DESIGN AND APPLICATION OF A STRUCTURAL GENERAL EQUILIBRIUM MODEL TO FARM POLICY ANALYSIS

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ABSTRACT

ABSTRACT. The large-scale macroeconomic model described in this paper captures the linkages between agriculture and the general economy in as fully simultaneous fashion. An overview of the model's properties is followed by its application to two alternative farm policy scenarios: (1) reducing target prices below levels called for in current legislation and (2) expanding the conservation reserve program from 45 to 65 million acres. The broad applicability of COMGEM to other policy issues, including macroeconomic and trade policy is also discussed.

KEYWORDS: General equilibrium, transmission mechanisms, product market disaggregation, financial market disaggregation, international trade flows and market shares, macroeconomic policy, farm program policy.

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I. Introduction

Considerable human and financial resources are required to maintain large-scale models once they have been developed and the dissertation has been placed in the library. To assess the full range of current policy issues confronting agriculture, these models require comprehensive, up-to-date data bases, periodic restiration, and development of a valid baseline scenario. The origin of theoretical structure underlying the econometric model presented in this paper can be traced to a Ph.D. dissertation by Hughes completed in 1980. Subsequent dissertations by Romain, Babula, Teboh and others have contributed significantly to the large-scale macroeconomic econometric model described and applied to policy analysis in this paper. The name given to this model is COMGEM, where COM signifies a commodity-specific approach taken to modeling agricultural activity and GEM indicates the model captures activity in a general equilibrium framework.

Section II of this paper presents an overview of the theoretical approach taken to modeling agriculture and the general economy in COMGEM. We begin with the macroeconomic structure before turning to the farm economy. Section III presents a discussion of the approach taken to modeling the supply and disappearance of specific farm commodities. Section IV presents the baseline projection to 1993 and the effects of two policy options: (1) lowering target prices by 10 percent and (2) expanding the Conservation Reserve Program by 20 million acres. The last section of this paper presents some concluding comments.

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II. Scope and Design of COMGEM

Numerous calls were made in the literature during the late-1970's for greater endogenization of macroeconomic linkages in econometric models of the farm business sector. Just suggested that the interface between the farm business sector and the general economy should include at least three forms of interaction: (1) the interaction between the general price and income levels, farm marketing costs and prices in the raw farm products market, (2) the interaction between farm input demand and the supply of raw farm products and (3) the interaction between international trade flows and world economic conditions, exchange rates and the trade deficit. Penson and Hughes added to this list of interactions by stressing the importance of the interaction between the bond and equity capital markets, financial intermediaries, and farm production and capital expenditures. This particular interaction eventually became very important to understanding the financial crisis facing many farm businesses during the 1980's.

These different forms of interaction between the farm business sector and the general economy taken together suggest that the sector has become a highly integrated partner in today's domestic and world economies. Furthermore, these interactions suggest that efforts to model events in the farm business sector should account for the inherent simultaneities.

The purpose of this section is to describe the scope and design of this large-scale econometric model. We will begin by describing the modeling of the general economy in the COMGEM model, including the monetary and fiscal policy transmission mechanisms and the solution technique used to solve the model. We will then turn to the farm business and farm household sectors in the COMGEM model and finish by describing the farm commodity relationships used to capture crop and livestock activities.

Modeling the general economy

The standard textbook macroeconomic model typically accounts for the equilibrium in the nation's product markets (the IS curve), money market (the LM curve) and labor market (the aggregate supply or AS curve). Such a model can be stated in mathematical terms as follows:

(1) $Y/P = c(Y/P, r, W/P) + i(Y/P, r) + g + xm$ (the IS curve)

(2) $M/P = l(Y/P, r, W/P)$ (the LM curve)

(3) $\overset{*}{P} = \overset{*}{P}{}^{e} + a(Y - Y_p)/Y_p$ (the AS curve)

where Y represents nominal gross national income, P is a measure of the overall price level (i.e., the numeraire), r is a real interest rate, W is the nominal value of wealth (which includes the capital stock (K), money (M) and government bonds (B)), c represents real consumption expenditures, i represents real investment expenditures, g is real government expenditures, xm represents real net exports, $\overset{*}{P}$ is the rate of change in the general price level, $\overset{*}{P}{}^{e}$ is the expected rate of change in the general price level and Y_p represents potential output.[1]

Replacing the LM curve. At first glance, there appear to be three endogenous variables in this three-equation model (i.e., Y/P, r and $\overset{*}{P}$). However, there are five variables imbedded in this simple model (the three above plus the quantity and interest rate on government bonds). To define wealth, government bonds must be included. Yet, equations detailing the demand for and supply of these bonds are omitted in most standard textbook models. Instead, most authors implicitly use Walras Law and the government budget constraint to remove references to government bonds.

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[1]Many of the simplifying assumptions reflected in these equations are *not* embodied in COMGEM. For example, COMGEM *does* capture the tax rate effects on consumption and investment expenditures, and money is *not* assumed to be neutral in the short run. These simplifying assumptions were made here to facilitate the presentation.

A simplistic interpretation of Walras Law is that every dollar of income is used in some way. Thus, dollars not spent on consumption or taxes (savings) are used to increase wealth. This statement can be expressed algebraically in nominal terms as follows:

(4) $S = \Delta W = \Delta M + \Delta B + I$

where S represents savings, ΔW is the change in wealth, ΔM is the change in base money, ΔB is the change in the value of government bonds owned by the public and I represents nominal gross investment.[2] Through algebraic manipulation, equation (4) can be solved to give the residual demand for bonds as shown below:

(5) $\Delta B = S - \Delta M - I$

The government budget constraint in nominal terms states that the federal budget deficit must be financed either by "printing money" or by issuing government bonds. This constraint is expressed as follows:

(6) $G - T = \Delta M + \Delta B$

where G represents government expenditures and T represents tax revenues. Rearranging equation (6) to solve for the residual supply of bonds, we see that:

(7) $\Delta B = G - T - \Delta M$

which simply states that the supply of bonds is equal to the size of the budget deficit minus any change in base money. In most macroeconomic textbook models, equations similar to equations (5) and (7) are used as the basis for omitting explicit references to the quantity and interest rate on government bonds.

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[2]Total gross investment does not necessarily represent an increase in wealth since part of gross investment constitutes replacement investment. Savings, however, must cover both replacement investment and any increases in the capital stock.

The decisions to exclude the bond market in standard textbook presentations is generally made for ease of exposition. Since the supply of money is one of the government's principal policy instruments, its inclusion in textbook models facilitates the development of macroeconomic multipliers and the analysis of policy options. Patinkin argues, however, that the exclusion of the bond market is not necessarily a good choice in practice. He has shown that, while the choice of market to exclude does not influence final market equilibriums, the choice does have implications for dynamics of the system. In his comparison of the dynamics of models including the money market with an LM curve versus models including the bond market with a BB curve, Patinkin concludes that the dynamics make more sense when the bond market is included.[3]

Given Patinkin's arguments, the bond market rather than the money market is included in COMGEM. Walras Law and the government budget constraint are used to residually solve for the demand and supply of money. Equations (5) and (7) thus must be respecified to solve for the change in money rather than the change in bonds. If we use these two new equations to eliminate the quantity of money (M) and the return on money (r), the macroeconomic model outlined earlier in equations (1) through (3) can be restated as follows:

(8) $Y/P = c(Y/P, r_b, W/P) + i(Y/P, r_b) + g + xm$ (the IS curve)

(9) $B/P = b(Y/P, r_b, W/P)$ (the BB curve)

(10) $\overset{*}{P} = \overset{*}{P}{}^e + a(Y - Y_p)/Y_p$ (the AS curve)

Monetary policy in this model is transmitted through changes in government bonds held by the public. The Federal Reserve controls the growth in money by deciding how

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[3]Patinkin's arguments relate to the direction of change in interest rates implied by the two curves whenever there is excess supply for both bonds and money. If there is excess supply in these two financial markets, there must be excess demand in the goods markets. Excess supply of bonds implies decreasing bond prices and higher interest rates. Excess supply of money implies declining interest rates. During a period of excess demand for goods, Patinkin argues that rising interest rates are more likely and thus inclusion of the bond market is more appropriate. A symmetric argument can be made for times when there is excess demand in both the bond and money markets.

many government bonds to buy. Models with an LM curve assume the Federal Reserve decides how much to add to bank reserves.[4] Fiscal policy is reflected in this model by the level of government expenditures and tax rates.

Respecifying the AS curve. The aggregate supply (AS) curve presented in equation (10) has been widely adopted in macroeconomic textbooks (see Gordon). It has many of the important properties deemed necessary in such a function. The first term on the right-hand side of equation (10) can be interpreted as representing *cost push* inflationary pressures. Workers expecting a given inflation rate will bargain for increases in their wages. Producers also expecting the same level of inflation will likely grant such wage requests. The second term in equation (10) reflects *demand pull* inflationary pressures. As gross national product grows relative to the nation's potential output, inflation will increase. Equilibrium is achieved in the long run only when there are no surprises (i.e., when actual inflation equals expected inflation). This can only be true in equation (10) when actual gross national product equals the nation's potential output. So, while equation (10) allows for a short term dynamic trade-off between inflation and the unemployment of labor and capital, long run equilibrium satisfies the classical requirement of full employment.

Unfortunately, equation (10) cannot be estimated in its present form since reliable data on general price expectations are unavailable. Assumptions therefore must be made regarding the formation of inflationary expectations. One approach is to assume that the expected level of inflation is directly related to current and past rates of change in the money supply. In COMGEM, however, the elimination of the money market requires further substitution before estimation. Solving equation (7) for ΔM and

[4]Purchases of government bonds account for only the nonborrowed reserves component of the monetary base. Two other exogenous variables are used in COMGEM - the discount rate and the level of currency - to control growth in other components of base money. The monetary base is then converted into maximum levels of deposits and bank loans based upon reserve requirements. These maximums help determine interest rates charged and paid by financial intermediaries.

partitioning the budget deficit from bond financing, the AS curve actually included in the COMGEM model takes the form:[5]

$$(11) \quad \overset{*}{P} = \theta_n(G - T) + \theta_m(\overset{*}{B}) + a(Y - Y_p)/Y_p$$

where θ_m represents an m-period distributed lag and $\overset{*}{B}$ is the growth rate for government bonds owned by the private sectors.

Equations (8), (9) and (11) form the theoretical basis of COMGEM's macroeconomic structure. COMGEM, however, is a *commodity-specific* macroeconomic model. The model is still general equilibrium in nature, since it captures the interactions between transactor groups taking place annually in specific markets in a fully simultaneous fashion over the life of the simulation period. Changes in farm product prices, for example, show up in the food component of the Consumer Price Index (CPI) and the rate of inflation. The rate of inflation, in turn, affects real interest rates, and hence a broad range of variables, such as foreign exchange rates, exports and farm revenue; interest expenses and other production expenses; real net farm income and real farm wealth. Thus, the agricultural component of COMGEM differs from the traditional agricultural sector models which are "stand alone" in nature; they capture the effects of macroeconomic activity upon farm businesses, but assume that events in agriculture have no effect on the general economy over the life of the simulation period.

Sectoring of model. To account for the complete interface between the farm business sector and the general economy, we must (a) have at least two production functions, two labor markets, and two final product markets to separate farm and nonfarm business activity; (b) partition consumers according to whether or not they have a financial interest in the farm business sector; (c) distinguish between the alternative sources of external financing to farm and nonfarm businesses; and (d) identify the

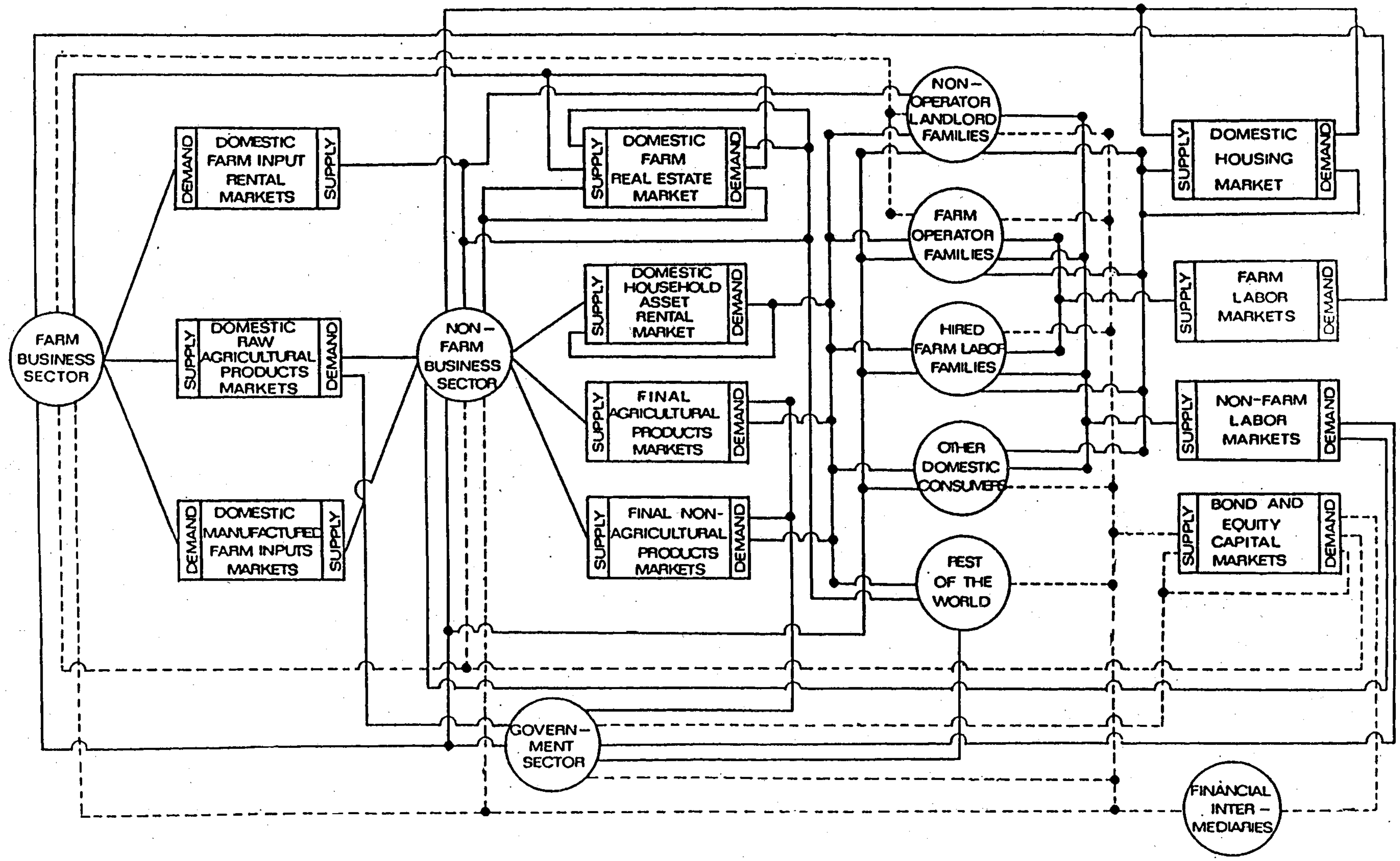
[5]Separation of the deficit from bond financing in this equation is done to accommodate the fact that the government budget constraint is not an exact identity (see footnote 3).

markets in which different financial intermediaries obtain their loanable funds.

The structure of the macroeconomic model discussed in this paper is illustrated in Figure 1. The *solid lines* in this figure represent physical linkages through which goods and services as well as associated expenditures of funds flow. The *dashed lines* represent pure financial linkages. Businesses in the economy have been allocated sectors by product lines. All resources used to produce raw agricultural products are included in the farm business sector regardless of where their ownership lies. The same approach has been taken in the nonfarm business sector which, among other functions, processes and distributes intermediate goods acquired from the farm business and "rest-of-the-world" sectors. The farm and nonfarm business sectors are directly linked by three sets of markets: (a) domestic raw agricultural products markets, (b) domestic manufactured farm inputs markets, and (c) farm input rental markets, where the services provided by capital leased by farm operators from nonfarm businesses and nonoperator landlord families are acquired. The farm and nonfarm business sectors are also linked to the farm real estate market when nonfarm businesses desire to purchase farmland from discontinuing proprietors for nonagricultural purposes. In addition to its linkage with the farm business sector, the nonfarm business sector is linked to a set of domestic consumer groups by the final markets for agricultural and nonagricultural products and by a household asset rental market.

Six different groups of transactors in the economy are specified in COMGEM. These groups are: (1) farm operator families, (2) nonfarm households, (3) nonfarm businesses, (4) financial intermediaries, (5) government and (6) the rest of the world sector. Farm operator families receive major attention in COMGEM; we model both farm business as well as farm household activities. This transactor group produces farm products, owns a major share of the means by which farm products are produced, consumes final products from other sectors and is the residual claimant of farm profits. The second transactor group in COMGEM is nonfarm households, which includes the nonoperator landlord families, hired farm labor families and other domestic consumers identified in Figure

Figure 1. Physical and financial linkages between agriculture and the general economy



1. These households account for the majority of total final demand for goods produced in the economy, own a major share of the means by which nonfarm products are produced, and offer their labor services in the farm and nonfarm labor markets in the domestic economy. Nonfarm businesses, the third transactor group in COMGEM, produce and supply manufactured farm inputs to farm businesses, supply all domestically produced final consumer goods, hire labor and arrange for financing of their firms. The fourth transactor group, financial intermediaries, provides markets which equate the supply of savings with the demand for loan funds. The government sector, another transactor group, purchases farm and nonfarm goods, hires labor, implements monetary, fiscal, trade and farm program policies, collects taxes, makes transfer payments and finances budget deficits. The final transactor group is the "rest-of-the-world" sector, which imports goods purchased from nonfarm businesses in the U.S. final agricultural and nonagricultural products markets and exports intermediate goods to the U.S. nonfarm business sector. When the nonfarm business sector takes delivery of imported intermediate goods, it processes and distributes them in either the final agricultural or nonagricultural products markets.

We can see how these individual transactor groups contribute to the nation's output in COMGEM by examining the calculation of gross national product. GNP expressed in constant dollars reflects expenditures by these groups summed over all products, or:

$$(12) \quad y = \sum_{i=1}^{nc} \sum_{k=1}^{mc} c_{ik} + \sum_{j=1}^{ni} \sum_{h=1}^{mi} i_{jh} + g$$

where y represents real GNP, c_{ik} represents real consumption expenditures for the k^{th} good by the i^{th} transactor group, i_{jh} represents real investment expenditures for the h^{th} good by the j^{th} transactor group, g represents total real government expenditures, nc represents the number of consumer groups, mc represents the number of consumer goods and services, ni represents the number of investor groups and mi represents the number of investor groups. In other words, COMGEM sums over the goods and services purchased by consumers (including foreigners), producers and government. Equation (12) above represents a disaggregation of equation (8), where the determinants of consumption and investment behavior by the individual transactor groups are discussed below.

Product market disaggregation. The demand and supply equations for *consumer goods and services* in general terms take the following general forms in the model:

(13) $q^{d}_{ik} = d(p_k, \Phi p_o, r_b, c_i)$

(14) $q^{s}_{k} = s(p_k, \Phi p_o, r_b, \Phi p_u)$

where the market clearing equation takes the form:

(15) $\sum_{i=1}^{nc} q^{d}_{ik} = q^{s}_{k}$

and where q^{d}_{ij} represents the quantity of the j^{th} good demanded by the i^{th} group, p_k is the own price of the k^{th} good, c_i represents the total expenditures by the i^{th} transactor group (which acts as a budget constraint), q^{s}_{k} is the quantity of the k^{th} good supplied, Φp_o represents a vector of the prices of all other consumer goods, r_b represents the real market interest rate, and Φp_u represents a vector of the prices of all the inputs used in the production of the k^{th} good. Forcing equilibrium using the market clearing equation allows us to solve one of the demand or supply equations for the price of the k^{th} good. Consumption for each transactor group and for each good can be calculated based upon these prices and quantities and aggregated to determine total consumption, which represents the *first* term in equation (12).

The demand and supply equations for *capital goods* in the COMGEM model take the following general forms:

(16) $q^{d}_{jh} = d(p_h, r_b, \Phi p_o, O_j, t, K_{jht-1})$

(17) $q_h^s = s(p_h, \Phi p_o, r_b, \Phi p_u)$

where the market clearing equation takes the form:

(18) $$q_h^s = \sum_{j=1}^{ni} (q_{jh}^d + D_{jh})$$

and where q_{jh} is the quantity of the h^{th} capital good added to the capital stock of the j^{th} group, p_h is the real price of the capital good, r_b represents real market interest rate, Φp_o is a vector of prices of all other capital goods, O_j represents expected output, t is the effective tax rate, K_{t-1} is the lagged capital stock, Φp_u is a vector of the prices of all inputs used to produce the h^{th} capital good, and D_{jh} is the depreciation of the h^{th} capital stock owned by the j^{th} group.

Total investment expenditures in the h^{th} capital good by the j^{th} investor group is then determined by:

(19) $$i_{jh} = p_h(q_{jh} + D_{jh})$$

(20) $$D_{jh} = e(\sum_{i=1}^{\infty} q_{jht-i}).$$

Thus, equations (16) through (20) solve for the price of capital goods, the net increase in capital stocks, depreciation and the quantity supplied for each capital good. Equation (19) summed across all goods for all transactor groups gives us total investment, which represents the *second* term in equation (12).

Note that the traditional determinants of investment - income and the interest rate - are included in equation (16), but with some extra detail. Income is represented by the prices and quantities of outputs. The interest rate is incorporated in an implicit rental cost of capital which also accounts for the price of capital, the method of financing and taxes (see Penson, Romain and Hughes). The lagged capital stock is included to reflect the base from which stock adjustments are made.

The disaggregated demand and supply equations for consumer goods and services as well as capital goods provide a direct linkage between a particular transactor group and primary and secondary input markets as well as final goods markets. Farm businesses, for example, create raw agricultural commodities by using primary inputs such as land and labor in combination with intermediate goods such as machinery and chemicals supplied by other groups. Derived demand functions for inputs used in farm production as well as the supply of these inputs are included in COMGEM. Total farm production expenses are related to the equilibrium prices and quantities of the inputs purchased. The profitability of the sector is thus endogenously determined.

Table 1 illustrates the general approach taken to disaggregating the product markets in COMGEM. While this table shows how different sectors interact in the economy, the goods markets in COMGEM are actually more disaggregated than shown here. COMGEM, for example, includes commodity-level detail for the major crop, livestock and livestock products produced in this country. Quantities of raw agricultural products are marketed by the farm operator families and the "rest-of-the-world" group and are purchased for processing by nonfarm businesses and for storage by the government. The supply and demand equations represented in Table 1 provide the quantities and relative prices required to calculate real gross national product given: (1) the simultaneous solution for interest rates in financial markets and (2) the general price level.

Financial market disaggregation. Financial markets in the COMGEM model are disaggregated to capture the linkages between farm operator families and the rest of the economy and to determine the financial condition of this transactor group. Unlike the disaggregation of the product markets, however, expanding beyond the money market to account for government bonds is not sufficient. With the exception of money and government, all financial assets cancel out in the standard textbook macroeconomic model. Once sectors are partitioned, however, there is a need to account for *each* sector's financial instruments since the liabilities of one group are no longer

Table 1 Disaggregation of Product Markets in COMGEM

Good or service	Farm Operator Families[1]	Nonfarm house-holds	Nonfarm Busi-nesses	Financial Interme-diaries	Govern-ment	Rest of the World
Primary Inputs:						
Land	D,S[2]	D	D,S	D		
Labor	D,S	S	D		D	
Petroleum			D			S
Secondary Inputs:						
Durable Farm Inputs	D		D,S			
Nondurable Farm Inputs	D		S			
Raw agricul-tural products	S		D		D	S
Final Products:						
Food	D	D	S		D	D
Consumer Durables	D	D	S			
Other	D	D	S		D	D

[1]Includes both farm business and farm household activities.

[2]D and S represent demand and supply of goods and services, respectively.

cancelled by the assets of another group.

This expansion of the number of financial instruments is one of the principal differences between aggregate macroeconomic analysis and standard microeconomic theory. Some who have an understanding of the standard textbook macroeconomic model may feel that many of the financial asset equations appearing in a multi-sectored general equilibrium model are included on an ad hoc basis. Their inclusion, of course, is *not* ad hoc. In microeconomic theory, the demands and supplies of financial instruments can be developed using portfolio balancing theory (see Tobin, Penson).

To better understand the need to endogenize these financial interfaces in modeling the farm business sector, let us examine the linkage between savers in the economy and the financing of farm business operating expenses and capital accumulation. Recall the channels through which these funds flow are indicated by the *dashed lines* in Figure 1. For example, each of the domestic consumer groups and the "rest-of-the-world" sector either invests funds in the bond and equity capital markets or places funds on deposit at commercial banks and other deposit-based financial intermediaries. These consumer groups also repay their existing loans and borrow new loan funds. One of the reasons nonoperator landlord families and farm operator families borrow is to supplement their internal equity capital when financing the purchase of farm business assets in either the manufactured farm input markets or the farm real estate market. Merchants and dealers also provide debt financing to farm operator families who purchase manufactured farm inputs. A relatively small number of incorporated farm businesses also acquire external financing by selling debt and equity instruments in bond and equity capital markets as well as by borrowing directly from financial intermediaries. Some financial intermediaries, such as the Farm Credit System, obtain their new loanable funds by issuing debt instruments in the bond markets. The government sector, principally in the name of the Farmers Home Administration, also provides loan funds to farm operator families. The Farmers Home Administration, in turn, receives its loanable funds either directly from government appropriations financed by tax revenues or from the issuance of debt in the bond markets. Other items also flow through this and other selected linkages in Figure 1. Transfer payments and government loans to businesses and consumers as well as government tax receipts, all government securities transactions are also captured.

Seven financial markets are included in the COMGEM model. As shown in Table 2, demand deposits and time and savings deposits are assets held by farm operator families, nonfarm households, nonfarm businesses and the "rest-of-the-world" group. These deposits also represent liabilities of financial intermediaries. Commercial bonds, bank loans and equities (stocks) finance the activities of nonfarm businesses. Government bond markets capture the financial implications of monetary and fiscal policies. Farm and nonfarm loan markets are also included.

The general form of the demand equations for financial instruments in COMGEM is described in the following equation:

(21) $$S^{d}_{ij} = d(r_j, \Phi Spa_i, \Phi Sfa_i, \Phi Sdt_i)$$

where S^{d}_{ij} represents the demand for the j^{th} financial instrument by the i^{th} sector, r_j is the rate of return on the j^{th} asset or interest rate on the j^{th} liability, and ΦSpa_i, ΦSfa_i and ΦSdt_i represent vectors of the stocks of physical assets, *other* financial assets (i.e., where $k \neq j$) and *other* liabilities in the i^{th} sector, respectively (Tobin, Penson).

The rates of return (interest) on assets (liabilities) are determined within COMGEM according to the following general relationship:

(22) $$r_j = s(\sum_i S^{d}_{ij}, \Phi r_o)$$

where ΣS^{d}_{ij} represents the total stock of financial instruments demanded by all groups and Φr_o represents a vector of rates of return (interest) on *other* assets (liabilities) relevant to the supplying sector. The yields on government bonds, however, are influenced by the supply rather than demand, as this is where the Federal Reserve influences the money supply and market rates of interest.

Table 2 Disaggregation of Financial Markets in COMGEM

Financial Instrument	Farm Operator Families[1]	Nonfarm households	Nonfarm Businesses	Financial Intermediaries	Government	Rest of the World
Bank deposits:						
Demand deposits	D[2]	D	D	S[2]		
Time deposits	D	D	D	S		
Bond market:						
Commercial bonds		D	D,S	D		
Government bonds		D	D	D	S	D
Stock market:						
Equities		D	S	D		
Loans funds market:						
Farm loans:						
Real estate	D			S		
Non-real estate	D			S		
Nonfarm loans		D	D	S		

[1]Includes both farm business and farm household activities.

[2]D and S represent demand and supply of financial instruments, respectively.

International trade linkages. Allowances have been made in COMGEM for most of the linkages between the domestic and foreign economies that have an impact on agriculture. The existence of linkages through the supply of raw agricultural products, demands for food and nonfood consumer goods, and the purchase of government bonds by the "rest-of-the-world" group has already been identified in Tables 1 and 2. Rather than having an IS curve with net exports listed as a separate item in calculating gross national product, the components of net exports have been identified and included as demands and supplies in individual markets (see equation (12)). The factors that influence these demands and supplies have not been described, however. This section presents the specification for the trade flows of U.S. raw agricultural products in COMGEM.

A major criticism of U.S. agricultural trade models is that they frequently focus on total U.S. exports of a particular commodity to an aggregate "rest-of-the-world" sector. One approach to relaxing this assumption is the multi-region structure of international demand developed by Armington that differentiates commodities by kind and by origin. Sources of differentiation can include political alliances, actual quality differences and degree of procurement risk.

Armington demand theory rests on three assumptions. First, the preferences of an importing nation's consumers are assumed to be homogeneously separable. Second, elasticities of substitution in the importing nation are constant. Third, there is a common elasticity of substitution for all product pairs within a particular market. These three assumptions together imply homogeneously separable, constant elasticity-of-substitution utility functions for importing nations. These assumptions further suggest that consumers in the importing nations follow a two-stage budget procedure. We assume here that foreign consumers initially maximize their utility subject to a budget constraint. These consumers are then assumed to minimize their expenditures in each market subject to their first-stage market demand.

The structure of the Armington demand model is summarized in equations (23) and

(25). Equation (23) represents a Marshallian market demand for the i^{th} good that results from maximizing the importing consumers' utility subject to an income constraint. Equation (25) represents a Hicksian demand for the i^{th} good supplied by the j^{th} exporting nation subject to the level of stage-one market demand.[6]

(23) $x_i = h^i(RLY, p_1, ..., p_i, ..., p_n)$

(24) $x_{ij} = g^{ij}(x_i, p_{i1}, ..., p_{ij}, ..., p_{im})$

which can be restated as follows:

(25) $x_{ij} = b_{ij}{}^{oi} x_i (p_{ij}/p_i)^{-oi}$

where i = 1, ..., n and j = 1, ..., m and where n represents the number of goods, m represents the number of exporting regions, x_i is the quantity index of the i^{th} good demanded from all sources (the first-stage demand), h^i is the first-stage Marshallian demand for the i^{th} good, RLY is the importing nation's real national income, x_{ij} is the second-stage demand for the i^{th} good supplied by the j^{th} exporting nation, g^{ij} is the second-stage Hicksian demand for the ij^{th} product, p_i is the index of m number of real export prices for the i^{th} good expressed in the *importing nation's currency*, p_{ij} is the real export price for the i^{th} commodity supplied by the j^{th} exporting nation, b_{ij} is a constant demand parameter associated with the demand for the ij^{th} product, and oi is the importing nation's constant elasticity of substitution associated with each product pair in the i^{th} market.

Other country-specific variables are included in COMGEM; Armington developed his general theory to capture any importing nation's (region's) demand for any particular product. These equations capture the linkage between an importing nation's monetary policies and such macroeconomic variables as its real gross national product, consumer price index and the real exchange rate between the importing nation and the U.S. (which

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[6]Notations denoting the identity of the importing nation and the period have been suppressed here for ease of exposition.

is influenced by changes in the real money supplies in both the U.S. and the importing nation as well as other financial variables). This specification permits analysis of changes in the importing nation's macroeconomic policies in COMGEM as well as U.S. macroeconomic policies (see Penson and Babula).

Modeling the farm economy

The general forms of the demand and supply equations for domestically-produced consumer goods and services as well as capital goods were described in the previous section. The purpose of this section is to provide further insight to the *sector level* equations for farm businesses. Some of these equations are definitional in nature; they sum together selected commodity level outcomes discussed in the *next* section. Others are behavioral in nature, reflecting events taking place in agriculture as well as the general economy.

Farm capital expenditures. The desired stock of specific categories of durable capital goods in agriculture (i.e., tractors, trucks, autos, other machinery, real estate improvements and breeding livestock) adopted in COMGEM are given by:

(26) $K_j^* = \beta_j(pX/c_j)^*$

where β_j is the partial production elasticity associated with the j^{th} input, pX^* is the expected revenue generated by another unit of capital and c_j^* is the expected implicit rental price of the j^{th} capital good. The desired expansion of the j^{th} durable capital good in period t would therefore be given by:

(27) $N_{jt}^* = \beta_j(pX/c_j)^* - K_{jt-i}$.

Penson, Romain and Hughes define the implicit rental price of capital adopted in COMGEM as follows:

(28) $c_j = [(q_j\rho)/(1 - F_j)][\alpha - i_c - i_\pi\{\delta/(\delta + \rho)\}]/(1 - i_\pi) + (Z - i_\pi r\psi)/(1 - i_\pi)$,

where

(29) $$F_j = \sum_{i=1}^{\infty} h_{ji}(1 + \rho)^{-i},$$

(30) $$1/(1 - F_j) = 1 + \sum_{t=1}^{\infty} (\partial R_{jt}/\partial K_j)(1 + \rho)^{-t},$$

(31) $$\delta/(\delta + \rho) = \sum_{t=1}^{\infty} \delta(1 - \delta)^{t-1}(1 + \rho)^{-t},$$

and where r is the real rate of interest on debt capital, ρ is the real after-tax opportunity rate of return on equity capital desired by farmers, q_j is the real price paid for the j^{th} capital good at the retail level, α is the proportion of the investment financed with equity capital, i_c is the investment tax credit rate, R_{jt} represents the real level of replacement investment required in period t, i_π is the income tax rate, δ represents the tax depreciation rate given by 2/n where n is the service life of the tractor, Z represents the value of the periodic loan payment (principal plus interest), ψ is the fraction of the purchase price financed with debt capital (i.e., $\psi = 1 - \alpha$), F_j is the present value of the stream of capacity depreciation associated with the j^{th} capital good, and h_{ji} is the fraction of the tractor's original productive capacity lost in the i^{th} year of its service life.

Equation (28) suggests that the implicit rental price of tractors will increase if their purchase price, the cost of debt and equity capital, capacity depreciation, or income tax rates increase. These effects will be offset to some extent by an increase in the investment tax credit rate and the deductibility of tax depreciation allowances and interest payments. The implicit rental price of tractors presented in equation (28) is a sharp contrast to the measures of the marginal factor cost specified in previous studies.

Farm production expenses. The demand equations for nondurable capital goods used to produce crops and livestock in COMGEM take much the same form adopted for durable capital goods expressed in equation (27). The major difference is in the specification of the implicit cost of durable versus nondurable capital goods. Several of the terms in equation (28) "drop out" of the implicit cost of nondurable goods adopted in COMGEM, including the present value of the stream of capacity depreciation (F_j) and the tax depreciation rate (δ).

Other significant features of equations addressing farm production expenses in COMGEM include the means by which interest expenses and depreciation are modeled. Interest expenses are modeled by accounting for both the average interest rates on real estate and non-real estate farm loans *and* the levels of these categories of farm debt outstanding. This requires an explicit modeling of the demand for farm debt capital. The demand and supply of farm debt capital is usually omitted in agricultural sector models. Depreciation expenses are modeled in COMGEM by accounting for stocks of durable capital goods, which is given in general form by a transformation of equation (27), as well as tax depreciation rates.

Net farm income. This closely watched statistic is modeled in COMGEM by subtracting farm production expenses from gross farm income. Gross farm income, in turn, is found by totaling cash receipts for individual crop and livestock commodities discussed later in this section as well as other sources of income, including direct government payments associated with program crops and livestock also described later in this section. While not included in net farm income, COMGEM also models off-farm income of farm operator families as well as farm household expenditures.

Balance sheet entries. In addition to modeling the income statement for the farm business sector as well as farm household income, COMGEM captures the factors influencing the values of physical assets on farms and the financial assets of farm businesses and households. The model also captures farm debt outstanding owed by farm operator families and nonoperator landlords. The demands for financial assets and farm debt by farm operator families are modeled based upon the general form expressed in equation (21). Stocks of durable capital goods on farms are influenced by capital expenditures captured in equation (27). Farm business and nonoperator demand for farm land and farm real estate prices specified by Hughes, Penson and Bednarz are adopted in COMGEM. The optimal quantity of a durable input such as land can be expressed in the following form:

$$(32) \quad K_{fl,FOF*} = \beta RE_{FOF}/(P_{fl}C)$$

where $K_{fl,FOF*}$ is the optimal quantity of land owned by farmers, β is the partial elasticity of production for land, RE_{FOF} is expected gross revenues from farm production, P_{fl} is the price of farm land, and C is the nonprice implicit rental cost of land, an adjusted marginal factor cost. Interest rates on debt enter into the demand for land through the rental cost (C), a complex function much like equation (28) where the cost of using a capital input was related to the price of the item, the required return on equity, the item's physical depreciation, income taxes, property taxes, debt financing decisions, and the interest rate on debt. The nonprice implicit rental cost reflects all of these factors except the price of the item. Since land does not depreciate and is not subject to investment tax credit, its *nonprice* implicit rental cost is significantly simplified and can be defined as follows:

$$(33) \quad C \equiv \rho \frac{[1 - \alpha + (1 - i_{\pi})\alpha U + \alpha V]}{(1 - t_{i\pi})}$$

where ρ is the required return on equity, α is the fraction of land purchased using debt financing, i_{π} is the tax rate on profits, U is the present value of the real interest payments on a loan of one dollar, and V is the present value of the real principal payments on a one dollar loan. Both U and V are discounted using the investor's required return on equity. The discounted present value of the loan, therefore, need not be equal to its starting principal balance.

Nonoperator landlord demand for land is assumed to be made on the basis of their desires to balance portfolios of assets and liabilities (Tobin, Penson). This means that their demand function can be expressed as follows:

(34) $K_{fl,NOL}{}^{d} = f(r_{land}, SOPA_{NOL}, SFA_{NOL}, SDT_{NOL}, Y_{NOL})$

where, $K_{fl,NOL}{}^{d}$ stands for the amount of farm land demanded, r_{land} is the total return on land ownership, $SOPA_{NOL}$ is a vector of other physical assets owned, SFA_{NOL} is a vector of the stocks of debt owed by nonoperator landlords and Y_{NOL} represents their current income.

Farm operator families, in addition to wanting land for production purposes, may also desire land as part of their portfolios. The demand for land by farmers is, therefore, a combination of equations (32) and (34), or

(35) $K_{fl,FOF}{}^{d} = f(RE_{FOF}/(P_{fl}C), SOPA_{FOF}, SFA_{FOF}, SDT_{FOF})$.

Farmers' demands for other assets and debt must also be simultaneously accounted for as discussed earlier.

The total supply of farm land is not fixed. Price increases for land can lead to land improvements, while price declines can lead to removal of farm land for other uses. It can be expected, therefore, that the supply of farm land in the United States has a small positive slope.

To complete the specification of the farm land equations, a supply function and a market clearing equation are needed. The supply of farm land is given by:

(36) $K_{fl}{}^{s} = f(P_{fl}, P_{lab}, P_{build})$

where $K_{fl}{}^{s}$ is the supply of farm land, P_{fl} is the price of farm land, P_{lab} is the wage rate for labor and P_{build} is the price of buildings; P_{lab} and P_{build} reflect the costs of transforming farm land to other uses or improving the quality of the land. The market clearing equation is therefore given by:

(37) $K_{fl}{}^{s} = K_{fl,FOF}{}^{d} + K_{fl,NOL}{}^{d}$.

The farm land market is thus expressed in four equations - numbers (34), (35), (36), and (37) above.

Because farmers purchase most of the farm land sold in the United States each year, it seems reasonable that the principal factors used in explaining changes in the price of farm land are those describing the economic conditions of farmers. Equation (32) was, therefore, solved for the price of farm land. In specifying equation (35), price thus became a function of the quantity of farm land owned by farmers, returns to farming, the nonprice components of the implicit rental cost of land, the stocks of other assets, and debts of farmers. The market clearing equation, equation (37), was eliminated by solving for the quantity of farm land owned by farm operators and then substituting the result into equation (35).

Modeling farm commodities

The COMGEM model explicitly captures commodity detail in the crop and livestock sectors of the U.S. farm economy. Specifically, eight major crops and four livestock elements are modeled. The major crops include food grains (wheat and rice), feed grains (corn, sorghum, oats and barley), cotton and soybeans. This choice of commodities to include in the model was based principally on the significance of their farm program provisions. The livestock sector is disaggregated into the beef, pork, broilers and dairy sectors.

This section presents the general forms of the commodity-specific relationships in COMGEM. Specific emphasis has been placed on illustrating the *policy transmission mechanisms* in these equations. All other variables are lumped together in a Z vector.

Acreage response and supply. The acreage response and supply functions in COMGEM reflect the potential impact of farm program policy instruments on producers' planting decisions. Based upon the microeconomic theory of the firm, there are several alternative ways of specifying structural econometric models of commodity sectors. These include (1) the production function and efficiency conditions approach, (2) the supply function approach, (3) the production and factor demand functions approach and (4) the revenue and cost function approach (Klein). COMGEM utilizes the revenue and cost function approach because it enables the establishment of a direct linkage between commodity policy and acreage response and supply.

The theoretical concept of implicit revenue adopted in COMGEM allows the model to incorporate a comprehensive set of policy instruments (both current and potential) with which to evaluate the interaction between producer behavior and government policy decisions (Chen, Penson and Teboh). The concept of implicit revenue in the model is reflected in the calculation of expected net returns per acre, which takes into account the following components: (1) cash receipts from farm marketings, (2) net loan receipts, (3) deficiency payments, (4) diversion payments, (5) disaster payments, (6) reserve storage payments, (7) value of grazing, (8) maintenance cost and income from acreage conservation and conserving use acres, (9) marketing loan benefits and (10) variable costs of production. Explicit evaluation of participation decisions is based upon the effects of these revenue and cost components. Program participation rates, in turn, affect planting decisions as well as total diverted acres and government costs.

The rate of participation in the acreage reduction program (ARP) in COMGEM is expressed as a behavioral relationship with the following variables:

(38) $P_{ARP} = f\{[E(RAVC_{ARP,PLD})/E(RAVC_{NARP,NPLD})], Z_{PARP}\}$

which says that participation in the acreage reduction program (P_{ARP}) is explained by the ratio of expected returns above variable cost from participation in the ARP and PLD program ($E(RAVC_{ARP,PLD})$) to expected returns from non-participation ($E(RAVC_{NARP,NPLD})$) and a vector of other factors that influence program participation (Z_{PARP}).

The rate of participation in the paid land diversion program (PLD) in the model is explained in part by the ratio of expected returns above variable costs from participation in both the ARP and PLD programs to expected returns from participation in the ARP only. The general functional form for this participation rate is:

(39) $P_{PLD} = f\{[E(RAVC_{ARP,PLD})/E(RAVC_{ARP,NPLD})],Z_{PLD}\}$

where the only variable not previously defined is Z_{PLD}, which represents a vector of other factors that influence the PLD participation decision.

The number of acres set aside under the acreage reduction program ($ACRES_{ARP}$), as well as the number of acres diverted under the PLD program ($ACRES_{PLD}$) are then explained in part by the rates of participation in the acreage reduction and paid land diversion programs, the announced ARP set-aside percentage (SARP), the announced paid land diversion percentage (SPLD) and the national base acreage (SNPA). The general functional forms for these two categories of diverted acres in COMGEM are as follows:

(40) $ACRES_{ARP} = f(P_{ARP},SARP,SNPA,Z_{ACARP})$

(41) $ACRES_{PLD} = f(P_{PLD},SPLD,SNPA,Z_{ACPLD})$

where Z_{ACARP} and Z_{ACPLD} represent vectors of other variables that influence the levels of these diverted acres.

Total planted acreage (AP) in COMGEM is expressed as a function of the national base acreage as well as the number of set-aside and diverted acres. The number of acres harvested (AH) is expressed as a function of planted acreage, among other factors. The general specifications for the acreage planted and acreage harvested equations adopted in COMGEM are as follows:

(42) $AP = f(SNPA,ACRES_{ARP},ACRES_{PLD},Z_{AP})$

(43) $AH = f(AP,Z_{AH})$

where Z_{AP} and Z_{AH} represent vectors of other variables that explain these acreages.

Finally, COMGEM defines total supply (TS) as the sum of current production as given by the product of acres harvested and yields per acre, total ending stocks (S_{total}), and imports (IMP). The arithmetical representation of the total supply identity is given by:

(44) $TS = (AH * SY) + S_{total} + IMP$.

Actual yields per acre (SY) in equation (44) are explained by the number of set-aside and diverted acres and variable cost of production (VC) deflated by the index of prices paid by farmers (IPP_{farm}), or:

(45) $SY = f(ACRES_{ARP}, ACRES_{PLD}, VC/IPP_{farm}, Z_{sy})$

where variable costs per acre for a specific crop are a function, in part, of the index of prices paid by farmers for production inputs (IPP_{farm}), expected yields per acre (E(SY)) and a vector of other variables (Z_{sy}). The functional form of this behavioral relationship is given by:

(46) $VC = f(IPP_{farm}, E(SY), Z_{VC})$

where Z_{VC} represents a vector of other variables that influence variable costs.

In summary, expected returns above variable costs per acre influence decisions regarding participation in acreage reduction and paid land diversion programs. These rates of program participation, in turn, affect the level of set-aside as well as diverted acres and, ultimately, the level of total planted acreage and acreage harvested. A similar analogy can be drawn for program livestock. Higher expected net returns associated with dairy programs would induce greater program participation, resulting in reduced supplies.

Commodity disappearance. Total domestic disappearance of crop commodities in COMGEM is typically disaggregated into the domestic demand for food (DU_{food}), the domestic demand for feed (DU_{feed}) and the domestic demand for seed (DU_{seed}). These components of total domestic demand are captured by behavioral relationships taking the following general functional forms:

(47) $DU_{food} = f(CYD, P_{food}, Z_{food})$

(48) $DU_{feed} = f(P_{LVSK}, PF_{own}, Z_{feed})$

(49) $DU_{seed} = f(PF_{own}, AP, Z_{seed})$

where CYD represents real consumer disposable income, P_{food} represents the real price of food, P_{LVSK} represents the real price of livestock and livestock products, PF_{own} represents the real market price, AP represents acres planted and Z_{food}, Z_{feed} and Z_{seed} represent vectors of other variables which influence domestic use for food, feed and seeds, respectively. Equations capturing export demand were specified earlier in equations (23) through (25).

Stocks and market price. CCC acquired inventories (S_{inv}) and the level of Farmer-Owned Reserve stocks (S_{for}) also represent behavioral relationships in COMGEM. The general functional forms for these two categories of stock demand are given by:

(50) $S_{inv} = f(S_{inv,t-1}, PL/PF_{own}, Z_{inv})$

(51) $S_{for} = f(RSVPAY, PLE/PF_{own}, Z_{for})$

where PL represents the adjusted CCC loan rate, RSVPAY represents reserve storage payments, PLE is the FOR entry price, and Z_{inv} and Z_{for} represent vectors of other variables that affect CCC loan stocks and FOR stocks, respectively.

The level of total stocks (S_{total}) is derived as the sum of CCC acquired inventories, FOR stocks and commercial stocks. The identities for both total stocks and commercial stocks are expressed as follows:

(52) $S_{comm} \equiv TS - DU_{total} - S_{inv} - S_{for} - EXP$

(53) $S_{total} \equiv S_{inv} + S_{for} + S_{comm}$,

where EXP represents total exports of the commodity.

The real farm level market price is hypothesized to be a function of the ratio of total stocks (S_{total}) to total domestic demand (DU_{total}) and a vector of other factors that might influence market price. The general functional form of the market price equation is as follows:

(54) $PF_{own} = f(S_{total}/DU_{total}, Z_{own})$

where S_{total} represents total stocks (i.e., the sum of CCC acquired inventories, FOR stocks and commercial stocks), DU_{total} represents total domestic utilization (i.e., the sum of DU_{food}, DU_{feed} and DU_{seed}) and Z_{own} represents other variables which affect the market price of the commodity.

Commodity program costs. Although agricultural commodity sector models have achieved greater accuracy in forecasting some of the crucial factors (e.g., acreage planted and domestic use) that determine the level of farm program costs in a given fiscal year, these costs are still difficult to forecast because of several unpredictable characteristics of current farm programs. These unpredictable characteristics include (1) provision of target price or complete income protection to participating farmers, which results in differing levels of deficiency payments, (2) provision of complete price protection to participating producers, which results in fluctuating levels of Commodity Credit Corporation (CCC) acquired inventories depending upon participating producers' price and yield expectations, and (3) the discretionary authority of the Secretary of Agriculture to announce or not announce certain program provisions in any year.

Government program costs for each program crop in COMGEM are disaggregated into deficiency payments, diversion payments, disaster payments and reserve storage payments. The functional form for deficiency payments is given by:

(55) $DEFPAY = f\{[PT - MAX(PL, PF_{own})] * SY_{PB} * (1 - P_{ARP} * SARP - P_{PLD} * SPLD) * SNPA\}$

where PT is the target price, PL is the adjusted loan rate, PF_{own} is the market price, SY_{PB} is the program payment yield, P_{ARP} and P_{PLD} represent the rates of participation in the acreage reduction and the paid land diversion programs, SARP is the announced acreage reduction program set-aside percentage, SPLD is the announced paid land diversion percentage and SNPA is the national base acreage.

Diversion payments (DIVPAY) are also modeled as a behavioral function. The functional form adopted in COMGEM is given by:

(56) $DIVPAY = f(ACRES_{PLD} * PPLD)$

where $ACRES_{PLD}$ represents diverted acres under this program and PPLD is the diversion payment rate.

Disaster payments (DISPAY) are not explicitly modeled in COMGEM. They are treated as an exogenous variable because they are most often influenced by non-economic factors which cannot be predicted with substantial accuracy. Disaster payments are defined as follows:

(57) $DISPAY \equiv (B_2 * SY_{PB}) * (B_3 * PT).$

where the coefficients B_2 and B_3 are assigned values of 0.75 and 0.33, respectively (see Glaser for provisions of the Food Security Act of 1985).

Reserve storage payments (RSVPAY) are defined in COMGEM as the product of the Farmer-Owned Reserve (FOR) storage payment rate (G_{store}) and FOR stocks (S_{for}), or:

(58) $RSVPAY \equiv G_{store} * S_{for}.$

Finally, total government payments for a specific crop in any crop year (TOTGCRY) are calculated in COMGEM using the following identity:

(59) $TOTGCRY \equiv DEFPAY + DIVPAY + DISPAY + RSVPAY.$

Reports provided by COMGEM

The model described in general terms in this section of the paper projects both economy-wide outcomes as well as sector-level outcomes. Not surprisingly, therefore, COMGEM provides a series of reports that reflect economy-wide aggregates as well as sector-level details. The various reports generated by the model *if requested* include:

- Nominal and real GNP, including its major components
- Nominal and real federal budgetary information on tax revenue, government expenditures and the budget deficit
- Nominal and real interest rates on a broad range of debt and equity financial instruments
- Implicit GNP price deflator and the components of the CPI, including food
- Balance sheets for farm businesses, farm operator families, nonfarm households, nonfarm businesses and financial intermediaries
- Commodity prices received, prices paid for specific production inputs and farm interest rates
- Detailed farm income statement which reports components of gross farm income and total production expenses as well as nominal and real net farm income
- Commodity balance sheets for major crops, which include information on carryin stocks, production, and imports as well as domestic use, exports and carryout stocks
- Detailed breakdown of government costs associated with farm programs by commodity
- Exports and market shares of corn, wheat and cotton for our major trading partners

General applicability of COMGEM

In the remaining section of this paper the results from simulating COMGEM under two alternative farm program policies are presented for farm sector variables only. To illustrate the broader applicability of this general equilibrium model of the U.S. economy, we would like to briefly identify other publications where the entire model was utilized to conduct multi-sector analyses of macroeconomic and farm program policies.

Five studies have been singled out for discussion here. The first is a study initially completed by Hughes and Penson in 1985 on the future financial conditions in the farm sector under alternative combinations of monetary and fiscal policy (see Hughes and Penson 1987). This study identified the role macroeconomic policy played in the deteriorating farm economy during the 1981-85 period and where existing policies would lead us to by 1990. Additional studies by Hughes, Penson, Richardson and Chen and by Knutson, et al. utilized COMGEM to identify macroeconomic and farm commodity policy responses to financial stress, including policy alternatives for modifying the 1985 Farm Bill. Penson (1985) used COMGEM to examine emerging trends in farm profitability in light of potential alternative macroeconomic policy combinations. Finally, Hopkin, et al. examined the transition taking place in agriculture and rural America utilizing the COMGEM model and what this meant for commercial banks and other financial intermediaries providing loan funds to agriculture. Each of these studies examined the effects of policy on agriculture in the context of the general economy's response to these policies, capturing both the direct *and* indirect effects of alternative policy choices. The reader is referred to these publications for a broader perspective on the potential usefulness of COMGEM.

III. Development of Baseline Scenario

The analytical framework of the COMGEM econometric model outlined above is particularly useful in examining ongoing policy issues and their potential impacts on the performance of the U.S. agricultural economy. In theory, policy evaluation with this model involves simulation of the complete model to ascertain the effects that alternative farm program provisions or assumptions about exogenous variables would have upon agricultural sector performance. In this study, however, the macroeconomic and international trade components of COMGEM have been exogenized for reasons discussed earlier.

Three scenarios are examined with COMGEM in the present study: (1) a baseline scenario, (2) an expanded conservation reserve program scenario, and (3) a reduced target price scenario. The baseline scenario will be used as a benchmark for evaluating the two alternative policy scenarios. It is important to note that these simulations were prepared in mid-June *before* the extent of severe drought in 1988 was known. All workshop participants were to ignore late weather information updates when developing their baseline scenario to facilitate model comparisons. In conducting these policy evaluations, we have chosen the immediate 5-year period from 1989 through 1993 as the simulation period.

Baseline scenario assumptions

A vast amount of data and information was required as input to the model in preparing the baseline scenario. Assumptions, including specific values of key policy parameters and interpretation of farm program provisions, were obtained through recent program announcements and previous policy research. These assumptions were designed reflect the most likely future policy directions.

Macroeconomic assumptions. Macroeconomic assumptions played an important role in projecting the baseline scenario in this study. Because of agriculture's increasing sensitivity to macroeconomic shocks, specifying assumptions for macroeconomic variables which have significant effects on the U. S. agricultural sector's performance has become a necessary first step. It has been well recognized that recent U.S. farm problems were due significantly to adverse general economic conditions, including a strong U.S. dollar and high real interest rates in the early 1980s. Our declining competitive position in agricultural trade, the substantial rise in farm interest payments as a component of total production expenses and the sharp decline in farm asset values and net worth were largely the consequences of macroeconomic disturbances. The macroeconomic environment influencing domestic and foreign agricultural economies has been improving steadily in recent years, however, due to the recovery of world economies and more accommodative U.S. fiscal and monetary policies.

Several key aggregate economic variables were used in developing the baseline scenario, including the real rate of growth in GNP, the rate of inflation, the real interest rate, the real exchange rate, the level of the federal budget deficit and the rate of growth in the U.S. monetary base. Projections of these variables showed some fundamental strength over the 1989-93 period. However, only modest gains in macroeconomic conditions were expected.

Specifically, the real rate of growth in GNP ranged from 2 to 3 percent through 1993. The rate of inflation as measured by the implicit GNP price deflator was expected to average about 3-4 percent while the real prime interest rates would approach the 5-6 percent level. Although declining materially, the federal budget deficit was projected to remain relatively high; $176 billion in 1988 and $112 billion by 1993. WEFA's projections also showed a gradual tightening of U.S. monetary policy, with annual growth of the U.S. monetary base averaging 7.6 percent in 1988 and 5.7 percent by 1993.

On the international side, the recovery of foreign economies together with projected declines in the value of U.S. dollar set the scene for a rebound in demand for U.S. agricultural products from the stagnation of the early-1980s. While these improvements are expected to enhance U.S. competitive trade position, the transition of U.S. agricultural policy to market-oriented farm programs as mandated by the 1985 Food Security Act should also help stimulate agricultural market prospects.

Agricultural policy parameters. The key policy assumption in the baseline scenario was that the 1985 Act would continue to operate in its present form after the current legislation expires in 1990, and that the current farm program would be extended to the simulation period through the 1993 crop year. A series of policy parameters required for program operations were incorporated, including price supports, income supplements and acreage control provisions for various crops. These policy parameters were determined initially in accordance with the 1985 Food Security Act but were later revised by the budget compromise adjustments under the Agricultural Reconciliation Act of December 1987. The 1987 amendment demonstrates an important shift in the direction of agricultural policy toward lower price and income supports, and a gradual reduction of government costs over the 5-year simulation period.

The budget compromise legislation set target prices for major program commodities through 1990. For the 1991-1993 period, we assumed that target prices would continue to fall at a modest annual rate. Assumptions for seven major crops (wheat, rice, cotton, corn, sorghum, oats and barley) used in the baseline reflect a broad-base reduction of target prices from the original levels mandated by the 1985 Act. Target prices for wheat and corn over the 5-year period were assumed to drop steadily, from $4.23 and $2.93 per bushel in 1988 to $3.76 and $2.59 in 1993, respectively. For the marketing loan program commodities such as cotton and rice, target prices were assumed to drop for both crops by 9.3 percent reduction between 1988 and 1993.

The budget compromise legislation had very little impact on loan rate adjustments. Conceptually, lower loan rates would enhance international competition and export sales. They would also cause greater deficiency payments and higher government program costs. For this reason, we assumed loan rates will remain at or near the minimum levels permitted by the 1985 Act. In the simulation period, wheat loan rates were assumed to drop first, from $2.21 per bushel in 1988 to $1.95 in 1990, and then rebound to average above $2.20 per bushel in 1992 and 1993. A continuous modest reduction in the corn loan rate was assumed, dropping from $1.77 per bushel in 1988 to $1.50 per bushel by 1993. For soybeans and the marketing loan program crops, loan rates over the 1990-93 period were set at the minimum allowable levels; $4.50 per pound for soybeans, $.50 per pound for cotton, and $6.50 per bushel for rice.

The 1985 Act provides the Secretary of Agriculture with discretionary power to adjust acreage control parameters within a flexible set of policy guidelines. Implementation of the acreage control policy involves not only the choice of the alternative policy options under the acreage reduction program (ARP), paid land diversion program (PLD) and conservation reserve program (CRP), but also decisions on the level of program instruments which determine set-aside percentages and base acres for program participation.

The baseline scenario assumed that the ARP and PLD program options would be heavily utilized to reduce excessive stocks in 1988 and 1989. For the later period, however, we expected an important shift in acreage control policy toward more reliance on the conservation reserve program and less uses of the traditional policy options of ARP and PLD to achieve acreage control goals. Determination of the ARP and PLD set-aside percentage rates required projection of commodity stocks and supply-demand conditions. Given the normal weather assumption incorporated in the baseline scenario, ending carry-over stocks for most program commodities would remain excessively large in 1988 and 1989. In accordance with acreage control guidelines mandated by the 1985 Act, set-aside levels for ARP would have to be high, in most cases at maximum levels. Therefore, it was assumed that the ARP set-aside rates for wheat, rice and corn in 1988 would be 27.5 percent, 25 percent and 20 percent, respectively. The early program announcement for a 10 percent ARP set-aside rate for wheat in 1989 was incorporated in to the baseline scenario. Cotton and rice ARP rates were projected to remain at 12.5 percent and 25 percent, respectively. It was further assumed that the ARP rate for corn, sorghum grains and barley in 1989 would be 20 percent, while the rate for oats would 5 percent.

The baseline scenario assumed the conservation reserve program would reach its maximum target of removing 45 million acres of erodible cropland from production by the end of 1990. With the CRP fully operational and the projected carry-over stocks working down to normal levels, a substantial reduction in the use of ARP and PLD programs was expected. The baseline scenario therefore reflects substantially lower set-aside rates under the acreage reduction program in 1993, ranging from 5 percent for wheat, cotton and oats, 10 percent for corn, sorghum and barley, and 20 percent for rice in 1993. We also assumed that the PLD program will not be in effect for all commodities after 1990.

To incorporate the 45 million acres CRP assumption in the baseline scenario, we needed assumptions for three sets of exogenous variables: (1) allocation of the CRP base acres by commodity and by year, (2) allocation of the reduced CRP acres into the complying base, non-complying base and non-base acres, and (3) projections of rental costs per acre to allow for adjustments to changes in farm commodity price and asset valuation. Through a ten-year contract, the assumed reduction of cropland is expected to cover the entire 1989-93 period.

The annual distribution of program base acreage for six major crops were provided by the USDA to participating modelers. We also used official estimates of CRP establishment and rental costs per acre to determine government program costs. Detailed assumptions of conservation reserve program acres for six program crops (wheat, cotton, corn, sorghum, oats and barley) are summarized in Appendix Table A-1. In 1988, a total of 17.2 million conservation reserve program acres were projected for these six crops; the total CRP acres were expected to reach 27.7 million acres by 1990. These six crops, together with soybeans and other CRP acres, reflected the assumption that a total of 45 million acres would be enrolled in the program by 1990.

Baseline scenario results

For the purpose of this study, policy evaluation is based on comparing specific aggregate performance measures associated with the baseline simulation results to those associated with the two alternative policy simulations for the expanded conservation reserve program scenario and the reduced target price scenario. Key economic variables selected for policy evaluation in this study include the program participation rates, supply, demand, prices and incomes for individual commodities and all commodities taken together. Also selected for presentation are aggregate measures of government costs, consumer surplus, producer surplus and foreign surplus. The annual average values of these aggregate performance measures for the baseline scenario are presented in Table 3. More detailed annual results are presented in the Appendix (see Appendix Table B-1 through Table B-12) as well as in figures 2 through 11 appearing in Section IV.

TABLE 3
SIMULATION EXPERIMENTS
10 % REDUCTION IN TARGET PRICES (RTP)
20 MILLION-ACRE EXPANSION OF CONSERVATION RESERVE PROGRAM (CRP)
(DEVIATIONS FROM BASELINE)*

	BASELINE 1989-93 (Average)
Cash Receipts (Billion $)	
Crop	62.36
Livestock	62.27
Production Cost (Billion $)	119.52
Government Payments (Billion $)	8.0
Net Farm Income (Billion $)	29.77
Asset Value Index (1987 = 100)	96.14
Total Government Cost (Billion $)	9.42
Value of Exports (Billion $)	14.48
Output Price Index	
Crop (1987 = 100) ...	101.69
Livestock (1987 = 100)	83.29
Input Price Index (1987 = 100)	101.22
Acreage Planted (Million acres)	261.31
Acres Idled**	
ARP and PLD (Million acres)	14.8
CRP (Million acres)	26.6
Acreage Equivalent of Stocks (Million acres)	68.04
Crop Yield Index (1987 = 100)	107.42

* Estimated annual impact, reported in constant 1987 dollars. All effects are <u>changes</u> from a baseline.
** Seven major crops only.

A combination of the relatively low set-aside rates and the low target prices over the 1989-93 simulation period is expected to cut producers' net returns above costs associated with program participation. With the expected reduction in program benefits, participation rates are projected to be substantially lower than in earlier years. The baseline projections indicate participation rates in the ARP program to average below 70 percent for wheat and feed grains over the 5-year period. Benefitting from the marketing loan program, cotton and rice producers are expected to be active program participants, with participation rates ranging from 81 percent for cotton to 77 percent for rice, respectively (see Appendix Table B-1).

Planted acreage for the eight major crops is projected at 246.5 million acres in 1988, then increase steadily to 266.9 million acres by 1993, a sizable 20.4 million acre gain in five years (see Figure 2). As shown in Table 3, the average planted acreage to these crops over the 1989-93 period would be 261.31 million acres. Crop yields per acre follow a long-term rising trend, with the crop yield index (1987=100) rising from 103 in 1988 to 109.5 by 1993 (see Figure 3). This crop yield index would average 107.42 over the 1989-93 period as shown in Table 3. The projected yields were estimated individually for each crop and then weighted by the harvested acres. These projections represent a moderate rate of crop yield growth, taking into account impacts of offsetting effects of technological gains and planted acreage expansion.

Total idled acreage has long been an useful policy parameter guiding government policy decisions on acreage control. Adoption of a policy with diminishing use of the traditional acreage reduction program (ARP) and paid land diversion (PLD) programs and greater reliance on conservation reserve program (CRP) would lead to a modest reduction in total idled acreage. Total U.S. cropland removed from production under the ARP, PLD and CRP programs for seven crops as shown in Table 3 to average 41.4 million acres over the 5-year period. A total of 35.0 million acres of idled acreage were expected for 1993, a significant 10.5 million acres reduction from the 1988 level (see Figure 4).

Cropland removed under the ARP and PLD programs for seven crops would average 14.8 million acres over the 1989-93 period (Table 3), dropping from 38.3 million acres in 1988 to 7.3 million acres by 1993. This contrasts with the increase expected for conservation reserve program acres for six major crops, which is projected to rise sharply from the current level of 17.2 million acres to reach a maximum of 27.7 million acres in 1990. Total CRP acreage during the 1991-93 period would remain at this maximum level of 27.7 million acres, which when combined with 17.3 million CRP acres for other crops, reach the targeted total of 45 million acres mandated by the 1985 Act.

Total carry-over stocks for seven major crops measured by the harvested acreage equivalent unit would average 68.04 million over the 1989-93 period (Table 3), falling from 72.9 million acres in 1988 to 66.3 million acres in 1990 (Figure 5). Following this two-year downward adjustment, stocks are expected to hold at the level slightly below 70 million acres in later years. These projected stocks, however, would be sufficiently large as to depress farm commodity prices for most of the years. Corn stocks would be sharply lower during the period, declining from the existing burdensome level of 28.62 million acres to 16.1 million by the end of 1993 crop year (see Appendix Table B-5). Wheat stocks, on the other hand are expected to rise, while stocks for cotton and soybean show little change between 1988 and 1993.

As world market prospects improve and U.S. dollar value depreciates, growth in volume of U.S. agricultural export would resume. Prices for most export commodities, however, would remain at relatively low levels, reflecting the effects of market-oriented trade policy and reduced domestic price support for the years ahead. The net exports for eight major crops would average $14.48 billion over the 1989-93 period (Table 3), and exhibit a relatively flat trend (Appendix Table B-6).

Critical to policy evaluation is the baseline simulation results for farm prices and farm income. A continuation of the 1985 Act, along with the budget compromise amendment and an increasing use of conservation reserve program for acreage reduction, would improve market prospects. Even with favorable demand conditions in domestic and international markets, excess capacity and large stocks are projected to continue to dampen farm price and income.

Nominal prices for major crops are expected to increase and follow a modest upturn, but real crop prices would fall steadily in the simulation period. As shown in Figure 6, the baseline scenario suggest that the aggregate crop price index in 1987 dollars would first increase from the 1988 level of 105.7 to 106.3 in 1989, and then decline steadily, reaching 98.7 by 1993. Table 3 shows the real crop price index would average 101.69 over the 1989-93 period. The baseline scenario also suggests a generally sluggish livestock price trend, declining significantly in early years in response to cyclical expansion of livestock output (Figure 7). Beginning in 1990, the livestock prices recover from the cyclical low and increase appreciably by the end of the simulation period.

The baseline scenario also points to a generally sluggish farm income trend through 1993. The annual projections of total cash receipts, production expenses and net farm income shown in Figures 8, 9 and 10 help disaggregate the 1989-93 average real net farm income of $29.77 reported in Table 3. Farm cash receipts are expected to average $62 billion over the five year simulation period for both crops and livestock. These projections reflect a largely stable trend in cash receipts for crops over the 1989-93 period, with annual crop receipts ranging between $61.4 and $63.8 billion (Appendix Table B-9). However, a significant eroding of cash receipts for livestock over time is projected, falling from $71.4 billion in 1988 to $57.9 billion by 1993 (Appendix Table B-9). These projections incorporated the assumption of normal weather conditions as well as a generally weakening price trend and a cyclical expansion of livestock output during the period. Total production costs are expected to be relatively stable, declining steadily from a peak of $121.2 billion in 1989 to $118.8 billion by 1993 (Figure 9). In addition to the prospect of lower production costs, another positive factor supporting net farm income is the relative increase in nonmoney and other sources of farm income. The effects of these projections point to a steady downtrend in net farm incomes over the evaluation period, falling from $43 billion in 1988 to $24.7 billion in 1993 (Figure 10).

Government program payments in the baseline scenario are projected to be substantially reduced, reflecting lower target prices and a significant reduction of deficiency, diversion, storage and other program costs. From 1988 through 1993, total government payments are projected to fall from $13.4 billion to $5.6 billion, a sizable reduction of $7.8 billion in five years (Figure 11).

IV. Alternative Policy Scenario Analyses

An expanded conservation reserve program, one of two alternative policy scenarios examined in this study, calls for a 20 million acres increase in conservation reserve acres, from the maximum of 45 million acres to 65 million acres. The second alternative policy scenario calls for a 10 percent across-the-board reduction in the target prices for all program crops. These two policy scenarios represent important modifications to current farm program provisions; both have recently been frequently discussed as possible modifications to the 1985 Food Security Act. This section begins with a discussion of the design for both scenarios. The results of both scenarios are then compared to the baseline scenario.

Expanded CRP scenario design

In developing the expanded conservation reserve program (CRP) scenario information on the latest sign-up reports, projections of base acres distribution, and assumptions on government establishment and rental costs was used to formulate the initial conditions. The legislative goal of the CRP is to enroll 45 million acres of highly erodible cropland by 1990 as mandated by the Food Security Act of 1985. The latest sign-up reports indicated that the 45 million CRP acreage target would be attainable. Total eligible cropland available for CRP was estimated at 70 million acres when eligibility is adjusted by the 25 percent county cropland restriction. With the increase of 20 million acres assumed in the expanded CRP scenario, a total of 65 million acres would be enrolled by the end of 1990. Through a ten-year contract, the 65 million CRP acres would continue in effect through the end of the 1989-93 period covered in this study. In the early stages of its implementation, the performance of the CRP has been particularly sensitive to the eligibility criteria, bid pool size, base acres allocation among crops and by regions. We assumed no further changes are made in eligibility criteria and bid pool size.

In designing this simulation experiment, it is useful to review the multiple program goals and objectives to determine performance evaluation of the CRP. Among the seven stated objectives (Reichelderfer and Boggess), only two of them have direct implications for this study; production controls and income support. Most of the other program objectives (e.g., water and wind erosion, water quality and other resource conservation objectives) were not considered.

In selecting the policy parameters and performance measures for the expanded CRP scenario, we followed the same procedures used to develop the baseline scenario. Three sets of exogenous variables were projected for simulation: (1) allocation of the 20 million additional CRP acres to each commodity for every year, (2) allocation of the increased CRP acres into the complying base acres, non-complying base acres, and non-base acres for the program crops and (3) projections of rental costs per acre adjusted by changes in farm commodity prices and asset valuation. The assumptions incorporated in the expanded CRP scenario were identical with the baseline scenario with the exception of the exogenous variables described above. Detailed assumptions for these policy instruments and other exogenous variables are summarized in Appendix Table A-1. The increase in CRP acres was assumed to reflect distribution proportional to the enrollment pattern associated with program base acreage. Assumptions about government rental costs per acre were designed to incorporate the effect of higher prices generated by increased acreage in the CRP.

It was assumed that the 20 million acres of additional cropland would be enrolled in CRP by 1990 and would continue in effect through the simulation period. Approximately 12.7 million acres of additional cropland would be removed from production, of which 7.9 million acres are associated with six program crops (wheat, cotton, corn, sorghum, oats and barley), and 4.8 million acres are associated with soybeans and other cropland (Appendix Table A-1). As shown in Table 4, the expanded CRP scenario assumed the CRP acreage for six crops would average 37.1 million acres over the 1989-93 period, up 10.5

TABLE 4
SIMULATION EXPERIMENTS
10 % REDUCTION IN TARGET PRICES (RTP)
20 MILLION-ACRE EXPANSION OF CONSERVATION RESERVE PROGRAM (CRP)
(DEVIATIONS FROM BASELINE)*

	BASELINE 1989-93 (Average)	RTP 1989-93 (Average)	CRP 1989-93 (Average)
Cash Receipts (Billion $)			
Crop	62.36	-0.112	+0.458
Livestock	62.27	-0.134	+0.538
Production Cost (Billion $)	119.52	+0.384	+0.184
Government Payments (Billion $)	8.0	-2.366	-0.266
Net Farm Income (Billion $)	29.77	-3.020	+0.742
Crop Consumers' Surplus (Billion $)	NA	+0.052	-0.285
Livestock Consumers' Surplus (Billion $)	NA	+0.105	-0.420
Foreign Surplus (Billion $)	NA	+0.118	-0.302
Asset Value Index (1987 = 100)	96.14	-1.768	+0.804
Total Government Cost (Billion $)	9.42	-2.066	-0.752
Value of Exports (Billion $)	14.48	+0.114	-0.291
Output Price Index			
Crop (1987 = 100) ...	101.69	-0.448	+2.252
Livestock (1987 = 100)	83.29	-0.368	+1.484
Input Price Index (1987 = 100)	101.22	-0.172	+0.220
Acreage Planted (Million acres)	261.31	+1.748	-9.198
Acres Idled**			
ARP and PLD (Million acres)	14.8	-2.79	-7.20
CRP (Million acres)	26.6	0.0	+10.5
Acreage Equivalent of Stocks (Million acres)	68.04	+0.252	-3.857
Crop Yield Index (1987 = 100)	107.42	-0.208	+0.220

* Estimated annual impact, reported in constant 1987 dollars. All effects are <u>changes</u> from a baseline.

** Seven major crops only.

million acres from the baseline scenario. The expanded CRP scenario shows projected acres for the major crops ranging from 16.1 million acres for wheat, 7.9 million acres for corn and 4.4 million acres for sorghum grains.

Government costs for the CRP program are endogenously determined in the model by relating rental rates to CRP acreage. Reflecting the effects of price changes on rental costs per acre, the per acre rental costs for the expanded CRP scenario were projected at $60.10 per acre, a 7 percent increase over the baseline scenario.

Reduced target price scenario design

Government program cost has been a sensitive policy issue in recent farm legislation. Given the current state of the federal budget deficit and pressures for government spending reduction, alterative policy options are being sought to cut farm program costs. This concern should not only address the approach taken to reduce program costs, but also on the impacts these changes will have on agricultural sector performance. The responsiveness of the quantity supplied and demanded, prices and incomes to such cost reduction policy is crucial to evaluating this policy proposal.

Target price reductions have long been considered a direct and effective approach for significantly reducing farm program expenditures. However, the impacts of lowering target prices in line with the budget compromise legislation has been viewed as not being large enough to significantly to reduce government program costs. In developing the baseline scenario, it was assumed that annual target prices are reduced by approximately 10 percent through the end of the 1990/91 crop year as called for under the 1985 Act, and would continue to fall by 2 percent thereafter. In the reduced target price scenario, we assume an *additional* 10 percent reduction in target prices is enacted over the from the 1989-93 period. This represents an annual across-the-board reduction for every program commodities. The target price reduction was assumed to be effective beginning with 1989 crop year; no phasing-in period was considered in implementing this policy.

The baseline policy scenario reflected assumptions for a complete set of commodity program instruments such as target prices, loan rates, loan repayment rates, and ARP and PLD percentages for each program commodity. The assumed target price levels used in the RTP scenario are listed and compared with the baseline scenario in Appendix Table A-2. As a result of this additional 10 reduction, target prices would be reduced to $3.38, $2.33 and $2.20 levels for wheat, corn and sorghum grains by the 1993 crop year, respectively. The target price for rice was assured to reach $9.43 per cwt by 1993 while the target price for cotton would reach 64.1 cents per pound by 1993. These values represent a sharp drop from existing levels.

All other program instruments incorporated in the RTP scenario were maintained at the same levels assumed in the baseline scenario. Loan rates for all program commodities were assumed to remain at the baseline levels (see Appendix Table A-2). The soybean loan rate was assumed to remain at $4.50 per bushel over the 1989-1993 period, which disregards the spirit of cutting costs for the other program crops.

Comparison of alternative policy options

The aggregate effects of these two policy options over the 5-year simulation period presented at the AAEA Workshop are summarized in Table 4. Comparisons of more detailed consequences of these three policy scenarios can be found in Appendix Tables B-1 through B-12 and in Figures 2 through 11 presented throughout the remainder of this section.

The performance indicators chosen for policy evaluation as discussed previously include policy transmission variables as well as specific broad-based performance measures. The former demonstrates the importance of policy transmission mechanism for farm program analysis while the latter takes into account the ability of policy to achieve specific program goals. Based on the concept implicit revenue, the effects of policy changes can be traced through major policy transmission channels outlined earlier in equations (38) and (39). For the purpose of this study, our discussions focus upon two components: individual producer's supply response and aggregate impact on government program costs.

Acreage response and yields. The conceptual framework for acreage response in

Figure 2: Acreage Planted

8 Major Crops

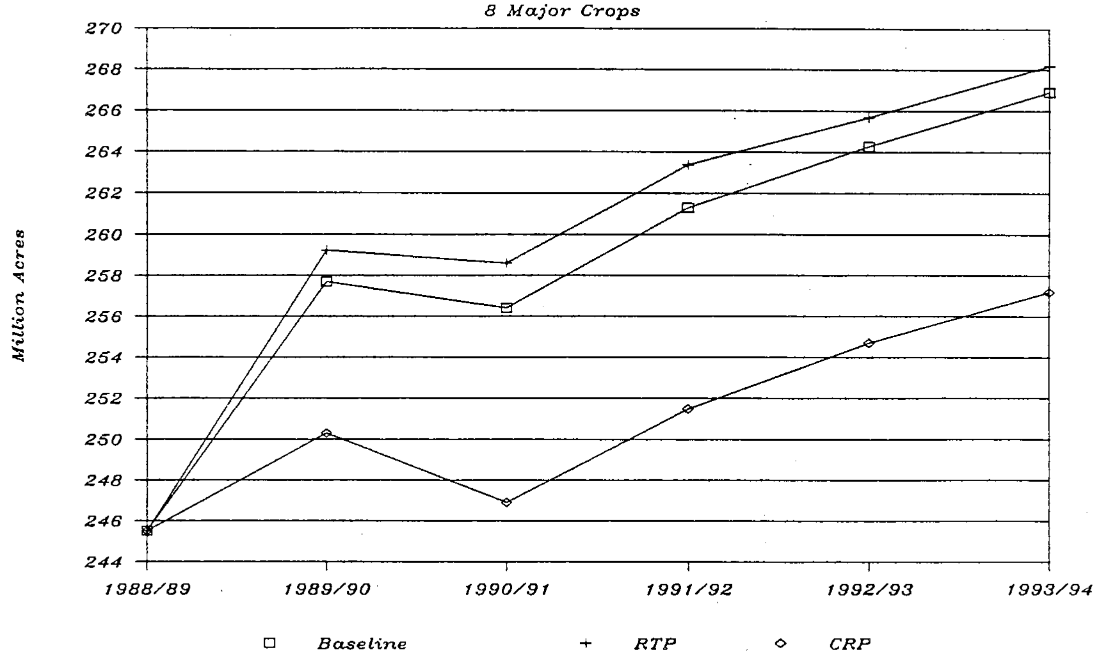
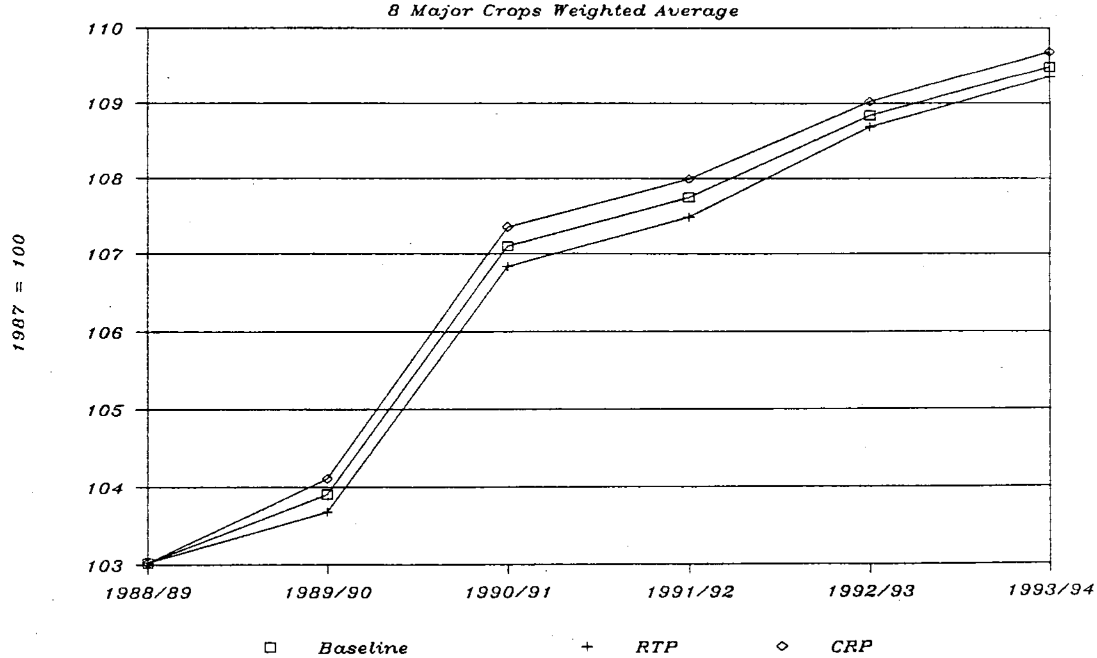


Figure 3: Crop Yield Index

8 Major Crops Weighted Average



the model, outlined earlier in equations (38) through (42) provides the means to analyze the impact of the expanded conservation reserve (CRP) and the reduced target price (RTP) policy options on acreage response for program crops. In the baseline scenario, total planted acreage for eight major crops averaged about 261 million acres over the 1989-93 period, while the idled acreage for seven crops (excluding soybeans from the eight crops for planted acreage) are projected to average 41.4 million acres over this 5-year period, including 14.8 million for ARP and PLD and 26.6 million for CRP acres (Table 4).

Under the CRP scenario, a significant increase in crop prices from the baseline scenario is expected due to reduced output and a tightening of supply conditions. The increase in crop prices would reduce government program payments and cut expected revenues for program participants relative to the expected returns for non-participants. This would lead to a significant reduction in participation rates in ARP and PLD programs. With a 20 million acres increase in CRP enrollment, a reduction of about 14 million effective base acres and 5-6 percent lower ARP participation rates is projected over the simulation period.

The impact of a 20 million acres increase in the CRP acreage would reduce planted acres by 9.918 million acres, and idled cropland by 7.2 million acres for the ARP and PLD program crops (Table 4). The reduction of planted acreage would be 7.4 million acres in 1989, and 9.7 million in 1993 crop year (Figure 2). Reflecting the expected cutback in planted acreage for major crops and removal of marginal land from production, the crop yield index would rise slightly over the period (Figure 3). As shown in Table 4, the crop yield index under the CRP scenario would average 107.64 in 1989-93 period, up 0.22 from the baseline scenario.

An assessment of the effects on acreage response to a 10 percent reduction in target prices, indicate that target price cutbacks of this magnitude would reduce expected net returns per acre for ARP participants. Based upon producers' behavioral response relationships, participation in the ARP would decline significantly, resulting in a reduction of set-aside acres over the simulation period. Much of the reduction of program acreage would shift out of the program and result in a significant expansion of planting from non-program acres. The net effect is that total planted acres would increase by 1.75 million acres, leading to an average total plantings of 263.1 million acres over the 5 year period (Table 4).

As target prices are reduced by 10 percent, program participation would decrease by 7-8 percent for major crops over the five year simulation period. As producers drop out of the acreage reduction program, the complying base acreage would fall and non complying base acreage would rise. A consequence of fewer acres set-aside is that more acres are planted, leading to a reduction in yields for major program crops. The crop yield index (1987 = 100) under the reduced target price scenario would average at 107.2 level over the 1989-93 period (Table 4), registering a modest 0.21 decline over the simulation period (Figure 3). The net impact of increasing plantings and reducing yields would be a modest expansion of crop production from the baseline projection.

Idled cropland and inventory stocks. The expanded CRP policy option would lead to an increase in total idled cropland and a substantial reduction in carry-over stocks for major crops. Total idled cropland as measured by the program acres removed from crop production under the three acreage control programs (ARP, PLD and CRP) for seven crops are expected to reach a total of 44.7 million acres under the expanded CRP scenario, up 3.3 million acres from the projected baseline level (Table 4 and Figure 4).

The impact of the expanded CRP policy option can be evaluated by examining changes in the composition of idled acres under the conventional ARP and PLD acreage control programs as well as under an expanded CRP program. An increase of 20 million CRP acres would result in 10.5 million additional CRP program acres and a 7.2 million acre reduction in acres idled under the ARP and PLD programs (Table 4). The results suggest an important shift in acreage control policy and less slippage under the examined CRP policy option.

The expanded CRP policy option would significantly reduce the inventory stocks of program crops. This scenario indicates that the acreage equivalent of stocks would average some 3.9 million acreage equivalents below the baseline scenario over 1989-93

Figure 4: Total Acres Idled

7 Crops for ARP, PLD and CRP

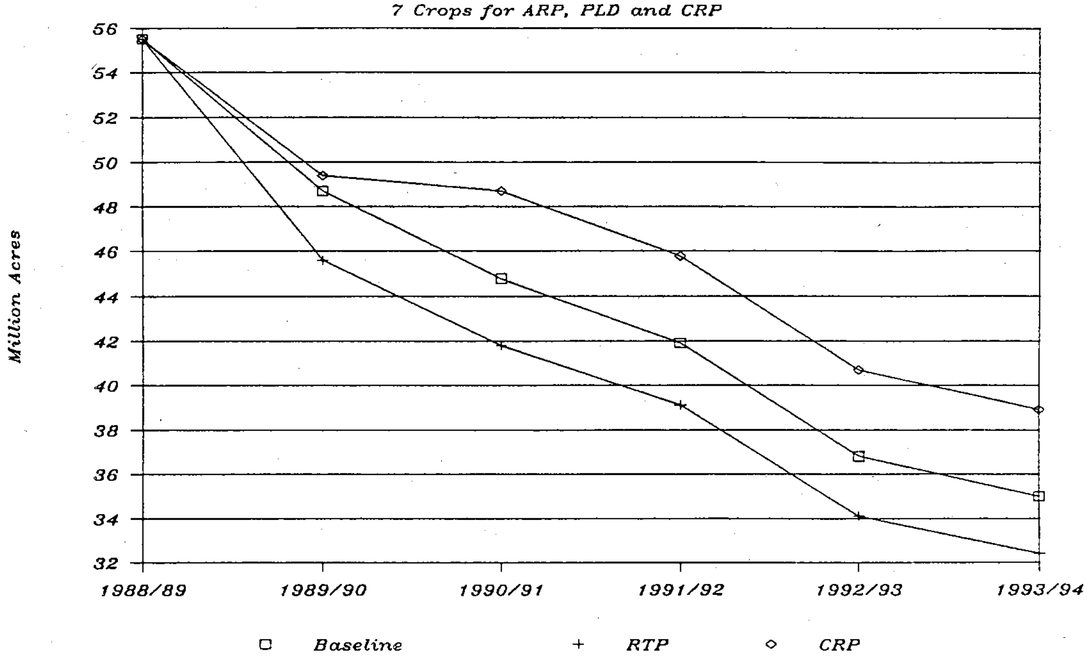
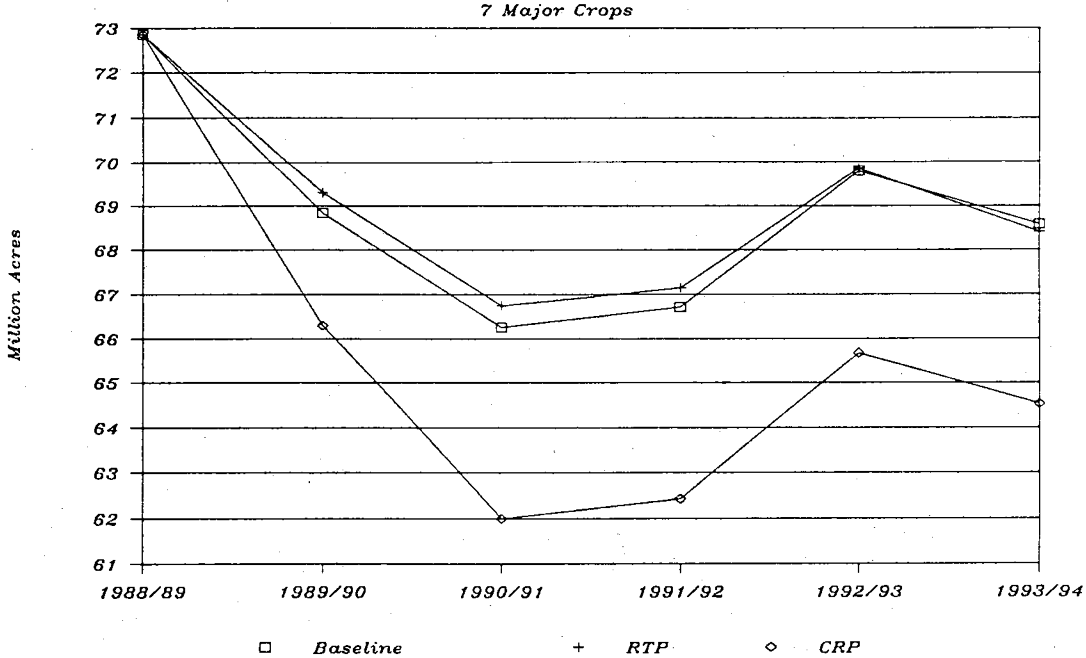


Figure 5: Acreage Equivalent of Stocks

7 Major Crops



period (Table 4). By the end of 1993 crop year, the stocks would be reduced by 4.1 million acreage equivalents below the baseline scenario (Figure 5).

A 10 percent reduction in target prices has a much smaller impact on idled acreage and inventory stocks projections over the 1989-93 period than the expanded CRP scenario. A modest decrease in ARP and PLD idled acres and slight increase in planted acres reflects the effects of lower target prices on program participation rates (Table 4).

The reduced target price scenario does not result in a significant change in inventory stocks for crops. The acreage equivalent of stocks would average 68.29 million acres over the 1989-93 period, only slightly higher than the baseline scenario projection of 68.04 million acres (Table 4). This increase can be traced to the effect of declining program participation rates in the ARP and PLD programs, a modest increase in plantings of non-program acres and a modest expansion of crop production.

Crop and livestock prices. Supply control and income support were assumed to be the only two specific policy goals of the expanded conservation reserve program to be evaluated in this study. Through the addition of 20 million additional CRP acres, the objective is to expand idled cropland sufficiently to reduce crop output. Under this policy option, a reduction in planted acreage and crop output would result in substantially higher farm commodity prices for crops. The price index for all crops shows a significant gain of 2.25 points above the baseline scenario 5-year average of 101.7 (Table 4). Stronger price impacts are found in the latter years; the crop price index would be 3.1 points higher than the baseline scenario projection of 98.65 in 1993 (Figure 6).

The CRP scenario also points to higher livestock prices than those projected under the baseline scenario, up 1.5 points from the 5-year average of 83.29 observed under the baseline scenario (Table 4). The baseline scenario projected livestock prices to be generally sluggish over the 1989-93 period due to the expected cyclical output expansion in the early years. The impact of higher crop prices under the expanded CRP scenario would cause some small supply adjustments in the livestock sector and result in price

Figure 6: Crop Output Price Index

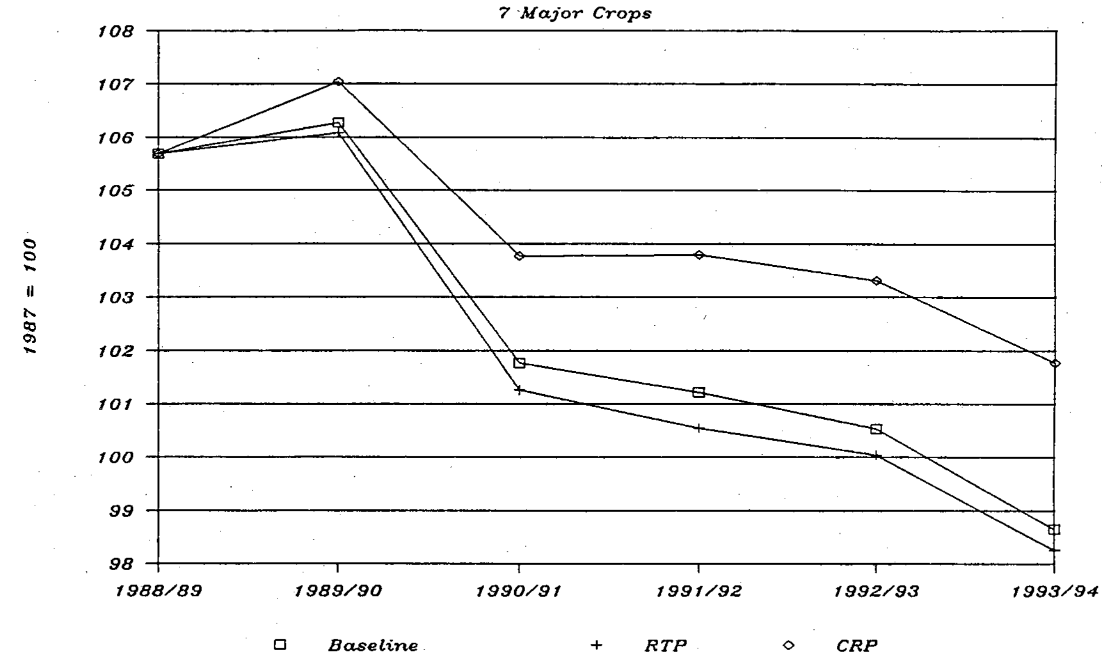
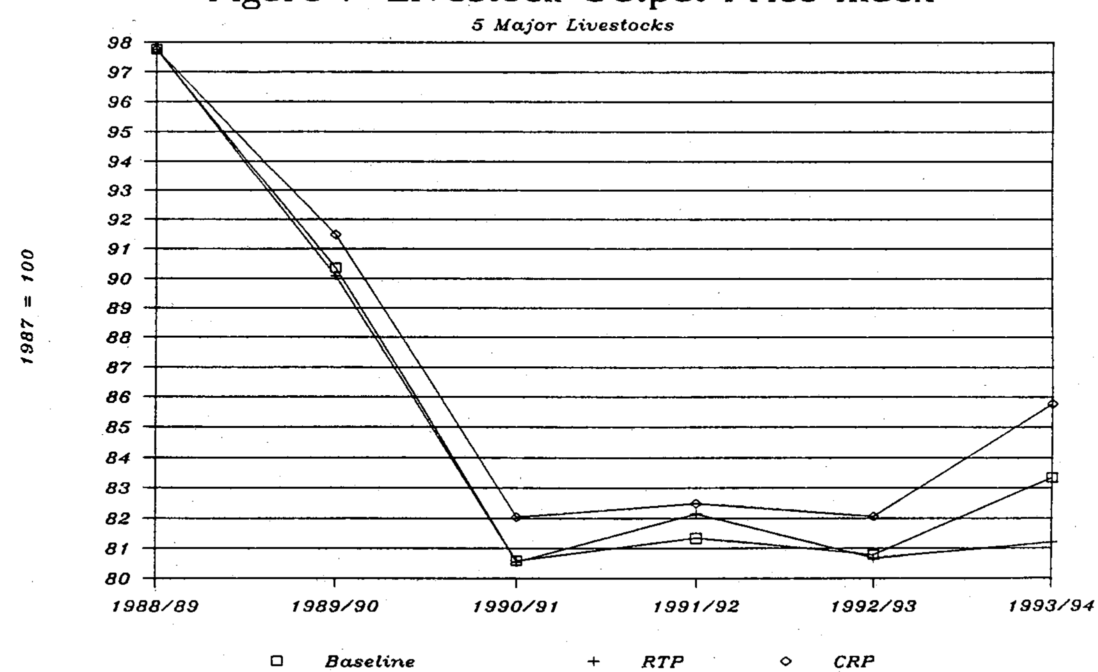


Figure 7: Livestock Output Price Index



gains over the baseline scenario. The gain in livestock prices would not be significant, however, because of the generally weak price trend projected under the baseline scenario and only a modest impact of the crop price upturn under the expanded CRP scenario (Figure 7).

The impact of an additional 10 percent reduction in target prices over the 1989-93 period would result in an increase in planted acres for the major crops. A modest expansion of crop output is projected in spite of the effects of a reduction in crop yields of 0.2 points under this policy scenario. The increased supply would lower crop prices by 0.4 points below baseline scenario levels (Table 4 and Figure 6.)

There would be a slight decline in price index for livestock from the values projected under the baseline scenario, some 0.37 points below the baseline scenario's 5-year average of 101.2. Largely reflecting the effect of lower crop prices, livestock and poultry prices would be affected only slightly due the input price changes and prospective supply adjustments (Figure 7).

Cash receipts and farm income. Results from the expanded CRP scenario indicate that higher commodity prices for crops and livestock would lead to increases in crop and livestock cash receipts, showing average gains over the 1989-93 period of $0.46 and $0.54 billion, respectively (Table 4). Significant higher crop prices (2.3 points) and livestock prices (1.5 points) over baseline scenario levels would more than offset the effects of slightly lower crop and livestock output (Table 4).

Production costs are increased under the expanded CRP scenario, registering a slight increase of $0.18 billion over the 5-year average level of $119.5 billion projected under the baseline scenario (Table 4). The projected increase of $1 billion in total cash receipts and a moderate increase of $0.18 billion in total production costs results in an increase in net farm income above the baseline scenario 5-year average of $29.77 billion to $30.6 billion (Table 4). Annual trends for these three variables are presented in Figures 8, 9, and 10. Significant losses in the 5-year average consumer surplus for crops and livestock are found under this scenario, amounting to $0.29 and

Figure 8: Total Cash Receipts

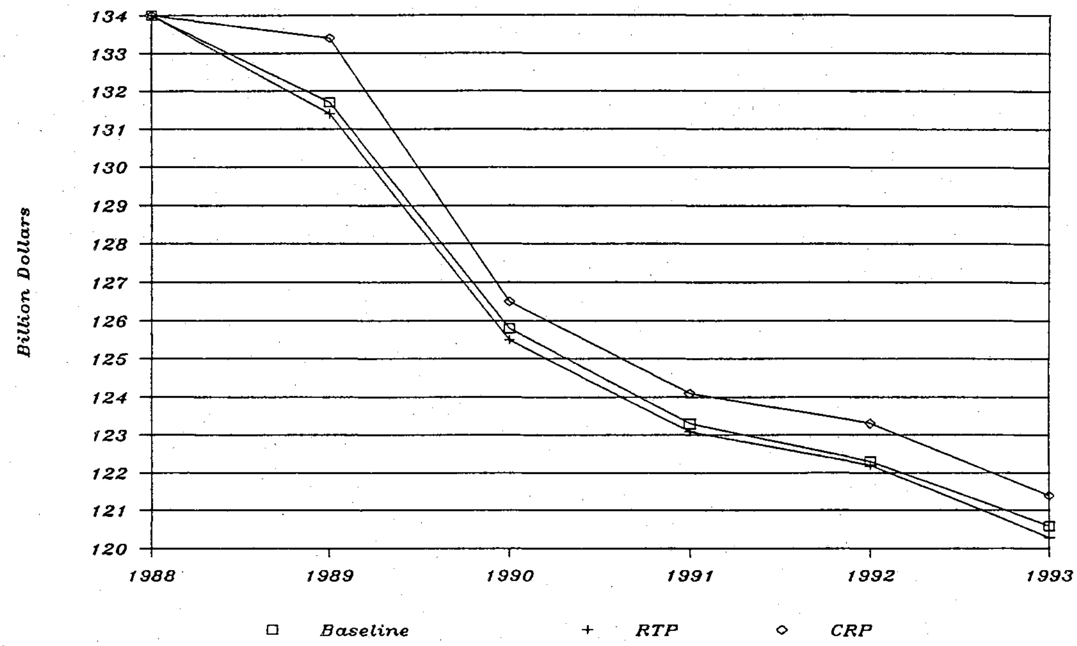
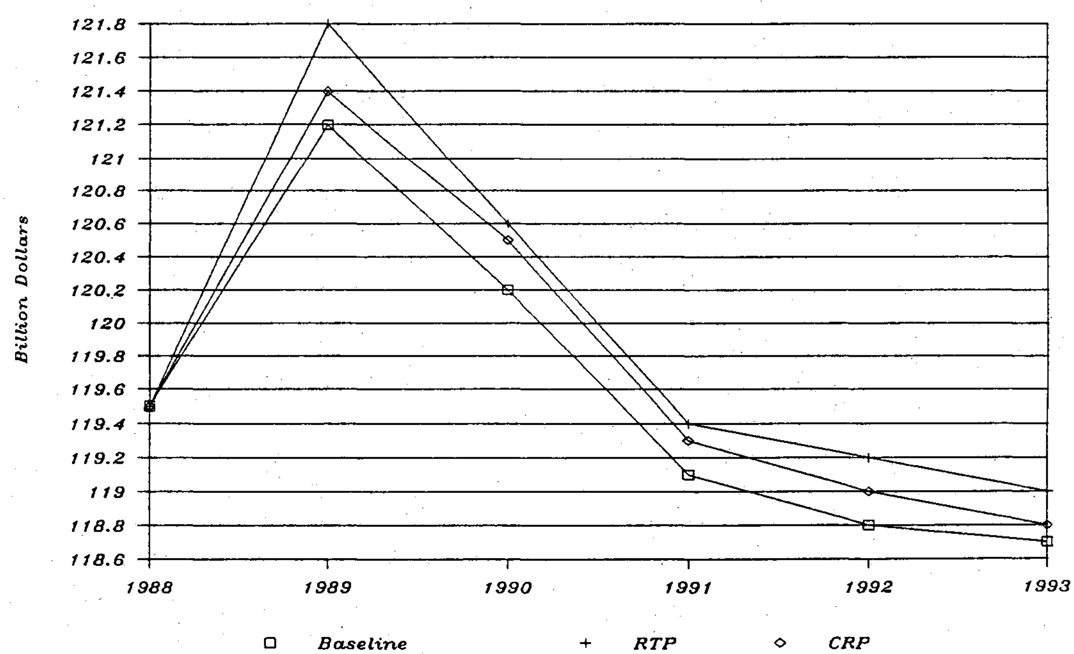


Figure 9: Production Costs



$0.42 billion, respectively (Table 4). This policy option would also reduce both the value of exports (-$0.29 billion) and foreign surplus (-$0.42 billion) below baseline scenario levels (Table 4).

Cash receipts from farm marketings of crops and livestock under the target price reduction scenario are projected to decline below baseline scenario 5-year averages by $0.11 and $0.13 billion, respectively (Table 4). The projected declines in crop and livestock prices more than offset the increases in crop and livestock output, causing the slight decrease in cash incomes.

The reduction in target prices would result in a substantial reduction in deficiency payments, causing total government payments to decline below the baseline scenario 5-year annual average of $8 billion by $2.4 billion. Production costs under the RTP scenario would show little change from the baseline scenario, causing net farm income over the 5-year period to average $3.02 billion below the baseline scenario (Table 4). Farm asset values would average 1.77 points below the baseline scenario projection of 94.14 over the simulation period (Table 4). Consumer surplus for crops and livestock would increase slightly, as would the value of exports and foreign surplus (Table 4).

<u>Government payments and government cost</u>. Under the expanded CRP scenario, program payments and total government cost would fall below the baseline scenario 5-year annual averages by $0.27 and $0.75 billion, respectively (Table 4). A factor contributing to the projected decline in program costs is higher crop prices, which would lead to a substantial cutback in deficiency payments. This payment reduction would be more than offset by the cost of a 20-million acre expansion of conservation reserve acres. Further reductions in total government costs would result from cost savings associated with maintaining CCC storage and loan activity. The savings of CCC loan program costs is attributable to the significant reduction in stocks.

The RTP scenario also indicates that government payments and total government costs would decline from baseline scenario levels by $2.37 and $2.07 billion,

Figure 10: Net Farm Income

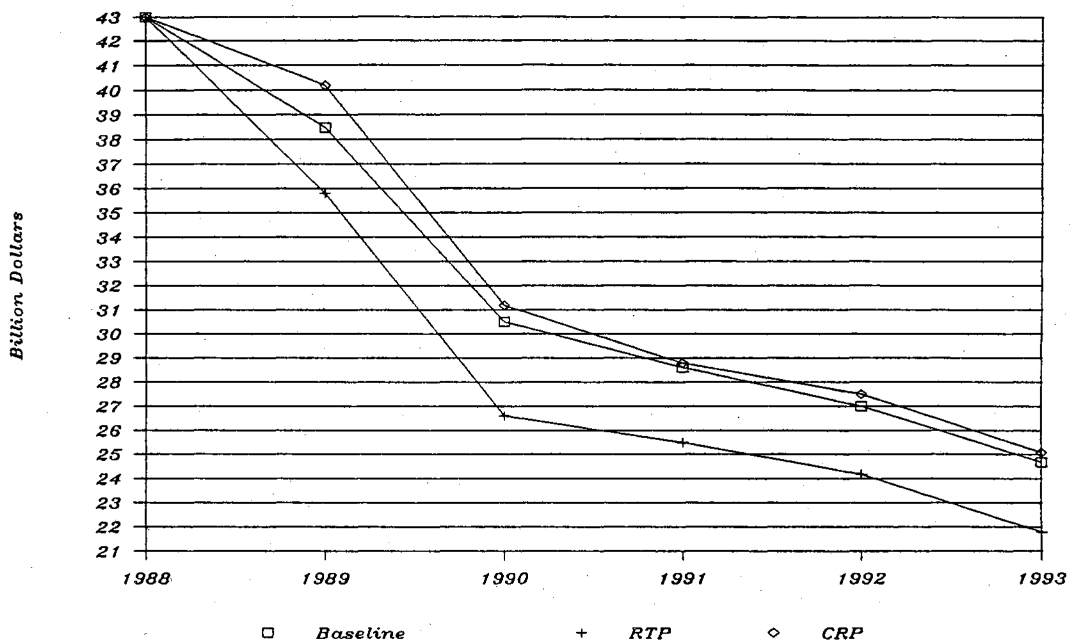
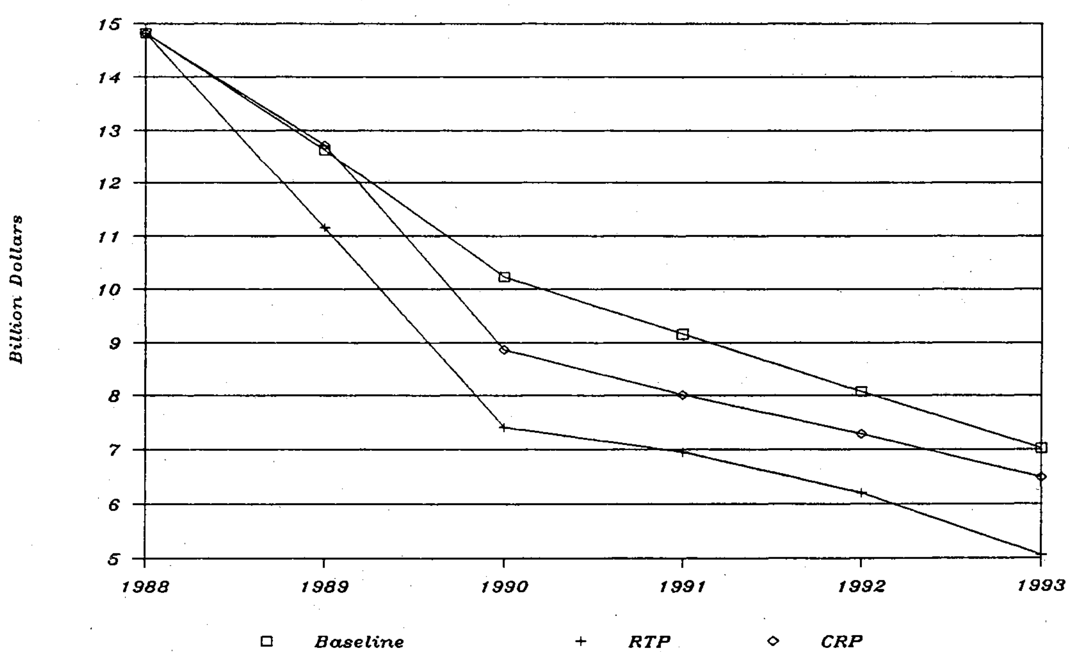


Figure 11: Total Government Costs



respectively (Table 4). Under this scenario, the reduction in total government cost is less than the expected savings in government program payments, reflecting in part the sight increase in CCC inventory stocks resulting from the projected increase in stocks.

V. Conclusions

COMGEM represents an annual econometric model of the U.S. economy, with endogenized international trade linkages, that places particular emphasis on agriculture. The model captures the interface between agriculture and the general economy through the interaction of demand and supply forces in farm input markets, farm product markets, farm credit markets and farm real estate markets, among others. It's general equilibrium framework allows for annual feedback between agriculture and the general economy in a fully simultaneous fashion.

The model is designed to address a broad range of macroeconomic and farm program policy issues. By capturing the linkages between agriculture and both national and international financial markets, COMGEM is capable of addressing the effects of changes in domestic and foreign macroeconomic policies. By capturing the linkages between farm program policy instruments, farm supply response and the cost of government programs, COMGEM is capable of addressing the effects of changes in domestic farm programs. Two such changes were examined in this study: (1) expansion of the Conservation Reserve Program by 20 million acres and (2) reducing target prices for program crops by 10 percent.

Expansion of Conservation Reserve Program acres and subsequent declines in participation in the ARP and PLD programs would lead to a substantial reduction in crop production and surplus stocks for major crops over the 5-year period covered in this study. The simulation results indicate the effectiveness of the conservation reserve program in achieving supply control policy objectives, and simultaneously accomplishing the goals for farm prices and incomes. Although the expanded Conservation Reserve Program would result in additional costs for program implementation, a substantial reduction in government deficiency payments and Commodity Credit Corporation storage and other expenses would more than offset the direct costs. As a result, total government costs under the expanded Conservation Reserve Program would yield an annual cost average saving of $.75 billion.

Reducing target prices an additional 10 percent achieves the objective of lowering farm program costs, some $2 billion annually. Such a policy would reduce expected net returns associated program participation, leading to a sizable reduction in program participation rates and an expansion in planted acreage and crop output. Farm prices would decrease marginally in response to increased production and higher inventory stocks. Lower farm prices would reduce net farm income for crop producers and thus reduce asset values. Livestock producers' income would be modestly lower under this policy option.

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Appendix A

Assumptions for Policy Analyses

TABLE A.1
EXPANDED CONSERVATION RESERVE PROGRAM (CRP) SIMULATION
POLICY INSTRUMENTS AND OTHER ASSUMPTIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
CONSERVATION RESERVE PROGRAM ACRES (Mil)							
BASELINE							
WHEAT..............	8.2	10.4	12.5	12.5	12.5	12.5	12.1
RICE...............	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTTON.............	1.0	1.4	1.7	1.7	1.7	1.7	1.6
CORN...............	2.9	4.3	5.7	5.7	5.7	5.7	5.5
SORGHUM............	2.0	2.6	3.1	3.1	3.1	3.1	3.0
OATS...............	0.9	1.2	1.5	1.5	1.5	1.5	1.4
BARLEY.............	2.1	2.6	3.1	3.1	3.1	3.1	3.0
7 CROPS..............	17.2	22.4	27.7	27.7	27.7	27.7	26.6
OTHERS...............	10.7	15.1	17.3	17.3	17.3	17.3	16.6
ALL CROPS............	27.9	37.5	45.0	45.0	45.0	45.0	43.2
CRP SIMULATION							
WHEAT..............	8.2	13.0	16.9	16.9	16.9	16.9	16.1
RICE...............	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTTON.............	1.0	2.0	2.4	2.4	2.4	2.4	2.3
CORN...............	2.9	6.2	8.3	8.3	8.3	8.3	7.9
SORGHUM............	2.0	3.7	4.5	4.5	4.5	4.5	4.4
OATS...............	0.9	1.7	2.2	2.2	2.2	2.2	2.1
BARLEY.............	2.1	3.8	4.5	4.5	4.5	4.5	4.3
7 CROPS..............	17.2	30.3	38.8	38.8	38.8	38.8	37.1
OTHERS...............	10.7	19.9	26.2	26.2	26.2	26.2	24.7
ALL CROPS............	27.9	50.2	65.0	65.0	65.0	65.0	61.8
CRP SIMULATION CHANGE FROM BASE							
7 CROPS............	0.0	7.9	11.1	11.1	11.1	11.1	10.4
OTHERS.............	0.0	4.8	8.9	8.9	8.9	8.9	8.1
ALL CROPS..........	0.0	12.7	20.0	20.0	20.0	20.0	18.5
CRP RENTAL COST ($/Acre)							
BASELINE..............	48.5	56.1	56.2	56.2	56.2	56.2	56.2
CRP SIMULATION........	48.5	60.0	60.2	60.2	60.2	60.2	60.1
CHANGE FROM BASE......	0.0	3.9	3.9	3.9	3.9	3.9	3.9
PERCENT CHANGE (%)....	0.0	7.0	7.0	7.0	7.0	7.0	7.0

* 1988-90 baseline CRP acres by year and by crop and US average rental cost per acre are ERS/USDA projections (Re: Table 3 and 5, Reichelderfer Memo of February 11, 1988, to Participating Modelers)

TABLE A.2
10% REDUCED TARGET PRICE (RTP) SIMULATION
POLICY INSTRUMENTS AND OTHER ASSUMPTIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
TARGET PRICE ($/bushel)							
BASELINE							
WHEAT	$4.23	$4.10	$4.00	$3.92	$3.84	$3.76	$3.92
RICE ($/cwt)	11.15	10.80	10.71	10.50	10.29	10.08	10.48
COTTON (cent/lb)	75.92	73.46	72.90	71.40	70.00	68.60	71.27
CORN	2.93	2.84	2.75	2.70	2.64	2.59	2.70
SORGHUM	2.78	2.70	2.61	2.55	2.50	2.45	2.56
OATS	1.55	1.50	1.44	1.41	1.38	1.36	1.42
BARLEY	2.51	2.43	2.35	2.30	2.26	2.21	2.31
RTP SIMULATION							
WHEAT	4.23	3.69	3.60	3.53	3.46	3.38	3.53
RICE ($/cwt)	11.15	9.72	9.64	9.45	9.26	9.07	9.43
COTTON (cent/lb)	75.92	66.11	65.61	64.26	63.00	61.74	64.14
CORN	2.93	2.56	2.47	2.43	2.38	2.33	2.43
SORGHUM	2.78	2.43	2.35	2.29	2.25	2.20	2.31
OATS	1.55	1.35	1.30	1.27	1.24	1.22	1.28
BARLEY	2.51	2.19	2.11	2.07	2.03	1.99	2.08
7 CROPS							
CHANGE FROM BASE (%)	0%	-10%	-10%	-10%	-10%	-10%	-10%
LOAN RATE ($/bushel)							
BASELINE							
WHEAT	2.21	2.06	1.95	2.10	2.22	2.27	2.12
RICE ($/cwt)	6.63	6.50	6.50	6.50	6.50	6.50	6.50
COTTON (cent/lb)	51.80	51.79	50.00	50.00	50.00	50.00	50.36
CORN	1.77	1.65	1.56	1.49	1.47	1.50	1.53
SORGHUM	1.68	1.56	1.48	1.41	1.42	1.50	1.47
OATS	0.90	0.86	0.82	0.91	0.96	0.96	0.90
BARLEY	1.44	1.35	1.29	1.32	1.40	1.43	1.36
SOYBEAN	4.53	4.50	4.50	4.50	4.50	4.50	4.50
ARP PERCENTAGE (%)							
BASELINE							
WHEAT	27.5	10.0	10.0	10.0	5.0	5.0	8.0
RICE	25.0	25.0	25.0	20.0	20.0	20.0	22.0
COTTON	12.5	12.5	12.5	10.0	10.0	5.0	10.0
CORN	20.0	20.0	20.0	10.0	10.0	10.0	14.0
SORGHUM	20.0	20.0	20.0	10.0	10.0	10.0	14.0
OATS	5.0	5.0	5.0	5.0	5.0	5.0	5.0
BARLEY	20.0	20.0	20.0	10.0	10.0	10.0	14.0

* 1988-90 baseline projections reflect budget compromise adjustments made under the Agricultural Reconciliation Act of 1987, announced by the Secretary of Agriculture in late December 1987

Appendix B

Selected Results from Policy Analyses

TABLE B.1
ACREAGE REDUCTION PROGRAM (ARP) AND PAID LAND DIVERSION (PLD) PARTICIPATION RATES
BASELINE, CRP AND RTP SIMULATIONS

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
PROGRAM PARTICIPATION RATE /ARP (%)							
BASELINE							
WHEAT	77.0	65.0	72.0	70.0	73.0	68.0	69.6
RICE	86.0	87.0	84.0	80.0	78.0	76.0	81.0
COTTON	80.0	81.0	88.0	75.0	72.0	68.0	76.8
CORN	78.1	68.3	69.8	74.0	67.4	68.6	69.6
SORGHUM	72.7	70.6	68.8	68.7	68.3	68.3	68.9
OATS	39.4	34.4	29.4	24.4	19.4	14.4	24.4
BARLEY	73.0	67.3	64.6	63.6	61.6	59.6	63.3
CRP SIMULATION CHANGE FROM BASE							
WHEAT	0.0	-3.1	-5.3	-6.0	-6.7	-5.7	-5.3
RICE	0.0	-4.1	-6.1	-6.8	-7.2	-6.3	-6.1
COTTON	0.0	3.2	-6.3	-5.6	-6.2	-5.1	-4.0
CORN	0.0	-3.2	-5.1	-6.3	-6.2	-5.7	-5.3
SORGHUM	0.0	-3.4	-5.0	-5.8	-6.3	-5.7	-5.2
OATS	0.0	-1.6	-2.1	-2.1	-1.8	-1.2	-1.8
BARLEY	0.0	-3.2	-4.7	-5.4	-5.7	-5.0	-4.8
RTP SIMULATION CHANGE FROM BASE							
WHEAT	-0.0	-6.3	-7.0	-7.1	-8.0	-7.5	-7.2
RICE	0.0	-8.4	-8.1	-8.1	-8.5	-8.4	-8.3
COTTON	0.0	0.0	-8.3	-6.9	-7.2	-6.2	-5.7
CORN	0.0	-6.6	-6.8	-7.5	-7.3	-7.6	-7.2
SORGHUM	0.0	-6.8	-6.7	-7.0	-7.4	-7.6	-7.1
OATS	0.0	-3.3	-2.9	-2.5	-2.1	-1.6	-2.5
BARLEY	0.0	-6.5	-6.3	-6.5	-6.7	-6.6	-6.5
PROGRAM PARTICIPATION RATE /PLD (%)							
BASELINE							
WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RICE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORN	75.4	65.6	0.0	0.0	0.0	0.0	13.1
SORGHUM	70.4	68.3	0.0	0.0	0.0	0.0	13.7
OATS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BARLEY	70.6	64.9	0.0	0.0	0.0	0.0	13.0

TABLE B.2
PLANTED ACREAGE FOR 8 MAJOR CROPS
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
ACREAGE PLANTED							
8 CROP TOTAL (Mil Acre)							
BASELINE............	245.5	257.7	256.4	261.3	264.3	266.9	261.3
CRP SIMULATION.......	245.5	250.3	246.9	251.5	254.7	257.2	252.1
CHANGE FROM BASE	0.0	-7.4	-9.5	-9.7	-9.6	-9.7	-9.2
% CHANGE FROM BASE	0.0	-2.9	-3.7	-3.7	-3.6	-3.6	-3.5
RTP SIMULATION.......	245.5	259.2	258.6	263.4	265.7	268.2	263.1
CHANGE FROM BASE	-0.0	1.5	2.2	2.2	1.4	1.3	1.7
% CHANGE FROM BASE	-0.0	0.6	0.9	0.8	0.5	0.5	0.7
ACREAGE PLANTED BY CROP							
(Mil Acres)							
CRP SIMULATION							
CHANGE FROM BASE							
WHEAT..............	0.0	-2.0	-2.8	-2.8	-2.8	-2.8	-2.6
RICE...............	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
COTTON.............	0.0	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4
CORN...............	0.0	-2.0	-2.6	-2.8	-2.7	-2.8	-2.6
SORGHUM............	0.0	-0.3	-0.4	-0.5	-0.4	-0.5	-0.4
OATS...............	0.0	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5
BARLEY.............	0.0	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
SOYBEANS...........	0.0	-1.9	-2.3	-2.3	-2.3	-2.3	-2.2
RTP SIMULATION							
CHANGE FROM BASE							
WHEAT..............	0.0	0.5	0.6	0.6	0.3	0.3	0.5
RICE...............	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTTON.............	0.0	0.0	0.2	0.1	0.2	0.1	0.1
CORN...............	0.0	0.4	0.6	0.6	0.4	0.4	0.5
SORGHUM............	0.0	0.1	0.1	0.1	0.1	0.1	0.1
OATS...............	0.0	0.1	0.1	0.1	0.1	0.1	0.1
BARLEY.............	0.0	0.1	0.1	0.1	0.1	0.1	0.1
SOYBEANS...........	0.0	0.4	0.5	0.5	0.3	0.3	0.4

*Planted acreage for 8 major crops (wheat, rice, cotton, corn, sorghum, oats, barley and soybeans).

TABLE B.3
IDLED ACREAGE FOR 7 MAJOR CROPS
BASELINE, CRP AND RTP SIMULATIONS *
ARP, PLD AND CRP ACRES

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
ACREAGE IDLED							
7 CROPS TOTAL (Mil.)							
BASELINE							
ARP & PLD..........	38.3	26.3	17.1	14.2	9.1	7.3	14.8
CRP................	17.2	22.4	27.7	27.7	27.7	27.7	26.6
ARP, PLD & CRP.....	55.5	48.7	44.8	41.9	36.8	35.0	41.4
CRP SIMULATION							
ARP & PLD..........	38.3	19.1	9.9	7.0	1.9	0.1	7.6
CRP................	17.2	30.3	38.8	38.8	38.8	38.8	37.1
ARP, PLD & CRP.....	55.5	49.4	48.7	45.8	40.7	38.9	44.7
RTP SIMULATION							
ARP & PLD..........	38.3	23.2	14.1	11.4	6.4	4.7	12.0
CRP................	17.2	22.4	27.7	27.7	27.7	27.7	26.6
ARP, PLD & CRP.....	55.5	45.6	41.8	39.1	34.1	32.4	38.6
ACREAGE PLANTED & IDLED							
TOTAL (Mil Acre)*							
BASELINE............	301.0	306.4	301.2	303.2	301.1	301.9	302.7
CRP SIMULATION.......	301.0	299.7	295.6	297.3	295.4	296.1	296.8
RTP SIMULATION.......	301.0	304.8	300.4	302.5	299.8	300.6	301.7
ACREAGE REDUCTION							
PROGRAM (ARP) ACRES							
BASELINE (Mil Acres)							
WHEAT.............	17.3	5.9	5.6	5.4	2.7	2.6	4.4
RICE..............	0.9	0.9	0.9	0.8	0.8	0.8	0.8
COTTON............	1.4	1.5	1.5	1.1	1.2	0.6	1.2
CORN..............	10.4	10.5	5.6	5.1	2.6	2.4	5.2
SORGHUM...........	2.3	2.2	2.0	1.0	1.0	0.5	1.3
OATS..............	0.2	0.2	0.1	0.1	0.1	0.1	0.1
BARLEY............	1.8	1.5	1.4	0.7	0.7	0.3	0.9
7 CROPS TOTAL.........	34.3	22.7	17.1	14.2	9.1	7.3	14.1

*Planted acreage for 8 major crops (wheat, rice, cotton, corn, sorhgum, oats, barley and soybeans) and idled acreage for 7 major crops (wheat, rice, cotton, corn, sorghum, oats and barley).

TABLE 8.4
CROP YIELDS PER ACRE
BASELINE, CRP AND RTP SIMULATIONS

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
CROP YIELD INDEX * (1987 = 100)							
8 CROP WEIGHTED AVERAGE							
BASELINE............	103.03	103.91	107.10	107.75	108.84	109.49	107.42
CRP SIMULATION.......	103.03	104.11	107.36	108.00	109.03	109.69	107.64
CHANGE FROM BASE.....	0.00	0.20	0.26	0.25	0.19	0.20	0.22
RTP SIMULATION.......	103.03	103.68	106.84	107.49	108.69	109.35	107.21
CHANGE FROM BASE.....	0.00	-0.23	-0.26	-0.26	-0.15	-0.14	-0.21
WEIGHT FACTOR: HARVESTED ACRES BY CROP(1987=100)							
BASELINE							
WHEAT.............	99.5	114.3	113.4	113.2	118.3	116.1	115.1
RICE..............	121.5	122.3	123.6	125.8	127.5	128.8	125.6
COTTON............	103.3	105.5	102.7	107.3	110.0	110.9	107.3
CORN..............	102.0	103.5	105.6	111.5	111.5	114.5	109.3
SORGHUM...........	96.2	92.5	95.3	106.6	104.7	109.4	101.7
OATS..............	114.5	108.7	104.3	104.3	98.6	94.2	102.0
BARLEY............	101.0	98.0	97.0	103.0	101.0	104.0	100.6
SOYBEANS..........	107.4	112.2	109.2	107.1	110.8	109.2	109.7
CROP YIELD INDEX BY CROP (1987 = 100)							
CRP SIMULATION							
WHEAT.............	103.6	102.7	105.5	106.8	107.7	108.8	106.3
RICE..............	101.0	102.2	103.3	104.3	105.3	106.3	104.3
COTTON............	91.8	91.7	94.5	96.4	98.1	99.8	96.1
CORN..............	97.3	97.9	98.7	99.3	100.8	101.8	99.7
SORGHUM...........	96.4	97.2	96.0	95.0	96.1	96.3	96.1
OATS..............	105.6	107.0	108.0	109.1	109.9	111.1	109.0
BARLEY............	101.3	103.0	104.4	105.6	106.6	107.6	105.5
SOYBEANS..........	98.2	98.5	99.6	100.8	101.7	102.6	100.6
RTP SIMULATION							
WHEAT.............	103.6	102.7	105.5	106.8	107.7	108.8	106.3
RICE..............	101.0	101.8	102.8	103.8	105.0	106.0	103.9
COTTON............	91.8	91.3	94.1	96.0	97.7	99.5	95.7
CORN..............	97.3	97.5	98.3	99.0	100.4	101.4	99.3
SORGHUM...........	96.4	96.8	95.6	94.7	95.8	95.9	95.8
OATS..............	105.6	106.5	107.4	108.6	109.6	110.7	108.6
BARLEY............	101.3	102.6	103.9	105.1	106.3	107.3	105.0
SOYBEANS..........	98.2	98.0	99.2	100.4	101.4	102.3	100.3

*Crop yield index is a weighted average for 8 major crops using harvested acres as the weight factors.

TABLE 8.5
ACREAGE EQUIVALENT OF STOCKS
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
ACREAGE EQUIVALENT OF STOCKS (Mil Acres) 7 CROPS TOTAL							
BASELINE............	72.85	68.84	66.25	66.71	69.80	68.59	68.04
CRP SIMULATION.......	72.85	66.29	61.99	62.43	65.67	64.53	64.18
CHANGE FROM BASE	-0.00	-2.55	-4.26	-4.28	-4.13	-4.07	-3.86
RTP SIMULATION.......	72.85	69.30	66.75	67.14	69.85	68.41	68.29
CHANGE FROM BASE	0.00	0.47	0.50	0.43	0.05	-0.19	0.25
ACREAGE EQUIVALENT OF STOCKS BY CROP (Million Acres)							
BASELINE							
WHEAT..............	20.4	21.4	24.2	28.8	31.8	30.0	27.2
COTTON.............	4.2	4.7	4.6	3.3	4.3	5.3	4.4
CORN...............	28.6	22.7	18.2	16.6	15.8	16.1	17.9
SORGHUM............	3.7	2.6	2.2	2.1	1.7	1.6	2.0
OATS...............	2.5	2.5	2.4	2.3	2.3	2.2	2.3
BARLEY.............	5.3	4.8	4.3	4.3	4.1	4.2	4.3
SOYBEANS...........	8.2	10.2	10.4	9.3	9.8	9.2	9.8
CRP SIMULATION							
WHEAT..............	20.4	20.6	22.6	27.0	29.9	28.2	25.7
COTTON.............	4.2	4.2	4.0	2.7	3.6	4.6	3.8
CORN...............	28.6	21.8	17.0	15.5	14.9	15.2	16.9
SORGHUM............	3.7	2.5	2.1	1.9	1.6	1.5	1.9
OATS...............	2.5	2.5	2.2	2.1	2.1	2.1	2.2
BARLEY.............	5.3	4.6	4.0	4.0	3.9	3.9	4.1
SOYBEANS...........	8.2	9.8	9.7	8.7	9.2	8.6	9.2
RTP SIMULATION							
WHEAT..............	20.4	21.5	24.4	29.0	31.8	29.9	27.3
COTTON.............	4.2	4.6	4.5	3.1	4.0	5.0	4.2
CORN...............	28.6	22.8	18.3	16.7	15.9	16.1	18.0
SORGHUM............	3.7	2.7	2.2	2.1	1.7	1.6	2.0
OATS...............	2.5	2.6	2.4	2.3	2.3	2.2	2.3
BARLEY.............	5.3	4.8	4.3	4.3	4.1	4.2	4.4
SOYBEANS...........	8.2	10.2	10.5	9.4	9.8	9.2	9.8

* Acreage equivalent of stocks is a ratio of total stocks to harvested acres for each crop.

TABLE 8.6
VALUE OF EXPORTS
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
VALUE OF EXPORTS (Bil $)							
8 CROPS TOTAL							
BASELINE............	16.02	14.61	14.00	14.34	14.34	15.09	14.48
CRP SIMULATION.......	16.02	14.51	13.75	13.87	13.97	14.85	14.19
CHANGE FROM BASE.....	0.00	-0.10	-0.25	-0.47	-0.37	-0.24	-0.29
RTP SIMULATION.......	16.02	14.64	14.07	14.44	14.50	15.26	14.58
CHANGE FROM BASE.....	0.00	0.03	0.07	0.10	0.16	0.17	0.11
VALUE OF EXPORTS (Bil $)							
BY CROP							
BASELINE							
WHEAT..............	4.51	4.26	3.66	3.35	3.66	3.99	3.78
RICE...............	0.42	0.44	0.46	0.47	0.47	0.46	0.46
COTTON.............	1.54	1.52	1.70	1.56	1.51	1.57	1.57
CORN...............	2.79	3.02	3.11	3.27	3.45	3.49	3.27
SORGHUM............	0.43	0.44	0.43	0.43	0.46	0.48	0.45
BARLEY.............	0.24	0.22	0.22	0.21	0.21	0.21	0.22
SOYBEANS...........	4.49	3.64	3.45	3.90	3.51	3.75	3.65
SOYBEAN MEAL.......	1.29	1.06	0.98	1.15	1.06	1.14	1.08
CRP SIMULATION							
WHEAT..............	4.51	4.36	3.73	3.38	3.70	4.03	3.84
RICE...............	0.42	0.45	0.46	0.45	0.46	0.44	0.45
COTTON.............	1.54	1.55	1.65	1.49	1.45	1.50	1.53
CORN...............	2.79	3.09	3.06	3.14	3.34	3.37	3.20
SORGHUM............	0.43	0.45	0.42	0.41	0.45	0.46	0.44
BARLEY.............	0.24	0.23	0.21	0.21	0.20	0.20	0.21
SOYBEANS...........	4.49	3.73	3.38	3.74	3.40	3.62	3.58
SOYBEAN MEAL.......	1.29	1.08	0.97	1.10	1.02	1.11	1.06
RTP SIMULATION							
WHEAT..............	4.51	4.24	3.65	3.34	3.66	3.99	3.78
RICE...............	0.42	0.44	0.47	0.47	0.48	0.46	0.46
COTTON.............	1.54	1.51	1.73	1.59	1.53	1.59	1.59
CORN...............	2.79	2.98	3.16	3.31	3.49	3.53	3.30
SORGHUM............	0.43	0.44	0.43	0.43	0.47	0.48	0.45
BARLEY.............	0.24	0.22	0.22	0.22	0.21	0.21	0.22
SOYBEANS...........	4.49	3.60	3.50	3.95	3.55	3.79	3.68
SOYBEAN MEAL.......	1.29	1.05	1.00	1.16	1.07	1.16	1.09

* Value of exports for 8 major crops (wheat, rice, cotton, corn, sorghum, barley, soybeans and soybean meal).

TABLE B.7
OUTPUT PRICE INDEX FOR CROPS
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
OUTPUT PRICE INDEX (1987 = 100) ALL CROPS							
BASELINE............	105.69	106.27	101.77	101.22	100.53	98.65	101.69
CRP SIMULATION.......	105.69	107.04	103.77	103.79	103.31	101.77	103.94
CHANGE FROM BASE.....	0.00	0.76	2.00	2.57	2.78	3.12	2.25
RTP SIMULATION.......	105.69	106.08	101.26	100.55	100.04	98.26	101.24
CHANGE FROM BASE.....	0.00	-0.19	-0.51	-0.67	-0.49	-0.39	-0.45
OUTPUT PRICE INDEX BY CROP (1987 = 100)							
BASELINE							
WHEAT..............	122.4	128.6	119.6	118.0	116.9	122.4	121.1
RICE...............	84.9	88.8	93.1	94.5	96.1	95.5	93.6
COTTON.............	90.8	86.1	93.9	90.2	88.9	93.0	90.4
CORN...............	114.0	130.7	133.3	136.7	144.7	144.0	137.9
SORGHUM............	109.4	119.4	127.5	126.9	128.8	132.5	127.0
OATS...............	88.5	91.5	96.4	99.4	103.0	102.4	98.5
BARLEY.............	112.8	115.6	119.4	117.8	120.0	120.0	118.6
CRP SIMULATION							
WHEAT..............	122.4	129.5	122.0	121.0	120.1	125.7	123.7
RICE...............	84.9	89.4	94.9	96.9	98.8	98.1	95.6
COTTON.............	90.8	86.7	95.7	92.5	91.3	95.5	92.3
CORN...............	114.0	131.6	136.0	140.1	148.7	147.9	140.8
SORGHUM............	109.4	120.2	130.0	130.1	132.3	136.1	129.7
OATS...............	88.5	92.2	98.3	101.9	105.9	105.2	100.7
BARLEY.............	112.8	116.4	121.8	120.7	123.3	123.2	121.1
RTP SIMULATION							
WHEAT..............	122.4	128.4	118.9	117.3	116.3	121.9	120.6
RICE...............	84.9	88.6	92.6	93.9	95.7	95.2	93.2
COTTON.............	90.8	85.9	93.3	89.6	88.5	92.6	90.0
CORN...............	114.0	130.4	132.6	135.8	144.0	143.5	137.2
SORGHUM............	109.4	119.2	126.8	126.0	128.1	132.0	126.4
OATS...............	88.5	91.4	95.8	98.7	102.5	102.0	98.1
BARLEY.............	112.8	115.3	118.7	117.0	119.4	119.5	118.0

* Output price index is calculated by using the 1987 price as 100.

TABLE B.8
OUTPUT PRICE INDEX FOR LIVESTOCK AND INPUT PRICE INDEX
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
OUTPUT PRICE INDEX (1987 = 100) LIVESTOCK AND LIVESTOCK PRODUCTS							
BASELINE............	97.77	90.37	80.59	81.33	80.79	83.35	83.29
CRP SIMULATION.......	97.77	91.49	82.04	82.49	82.05	85.79	84.77
CHANGE FROM BASE.....	0.00	1.12	1.45	1.16	1.26	2.44	1.49
RTP SIMULATION.......	97.77	90.09	80.55	82.14	80.67	81.20	82.93
CHANGE FROM BASE.....	0.00	-0.28	-0.04	0.81	-0.12	-2.15	-0.36
OUTPUT PRICE INDEX (1987 = 100) FOR LIVESTOCK AND LIVESTOCK PRODUCTS							
CATTLE.............	103.3	105.3	98.3	92.9	88.8	86.4	94.3
HOGS...............	86.3	72.4	67.7	77.0	80.2	87.0	76.8
DAIRY..............	91.6	84.6	81.5	78.6	75.5	73.1	78.6
BROILERS...........	96.9	96.7	98.7	100.3	100.1	102.0	99.5
TURKEY.............	91.2	100.8	111.9	113.1	112.9	110.6	109.9
INPUT PRICE INDEX (1987 = 100)							
BASELINE.............	104.9	109.8	113.8	118.3	123.7	129.6	119.1
CRP SIMULATION........	104.9	110.0	114.0	118.6	124.0	130.0	119.3
CHANGE FROM BASE......	0.0	0.1	0.2	0.3	0.3	0.4	0.3
RTP SIMULATION........	104.9	109.8	113.7	118.1	123.4	129.3	118.9
CHANGE FROM BASE......	0.0	-0.1	-0.2	-0.2	-0.3	-0.3	-0.2

* Output price index for all livestock and livestock products and input price index for crops and livestocks.

TABLE B.9
FARM CASH RECEIPTS
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
CROP RECEIPTS (Bil $)							
BASELINE............	62.67	63.78	61.65	61.38	62.67	62.67	62.43
CRP SIMULATION.......	62.67	63.96	62.01	61.90	63.33	63.15	62.87
CHANGE FROM BASE.....	0.00	0.19	0.36	0.52	0.67	0.48	0.44
RTP SIMULATION.......	62.67	63.59	61.56	61.30	62.59	62.51	62.31
CHANGE FROM BASE.....	0.00	-0.19	-0.09	-0.09	-0.08	-0.16	-0.12
CRP SIMULATION CHANGE FROM BASE							
WHEAT..............	0.00	0.09	0.13	0.17	0.20	0.18	0.15
COTTON.............	0.00	0.08	0.05	0.05	0.04	0.05	0.05
CORN...............	0.00	0.02	0.05	0.07	0.09	0.06	0.06
SORGHUM............	0.00	0.00	0.01	0.01	0.01	0.01	0.01
SOYBEANS...........	0.00	0.03	0.05	0.08	0.10	0.07	0.07
RTP SIMULATION CHANGE FROM BASE							
WHEAT..............	0.00	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03
COTTON.............	0.00	-0.05	-0.01	-0.01	-0.01	-0.01	-0.02
CORN...............	0.00	-0.02	-0.01	-0.01	-0.01	-0.02	-0.02
SORGHUM............	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
SOYBEANS...........	0.00	-0.03	-0.01	-0.01	-0.01	-0.02	-0.02
LIVESTOCK RECEIPTS (Bil $)							
BASELINE............	71.35	67.95	64.15	61.90	59.67	57.93	62.32
CRP SIMULATION.......	71.35	69.43	64.50	62.25	60.01	58.25	62.89
CHANGE FROM BASE.....	0.00	1.48	0.36	0.34	0.33	0.32	0.57
RTP SIMULATION.......	71.35	67.86	63.97	61.82	59.59	57.77	62.20
CHANGE FROM BASE.....	0.00	-0.09	-0.18	-0.09	-0.08	-0.16	-0.12
CRP SIMULATION CHANGE FROM BASE							
CATTLE.............	0.00	0.61	0.14	0.13	0.12	0.11	0.22
HOGS...............	0.00	0.17	0.04	0.04	0.04	0.04	0.07
DAIRY..............	0.00	0.34	0.08	0.08	0.08	0.08	0.13
RTP SIMULATION CHANGE FROM BASE							
CATTLE.............	0.00	-0.04	-0.07	-0.03	-0.03	-0.06	-0.05
HOGS...............	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01
DAIRY..............	0.00	-0.02	-0.04	-0.02	-0.02	-0.04	-0.03

* Crop and livestock receipts are for all crops and all livestock components.

TABLE 8.10
TOTAL CASH RECEIPTS AND NET FARM INCOME
BASELINE, CRP AND RTP SIMULATIONS *

	1988	1989	1990	1991	1992	1993	AVG 89-93
TOTAL CASH RECEIPTS (Bil $)							
BASELINE............	134.0	131.7	125.8	123.3	122.3	120.6	124.7
CRP SIMULATION.......	134.0	133.4	126.5	124.1	123.3	121.4	125.8
CHANGE FROM BASE.....	0.0	1.7	0.7	0.9	1.0	0.8	1.0
RTP SIMULATION.......	134.0	131.4	125.5	123.1	122.2	120.3	124.5
CHANGE FROM BASE.....	0.0	-0.3	-0.3	-0.2	-0.2	-0.3	-0.2
GOVERNMENT PAYMENTS (Bil $)							
BASELINE............	13.4	11.2	8.8	7.8	6.7	5.6	8.0
CRP SIMULATION.......	13.4	11.3	7.9	7.5	6.5	5.6	7.7
CHANGE FROM BASE.....	0.0	0.1	-0.9	-0.3	-0.2	-0.0	-0.3
RTP SIMULATION.......	13.4	9.4	5.7	5.3	4.5	3.3	5.6
CHANGE FROM BASE.....	0.0	-1.8	-3.1	-2.5	-2.2	-2.3	-2.4
PRODUCTION COSTS (Bil $)							
BASELINE............	119.5	121.2	120.2	119.1	118.8	118.7	119.6
CRP SIMULATION.......	119.5	121.4	120.5	119.3	119.0	118.8	119.8
CHANGE FROM BASE.....	0.0	0.2	0.4	0.3	0.2	0.1	0.2
RTP SIMULATION.......	119.5	121.8	120.6	119.4	119.2	119.0	120.0
CHANGE FROM BASE.....	0.0	0.6	0.4	0.3	0.3	0.2	0.4
NET FARM INCOME (Bil $)							
BASELINE............	43.0	38.5	30.5	28.6	27.0	24.7	29.8
CRP SIMULATION........	43.0	40.2	31.2	28.8	27.5	25.1	30.6
CHANGE FROM BASE......	0.0	1.8	0.7	0.3	0.5	0.4	0.7
RTP SIMULATION........	43.0	35.8	26.6	25.5	24.2	21.8	26.8
CHANGE FROM BASE......	0.0	-2.7	-3.8	-3.1	-2.7	-2.9	-3.1

* Calendar Year Basis

TABLE B.11
CONSUMERS' SURPLUS, FOREIGN SURPLUS, AND ASSET VALUE INDEX
BASELINE, CRP AND RTP SIMULATIONS *

	88/89	89/90	90/91	91/92	92/93	93/94	AVG 89-93
CROP CONSUMERS' SURPLUS (Bil $)							
CRP SIMULATION CHANGE FROM BASE.....	-0.00	-0.22	-0.28	-0.31	-0.31	-0.30	-0.29
RTP SIMULATION CHANGE FROM BASE.....	-0.00	0.06	0.06	0.06	0.05	0.04	0.05
LIVESTOCK CONSUMERS' SURPLUS (Bil $)							
CRP SIMULATION CHANGE FROM BASE.....	0.00	-0.45	-0.43	-0.42	-0.41	-0.40	-0.42
RTP SIMULATION CHANGE FROM BASE.....	0.00	0.11	0.11	0.10	0.10	0.10	0.10
TOTAL CONSUMERS' SURPLUS (Bil $)							
CRP SIMULATION CHANGE FROM BASE.....	-0.00	-0.66	-0.71	-0.72	-0.72	-0.71	-0.70
RTP SIMULATION CHANGE FROM BASE.....	-0.00	0.17	0.16	0.16	0.15	0.14	0.16
FOREIGN SURPLUS (Bil $)							
CRP SIMULATION CHANGE FROM BASE.....	0.00	-0.10	-0.25	-0.47	-0.37	-0.24	-0.29
RTP SIMULATION CHANGE FROM BASE.....	0.00	0.03	0.07	0.10	0.16	0.17	0.11
ASSET VALUE INDEX (1987 =100)							
CRP SIMULATION CHANGE FROM BASE	0.0	0.6	0.7	0.8	1.0	1.2	0.8
RTP SIMULATION CHANGE FROM BASE	0.0	-0.4	-1.1	-0.9	-2.4	-3.0	-1.7

* Crop and livestock consumers' surpluses are calculated using changes in domestic consumption and prices. Foreign surplus reflects the effects of changes in price and volume of exports.

TABLE 8.12
TOTAL GOVERNMENT PAYMENTS AND GOVERNMENT COSTS
BASELINE, CRP AND RTP SIMULATIONS *

	1988	1989	1990	1991	1992	1993	AVG 89-93
TOTAL GOVERNMENT COSTS (Bil $)							
BASELINE.............	14.82	12.63	10.23	9.16	8.07	7.03	9.42
CRP SIMULATION.......	14.82	12.72	8.86	8.01	7.30	6.49	8.68
CHANGE FROM BASE.....	0.00	0.09	-1.37	-1.15	-0.77	-0.54	-0.75
RTP SIMULATION.......	14.82	11.15	7.41	6.96	6.21	5.06	7.36
CHANGE FROM BASE.....	0.00	-1.48	-2.82	-2.20	-1.86	-1.97	-2.07
TOTAL GOVERNMENT PAYMENTS (Bil $)							
BASELINE.............	13.40	11.22	8.82	7.75	6.66	5.62	8.01
CRP SIMULATION.......	13.40	11.29	7.93	7.47	6.47	5.57	7.75
CHANGE FROM BASE.....	0.00	0.07	-0.89	-0.28	-0.19	-0.05	-0.27
RTP SIMULATION.......	13.40	9.44	5.70	5.25	4.50	3.35	5.65
CHANGE FROM BASE.....	0.00	-1.78	-3.12	-2.50	-2.16	-2.27	-2.37

* Total government payments are calendar year basis and total government costs are on fiscal year basis.