability found in the years before 1972. (See Chapter III.)

This scenario assumed the continuation of present world trends in supply, demand, and trade, domestic food policies as they affect production and those affecting trade. Impediments to trade might be

reduced somewhat, or purchase agreements and long or medium term contracts with major trading partners with unstable import demand will reduce the possibility of large, sporadic purchases and therefore will somewhat reduce instability and uncertainty.

The "Unstable Prices" Scenario assumed that the events of the 1970's were heralding a new era of fluctuating prices and that the future will be characterized by this erratic pattern. Uncertainty facing farmers would continue to be high and the potential for gains and losses in any particular year would be greater. This scenario assumed that the instability of this decade will continue with expanded trade and the concomitant increased reliance on foreign demand in determining domestic prices. Price variation would continue to be accentuated by protectionist measures in other countries.

The situations in each of these scenarios could be caused by any number of combinations of events not specifically mentioned. The Stable Prices Scenario, for example, could also come about through the increased liberalization of trade policies—notably in the EEC and Japan—negotiated in the Tokyo Round of the GATT talks, accompanied by reserve stocks in many important countries. On the other hand, continued instability in the supply and the price of petroleum, relatively high income growth around the world, changing weather patterns, more success in increasing production in the LDC's, or more progress in the self-sufficiency movements in many countries could create more international instability such as that modeled in the Unstable Prices Scenario.

The price movements assumed to be associated with both scenarios were constructed through manipulation of the base year (year 0) prices.

(See Table 5.) The base year prices were the average price of each of the commodities for the period 1967-1978 in current (1978) dollars.

(See Appendix B.) The projected prices were calculated with respect to three important factors: (1) the magnitude of price fluctuations as measured by the coefficient of variation (Chapter III); (2) the correlation between the price movements of the commodities (see section III, this chapter), and to a lesser degree; (3) the basic trends of each commodity (see Chapter III). Lacking a sophisticated program to generate the numbers to meet the requirements of all of these factors, a trial and error method was used. The coefficient of variation (which is the standard deviation as a percentage of the mean) was used to generate the yearly prices from the base year price. The prices in the Unstable Prices Scenario reflect the coefficients of variation of a period of high price fluctuations (1972-1978) and the Stable Prices Scenario reflects those of a period of relatively low price fluctuations (1967-1971). These prices were then arranged and modified to reflect the price trends and correlation coefficients among the commodities.

The third scenario, Low Soybean Prices, was a modification of the Stable Prices Scenario with a series of low price years for soybeans. (No actual period with a series of low price years for soybeans occurred in the study period. This scenario is to illustrate the impact of such an event.) This scenario was paired selectively with certain programs and strategies to assess the implications of a run of "bad years" for West Tennessee farmers.

Table 5
Basic Simulated Tennessee Price Movement

Crop	Year						Coeffi- cient of	
	0	1	2	3	4	5	Slope	variation
Stable Prices Scenario								
Soybeans	6.22	6.57	6.48	5.70	5.87	6.05	-.11	6.2
Corn	2.90	3.23	3.13	2.78	2.23	2.57	-.14	13.0
Wheat	3.07	3.20	2.93	3.36	2.52	2.80	-.08	10.0
Cotton	.539	.618	.490	.668	.459	.520	-.01	14.4
Unstable Prices Scenario								
Soybeans	6.22	7.40	8.20	5.75	4.95	6.10	-.29	18.0
Corn	2.90	2.65	3.66	4.07	1.77	2.38	-.14	29.0
Wheat	3.07	3.83	2.76	4.28	2.09	2.31	-.21	28.0
Cotton	.539	.625	.476	.581	.532	.698	.02	13.6
Low Price Soybeans Scenario								
Soybeans	6.22	6.48	5.65	4.83	4.95	5.20	-.30	12.3

II. Explanation of the Projected Domestic Programs

A major purpose of domestic agricultural programs is to protect farmers from some of the effects of uncertainty in the agricultural sector. While these programs can have a decisive influence on the real effects of worldwide destabilizing events on farmers, it would be impossible to cover here the entire spectrum of possible programs, real, proposed and conjectured, in all of their combinations and permutations. Therefore, this study dealt with only a few program types which directly affect the prices of the commodities.

The "real world" of agricultural programs involves annual adjustments of price support levels and production controls, based on political expedience and the best available knowledge and interpretation of the existing supply and demand situation. This study did not attempt to "second guess" policy makers on this point, but assumed that programs and details were held constant over the simulated five year period.

The skeletons of three major program types were used in the analysis. Farm costs were held constant and commodity price movements were on a deflated basis (constant 1978 dollars). Therefore, if the program price levels were also held constant, this assumed that yearly adjustments are made in the price levels to reflect the rising costs of living and production. Since this was not actually the case at that time and annual adjustments may not cover the full extent of increased costs, two versions of each program were presented. One version held price support levels constant throughout the period, implying cost-of-production adjustments. The discounted version reduced prices by 5 percent each

year to reflect a gradual decrease in the support level in real terms. The base year support rates were the 1978 loan and target prices set by the USDA.

The Market Floor Program set a market floor price, representing the loan rate concept, at the 1978 levels for each commodity. These levels were assumed to be constant in real terms, while the Discounted Market Floor Program allowed for decreasing real support levels.

The Income Support and Discounted Income Support Programs assumed an income support level of constant and decreasing real levels, respectively, at a higher level than for the Market Floor Programs. This alternative implicitly assumed that the income support level was the only one of importance to farmers when making their cropping decisions. This price, therefore, included the direct payments to farmers in those years when the market price was below that of the assumed target price.

The Price Band and Discounted Price Band Programs established both a floor and a ceiling to the market price similar to the effects of a buffer stock arrangement. The market floor price was set at the same level as for the Market Floor Programs and the market ceiling price was set at 175 percent of the floor price.

These programs were greatly oversimplified. Their purpose was not to simulate the details of actual programs but rather to illustrate likely impacts on farmers of contrasting program features. The program price levels are shown in Table 6.

Table 6

Assumed Price Levels for Government Programs

Program	Year					
	0	1	2	3	4	5
I. Market Floor, Constant						
Soybeans ^a	4.50	4.50	4.50	4.50	4.50	4.50
Corn	2.00	2.00	2.00	2.00	2.00	2.00
Wheat	2.25	2.25	2.25	2.25	2.25	2.25
Cotton	.48	.48	.48	.48	.48	.48
I-A. Market Floor, Discounted						
Soybeans ^a	4.50	4.28	4.06	3.86	3.67	3.48
Corn	2.00	1.90	1.81	1.71	1.63	1.55
Wheat	2.25	2.14	2.03	1.93	1.83	1.74
Cotton	.48	.46	.43	.41	.39	.37
II. Income Support Constant						
Soybeans	5.00	5.00	5.00	5.00	5.00	5.00
Corn	2.10	2.10	2.10	2.10	2.10	2.10
Wheat	3.40	3.40	3.40	3.40	3.40	3.40
Cotton	.52	.52	.52	.52	.52	.52
II-A. Income Support, Discounted						
Soybeans ^a	5.00	4.75	4.51	4.29	4.07	3.87
Corn	2.10	2.00	1.90	1.80	1.71	1.62
Wheat	3.40	3.23	3.07	2.92	2.77	2.64
Cotton	.52	.49	.47	.45	.42	.40
III. Price Bands, Constant						
Soybeans ^a	floor	4.50	4.50	4.50	4.50	4.50
	ceiling	7.88	7.88	7.88	7.88	7.88
Corn	floor	2.00	2.00	2.00	2.00	2.00
	ceiling	3.50	3.50	3.50	3.50	3.50
Wheat	floor	2.25	2.25	2.25	2.25	2.25
	ceiling	3.94	3.94	3.94	3.94	3.94
Cotton	floor	.48	.48	.48	.48	.48
	ceiling	.84	.84	.84	.84	.84

Table 6 (Continued)

Program	Year						
	0	1	2	3	4	5	
III-A. Price Bands, Discounted							
Soybeans ^a	floor	4.50	4.28	4.06	3.86	3.67	3.48
	ceiling	7.88	7.49	7.11	6.76	6.42	6.10
Corn	floor	2.00	1.90	1.81	1.71	1.63	1.55
	ceiling	3.50	3.33	3.16	3.00	2.85	2.71
Wheat	floor	2.25	2.14	2.03	1.93	1.83	1.74
	ceiling	3.94	3.74	3.56	3.38	3.21	3.05
Cotton	floor	.48	.46	.43	.41	.39	.37
	ceiling	.84	.80	.76	.72	.68	.65

^aSoybeans, corn, and wheat are expressed in \$/bushel, and cotton is expressed in \$/hundredweight.

III. Risk in Agriculture and Farm Level Strategies

The previous sections dealt primarily with macro-level events and their effects on agricultural prices. A closer look at the relationships between overall price instability and the risk and uncertainty situation facing individual farmers would be helpful at this point to clarify the problem.

Risk and Uncertainty

The risk and uncertainty elements in agriculture stem from two sources—prices and yields. Agriculture is somewhat unique among industries in that the production process itself is a major source of uncertainty. Yields may be affected by weather (the amount and timing of rain, for example) and other natural phenomena such as disease or insects. The probability of good and bad years occurring may be approximately known, making the situation one of risk. A catastrophe caused by a major aberration of these factors, such as a flood or locusts or snow in April may be totally unpredictable and adds an element of uncertainty. Other forms of uncertainty facing the farm decision maker stem from changes in the technological and legal environment of the agricultural sector.

As was mentioned in Chapter III, agricultural prices are also subject to phenomena of both predictable and unpredictable natures. A standard risk in agriculture is that of changes in aggregate production causing price changes. In an international commercial arena created by increased trade, the risks are greater and events somewhat less certain, but some probability distribution still exists for changes in production and

demand. Standard trade policies such as those practiced by Japan, the EEC, or Australia are predictable. Although they may add to the magnitude of price fluctuations in the U.S., and therefore increase the risk facing the farmer, the uncertainty element is not increased. However, uncertain events, such as major worldwide droughts and poor harvests, the oil embargo, the revolution in Iran, war in Africa or the Middle East, or abrupt policy changes in the USSR or China, etc., play an increasingly important role in a period of increased world trade. With respect to their impact on foreign demand for American produce and therefore on domestic market prices, such events are more likely to occur if only because of the greater number of actors and influences. The convergence of such extraordinary events on both domestic and international levels interacting with the timing of the ordinary risk factors, is what creates uncertainty in farm income, and the risks of agriculture.

The focus of this study was how all of these factors interact to affect farm income. Regardless of the uncertainty involved, fluctuations in prices would have no real significance if they occurred outside an economic system. The measure of importance is "real income," or the buying power of farm income, which reflects both relative inflation rates and the relative productivity in the agricultural and industrial sectors. Therefore, real income is a function of real (deflated) prices and yield.

Variation in real income obviously depends on the variation of its major components—price and yield. Both the magnitude of variation of these factors and the correlation between them for any particular

commodity will influence income variability. The statistics in Table 7 show that soybeans had the lowest variation in both price and yield, as well as a high negative correlation between price and yield. Income variability was lowest in wheat and soybeans, followed by cotton, while corn returned the least stable income. Choice of enterprises could depend not only on income variation in the commodities, but also on the correlation between the real income returned by each commodity. The correlation coefficients in Table 8 indicated that soybeans and cotton, and corn and cotton, would make reasonably good combinations of enterprises if the goal was to reduce income variability. (See section on diversification.)

Alternative Strategies

The variations in strategies employed by farmers to cope with uncertainty are as numerous as the farms themselves. However, general categories of such strategies can be helpful in identifying possible courses of action.

A beginning point in coping with uncertainty is to develop expectations of future events upon which to base future plans. Some indicators of future price and yield situations would fall into the category of "naive" procedures, among them: (1) averages from the past, (2) the modal, or most frequent occurrence in the past, (3) extension of a linear trend, (4) the events of a normal or parallel period, (5) random choice, and (6) simple projection of current yields and prices (or their opposite) (Heady, 1952, Chapters 15 and 17). Somewhat more sophisticated methods might include the use of future

Table 7

Selected Variation Statistics of Crops in
Tennessee, 1950-1977

	Crop			
	Soybeans	Corn	Wheat	Cotton
Coefficient of variation-price	18.8	21.4	24.3	23.5
Coefficient of variation-yield	13.9	32.4	26.0	23.7
Yield-Price correlation ^a	-.469	.056	-.434	-.328
Coefficient of variation-income	22.0	36.1	17.3	30.4

^aCalculated from trend-deflated figures.

Table 8

Correlation of the Real Income of the Major
Tennessee Commodities, 1950-1977^a

	Soybeans	Corn	Wheat	Cotton
Soybeans	1.000	.913	.594	-.490
Corn		1.000	.616	-.484
Wheat			1.000	-.050
Cotton				1.000

^aReal income is yield times deflated price.

prices or formal methods of prediction. Farmers can also make use of the econometric models and outlook forecasts of the land grant colleges and the USDA. Whatever method a farmer might choose to employ entails costs in terms of time, money, or both. The value of getting additional and better information must be weighed against the costs involved.

Once the farmer has some expectations of the future, he may adjust his products or production processes accordingly. Individuals vary in their response to the same information, since some people are more willing to take risks than others. Adjustments can be made with a view to achieving any of three general aims: (1) reducing income variability, (2) maintaining a minimum level of income, and (3) increasing the firm's ability to withstand poor years. The precautionary measures can require a sacrifice of a certain amount of potential income in return for greater income stability.

Variability can be reduced through the use of discounting, insurance, forward contracting (in which future prices are made a certainty), or diversification, which allows the selection of several different enterprises so as not to "put all the eggs in one basket." A diversification system can be used for either of two purposes: to exploit complementary and supplementary relationships between inputs and outputs (which assumes an environment characterized by certainty), and to reduce income variability through the choice of enterprises. The theory in reducing uncertainty is that high income years in one crop may coincide with low income years in other, thus reducing the total variation of income from a single enterprising system. A strong negative correlation coefficient among the enterprises will reduce variability in

in most cases, but even positive correlations can reduce variability with the proper relationships between the relative variance of the enterprises. (See Heady, 1952, pp. 510-513.)

Selection of enterprises with low income variability can also reduce income variation, as well as maintain a minimum income. In many states, dairy enterprises are considered a good source of stable income.

Some farmers attempt to maintain a degree of flexibility in order to be able to take advantage of opportunities as they arise (or to be able to cut losses by getting out of a bad situation). Flexibility can be maintained with respect to activities, costs, and time (which is related to the other two) as well as through the use of cash reserves and storage capacity. Liquidity would allow the farmer to acquire needed capital if the situation indicated a change of direction, and storage capacity would allow him to sell his products at the most advantageous time and therefore to receive prices somewhat higher than the average. The costs of such strategies are that potential savings through economies of scale or through the acquisition of new time and labor saving specialized equipment might be foregone, adding to costs in some years.

Farm level strategies can obviously reach many levels of sophistication—from trading on the future markets and hedging to assuming a random and unpredictable world and sticking to traditional enterprises and methods. Decision making models using Bayesian analysis, decision trees, and other methods have been examined in academic research. In actually making their decisions, farmers also incorporate their own subjective judgments and personal preferences, and perception of the long term trends in demand.

With respect to the choices between the relevant crop enterprises open to the farms in the illustrative model, enterprise flexibility is maintained to a large degree because the equipment used is much the same for all of the crops. Obviously any serious involvement in some livestock or dairy enterprise would entail large financial commitments and therefore reduce the flexibility of the firm.

In terms of income stability and future potential, the analysis in Chapter 3 and the statistics presented in Table 7 indicate that soybeans and wheat are both relatively stable income earners and that a diversification scheme with cotton and either soybeans or corn would stabilize income. In addition, prospects for soybeans appear to be good, as do the prospects for corn, while cotton faces a more uncertain future. The risk of losses for cotton are relatively high due to high operating costs, although the potential profit is also high. A storage strategy is best suited to corn and wheat, and to a lesser degree to soybeans, because of the relatively stable seasonal variation patterns.

Strategies for the Illustrative Model

For purposes of illustration, this study used five general strategies, all of which were naïve and did not take into account changing assessments through learning by either the farmer or the institutional forecasters. Two of the strategies made use of a linear programming model to obtain the optimal allocation of resources for any given year. The first, Perfect Information, was not really a strategy in that it assumed perfect knowledge and was used primarily as a standard against which the other strategies could be compared (since the

income levels were the highest possible). The other strategy which used the L.P. model was Forecast, a naive expectation model in which prices and yields in any one year were assumed to be the same as in the preceding year. Therefore, the allocation of resources for any particular year was that which would have been optimal in the preceding year.

The third strategy, Tradition, assumed the three traditional crops in West Tennessee, soybeans, corn, and cotton, each on the land best suited for the crop. The fourth strategy, Diversification, was an income stabilization scheme which was also intended to maximize profits to some extent through the use of the high income enterprises. This utilized the soybean-wheat double cropping system, which was still not in widespread use, as well as growing cotton to the allotment level and soybeans on the remaining land.

The last strategy, Minimum, depicted the least desirable crop combination of the five. If the farmer could not double crop soybeans and wheat because of land limitations, and the problem with cotton yields continued, then only soybeans and corn could be grown. This combination could be expected to have high variation in income levels because the correlation of real income was positive.

IV. Description of the Illustrative Farms

The two illustrative farm situations in West Tennessee, where these cash crops are grown, were intended to show the different effects of price instability on a medium-sized commercial operation as contrasted with a part-time, small farm. Since the diversity of the agricultural community in Tennessee creates difficulties in finding a "typical" situation, these models might better be described as "not atypical."

The situations described were based on the dissertation of Donald Layne Williams (1975), statistics from the Census of Agriculture (1974), farm files of the Tennessee Cooperative Extension Service, and the opinions of agricultural experts at The University of Tennessee.

As many variables as possible were held constant on both farms in order to more directly compare the effects of instability. The resource endowments—specifically the proportion of different soil classes and the attendant yield differentials for each soil class—were assumed to be the same for both farms, as was the level of managerial skill. While these assumptions might not accurately reflect reality, they were useful for purposes of comparison. The family size on both farms was also the same, although the amount of available family labor differed with the situation. Both farms had the same percentage of their land in cotton allotment, which was considered the upper limit for cotton acreage, and both had a feeder steer operation. The livestock operation could as well have been a cow/calf operation or a hog operation, both of which are common in West Tennessee. Since the study dealt primarily with the effects of price instability of cash crops, the livestock enterprises were considered an exogenous fixed source of farm income.

The basic characteristics of the illustrative farms are shown in Table 9. Farm I was a medium-sized commercial farm with 334 acres of open land, including pastureland. The farmer did all of his own work except for harvesting the cotton crop, which he custom hired. The farm was somewhat overmechanized, but still benefited from some economies of size. (See Table 9.)

Table 9
Characteristics of the Illustrative Farms

Characteristic	Farm I	Farm II
Total acreage ^a	450 acres	60 acres
Open land	334	43
Group I Soils	161	21
Group II Soils	36	5
Group III Soils	65	8
Group IV Soils	72	9
Cotton allotment	44	6
Machinery and equipment	1 100 HP tractor 1 60 HP tractor 4 row equipment 1 combine 10' Cotton is custom harvested	1 40 HP tractor 2 row equipment All harvesting and baling is custom hired
Labor source	Husband/full time Wife/full time Son/part-time	Husband/part-time Wife/part-time Son/part-time
Feeder steers	To limit of labor	To limit of land

^a Soil Group Classifications: I-best quality soil, all purpose; II-still all purpose, but with restrictions on use due to erosion, lower yields; III-can be used for row crops, but less intensive use; IV-used only for hay and pasture enterprises.

Farm II was a smaller farm which was run as a part-time operation. Both the husband and wife held jobs off the farm, and their primary objective in unstable times was to insure that the farm did not drain their off-farm income. All of the harvesting and baling work was custom hired.

The assumption was made that both farms could sell of their products, including the straw from any wheat crop. It was further assumed that the return from cotton acreage was equal to the value of the cotton lint plus \$10.00 per bale contributed by the cottonseed after ginning expenses (Ray and Walch, 1978). The fixed costs and payments on equipment were not quite as high as they would be in 1979, indicating that they were both going concerns and not establishing new operations. This assumption of established operations also held in the levels of mortgage payments, although sensitivity of the findings to different levels of mortgage payments was included. The cost and yield figures given in Table 10 implied a standard level of managerial ability for both farms. The higher variable costs incurred by production on Farm II were caused primarily by the costs of hiring custom work, although some were caused by higher machinery costs.

Both farms were assumed to use conventional tilling methods. Land conservation recommendations of the SCS were not closely followed, with some Class 3 land being put into row crops. This system is detrimental to the soil and productivity of the farm in the long-run and therefore can only be a temporary situation. Nonetheless, these practices have been followed by farmers in recent years and were included in the study for that reason. The yields, which were held

Table 10
Yields and Variable Costs of Alternative
Enterprises

Crop	Soil Group	Yield/acre	Costs (\$)	
			Farm 1	Farm 2
Corn	I	105 bu.	76.31	89.82
	II	90 bu.	64.76	78.27
	III	70 bu.	59.26	72.77
Soybeans	I	42 bu.	55.34	67.93
	II	36 bu.	52.84	65.43
	III	30 bu.	51.59	64.18
Wheat	I	50 bu.	57.63	73.74
	II	45 bu.	55.38	70.19
	III	35 bu.	53.58	67.09
Cotton	I	800 lbs.	162.48	167.71
	II	700 lbs.	159.48	164.96
	III	500 lbs.	154.48	159.96
Soybeans/ Wheat	I	33 bu.	105.60	121.84
		40 bu.		
	II	28 bu.	92.84	116.63
		36 bu.		

Source: Adapted from unpublished dissertation of Donald Layne Williams, The University of Tennessee, 1975; Farm Planning Manual by Ray and Walch, 1978; and Doane's Agricultural Report, 1976 Machinery Custom Rates Guide, Vol. 41, No. 17-5, p. 303; and Yield Estimates for the Major Crops Grown on the Soils of West Tennessee, Buntley and Bell, 1976.

constant for the five-year simulation period, were somewhat lower than those achieved on better-managed farms.

The linear programming model used for the Perfect Information and Forecast strategies consisted of three general constraints and nine general activities. The rows included constraints on the land by soil group, constraints on labor by two month intervals, and a cotton allotment for each farm. The activities were the cash crops (soybeans, corn, cotton, wheat, and soybeans/wheat), by soil group, hay, cover crops and permanent pasture, by soil group, and three types of feeder steer operations. The coefficients used are shown in Table 9, Table 10, and Appendix B-3.

CHAPTER V

RESULTS OF THE ILLUSTRATIVE MODEL

This chapter presents the results of the illustrative model described in Chapter IV. The income levels were obtained through the use of the linear programming model and budgeting techniques. The alternative programs and strategies were assessed as to their effects on average income levels, income variability, and on the farm's ability to meet fixed financial commitments in the short and medium run.

It should be noted that the domestic agricultural programs which influence prices were assumed to be constant throughout the five-year period of simulation. This implied that one particular source of uncertainty for the farmer was eliminated—he knew the minimum and maximum prices set by the government. This was particularly important in the Forecast Strategy because the optimum allocation for any year may depend on the government support prices. The yields and input costs were also held constant, so all of the income variability was attributable to price changes.

I. Effects on the Levels and Variability of Average Income

A broad view of the effects of the different programs and strategies under the alternative scenarios can be gained by looking at the average income levels and the variability of the income. The income referred to is the net income after variable expenses (or the return to land, labor,

capital, management, and overhead). The average income figures and their attendant variability coefficients for the various combinations of programs and strategies under the Stable Price Scenarios and the Unstable Prices Scenario are shown in Tables 11 and 12. The emphasis in this section was on the difference between the stable and unstable situation. The Low Soybean Prices Scenario was used in a later section of this chapter to illustrate the effects on the financial viability of the illustrative farms of a series of "bad" years. Data for this scenario can be found in Appendix C.

The Programs

In general, the Income Support Program achieved the highest average income levels for both farms under both scenarios, as well as maintaining relatively low income variability. The income level finding should be no surprise since this program supported prices at the highest levels of the programs presented. The primary impact of this program in the Stable Prices Scenario was in supporting the price of wheat. Because wheat prices were generally below the Income Support level, this program could influence the profitability of the soybeans-wheat double-cropping scheme. Under the Unstable Prices Scenario, all of the crops needed support at the levels provided for in this program in at least one year.

The Market Floor Program had very little effect in the Stable Prices Scenario since prices did not generally fall below the support levels. It therefore had a relatively small effect on either income level or variability. Even in the Unstable Prices Scenario this program didn't affect average income by more than 2 percent in any case.

Table 11

Average Income Levels and Variation Results of the
Simulation Period for the Commercial
Farm

Strategy	Price Support Program							
	I. Market Floor Constant	II. Market Floor Discounted	III. Income Supp. Constant	IV. Income Supp. Discounted	V. Price Band Constant	VI. Price Band Discounted	VII. Price Band Constant	VIII. Price Band Discounted
	Average Income	C.V. ^a	Average Income	C.V.	Average Income	C.V.	Average Income	C.V.
<u>Stable Prices Scenario</u>								
Perfect Information	64,324	9.0	64,232	9.3	66,898	5.6	64,924	8.5
Forecast	62,085	10.5	61,962	10.8	65,505	6.6	62,587	10.0
Traditional	61,036	11.7	60,912	12.1	61,446	11.0	60,912	12.1
Diversification	62,889	7.6	62,766	8.0	65,809	4.3	63,513	7.4
Minimum	57,390	12.4	57,390	12.4	57,390	12.4	57,390	12.4
<u>Unstable Prices Scenario</u>								
Perfect Information	70,868	20.1	70,709	20.6	73,920	15.7	72,528	18.0
Forecast	66,890	25.2	65,920	28.5	68,002	20.8	67,168	27.8
Traditional	64,506	18.2	63,949	20.0	64,994	17.8	63,949	20.0
Diversification	66,226	15.2	66,000	15.7	69,782	11.9	67,754	13.4
Minimum	60,636	25.0	59,988	27.1	60,945	24.1	59,988	27.1

^a C.V. is the coefficient of variation.

Table 12

Average Income Levels and Variation Results of the
Simulation Period for the Part-time Farm

Strategy	Price Support Program							
	I. Market Floor Constant	IA. Market Floor Discounted	II. Income Supp. Constant	III. Income Supp. Discounted	IV. Price Band Constant	V. Price Band Discounted	Average Income	C.V.
<u>Stable Prices Scenario</u>								
Perfect Information	8,105	10.7	8,089	11.0	8,315	7.2	8,110	10.8
Forecast	7,772	14.2	7,756	14.7	8,015	8.3	7,807	11.0
Traditional	7,865	12.6	7,848	13.1	7,921	11.9	7,848	13.1
Diversification	7,718	8.2	7,701	8.6	8,102	4.7	7,799	8.0
Minimum	7,448	12.5	7,448	12.5	7,448	12.5	7,448	12.5
<u>Unstable Prices Scenario</u>								
Perfect Information	9,040	21.4	9,040	21.4	9,260	18.0	9,087	20.5
Forecast	8,285	25.8	8,158	29.1	8,767	23.7	8,428	28.6
Traditional	8,323	19.6	8,242	21.5	8,390	19.1	8,242	21.5
Diversification	8,163	16.0	8,139	16.5	8,620	12.4	8,354	14.0
Minimum	7,859	25.4	7,786	27.2	7,899	24.4	7,786	27.2

^aC.V. is the coefficient of variation.

The Price Band Program had the same effect as the Market Floor in the Stable Prices Scenario, because the prices never reached the levels which would bring the price ceiling into effect. In the Unstable Prices Scenario, however, it had a real effect on both average income levels and on income variability. In this case, the positive effects of stabilizing income were at the expense of average income because the price ceilings had a greater effect than did the price floors.

The discounted versions of the programs were implemented less often than were the cost-adjusted versions because the price support levels continuously decreased in real terms. The Discounted Price Band Program generally achieved the lowest degree of income variability in the Unstable Prices Scenario, but generally at the expense of average income. The Discounted Market Floor Program was never implemented because the prices never fell to the support levels. Therefore, this program was used as indicative of a situation in which the government has no programs with which to influence market prices (a "free market" situation). Of course, in a true "free market," the market signals influencing the supply response and some aspects of demand might be quite different, which in turn would change the market prices from those envisioned here.

The Strategies

If the most effective strategy is defined as the one which yields the highest average income with the lowest variation, then the Diversification Strategy could be considered the most effective. This was generally true for the Commercial Farm, but the situation for the part-time farm is less clear. One reason for the difference was that the soybeans/wheat double-cropping system was less profitable for this

smaller farm. However, even for this farm, the Diversification Strategy returned reasonable income levels and generally stabilized income effectively.

The Forecast Strategy was relatively effective both as an income earner and an income stabilizer in the Stable Prices Scenario but tended toward much greater income variation in the Unstable Prices Scenario.

The Traditional Strategy, growing corn, cotton, and soybeans, generally fell in the middle of terms of both income levels and variation. This strategy was more effective for the part-time farm, providing generally high average income levels, particularly in the Stable Prices Scenario.

The Minimum Strategy, which grew only corn and soybeans, predictably generated the lowest income levels and, on the whole, the highest variability. This is because of the relative weight of the more unstable crop, corn; the high positive income correlation between the two crops; and the lack of either of the highest income enterprises, cotton or soybeans/wheat.

The Perfect Information Strategy obviously returned the highest average income. The variation in income was generally higher than that of the Diversification Strategy, however, and occasionally higher than other strategies as well.

II. Effects on the Farmer's Ability to Meet

Annual Commitments

The results presented in the first section show the absolute levels of average income after variable expenses, which was an indication of

each farm's ability to meet fixed financial commitments. At this point, a closer look at this aspect of the situation of each farm is necessary.

This analysis presented selected combinations of strategies and programs for each of the three strategies in graphical and tabular form to show the effects of yearly fluctuations on net income. The Discounted Market Floor program was used as a proxy for no government price support programs. The actual difference in income between the discounted and cost-adjusted versions of the program was minimal in the Stable Prices Scenario. The focus for the Stable Prices Scenario was on the different effects of the Income Support program and the Discounted Market Floor program, while in the Unstable Prices Scenario the Price Band program was emphasized. In the more detailed tables, the Forecast and Diversification strategies were contrasted for the Commercial Farm because they presented extremes of income variability and enterprise flexibility while maintaining relatively high income levels. The Traditional Strategy was emphasized in the analysis of the Part-time Farm.

The viability of the firm depends not only with long-term decisions but also on the ability to meet short-term financial obligations. After the operating expenses, which were accounted for in the L.P. model and the budgets, the firm has annual obligations which are not specific to any enterprise. In the case of these illustrative farms, these fixed costs include the principal and interest on the mortgage, interest on investment and operating capital, taxes, electricity, and the maintenance and upkeep of machinery, including insurance and housing. (See Appendix B-4.)

Because of the rapid inflation of land values in recent years, the absolute level of mortgage payments depends on when the farm was purchased. To reflect this reality in the analysis, this study assumed one level of mortgage costs and varied it to show three other levels. The different levels of mortgage costs reflected land valued at \$600, \$800, \$1,000, and \$1,300 per acre, respectively.

In considering the farm family as a financial entity, this study recognized that the objective must include a reasonable living for the family. If this level of living is not achieved, the family would find other means of earning a livelihood. The net income, after fixed and variable expenses, was therefore adjusted by a family living expense, leaving the actual cash reserves of the family. These reserves could be used in savings, consumption, or investments. The assumed living expense was \$5,700—the 1979 poverty level for a rural family of four.⁶ This was meant to represent a minimum level of family expenditures—certainly well below the average expenditures of nonfarm families.

The fixed cost levels used for the detailed cost breakdowns in the tables were different because the Commercial Farm is viable at a higher cost level than was the Part-time Farm. Therefore, the cost levels used were the highest viable level for each farm, in this case, Cost Level 3 for the Commercial Farm and Cost Level 2 for the smaller farm.

The Commercial Farm

Stable Prices Scenario. In the Stable Price situation, the Commercial Farm could meet fixed costs under all but the highest cost

⁶Parade Magazine; May 27, 1979.

level in most years. The Diversification and Forecast Strategies provided reasonably secure income (under Cost Level 3) even without government price supports (Figure 6A), and a comfortable margin over fixed costs with the Income Support Program. The Traditional and Minimum Strategies entailed more substantial losses in Year 4 (and Year 5 with the Minimum Strategy) and were not significantly affected by the Income Support Program.

The more detailed income accounts in Table 13, which include the family living expenses, show that both strategies indicated a cumulative gain in income at the end of the simulated period, but that the greater fluctuations with the Forecast strategy resulted in more years with a negative net income. On the other hand, the Forecast Strategy derived greater benefit from the Income Support Program because of its flexibility in resource allocation. Of the other two strategies, the Traditional Strategy would end the period with a small cumulative gain under both programs and the Minimum Strategy would end with a cumulative loss of \$18,801 under either program (see Appendix C).

Unstable Prices Scenario. In the situation of unstable prices, this farm had the potential for greater profits but also faced the possibility of considerable losses. (See Figure 7.) Without government price supports, the Forecast Strategy could return both very high and very low incomes, while the Diversification Strategy evened out the earning levels somewhat. The other two strategies tended to fall between in terms of income levels.

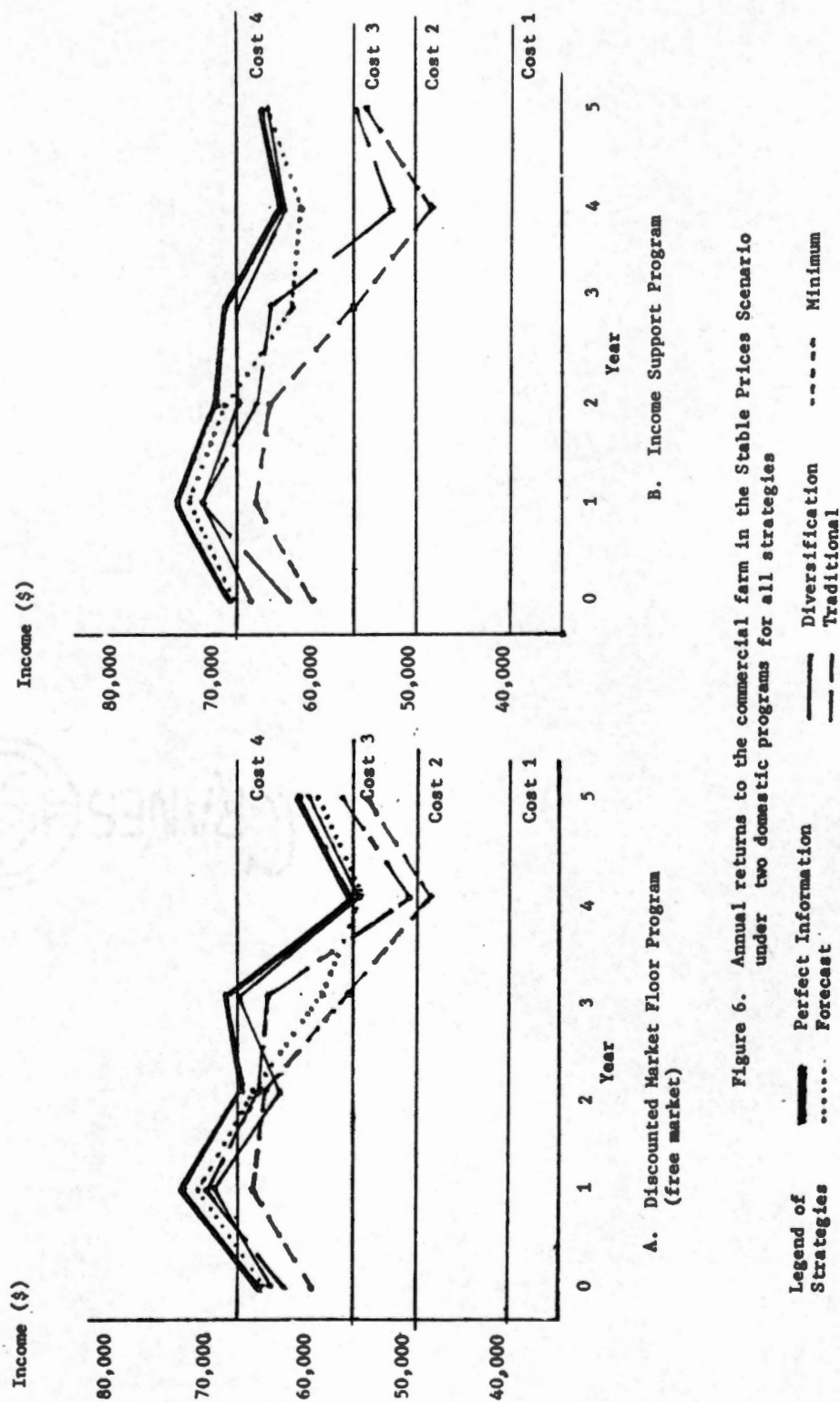


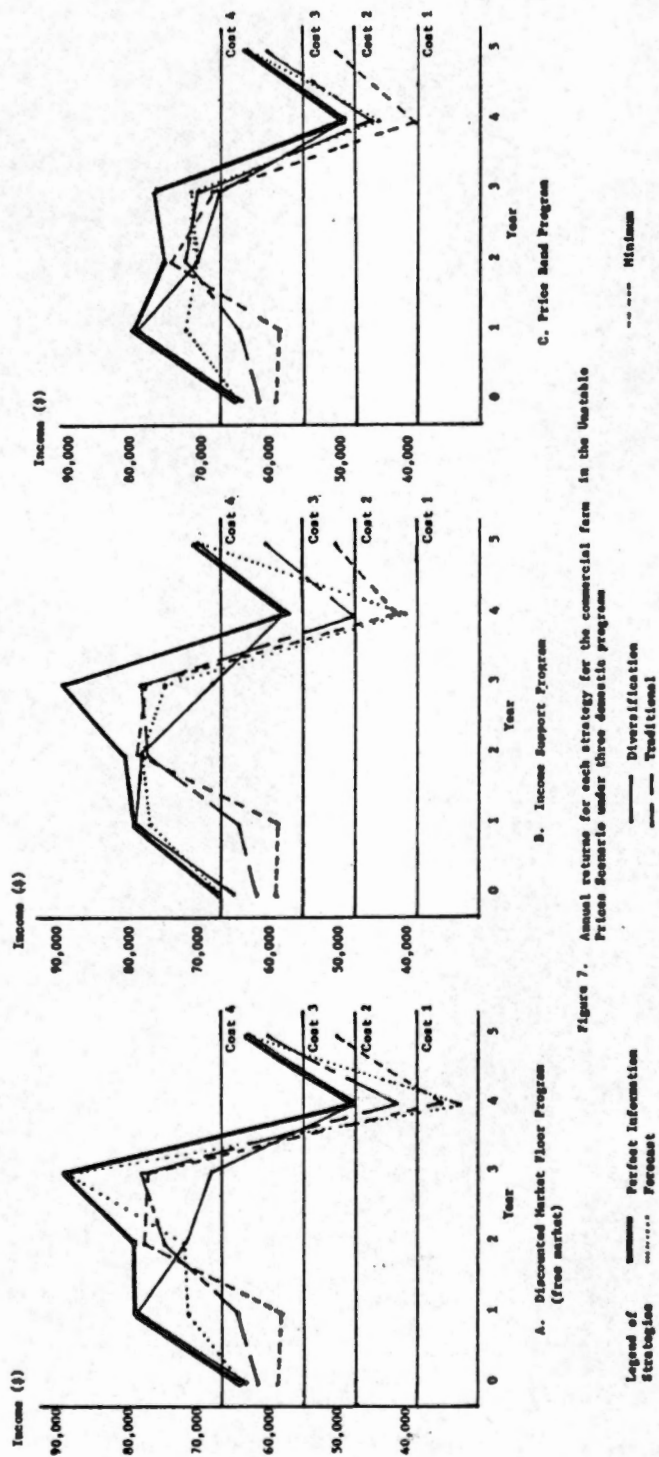
Figure 6. Annual returns to the commercial farm in the Stable Prices Scenario under two domestic programs for all strategies

Table 13

Returns to the Commercial Farm under the Stable Prices Scenario
with Selected Programs and Strategies

Year	Forecast Strategy in year					Diversification Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
<u>Discounted Market Floor Program</u>												
Return after variable expenses	64,467	71,951	65,745	57,398	53,416	58,792	63,440	69,385	62,652	66,168	54,952	59,999
(less) Land Cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed Costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Return to family labor and management	9,527	17,011	10,805	2,458	(1,524)	3,852	8,500	14,445	7,712	11,228	12	5,059
(less) family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	3,827	11,311	5,105	(3,242)	(7,224)	(1,848)	2,800	8,745	2,012	5,528	(5,688)	(641)
Cumulative gain (loss)	3,827	15,138	20,243	17,001	9,777	7,929	2,800	11,545	13,557	19,085	13,397	12,956
<u>Income Support Program</u>												
Return after variable expenses	66,643	72,230	68,178	61,578	60,822	63,581	65,412	70,580	66,516	66,407	62,357	63,584
(less) Land Cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed Costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Return to family labor and management	11,693	17,280	13,228	6,628	5,872	8,631	10,462	15,630	11,566	11,457	7,407	8,634
(less) family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	5,993	11,580	7,528	928	172	2,931	4,762	9,930	5,866	5,757	1,707	2,934
Cumulative gain (loss)	5,993	17,573	25,101	26,029	26,201	29,132	4,762	14,692	20,558	26,315	27,022	29,956

^aBased on a 30-year mortgage at 8% interest with land valued at \$1,000 per acre (cost level 3).^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.^cBased on 1979 poverty level for rural family of four.



The primary effect of the Income Support Program was to reduce losses in Year 4 somewhat, but only the Diversification Strategy covered fixed costs (at level 3) in that year.

The Price Band Program had a significant impact on income levels in this situation because under each strategy the cumulative income depended on the high income years compensating for the lower income years. Since the Price Band cut off the highest income levels, cumulative income was reduced. (See Table 14.) The Forecast Strategy was affected most by this program, both in terms of loss of the high income years and limiting losses in the low income years. In either case, however, this farm could easily survive under Cost Level 3 after family expenses.

Of the other two strategies, the Traditional Strategy would provide a cumulative gain at the end of the period under Cost Level 3 after family expenses, but the Minimum Strategy created a cumulative loss in all except the Target Price Program. (See Appendix C.)

Under the highest level of fixed costs (Cost Level 4), the Commercial Farm was not viable in its present method of operations. The only possibility of a cumulative gain at the end of the simulated period was from the Perfect Knowledge Strategy with an Income Support Program (Appendix C).

Low Soybean Price Scenario. This scenario, which posited a series of years with low prices for soybeans, obviously had the greatest impact on strategies with little flexibility in the product mix and a heavy reliance on soybeans. Therefore, as one would expect, the Forecast Strategy provided the best protection against this situation.

Table 14

Returns to the Commercial Farm under the Unstable Prices Scenario with Selected Programs and Strategies

Year	Forecast Strategy in year					Diversification Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
<u>Discounted Market Floor Program</u>												
Return after variable expenses	64,467	72,797	72,869	89,254	32,456	63,674	63,440	79,053	72,872	68,944	48,674	63,674
(less) Land cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed Costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Returns to family labor and management	9,527	17,857	17,929	34,314	(22,484)	8,734	8,500	24,113	17,932	14,004	(6,266)	8,734
(less) Family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	3,827	12,157	12,229	28,614	(28,184)	3,034	2,800	18,413	12,232	8,304	(11,966)	3,034
Cumulative gain (loss)	3,827	15,984	28,213	56,827	28,643	31,677	2,800	21,213	33,445	41,749	29,783	32,817
<u>Price Band Program</u>												
Returns after variable expenses	64,467	72,797	70,828	71,096	44,539	63,674	63,440	79,053	70,831	66,912	49,630	63,674
(less) Land cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed Costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Return to family labor and management	9,527	17,857	15,888	16,156	(10,401)	8,734	8,500	24,113	15,891	11,972	(5,310)	8,734
(less) Family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	3,827	12,157	10,188	10,456	(16,101)	3,034	2,800	18,413	10,191	6,272	(11,010)	3,034
Cumulative gain (loss)	3,827	15,984	26,172	36,628	20,527	23,561	2,800	21,213	31,404	37,676	26,666	29,700

^aBased on a 30-year mortgage at 8% interest with land valued at \$1,000 per acre (cost level 3).^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.^cBased on 1979 poverty level for rural family of four.

In the year with the lowest income, Year 4, the Forecast Strategy returned a lower net income than any of the other strategies except the Minimum. (See Figure 8.) However, this loss was compensated for by the returns in the other years. This situation was the same whether an Income Support Program was in effect or not.

With the Discounted Market Floor Program, all of the strategies (except for the Perfect Knowledge situation) resulted in a cumulative loss. (See Table 15.) The Diversification Strategy still had less income variability, but the income levels were not sufficient to avoid a cumulative loss with either program. The Forecast Strategy, on the other hand, was vulnerable to some years with relatively large losses, but was able to compensate for these with some high income years.

This result was to be expected because this was exactly the type of situation for which the Forecast Strategy was designed.

The Part-time Farm

In this case, the Part-time Farm might be better described as a limited resource, part-time commercial farm and was in a different situation from the Commercial Farm. The family firm was diversified into farm and nonfarm enterprises. The nonfarm income provided an income base and the farm enterprises contributed supplementary income. The assumption was made that the off-farm employment was dependable. The farm enterprise was nonetheless a profit-making venture, although a minimum objective was that the farm enterprise not drain the off-farm income. In other words, the family did not want to pay for the privilege of farming.

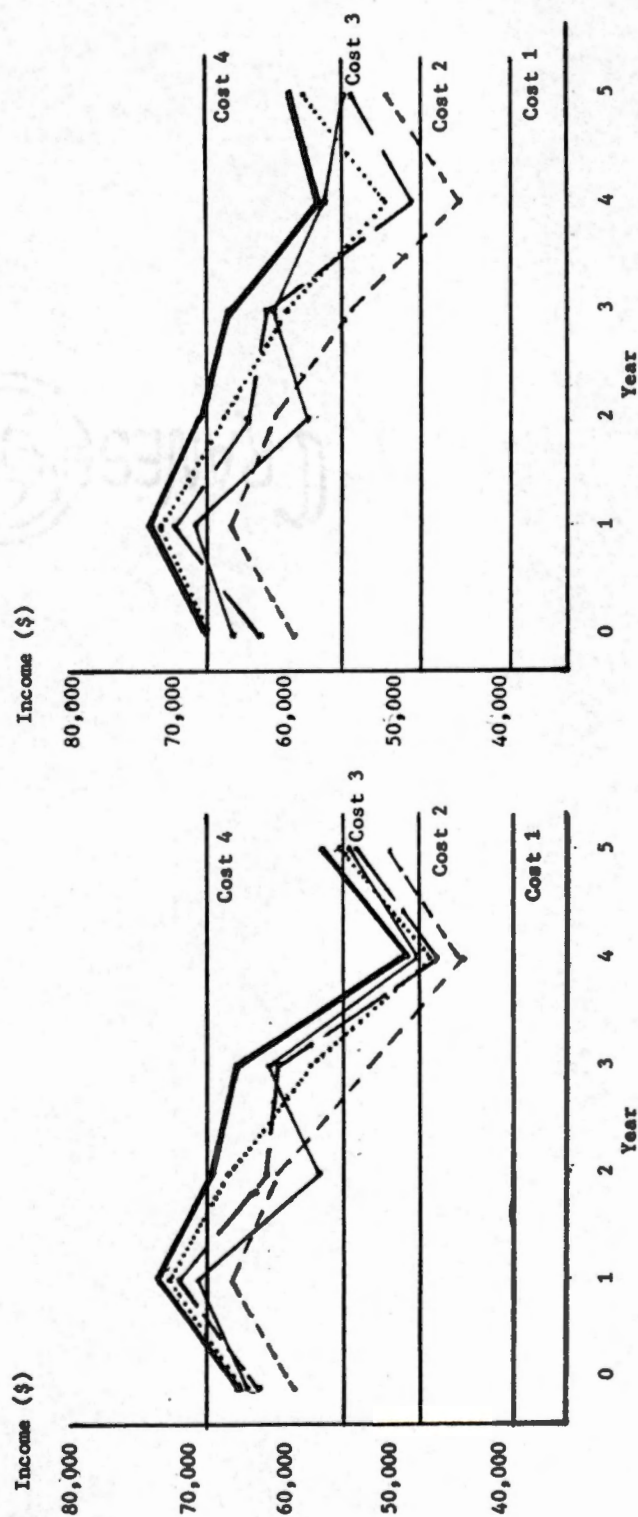


Figure 8. Annual returns for each strategy for the commercial farm in the Low Soybean Price Scenario under two domestic programs

Legend of Strategies

Perfect Information Forecast

Diversification

Traditional

Minimum

Table 15

Returns to the Commercial Farm under the Low Soybean Price Scenario with
Selected Programs and Strategies

Year	Forecast Strategy in year					Diversification Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
<u>Discounted Market Floor Program</u>												
Return after variable expenses	64,467	71,633	65,744	57,398	46,586	55,572	63,440	68,771	56,992	60,236	48,678	54,203
(less) Land cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed Costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Returns to family labor and management	9,527	16,693	10,804	2,458	(8,354)	632	8,500	13,831	2,052	6,052	(6,262)	(737)
(less) Family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	3,827	10,993	5,104	(3,242)	(14,054)	(5,068)	2,800	8,131	(3,648)	352	(11,962)	(6,437)
Cumulative gain (loss)	3,827	14,820	19,924	16,682	2,628	(2,440)	2,800	10,931	7,283	7,635	(4,327)	(10,764)
<u>Income Support Program</u>												
Return after variable expenses	66,643	71,791	65,239	59,775	50,634	58,859	65,412	68,771	56,992	61,634	56,424	54,203
(less) Land cost ^a	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972	39,972
(less) Other Fixed costs	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968	14,968
Return to family labor and management	11,703	16,851	10,299	4,834	(4,306)	3,919	10,472	13,831	2,052	6,694	1,484	(737)
(less) Family expenses ^c	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
Annual Cash Surplus	6,003	11,151	4,599	(865)	(10,006)	(1,781)	4,772	8,131	(3,648)	994	(4,216)	(6,437)
Cumulative gain (loss)	6,003	17,154	21,753	20,888	10,882	9,101	4,772	12,903	9,255	10,249	6,033	(404)

^aBased on a 30-year mortgage at 8% interest with land valued at \$1,000 per acre (cost level 3).

^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.

^cBased on 1979 poverty level for rural family of four.

This type of diversified farm had implications for the treatment of fixed and variable expenses. Because the mortgage payments included the living area of the farm as well as land which could also be considered an investment, a strict allocation of all fixed expenses to the farm enterprise would be somewhat misleading. The same logic would apply to the allocation of living expenses. In order to assign a share of expenses to each enterprise, this study assumed that the nonfarm income was used to pay for family living expenses while the farm income was used to pay for the farm, housing, and investment in land.

The Stable Prices Scenario. As was obvious from the illustration in Figure 9, the Part-time Farm could not hope to meet fixed costs at either Cost Level 3 or Cost Level 4 in a stable prices situation. As was the case with the larger farm, the Forecast Strategy reached both very high and very low levels of income if not regulated by government price support programs. Under the Income Support Program, the Traditional Strategy had the greater income variability (in part because it was not affected by the price supports to the extent that the Forecast and Diversification Strategies were).

Under the Market Floor Program, losses would occur in at least two years with all programs (with Cost Level 2). (See Table 16.) The Forecast Strategy ended with a higher cumulative gain than the Diversification Strategy despite larger losses in more years. Under this program, however, the optimum strategy was actually the Traditional Strategy with a cumulative gain of \$1,857 (Appendix C). This advantage was lost in the Income Support Program, however, as both the Forecast and Diversification Strategies benefited from the price supports on

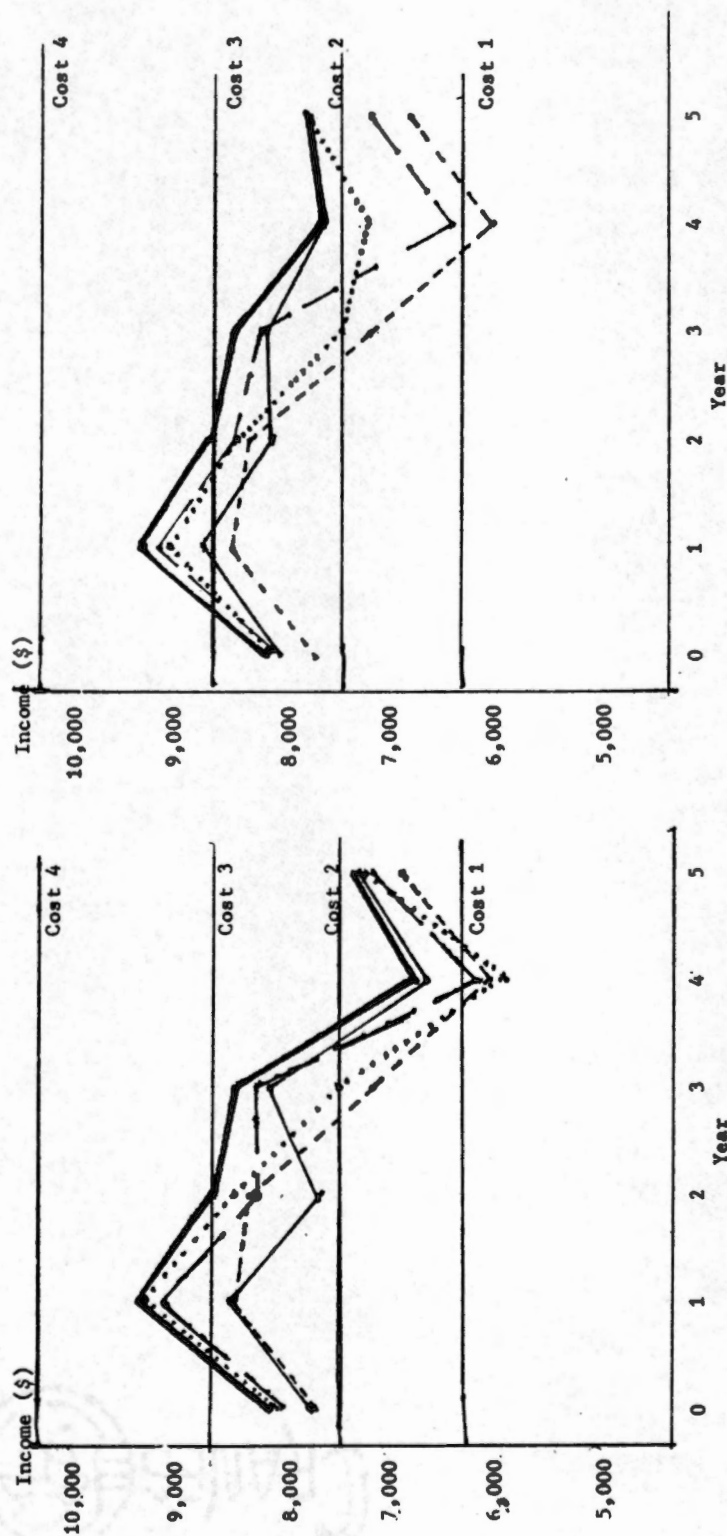


Figure 9. Annual returns to the part-time farm in the Stable Prices Scenario under two domestic programs, for all strategies

Table 16

Returns to the Part-time Farm under the Stable Prices Scenario
with Selected Programs and Strategies

	Forecast Strategy in year					Diversification Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
Market Floor Program												
Return after variable expenses	8,070	9,302	8,429	7,482	6,055	7,296	7,786	8,573	7,669	8,177	6,768	7,336
(less) Land cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	515	1,747	874	(73)	(1,500)	(259)	231	1,018	114	622	(787)	(219)
(less) family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	515	1,747	874	(73)	(1,500)	(259)	231	1,018	114	622	(787)	(219)
Cumulative gain (loss)	515	2,262	3,136	3,063	1,563	1,304	231	1,249	1,363	1,985	1,198	979
Income Support Program												
Return after variable expenses	8,142	9,028	8,429	7,482	7,201	7,807	8,043	8,729	8,180	8,208	7,646	7,804
(less) Land Cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	587	1,473	874	(73)	(354)	252	487	1,174	625	653	91	249
(less) Family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	587	1,473	874	(73)	(354)	252	487	1,174	625	653	91	249
Cumulative gain (loss)	587	2,060	2,934	2,861	2,507	2,759	487	1,661	2,286	2,939	3,030	3,279

^aBased on a 30-year mortgage at 8% interest with land valued at \$800 per acre (cost level 2).^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.^cThis family is assumed to pay living expenses from off-farm income.

wheat, making the double-cropping scheme profitable. The Diversification Strategy was the best under the higher support prices. The Minimum Strategy ended with a cumulative loss under any program.

With the exception of the Minimum Strategy, therefore, the Part-time Farm was self-supporting with any strategy and with any program under Cost Level 2. With the higher cost levels, however, even perfect information would not make the operation viable. If the operator were to decide to subsidize the farm at Cost Level 3, the strategy chosen would be important in determining the amount of the annual loss. Under the Market Floor Program, the Diversification Strategy would entail lower losses in the bad years but would have a higher average loss than the Traditional Strategy. If the farmer were to maintain an emergency fund of \$2,000 with which to absorb losses, he could keep the farm operable with the Diversification Strategy.

The Unstable Prices Scenario. As with the larger farm, a period of unstable prices offered the possibility of both greater profits and greater losses. (See Figure 10.) The Forecast Strategy was the most unstable, followed by the Traditional and Minimum Strategies.

The Traditional Strategy was the best alternative for this farm under both the Discounted Market Floor Program and the Price Band Program in terms of the amount of loss in any one year and the cumulative gain. (See Table 17.) The Price Band Program caused about a 25% loss in income with either strategy from the situation without government programs. Under the Income Support Program, income levels were the highest and the Forecast Strategy worked the best. (See Appendix C.)

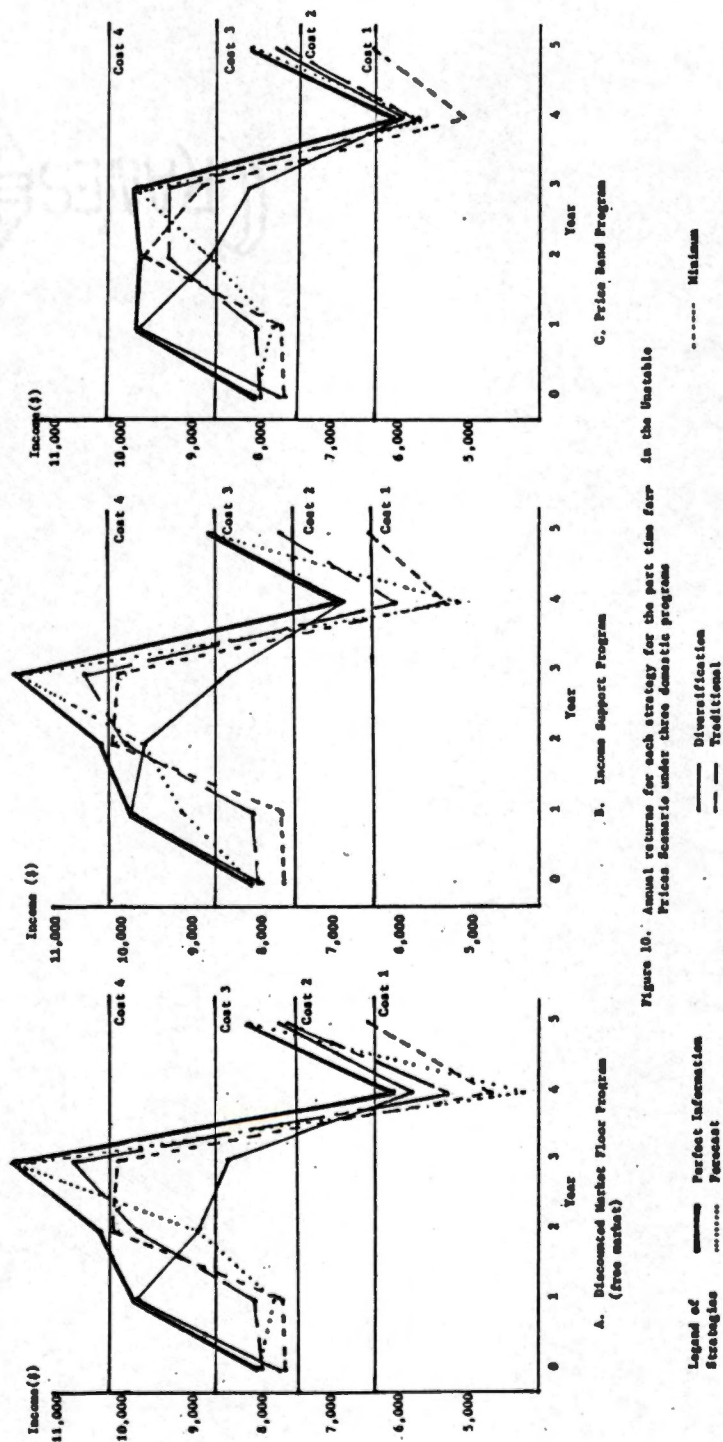


Table 17
Returns to the Part-time Farm under the Unstable Prices Scenario
with Selected Programs and Strategies

Year	Forecast Strategy in year					Traditional Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
<u>Discounted Market Floor Program</u>												
Returns after variable expenses	8,070	7,837	8,978	11,628	4,231	8,203	8,006	8,196	9,718	10,464	5,380	7,687
(less) Land cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	515	282	1,423	4,073	(3,324)	648	451	641	2,163	2,909	(2,175)	132
(less) Family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	515	282	1,423	4,073	(3,324)	648	451	641	2,163	2,909	(2,175)	132
Cumulative gain (loss)	515	797	2,220	6,293	2,969	3,617	451	1,092	3,255	6,164	3,989	4,121
<u>Price Band Program</u>												
Returns after variable expenses	8,070	7,837	8,717	9,823	5,710	8,203	8,006	8,196	9,336	9,310	5,845	7,687
(less) Land cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	515	282	1,162	2,268	(1,845)	648	451	641	1,781	1,755	(1,710)	132
(less) Family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	515	282	1,162	2,268	(1,845)	648	451	641	1,781	1,755	(1,710)	132
Cumulative gain (loss)	515	797	1,959	4,227	3,382	2,734	451	1,092	2,873	4,628	2,918	3,050

^aBased on a 30-year mortgage at 8% interest with land valued at \$800 per acre (cost level 2).

^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.

^cThis family is assumed to pay living expenses from off-farm income.

In all situations and with all of the strategies however, the farm was self-supporting at this level of fixed costs.

With the higher fixed costs of level 3, this farm could be self-supporting with perfect knowledge in any program. If prices were supported at the Income Support levels, both the Forecast Strategy and the Diversification Strategy allowed the farm to support itself.

Low Soybean Prices Scenario. In dealing with a series of years with low soybean prices, the Part-time Farm was equally well-off with either the Forecast Strategy or the Traditional Strategy (Figure 11 and Table 18). As was the case with the larger farm, the Diversification Strategy was particularly vulnerable to low soybean prices, as was the Minimum Strategy. Either with or without government price supports, these two strategies allowed the farm to be self-supporting under Cost Level 2.

The situation remained unchanged from the Stable Prices Scenario, however, in that the higher cost levels could not be met without significant subsidies in most years.

III. Discussion

A few general observations might be made at this point to clarify and highlight some of the findings of the preceding analysis.

The first, and most noticeable, point was that regardless of the price scenario, government program or strategy the most important factor affecting the net income was the level of fixed costs. This was caused in part by the relatively large differences between the respective cost levels. Nevertheless, it did reflect the important point that, other things being equal, those farmers with higher costs were in more

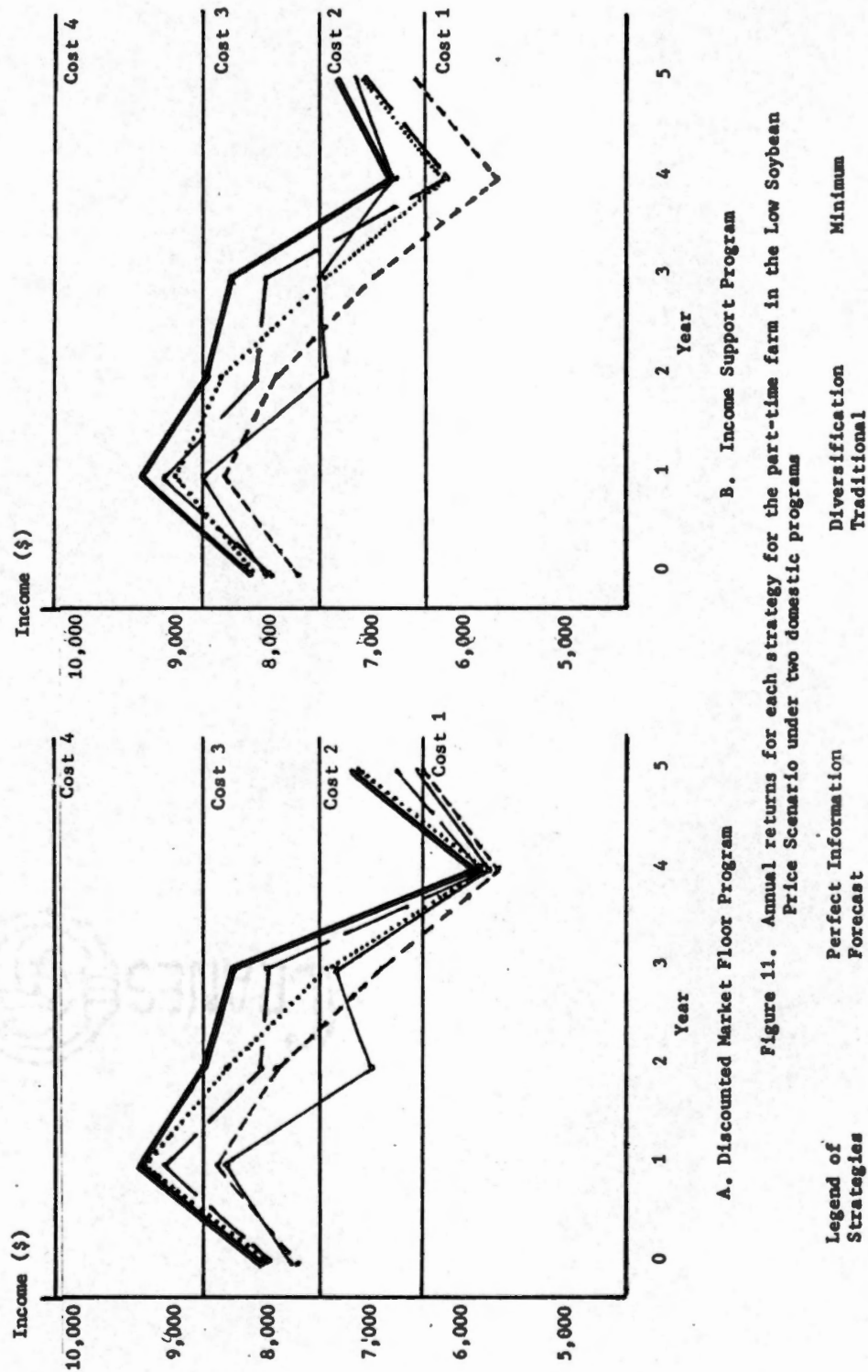


Table 18

Returns to the Part-time Farm under the Low Soybean Price Scenario
with Selected Programs and Strategies

Year	Forecast Strategy in year					Traditional Strategy in year						
	0	1	2	3	4	5	0	1	2	3	4	5
Discounted Market Floor Program												
Return after variable expenses	8,700	9,302	8,429	7,482	5,955	7,126	8,006	9,115	8,100	8,048	5,960	7,002
(less) Land cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs ^b	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	515	1,747	874	(73)	(1,600)	(429)	451	1,560	545	493	(1,595)	(553)
(less) Family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	515	1,747	874	(73)	(1,600)	(429)	451	1,560	545	493	(1,595)	(553)
Cumulative gain (loss)	515	2,262	3,136	3,063	1,463	1,034	451	2,011	2,556	3,049	1,454	901
Income Support Program												
Return after variable expenses	8,142	8,984	8,573	7,482	6,247	7,063	8,006	9,115	8,244	8,089	6,265	7,002
(less) Land cost ^a	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264	4,264
(less) Other Fixed costs ^b	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291	3,291
Return to family labor and management	587	1,429	1,018	(73)	(1,308)	(492)	451	1,560	689	534	(1,290)	(553)
(less) Family expenses ^c	—	—	—	—	—	—	—	—	—	—	—	—
Annual Cash Surplus	587	1,429	1,018	(73)	(1,308)	(492)	451	1,560	689	534	(1,290)	(553)
Cumulative gain (loss)	587	2,016	3,034	2,961	1,653	1,161	451	2,011	2,700	3,234	1,944	1,391

^aBased on a 30-year mortgage at 8% interest with land valued at \$800 per acre (cost level 2).

^bIncludes annual machinery costs, land tax, utilities, and interest on operating and investment capital.

^cThis family is assumed to pay living expenses from off-farm income.

difficulty in periods with prices stabilized at moderate levels than were farmers with low fixed costs.

While this observation was self-evident, one might pursue it slightly at the risk of belaboring the obvious. To some extent, the different levels of fixed costs reflect the time of purchase of the farmland and the equipment and, therefore, the maturity of the enterprise. The higher costs would be associated with younger farmers and newly established operations, while the older, more established farms would have generally lower levels of fixed costs. Faced with the burden of high overhead costs, the newer farmers must depend on better management—both technical and economic. To an extent, however, the option of maintaining some degree of flexibility and liquidity through the choice of production processes and capital commitments are closed to these newer farmers. Increases in productivity and greater efficiency are generally a function of using new, better, and more expensive technologies. In order to compensate for the relatively high overhead costs, these newer farmers may be compelled to further increase their debt burden in hopes of increasing production more than proportionately. In this case, therefore, the classic flexibility strategy, in which the scale and efficiency of an operation may be sacrificed for greater safety and flexibility, may not be an option.

A second noticeable point was that with the yields which these farms have, the Minimum Strategy, which grew only soybeans and corn, would not make a profit at a higher cost level. The other crops, particularly cotton and the soybean-wheat combination, might be necessary to provide more stable income at higher levels.

Third, the optimal strategy for either farm depended on (1) the government program in effect, (2) the degree of risk aversion of an individual farmer, and (3) the ability of the farmer to sustain a loss. The Commercial Farm was generally in the best shape with the Diversification Strategy, but a series of low price years for soybeans would cause serious losses. The Forecast Strategy entailed generally more risk in other situations but could avoid the long-term losses of a series of bad years.

The Part-time Farm could not profit as much from the soybean-wheat combination and was generally better off with the more traditional cropping pattern of corn, cotton and soybeans. A price support for wheat at Income Support levels made the double-cropping more profitable and secure for this farm as well as for the larger one.

Fourth, the Income Support Program was obviously best for the farmer, under the conditions simulated here. In the prices simulated here, the loan rate did not play a major role, and the Price Band Program, in the Unstable Prices Scenario, seriously reduced the farms' earning power.

Fifth, again an obvious point, perfect information was better than imperfect information. In many cases, the sole deciding factor between a profit and a large loss was the amount and quality of information.

Sixth, the discounted versions of the programs, those without cost-of-production increases, were little better than no programs at all in a period of inflation. Because the market floor price kept dropping in real terms, the price support programs were effectively dismantled over time.

Finally, the point should be made that the illustrative farms were not necessarily optimally utilizing their resources as they were described. Both of them might have had opportunities for increasing their income or decreasing their costs. Both were somewhat over-mechanized and could have expanded acreage of row crops with rented land. They could also have experimented with minimum or no till systems for some of the crops to reduce operating expenses.

Reflecting back to the first observation, however, it should be noted that only the farms with relatively low fixed costs could afford to expand and achieve greater economies of size. They were able to compete more effectively for any available land because they could afford to pay a higher price for it.

CHAPTER VI

SUMMARY AND IMPLICATIONS

I. Summary

The primary objective of this study was to provide an overview of the political and economic environment in which farmers in West Tennessee must make decisions, and to assess their options for coping with these potential environments. The study focused on the impact that foreign trade has had in determining the stability of domestic market prices and therefore on the uncertainty facing farmers.

Components of the Study

This study has consisted of three basic parts:

1. An overview of foreign agricultural trade of the United States in recent history, with an emphasis on how world trade policies and domestic agricultural programs affect price stability.

2. An analysis of the four basic cash crops in West Tennessee—soybeans, cotton, corn, and wheat—with respect to price movements and predictability, the importance of the crop in both the state and national economies, and how agricultural policies, trade policies, and world events might affect the foreign demand for each commodity in the near future.

3. A model to illustrate the interaction of domestic agricultural price support programs and farm-level strategies under three different commodity price scenarios. Two West Tennessee farms have been assumed

for this model, a 450-acre commercial farm and a 60-acre part-time operation. They have been used as vehicles to assess the relative efficacy of four "naive" strategies which individual farmers might use to cope with uncertainty. Linear Programming and simple budgeting techniques were used to determine income levels.

General Findings

Foreign Trade. The trend in international policies influencing world trade has been strongly in favor of trade liberalization since the 1930's. The focus in international forums in recent years has been on liberalizing agricultural trade, a development which would be beneficial to the U.S. for the commodities considered here. The latest agreements of the Multilateral Trade Negotiations, in the Tokyo Round of GATT, will open new markets for American agricultural goods if the negotiations are approved by Congress.

A continuing expansion of world trade means that events in foreign countries will continue to influence domestic market prices for some heavily traded commodities. These events may be either in the form of purely physical changes in world supply and demand, or in artificial changes caused by trade and domestic policies of our major trading partners. While the GATT agreements would open some markets for U.S. farm products, the basic structure which distorts the international markets will probably continue. This implies that commodity prices may continue to be relatively unstable. While international marketing agreements and the creation of reserve stocks may reduce the degree of price variability, the possibility of major price fluctuations still exists.

Commodity Characteristics. Of the four crops with which this study was concerned, soybeans was the most promising in terms of price and income stability, potential growth in domestic and foreign demand, and income earnings. It can be double-cropped with wheat in a profitable operation—one which may also be promoted for soil conservation reasons,⁷ and the operating capital required is relatively low. On the negative side, yield increases are not expected until 1985 at the earliest and competition from foreign producers and substitute products may increase.

Corn also had relatively good potential in terms of foreign demand and income earnings, although price variability and income variability were relatively high. The potential for continued increases in yields was good and stable seasonal price patterns increased the crop's attractiveness for farmers with storage capacity.

Neither cotton nor wheat were particularly promising crops. Cotton had some potential in that some new textile technologies and the high costs of substitute products renewed interest and demand for cotton garments. The price trend since 1972 had been strongly upward, but prices tended to be unstable and unpredictable. Moreover, American producers face stiff competition from producers in other countries. A local, and more serious, problem was that Tennessee farmers suffered from low yields in recent years, causing losses and reducing production in the State dramatically as farmers switched to more profitable crops. Although the operating capital required for cotton (and hence the

⁷This is only a good conserving practice relative to single crop soybeans, however, and is not promoted as an absolute answer.

potential loss) is quite high, new agricultural legislation set support prices high enough to compensate for this, reducing the risk somewhat if the yields are normal.

Wheat was also an uncertain crop in terms of market potential and price. The deflated price trend has been downward since 1950 and government programs have generally been required to support price. Much of the foreign demand for wheat will come from developing countries in the future. As these countries may or may not have the foreign exchange to pay for wheat, demand may depend to some extent on the largesse of the industrialized countries. The crop was unprofitable to grow in Tennessee unless it is double-cropped with soybeans. This combination became particularly stable and profitable under an Income Support Program (with supports at the current levels). One encouraging aspect of wheat was that the seasonal price patterns are particularly stable, allowing for benefits to be gained from storage capabilities.

In many ways, these four crops were very complementary. The low income variability and relatively profitable price levels of soybeans made it an ideal crop on which to base earnings, while the correlation coefficients of income with cotton were strongly negative, allowing this risky but high profit crop to be grown with less risk. The soybean-wheat double-cropping system also benefited from offsetting price and income cycles, as did corn and cotton to an extent.

Programs and Strategies. This study assumed two versions of three general types of government price support programs—one with annual adjustments for cost-of-production increases and the other without. The three program types—a Market Floor program, an Income Support program,

and a price band program—were representative of programs either being used or having been proposed. Of these, the cost-adjusted version of the Income Support program provided the best income protection to farmers regardless of the overall price scenario.

In a situation of relatively unstable prices, farmers were found to be better off with no price supports at all rather than with the price band program at the support levels assumed in this study. This was because the price band program had a greater effect in limiting the high income years than in supporting prices in the low income years (indicating that the levels were set too low for the price structure as a whole).

The programs without cost adjustments were effectively dismantled over time because the support levels were reduced in real terms every year. This version of the market floor program was never implemented.

At the farm level, five "naive" strategies were assumed: a Perfect Knowledge strategy; Forecast, which based each year's cropping pattern on the prices of the preceding year; Traditional, in which the farm grew a set pattern of corn, cotton, and soybeans; Diversification, which based production on soybeans, some of which was double-cropped with wheat, and cotton; and Minimum, which assumed that cotton and the double-cropping were infeasible and therefore only corn and soybeans were grown.

The Perfect Knowledge situation served as a measure of the value of additional information. In some instances, the only difference between a cumulative gain and a significant loss was information.

Because the production processes and costs may differ among farms, the best strategy depended on the relative profitability of the different

crops and combinations for each farm. In general, the Commercial Farm profited most from the Diversification strategy—the mixture of high income and stable crops and the negative income correlation between the crops proved suitable in both the stable and unstable price situations. However, in the situation of a series of low prices for soybeans, this strategy is particularly vulnerable and the Forecast strategy is more suitable. The Forecast strategy also generated relatively high levels of average income, but income variability was also relatively high, thus increasing the risk of a substantial loss in any one year.

The Part-time Farm was generally better off with the Traditional strategy in terms of income levels and variability. Under an Income Support program, however, the Diversification strategy became more feasible. The Forecast strategy had the same problems as with the larger farm—income variability and the risk of loss.

The Minimum strategy was the least desirable of those surveyed. Backing the options of either double-cropping or growing cotton because of low yields, farmers in West Tennessee would face generally lower income levels and relatively high income variation.

Viability of the Farm. The difference in ability of the two illustrative farms to stay in business depended primarily on the level of fixed costs under which they were operating. The Commercial Farm was able to function profitably at a level of fixed costs which assumed mortgage payments with land valued at \$1,000 per acre (as well as other components such as utilities, taxes, and annual machinery costs), assuming very minimal family expenses. If the family wishes to live at a level somewhat above poverty level, however, the farm would be less viable in

a stable prices situation. With more unstable prices, however, the farmer has the possibility of greater overall profits (in the price scenarios described in this study).

The Part-time Farm, on the other hand, cannot operate profitably at that level of cost. At a slightly lower level of fixed costs, however, the farm is viable (with land valued at \$800). At any higher levels of cost, the operator would have to subsidize his farm operations with his off-farm income.

II. Implications

The results of this study are obviously fragmentary and the findings cannot be interpreted too broadly. The illustrative model reflected only price changes as a source of uncertainty and the farm situations depicted, strategies, and government programs tested were necessarily broad and nonspecific. Nonetheless, even with the limitations imposed by restricted data and generalized situations, the results do have some implications for farmers and policy-makers as well as providing some direction for future researchers.

Implications for Farmers

A primary implication of this study for Tennessee farmers is that the environment in which they operate is directly affected by this country's relationships with our major trading partners, the policy of other countries as regards agricultural trade, and the structure of international agreements and marketing understandings as well as domestic agricultural programs. Therefore, farmers might do well to direct their

lobbying efforts as much toward international trade legislation as toward the level of domestic price supports.

In addition, a knowledge of events occurring in other parts of the world may help the farmer arrive at a strategy which best protects him against losses. In arriving at a suitable cropping pattern, the farmer should be aware of, and take advantage of, the interrelationships among the possible crops and should apply this knowledge to the constraints in his particular situation to arrive at a suitable system. Specifically, the price and income correlation between soybeans and cotton, and soybeans and wheat, and to a degree between corn and cotton and wheat, can be exploited to buffer income fluctuations. With these four crops, a diversification program did not entail any significant loss in income, but did reduce income variability.

The importance of trade and policies on commodities and enterprises not covered in this study must also be considered. Dairy enterprises, for example, have been started on many Tennessee farms in recent years. The stability of this source of income, however, is dependent on government price supports which may be affected by the GATT agreements.

Farmers in some situations, particularly those with high levels of fixed costs, may find their options, as regards strategies, limited by the need to achieve maximum efficiency. Such people may be more vulnerable to price fluctuations than are the farmers with more flexibility. This is particularly significant for any farmer wishing to begin a new operation or to expand an existing operation. In terms of expansion, the savings of greater economies of size must outweigh the high cost of new land.

If the trend of recent years in cotton yields continues and, as predicted by some agricultural experts, the crop is phased out of production in the State, farmers may need to find another enterprise to add to corn and soybeans to achieve higher average income levels and more stable income. One possibility for this is a soybean-wheat double-cropping system, particularly if an Income Support (or Target Price) program is in effect for wheat. This crop mix might also be advantageous in meeting proposed soil conservation standards.

Implications for Policy-makers

The major implication of this study for policy-makers is to emphasize a point which they should already realize—that the legislation affecting farmers, whether domestic agricultural programs or foreign trade agreements can affect not only the profit and loss statements of individual farms but also the structure of the agricultural industry in the future.

The finding that the level of fixed costs is the major factor in determining the viability of a farm enterprise reflects not only a simple truth but also implies that the farmers in the high-cost group could be a threatened class. In light of the rapid increases in the value of farmland and equipment, many of the farmers with high fixed costs would be those with recently purchased assets. These newer farmers would be predominantly younger farmers starting out, and they may tend to be better educated and more willing to try new and innovative practices. In other words, these threatened high-cost farmers may be more efficient than the farmers with the lower fixed costs, yet are

handicapped by having bought a farm when exceptionally high commodity prices were capitalized into land prices.

If this is true, the classical argument of "bad" years being good for the economy by weeding out inefficient producers may no longer be true. In fact, those being weeded out may be the farmers with the resources and management skills required to run a viable family farm. The older and possibly less efficient farmers may be protected by the relatively low levels of mortgage payments and other fixed costs. In time, of course, these older farmers would retire and sell out—at the higher prices.

The younger farmers may also be particularly vulnerable to bad years if they have had to extend themselves financially in order to achieve maximum production through the new and expensive technologies.

The politics of farm programs becomes important at this point. The policy-maker is in the position of attempting to balance the needs and desires of many diverse groups—farmers, consumers, agribusiness, and a budget-conscious general public. Consumers may prefer some sort of Price Band program to avoid period of very high food prices, even though this type of program puts an extra burden on farmers with high fixed costs. Farmers would benefit most from income support programs with support levels at the highest possible levels while budgeters disapprove of the costs involved to the federal government. While it is a truism that in politics no group can be made entirely happy, the policy-makers should keep in mind the long-term effects of the programs so that the results are those anticipated.

In other areas, policy-makers should be aware that such problems as soil erosion in West Tennessee, caused in part by overly extensive row

cropping, might be approached with relatively high support prices of desirable crops or crop combinations such as soybeans and wheat. This could provide some incentive for farmers to try different practices which could reduce erosion.

Directions for Future Research

This study was designed to be exploratory rather than detailed in nature. Limitations in the applicability and interpretation of the findings stem from this fact. In order to be able to draw firmer conclusions, and therefore to provide more applicable information to farmers and policy-makers, a number of extensions might be made to this study, including the following:

1. Use of more specific data (yield, prices received, costs, resources, constraints, etc.) from working farms in West Tennessee would allow the analysis to provide greater insight into the workings of "real world" economic units and would allow more detailed strategies to be included.

2. This focus on real farms would also enable analysts to gain some historical perspective on how a particular farmer actually did deal with the uncertainty of a previous time. This case history could be used as a base from which to look at the future.

3. Other farmer strategies for coping with uncertainty and price variability could be considered.

4. The inclusion of seasonal price movements in the scenarios, in addition to annual averages, would enable a study to assess the economics of such farm strategies as developing storage facilities.

5. The decision-making environment should be made more realistic by adding variability in yields and livestock enterprises as well as allowing for greater breadth in production processes and enterprises.

6. Greater detail in the government programs assessed, including consideration of production control measures, disaster payments, pollution control legislation, etc., could also be included.

7. The future scenarios could be improved by the incorporation of more sophisticated analysis of prices.

8. The effects of the GATT agreements on such stable enterprises as dairy is also an important avenue of inquiry.

9. Finally, the impact of a major change in the direction of international trade might be considered. Specifically, this study has generally assumed either an expansion of world trade or a continuation of trade at present levels. However, this study does not address the problems connected with, nor the economic conditions resulting from, a rejection of the GATT agreement. Should this occur, one possible outcome is a trade war with our major trading partners. While restrictions imposed by the U.S. would primarily affect industrial goods, the EEC, Japan, and other nations might retaliate with sanctions against U.S. agricultural goods, as well as against industrial goods. This could seriously affect foreign demand for American farm products, result in a situation of oversupply in this country, and force the return of mandatory production controls. All of these occurrences would significantly affect farmers in Tennessee.

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APPENDICES

APPENDIX A

Table A-1

Average Annual Nominal and Deflated Prices Received
by Tennessee Farmers, 1950-1977

Year	Soybeans		Corn		Cotton		Wheat	
	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
1950	2.35	2.35	1.63	1.63	40.2	40.2	2.10	2.10
1951	2.67	2.43	1.84	1.67	38.3	34.8	2.18	1.98
1952	2.63	2.37	1.84	1.66	36.1	32.5	2.14	1.93
1953	2.52	2.38	1.52	1.43	33.4	31.5	1.95	1.84
1954	2.54	2.37	1.52	1.42	34.7	32.4	1.99	1.86
1955	2.09	1.99	1.24	1.18	33.6	32.0	1.98	1.89
1956	2.13	2.01	1.34	1.26	33.2	31.3	1.97	1.86
1957	2.10	1.92	1.37	1.26	31.7	29.0	1.93	1.77
1958	1.94	1.75	1.19	1.07	35.4	31.9	1.89	1.70
1959	1.91	1.71	1.12	1.00	33.8	30.2	1.78	1.59
1960	2.04	1.82	1.12	1.00	31.4	28.0	1.77	1.58
1961	2.27	2.03	1.17	1.04	34.2	30.5	1.75	1.56
1962	2.32	2.04	1.18	1.04	32.8	28.8	1.91	1.68
1963	2.58	2.24	1.20	1.04	33.4	29.0	1.83	1.59
1964	2.56	2.23	1.25	1.09	30.2	26.3	1.46	1.27
1965	2.40	2.05	1.26	1.08	29.1	24.9	1.39	1.19
1966	2.77	2.29	1.38	1.14	22.3	18.4	1.58	1.31
1967	2.43	1.98	1.15	.93	28.4	23.1	1.46	1.19
1968	2.39	1.90	1.18	.94	24.1	19.1	1.24	.98
1969	2.30	1.74	1.30	.98	21.2	16.1	1.25	.95
1970	2.79	2.07	1.55	1.15	23.0	17.0	1.34	.99
1971	2.88	2.04	1.20	.85	27.7	19.6	1.47	1.04
1972	4.07	2.71	1.66	1.11	26.6	17.3	1.43	.95
1973	5.48	3.15	2.72	1.56	39.7	22.8	2.81	1.61
1974	7.07	3.58	3.39	1.71	41.1	20.8	3.49	1.76
1975	4.62	2.13	2.73	1.26	52.3	24.1	2.88	1.33
1976	6.30	2.75	2.60	1.14	63.4	27.7	3.05	1.33
1977	5.35	2.22	2.05	.85	48.0	19.9	2.25	.93

Nominal prices deflated by Index of Prices Paid by Farmers for
Production and Living Expenses, USDA Agricultural Prices, Base Year 1950.

Source: Tennessee Agricultural Statistics, 1978, and Agricultural
Prices, various issues.

Table A-2
Selected Statistics from the Regression Models

Statistic	Soybeans	Corn	Cotton	Wheat
<u>Model I. Deflated Price=Time^a</u>				
r^2	.10	.16	.69	.61
C.V. ^c	18.3	20.0	13.4	15.5
Significance of intercept	.05	.0001	.0001	.0001
time	.11	.0360	.0001	.0001
<u>Model II. Deflated Price=Time, B72, B72T^b</u>				
r^2	.58	.58	.42	.80
C.V. ^c	12.9	14.8	6.05	11.7
Significance of intercept	.01	.02	.24	.18
time	.04	.05	.78	.35
B72	.05	.16	.46	.87
B72T	.07	.21	.40	.73
<u>Model III. Deflated Price=Time, B72^d</u>				
Significance of intercept	.0001	.0001	.0001	.0001
time	.0001	.0001	.0001	.0001
B72	.0001	.0001	.0001	.0001

^aTime is years from 1950-1977.

^bB72 is a dummy variable to distinguish before and after 1972 intercepts, and B72T is that dummy variable times time, which allows for different slopes for the different time periods.

^cC.V. is coefficient of variation.

^dThis model takes the B72T variable out to counter possible auto-correlation between the two variables, B72 and B72T, which affected the significance readings.

Table A-3

Values used for Price Cycles of the Four Commodities¹

Year	Soybeans	Corn	Cotton	Wheat
1950	1.05	1.08	1.08	1.00
1951	1.09	1.13	.96	.97
1952	1.07	1.14	.92	.97
1953	1.09	1.01	.92	.95
1954	1.09	1.03	.97	.98
1955	.92	.87	.98	1.03
1956	.94	.96	.99	1.04
1957	.90	.98	.95	1.03
1958	.83	.85	1.07	1.02
1959	.81	.82	1.04	.98
1960	.87	.84	1.00	1.01
1961	.98	.90	1.13	1.03
1962	.99	.92	1.10	1.15
1963	1.10	.95	1.15	1.13
1964	1.10	1.02	1.08	.94
1965	1.02	1.04	1.06	.92
1966	1.15	1.14	.81	1.05
1967	1.00	.97	1.06	1.00
1968	.97	1.00	.92	.87
1969	.89	1.09	.81	.88
1970	1.07	1.32	.89	.97
1971	1.07	1.01	1.09	1.07
1972	.87	.82	.88	.67
1973	1.06	1.19	1.09	1.17
1974	1.26	1.33	.95	1.32
1975	.79	1.00	1.07	1.02
1976	1.08	.93	1.18	1.06
1977	.93	.71	.82	.76

¹Calculated by dividing the deflated price of each commodity by the respective trend line from the results of the regression analysis.

Table A-4

Indices of Seasonal Variation of Four Tennessee
Commodities, by Time Period¹

	MONTH											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Soybeans												
1951-1956	99	101	106	110	106	113	105	96	90	88	94	92
1957-1961	98	99	100	103	107	107	104	99	95	95	96	97
1962-1966	98	101	101	103	103	103	99	99	99	98	98	98
1967-1971	97	100	102	102	102	102	102	101	99	98	98	98
1972-1978	93	95	101	105	103	102	104	105	101	98	95	99
Corn												
1951-1956	99	102	103	103	103	104	104	103	102	93	90	95
1957-1961	97	100	102	104	104	105	106	105	100	93	91	94
1962-1966	98	101	102	103	103	102	104	103	99	95	94	96
1967-1971	98	100	101	102	104	106	105	102	96	93	94	98
1972-1978	96	98	100	101	101	102	103	103	101	99	97	99
Cotton lint												
1951-1956	95	97	98	99	101	101	100	100	106	104	100	98
1957-1961	90	91	95	98	101	102	103	102	108	109	105	97
1962-1966	92	95	99	101	103	107	108	100	103	100	98	93
1967-1971	89	94	99	99	102	105	107	—	—	107	104	95
1972-1978	95	94	93	90	96	100	97	106	110	109	106	104
Wheat												
1951-1956	103	102	103	103	102	99	94	96	97	100	100	101
1957-1961	100	102	103	103	104	98	96	96	97	100	100	101
1962-1966	101	101	101	101	100	97	97	98	100	100	102	102
1967-1971	101	102	102	103	101	97	96	97	98	100	101	101
1972-1978	102	104	104	102	99	93	93	98	101	100	100	104

¹Calculated by the link relative method.

Table A-5

Coefficient of Variation from Seasonal Variation
Indices for Each Crop

Year	Soybeans	Corn	Cotton	Wheat
1950	93.9	65.5	63.9	89.5
1951	58.9	60.3	42.0	64.3
1952	71.0	63.7	57.1	48.9
1953	72.7	54.9	52.4	24.5
1954	50.6	86.6	41.8	77.6
1955	75.9	51.9	119.3	62.2
1956	76.5	90.1	58.0	51.2
1957	50.3	67.2	77.1	60.9
1958	48.8	48.7	32.7	74.5
1959	37.9	56.7	40.4	70.2
1960	69.2	67.8	92.0	64.4
1961	82.7	25.9	33.3	57.6
1962	50.4	63.8	68.1	60.2
1963	39.7	61.4	78.2	80.9
1964	68.9	48.0	63.9	90.9
1965	66.7	72.6	48.7	58.4
1966	67.5	30.7	73.5	42.3
1967	65.2	57.1	45.6	61.7
1968	75.3	62.9	52.0	96.9
1969	72.2	64.7	47.8	69.0
1970	63.3	57.4	22.9	88.2
1971	66.2	63.0	46.6	91.2
1972	24.6	31.8	60.8	121.1
1973	113.7	75.0	51.2	49.5
1974	78.0	53.5	86.8	72.2
1975	85.4	81.3	38.3	60.9
1976	90.8	85.4	51.1	69.2
1977	91.7	79.6	92.7	54.5

APPENDIX B

Table B-1

Average Annual Prices Paid to Tennessee Farmers
for the Four Major Commodities, 1967-1978,
in 1978 Dollars^a

Year	\$/bu Soybeans	\$/bu Corn	\$/cwt Cotton	\$/bu Wheat
1967	5.32	2.52	62.20	3.20
1968	5.12	2.54	51.68	2.67
1969	4.70	2.65	43.40	2.56
1970	5.45	3.02	44.90	2.63
1971	5.26	2.19	50.60	2.69
1972	7.07	2.89	46.20	2.47
1973	8.06	4.01	58.30	4.14
1974	9.15	4.40	53.20	4.53
1975	5.43	3.22	61.50	3.39
1976	6.96	2.87	70.10	3.37
1977	5.63	2.17	50.60	2.37
1978	6.48	2.37	54.60	2.84
average	6.22	2.90	53.90	3.07
coefficient of variation	21.7	23.8	14.7	22.3

^aInflated by the 1967 index for prices paid by farmers for commodities, service, interest, taxes and wage rates.

Source: Tennessee Agricultural Statistics and Agricultural Prices.

Table B-2

Machinery and Equipment Costs for the Illustrative
Farms

Machinery		Purchase Cost (\$)	Annual Fixed Cost (\$)
<u>Commercial Farm</u>			
Tractor	100 H.P.	16,074	1,703
	60 H.P.	10,465	1,112
Combine	10'	21,000	2,746
Plow	4-14"	1,638	179
Disk	12' wheel	2,467	275
Spreader	10'	934	165
Seeder	10'	2,415	261
Cultivator	4 row	1,669	190
Sprayer	w/boom	504	70
Harrow	10'	340	37
Baler	round	4,515	490
Corn header	2 row	3,465	460
Truck	2 ton	10,500	1,135
TOTAL		75,986	8,823
<u>Part-time Farm</u>			
Tractor	40 H.P.	7,828	833
Disk	8'	814	92
Plow	2-14"	791	86
Spreader	10'	934	165
Harrow	10'	340	37
Sprayer	w/boom	504	70
Cultivator	2 row	829	91
Seeder	10'	2,415	261
Truck	1 ton	8,500	900
TOTAL		22,955	2,535

Source: Farm Planning Manual; Ray, Robert M. and Herbert N. Walch, The University of Tennessee, revised April 1978.

Table B-3

Labor Requirements and Supply for Illustrative
Farms by Two Month Periods

	JAN-FEB	MAR-APR	MAY-JUN	JUL-AUG	SEP-OCT	NOV-DEC	TOTAL
<u>Commercial Farm Requirements</u>							
<u>Enterprise</u>							
Soybeans ^a		.54	1.64	.74	.50	.36	3.78
Corn ^a		.99	.98	.37	.74	.26	3.34
Cotton ^a		1.70	2.59	1.11	.61	1.24	7.25
Wheat ^a			1.60	1.07		1.35	4.02
Soybeans/Wheat ^a			1.99	.74	1.94	.50	5.17
Winter Pasture ^a					2.80		2.80
Hay ^a			2.61	3.12			5.73
Pasture ^a			.52	.72			1.24
Beef 1 ^b	58	27	40	2	3	73	203
Beef 2 ^b	46	36	51	5	30	58	226
Beef 3 ^b	52	51	63	29	19	32	246
<u>Supply</u>							
Husband	500	500	500	500	500	500	3000
Wife	160	160	160	160	160	160	960
Son			60	160	60		280
TOTAL SUPPLY	660	660	720	820	720	660	4210
<u>Part-time Farm Requirements</u>							
<u>Enterprise</u>							
Soybeans ^a		.82	2.50	1.13	.26	.49	5.20
Corn ^a		1.78	1.76	.67	.61	.47	5.29
Cotton ^a		3.33	4.82	2.22	1.23	2.40	14.0
Wheat ^a			1.00	.40		2.69	4.09
Soybeans/Wheat ^a			2.63	1.21	.99	.96	5.79
Winter Pasture ^a					3.30		3.30
Hay ^a			2.50	2.90			5.40
Pasture ^a			.62	.86			1.48
Beef 1 ^b	58	27	40	2	3	73	203
Beef 2 ^b	46	36	51	5	30	58	226
Beef 3 ^b	52	51	63	29	19	32	246
<u>Supply</u>							
Husband	250	250	250	250	250	250	1500
Wife	50	50	50	50	50	50	300
Son			60	160	60		280
TOTAL SUPPLY	300	300	360	460	360	300	2080

^a Requirements in man-hours per acre.

^b Requirements in units of 50 head.

Source: Adapted from Farm Planning Manual, Robert L. Ray and Herbert N. Walch.

Table B-4

Fixed Cost Components for the Illustrative Farms

Component	Cost Level 1	Cost Level 2	Cost Level 3	Cost Level 4
<u>Commercial Farm</u>				
Interest on operating and investment capital ^a	4,375	4,375	4,375	4,375
Utilities ^a	935	935	935	935
Land taxes ^a	835	835	835	835
Annual machinery costs ^b	8,823	8,823	8,823	8,823
Mortgage payments ^c	<u>23,983</u>	<u>31,978</u>	<u>39,972</u>	<u>51,964</u>
TOTAL	38,951	46,946	54,940	66,932
<u>Part-time Farm</u>				
Interest on operating and investment capital ^a	563	563	563	563
Utilities ^a	120	120	120	120
Land taxes ^a	108	108	108	108
Annual machinery costs ^b	2,500	2,500	2,500	2,500
Mortgage payments ^c	<u>3,198</u>	<u>4,264</u>	<u>5,330</u>	<u>6,929</u>
TOTAL	6,489	7,555	8,621	10,220

^aBased on average per acre costs of West Tennessee farms in The University of Tennessee Resource Management Farm Extension Program.

^bFarm Planning Manual, Ray and Walch, 1978.

^cBased on a 30-year mortgage at 8% interest with land valued at \$600, \$800, \$1,000, and \$1,300 respectively.

APPENDIX C

Table C-1

Resource Allocation for the Diversification,
Traditional and Minimum Strategies for
Both Farms

	Diversification	Traditional	Minimum
<u>Commercial Farm</u>			
Corn 1 (ac) ^a		117	161
Corn 2 (ac)		18	
Corn 3 (ac)			
Soybeans 1 (ac)			
Soybeans 2 (ac)		18	36
Soybeans 3 (ac)	65	65	65
Soy/Wheat 1 (ac)	117		
Soy/Wheat 2 (ac)	36		
Cotton 1 (ac)	44	44	
Wheat 1,2,3 _b (ac)			
Beef 1 (hd) ^c	60	18	
Beef 2 (hd) ^c	83	199	195
Beef 3 (hd) ^d		37	54
<u>Part-Time Farm</u>			
Corn 1 (ac) ^a		15	21
Corn 2 (ac)		5	
Corn 3 (ac)			
Soybeans 1 (ac)			
Soybeans 2 (ac)			5
Soybeans 3 (ac)	8	8	8
Soy/Wheat 1 (ac)	15		
Soy/Wheat 2 (ac)	5		
Cotton 1 (ac)	6	6	
Wheat 1,2,3 _b (ac)			
Beef 1 (hd) ^c			
Beef 2 (hd) ^c	11	38	46
Beef 3 (hd) ^d	8	6	6

^aFor row crops, 1 refers to crop planted on Soil Group 1; 2 refers to Soil Group 2; and 3 refers to Soil Group 3.

^bBeef 1 is feeder steer operation backgrounded, wintered and grazed until late spring and requires 1/acre permanent pasture/hd., .13/acre hay/hd.

^cBeef 2 is feeder steer operation backgrounded on small grain pasture to late spring and requires .75/acre small grain pasture/hd. and .05/acre hay/hd.

^dBeef 3 is feeder steer operation wintered and grazed on permanent pasture to mid-summer and requires 1/acre permanent pasture/hd. and .16/acre hay/hd.

Table C-2

Allocation of Land Among Alternative Enterprises on the
Commercial Farm under the Perfect Information
Strategy

	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b			
	1 2 3			1 2 3			1	2	(ac)	(ac)	1	2	3	
	1	2	3	1	2	3								
Base Year (0)														
Program ^c														
I, IA, III, IIIA				40		65	77	36	44		12	140	45	
II, IIA						65	117	36	44			87	59	
Stable Prices Scenario														
Year 1														
Program														
I, IA, III, IIIA				117	36	65			44			190	54	
II				40		65	77	36	44		12	140	45	
IIA				117		65		36	44			175	55	
Year 2														
Program														
I, IA, III, IIIA				161	36	65						185	54	
II				14		65	147	36				106	60	
IIA				161		65		36				170	55	
Year 3														
Program														
I, IA, II, IIA, III, IIIA						65	117	36	44			87	59	

Table C-2 (Continued)

	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b		
	1	2	3	1	2	3	1	2	1		1	2	3
Year 4													
Program													
I, II, III			65				117	3	44		60	83	
IA, IIA, IIIA			65				161	3			14	87	46
Year 5													
Program													
I, IA, II, IIA, III, IIIA			59			6	117	3	44		60	87	
Unstable Prices Scenario													
Year 1													
Program													
I, IA, II, IIA, III, IIIA			65				117	36	44		60	83	
Year 2													
Program													
I, IA				161	36	65					187	54	
II				14		65	147	36			106	60	
IIA				161		65		36			170	55	
III			65	161	36						193	54	
IIIA			44	19		21	142	36			110	60	
Year 3													
Program													
I, IA, II, IIA				161	36	65					187	54	
III				117	36	65			44		190	54	
IIIA				48		65	69	36	44		145	55	

Table C-2 (Continued)

Year 4 Program	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b		
	1	2	3	1	2	3	1	2	1		1	2	3
I, IA, IIA, III, IIIA			65				117	36	44		60	83	
II			59		6		117	36	44		60	87	
Year 5													
Program													
I, IA, II, IIA, III, IIIA			65				117	36	44		60	83	
Loy Soybean Price Scenario													
Year 1													
Program													
I, IA, II, IIA, III, IIIA				40		65	77	36	44		12	140	45
Year 2													
Program ^c													
I, IA, IIA, III, IIIA				161	36	65					185	54	
II				117	36	65			44		190	54	
Year 3													
Program													
I, IA, IIA, III, IIIA				117	36	65			44		190	54	
II				117		65		36	44		175	55	

Table C-2 (Continued)

Year 4 Program	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b		
	1	2	3	1	2	3	1	2	1		1	2	3
I, IA, IIA, III, IIIA II					26	65	117	11	44		120	58	
			15			50	117	36	44		85	59	
Year 5 Program													
I, IA, IIA, III, IIIA II				40		65	77	36	44		12	141	45
						65	117	36	44		85	59	

^aFor each of the row crops, 1 refers to the crop planted on Soil Group 1, 2 refers to crops planted on Soil Group 2, and 3 refers to crops planted on Soil Group 3.

^bBeef 1 is a feeder steer operation backgrounding through winter until late spring and requires 1 acre of permanent pasture/hd. and .13 acre hay/hd. Beef 2 is a feeder steer operation backgrounded on a small grain pasture until late spring and requires .75 acre small grain pasture/hd. and .05 acres hay/hd. Beef 3 is a feeder steer operation wintered and grazed on permanent pasture to mid-summer and requires 1 acre of permanent pasture/hd. and .16 acre hay/hd.

^cPrograms I and IA refer to the Market Floor and Discounted Market Floor programs respectively, II and IIA refer to the Income Support and Discounted Income Support programs respectively, and III and IIIA refer to the Price Band and Discounted Price Band programs respectively.

Table C-3

Allocation of Land Among Alternative Enterprises on the
Part-time Farm under the Perfect Information
Strategy

	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b		
	1	2	3	1	2	3	1	2			1	2	3
Base Year (0)													
Program ^c													
I, IA, III, IIIA				15	5	8			6		38	6	
II, IIA					5	8	15		6		18	7	
Stable Prices Scenario													
Year 1													
Program													
I, IA, II, IIA, III, IIIA				15	5	8			6		38	6	
Year 2													
Program													
I, IA, II, IIA, III, IIIA				21	5	8					45	6	
Year 3													
Program													
I, IA, IIA, III, IIIA				15	5	8			6		38	6	
II					5	8	15		6		18	7	
Year 4													
Program													
I, IA, III, IIIA	15	5	8						6		38	6	
II			8				15	5	6		11	8	
IIA		5	8				15		6		18	7	

Table C-3 (Continued)

	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)		Beef (head) ^b		
	1 2 3			1 2 3			1 2			1	1 2		1 2 3	
	1	2	3	1	2	3	1	2			1	2	1	2
Year 5														
Program														
I, IA, IIA, III, IIA			8		5		15		6			18	7	
II			8				15	5	6			11	8	
Unstable Prices Scenario														
Year 1														
Program														
I, IA, II, IIA, III, IIIA			8				15	5	6			11	8	
Year 2														
Program														
I, IA, II, IIA, III					21	5	8					46	6	
IIIA			8		21	5						46	6	
Year 3														
Program														
I, IA, II, IIA					21	5	8					46	6	
III, IIIA					15	5	8		6			38	6	
Year 4														
Program														
I, IA, III, IIIA	15	5	8									38	6	
II, IIA			8					15	5	6		11	8	

Table C-3 (Continued)

	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)	Wheat (ac)	Beef (head) ^b		
	1 2 3			1 2 3			1 2				1 2 3		
	1	2	3	1	2	3	1	2	1		1	2	3
Year 5													
Program													
I, IA, IIA, III, IIIA	15	5	8				15	5	6		38	6	
II			8						6		11	8	
Low Soybean Price Scenario													
Year 1													
Program													
I, IA, II, IIA, III, IIIA				15	5	8			6		38	6	
Year 2													
Program ^c													
I, IA, II, IIA, III, IIIA				21	5	8					45	6	
Year 3													
Program													
I, IA, II, IIA, III, IIIA				15	5	8			6		38	6	
Year 4													
Program													
I, IA, IIA, III, IIIA			8	15	5						38	6	
II			8				15	5	6		11	6	

Table C-3 (Continued)

Year 5	Soybeans (ac) ^a			Corn (ac)			Soy/Wheat (ac)		Cotton (ac)		Wheat (ac)		Beef (head) ^b		
	1	2	3	1	2	3	1	2	1				1	2	3
Program															
I, IA, IIA, III, IIIA				15	5	8			6				38	6	
II					5	8	15		6				18	8	

^aFor each of the row crops, 1 refers to the crop planted on Soil Group 1, 2 refers to crops planted on Soil Group 2, and 3 refers to crops planted on Soil Group 3.

^bBeef 1 is a feeder steer operation backgrounding through winter until late spring and requires 1 acre of permanent pasture/hd. and .13 acres hay/hd., Beef 2 is a feeder steer operation backgrounded on a small grain pasture until late spring and requires .75 acre of small grain pasture/hd. and .05 acre hay/hd., Beef 3 is a feeder steer operation wintered and grazed on permanent pasture to mid-summer and requires 1 acre of permanent pasture/hd. and .16 acre hay/hd.

^cPrograms I and IA refer to the Market Floor and Discounted Market Floor programs respectively, II and IIA refer to the Income Support and Discounted Income Support programs respectively, and III and IIIA refer to the Price Band and Discounted Price Band programs respectively.

Table C-4

Net Income after Variable Expenses for all
Strategies, for the Commercial Farm

	PROGRAMS					
	I	IA	II	IIA	III	IIIA
<u>PERFECT INFORMATION STRATEGY</u>						
Base Year (0)	64,467	64,467	66,643	66,643	64,467	64,467
<u>Stable Prices Scenario</u>						
Year 1	72,258	72,258	72,824	72,280	72,258	72,258
2	66,041	66,041	68,253	66,090	66,041	66,041
3	67,467	67,461	67,706	67,467	67,467	67,461
4	55,687	55,137	62,354	57,071	55,687	55,137
5	60,022	60,022	63,608	60,022	60,022	60,022
<u>Unstable Prices Scenario</u>						
Year 1	79,053	79,053	79,053	79,053	79,053	78,515
2	79,130	79,130	81,521	79,194	75,249	67,595
3	89,254	89,254	89,254	89,254	76,376	66,513
4	49,630	48,674	56,862	52,738	49,630	48,674
5	63,674	63,674	70,188	65,646	63,674	61,984
<u>Low Soybean Prices Scenario</u>						
Year 1	72,258	72,258	72,505	72,258	72,258	72,258
2	66,042	66,042	66,801	66,042	66,042	66,042
3	64,985	64,985	65,103	64,985	64,985	64,985
4	49,683	48,944	56,610	48,944	49,683	48,944
5	56,111	56,111	59,107	56,111	56,111	56,111
<u>FORECAST STRATEGY</u>						
Base Year (0)	64,467	64,467	66,643	66,643	64,467	64,467
<u>Stable Prices Scenario</u>						
Year 1	71,951	71,951	72,230	71,214	71,951	71,951
2	65,745	65,745	68,178	65,793	65,745	65,745
3	57,398	57,398	61,578	58,169	57,398	57,398
4	54,155	53,416	60,822	54,910	54,155	53,416
5	58,792	58,792	63,581	58,792	58,792	58,792

Table C-4 (Continued)

	PROGRAMS					
	I	IA	II	IIA	III	IIIA
Unstable Prices						
Scenario						
Year 1	72,797	72,797	76,448	76,448	72,797	72,404
2	73,010	72,869	78,242	74,722	70,828	65,436
3	89,254	89,254	75,959	87,090	71,096	61,820
4	38,136	32,456	40,605	32,456	44,539	45,115
5	63,674	63,674	70,113	65,646	63,674	61,984
Low Soybean Price						
Scenario						
Year 1	71,633	71,633	71,791	71,633	71,633	71,633
2	65,744	65,744	65,239	65,744	65,744	65,744
3	57,398	57,398	59,775	57,398	57,398	57,398
4	47,325	46,586	50,634	46,586	47,325	46,586
5	55,872	55,872	58,859	55,572	55,872	55,572
DIVERSIFICATION STRATEGY						
Base Year (0)	63,440	63,440	65,412	65,412	63,440	63,440
Stable Prices						
Scenario						
Year 1	69,385	69,385	70,580	69,564	69,385	69,385
2	62,652	62,652	66,516	63,488	62,652	62,652
3	66,168	66,168	66,407	66,168	66,168	66,168
4	55,691	54,952	62,357	56,445	55,691	54,952
5	59,999	59,999	63,584	59,999	59,999	59,999
Unstable Prices						
Scenario						
Year 1	79,053	79,053	79,053	79,053	79,053	78,515
2	73,274	72,872	78,245	74,724	70,831	65,439
3	68,944	68,944	68,944	68,944	66,912	63,566
4	49,630	48,674	56,862	52,738	49,630	48,674
5	63,674	63,674	70,188	65,646	63,674	61,984
Low Soybean Price						
Scenario						
Year 1	68,771	68,771	68,771	68,771	68,771	68,771
2	56,992	56,992	56,992	56,992	56,992	56,992
3	60,236	60,236	61,634	60,236	60,236	60,236
4	49,418	48,678	56,424	48,678	49,418	48,678
5	54,203	54,203	54,203	54,203	54,203	54,203

Table C-4 (Continued)

	PROGRAMS					
	I	IA	II	IIA	III	IIIA
<u>TRADITIONAL STRATEGY</u>						
Base Year (0)	62,045	62,045	62,045	62,045	62,045	62,045
Stable Prices						
<u>Scenario</u>						
Year 1	70,323	70,323	70,323	70,323	70,323	70,323
2	64,193	64,193	65,249	64,193	64,193	64,193
3	63,566	63,566	63,566	63,566	63,566	63,566
4	49,741	49,002	51,149	49,002	49,741	49,002
5	56,345	56,345	56,345	56,345	56,345	56,345
Unstable Prices						
<u>Scenario</u>						
Year 1	64,660	64,660	64,660	64,660	64,660	64,660
2	75,679	75,538	77,087	75,538	72,623	65,754
3	78,570	78,570	78,570	78,570	70,645	63,692
4	45,983	42,785	47,504	42,785	45,983	42,785
5	60,098	60,098	60,098	60,098	60,098	58,408
Low Soybean Price						
<u>Scenario</u>						
Year 1	70,089	70,089	70,089	70,089	70,089	70,089
2	62,037	62,037	63,093	62,037	62,037	62,037
3	61,306	61,306	61,747	61,306	61,306	61,306
4	47,351	46,612	48,889	46,612	47,351	46,612
5	54,137	54,137	54,137	54,137	54,137	54,137
<u>MINIMUM STRATEGY</u>						
Base Year (0)	59,200	59,200	59,200	59,200	59,200	59,200
Stable Prices						
<u>Scenario</u>						
Year 1	65,915	65,915	65,915	65,915	65,915	65,915
2	63,932	63,932	63,932	63,932	63,932	63,932
3	55,484	55,484	55,484	55,484	55,484	55,484
4	46,738	46,738	46,738	46,738	46,738	46,738
5	53,070	53,070	53,070	53,070	53,070	53,070
Unstable Prices						
<u>Scenario</u>						
Year 1	58,804	58,804	58,804	58,804	58,804	58,804
2	78,475	78,475	78,475	78,475	74,732	66,485
3	77,453	77,453	77,453	77,453	67,818	59,365
4	39,863	35,975	41,716	35,975	39,863	36,975
5	50,020	50,020	50,020	50,020	50,020	50,020

Table C-4 (Continued)

	PROGRAMS					
	I	IA	II	IIA	III	IIIA
Low Soybean Price						
Scenario						
Year 1	65,623	65,623	65,623	65,623	65,623	65,623
2	61,238	61,238	61,238	61,238	61,238	61,238
3	52,660	52,660	53,212	52,660	52,660	52,660
4	43,752	43,752	43,914	43,752	43,752	43,752
5	50,310	50,310	50,310	50,310	50,310	50,310

^aPrograms I and IA are the Market Floor and Discounted Market Floor programs respectively, Programs II and IIA are the Income Support and Discounted Income Support programs respectively, and III and IIIA are the Price Band and Discounted Price Band programs respectively.

Table C-5

Net Income after Variable Expenses for all
Strategies, for the Part-Time Farm

	PROGRAMS					
	I	IA	II	IIA	III	IIIA
PERFECT INFORMATION STRATEGY						
Base Year (0)	8,070	8,070	8,142	8,142	8,070	8,070
Stable Prices						
Scenario						
Year 1	9,302	9,302	9,302	9,302	9,302	9,302
2	8,606	8,606	8,606	8,606	8,606	8,606
3	8,379	8,379	8,383	8,379	8,379	8,379
4	6,915	6,815	7,650	6,876	6,915	6,815
5	7,355	7,355	7,807	7,355	7,355	7,355
Unstable Prices						
Scenario						
Year 1	9,828	9,828	9,828	9,828	9,828	9,758
2	10,310	10,310	10,310	10,310	9,796	8,709
3	11,628	11,628	11,628	11,628	9,823	8,530
4	6,199	6,199	6,946	6,411	6,199	6,199
5	8,203	8,203	8,705	8,203	8,203	7,973
Low Soybean Price						
Scenario						
Year 1	9,302	9,302	9,302	9,302	9,302	9,302
2	8,606	8,606	8,606	8,606	8,606	8,606
3	8,379	8,379	8,379	8,379	8,379	8,379
4	6,063	5,962	6,888	5,962	6,063	5,962
5	7,126	7,126	7,213	7,126	7,126	7,126
FORECAST STRATEGY						
Base Year (0)	8,070	8,070	8,142	8,142	8,070	8,070
Stable Prices						
Scenario						
Year 1	9,302	9,302	9,028	8,908	9,302	9,302
2	8,429	8,429	8,429	8,429	8,429	8,429
3	7,482	7,482	7,482	7,482	7,482	7,482
4	6,055	5,954	7,201	6,530	6,055	5,954
5	7,296	7,296	7,807	7,352	7,296	7,296

Table C-5 (Continued)

		PROGRAMS					
		I	IA	II	IIA	III	IIIA
Unstable Prices							
Scenario							
Year 1		7,837	7,837	9,144	9,144	7,837	7,837
2		8,997	8,978	9,689	9,220	8,717	8,278
3		11,628	11,628	11,628	11,628	9,823	7,958
4		4,973	4,231	5,295	4,231	5,710	5,115
5		8,203	8,203	8,705	8,203	8,203	7,973
Low Soybean Price							
Scenario							
Year 1		9,302	9,302	8,984	9,302	9,302	9,302
2		8,429	8,429	8,573	8,429	8,429	8,429
3		7,482	7,482	7,482	7,482	7,482	7,482
4		6,055	5,955	6,247	5,955	6,055	5,055
5		7,004	7,126	7,063	7,126	7,004	7,126
DIVERSIFICATION STRATEGY							
Base Year (0)		7,786	7,786	8,043	8,043	7,786	7,786
Stable Prices							
Scenario							
Year 1		8,573	8,573	8,729	8,596	8,573	8,573
2		7,669	7,669	8,180	7,779	7,669	7,669
3		8,177	8,177	8,208	8,177	8,177	8,177
4		6,768	6,667	7,646	6,862	6,768	6,667
5		7,336	7,336	7,804	7,336	7,336	7,336
Unstable Prices							
Scenario							
Year 1		9,824	9,824	9,824	9,824	9,824	9,754
2		8,994	8,975	9,685	9,217	8,714	8,021
3		8,520	8,520	8,520	8,520	8,255	7,818
4		6,002	5,877	6,943	6,408	6,002	5,877
5		7,852	7,852	8,702	8,109	7,852	7,622
Low Soybean Price							
Scenario							
Year 1		8,494	8,494	8,650	8,494	8,494	8,494
2		6,943	6,943	7,454	6,943	6,943	6,943
3		7,415	7,415	7,595	7,415	7,415	7,415
4		5,963	5,862	6,885	5,862	5,963	5,862
5		6,592	6,592	7,060	6,592	6,592	6,592

Table C-5 (Continued)

		PROGRAMS					
		I	IA	II	IIA	III	IIIA
<u>TRADITIONAL STRATEGY</u>							
Base Year (0)		8,006	8,006	8,006	8,006	8,006	8,006
Stable Prices							
<u>Scenario</u>							
Year 1		9,137	9,137	9,137	9,137	9,137	9,137
2		8,299	8,299	8,299	8,299	8,299	8,299
3		8,257	8,257	8,257	8,257	8,257	8,257
4		6,282	6,181	6,474	6,181	6,282	6,181
5		7,206	7,206	7,206	7,206	7,206	7,206
Unstable Prices							
<u>Scenario</u>							
Year 1		8,196	8,196	8,196	8,196	8,196	8,196
2		9,737	9,718	9,929	9,718	9,336	8,443
3		10,464	10,464	10,464	10,464	9,310	8,297
4		5,845	5,380	6,060	5,380	5,845	5,380
5		7,687	7,687	7,687	7,687	7,687	7,457
Low Soybean Price							
<u>Scenario</u>							
Year 1		9,115	9,115	9,115	9,115	9,115	9,115
2		8,100	8,100	8,244	8,100	8,100	8,100
3		8,048	8,048	8,089	8,048	8,048	8,048
4		6,061	5,960	6,265	5,960	6,061	5,960
5		7,002	7,002	7,002	7,002	7,002	7,002
<u>MINIMUM STRATEGY</u>							
Base Year (0)		7,684	7,684	7,684	7,684	7,684	7,684
Stable Prices							
<u>Scenario</u>							
Year 1		8,558	8,558	8,558	8,558	8,558	8,558
2		8,300	8,300	8,300	8,300	8,300	8,300
3		7,200	7,200	7,200	7,200	7,200	7,200
4		6,059	6,059	6,059	6,059	6,059	6,059
5		6,884	6,884	6,884	6,884	6,884	6,884
Unstable Prices							
<u>Scenario</u>							
Year 1		7,628	7,628	7,628	7,628	7,628	7,628
2		10,191	10,191	10,191	10,191	9,704	8,630
3		10,066	10,066	10,066	10,066	8,809	7,706
4		5,096	4,658	5,337	4,658	5,096	4,658
5		6,486	6,486	6,486	6,486	6,486	6,486

Table C-5 (Continued)

		PROGRAMS					
		I	IA	II	IIA	III	IIIA
Low Soybean Price							
Scenario							
Year	1	8,520	8,520	8,520	8,520	8,520	8,520
	2	7,950	7,950	7,950	7,950	7,950	7,950
	3	6,835	6,835	6,906	6,835	6,835	6,835
	4	5,673	5,673	5,694	5,673	5,673	5,673
	5	6,527	6,527	6,527	6,527	6,527	6,527

^aPrograms I and IA are the Market Floor and Discounted Market Floor programs respectively, Programs II and IIA are the Income Support and Discounted Income Support programs respectively, and Programs III and IIIA are the Price Band and Discounted Price Band programs respectively.

VITA

John Arrin Gillies III was born in Denver, Colorado on February 21, 1951. He graduated from Littleton High School in May of 1969 and received a Bachelor of Science in Business Administration from the University of Colorado in Boulder in May of 1973. From 1973 to 1976, he served as a Peace Corps Volunteer in Afghanistan. Upon returning to the United States, he entered the graduate program at The University of Tennessee and received a Master's degree in Agricultural Economics in August 1979.

He is married to Lydia Joy Noelle Petersson of Deerlodge, Tennessee.