

Farm Real Estate Values— Some Important Determinants

By Marvin Duncan

The value of all farm assets has grown markedly since 1940, increasing from \$53 billion to a total of \$585 billion on January 1, 1976. Though all asset categories have increased sharply, none has grown faster than real estate. The value of real estate in the farm sector balance sheet has grown from \$34 billion in 1940 to \$422 billion in 1976—over 12.5 times its 1940 value. By comparison, total assets less land have increased from \$19 billion in 1940 to \$163 billion in 1976—just under 8.5 times its 1940 value. By another standard of comparison, real estate represented 64 per cent of the total assets of the farming sector in 1940. By 1976, the proportion had risen to 72 per cent. Total liabilities have also grown, from \$10 billion to \$91 billion, during that period. However, the proportion of total liabilities accounted for by real estate debt has decreased over that period from 66 per cent to 56 per cent.

Over the past 36 years, farm real estate has accounted for an increasing proportion of proprietors' equities (net worth) in the farming sector (Chart 1). For example, while proprietors' equities increased 13 per cent during 1975, farm real estate values increased 14 per cent. It is not surprising that farmers and ranchers have become increasingly interested in the land as an asset and in the factors affecting land values. Farmers, ranchers, nonfarm investors, and lenders are asking if the mix of factors affecting

land values has changed—and if present rates of increase in property values are sustainable in the future.

VARIABLES AFFECTING LAND VALUES

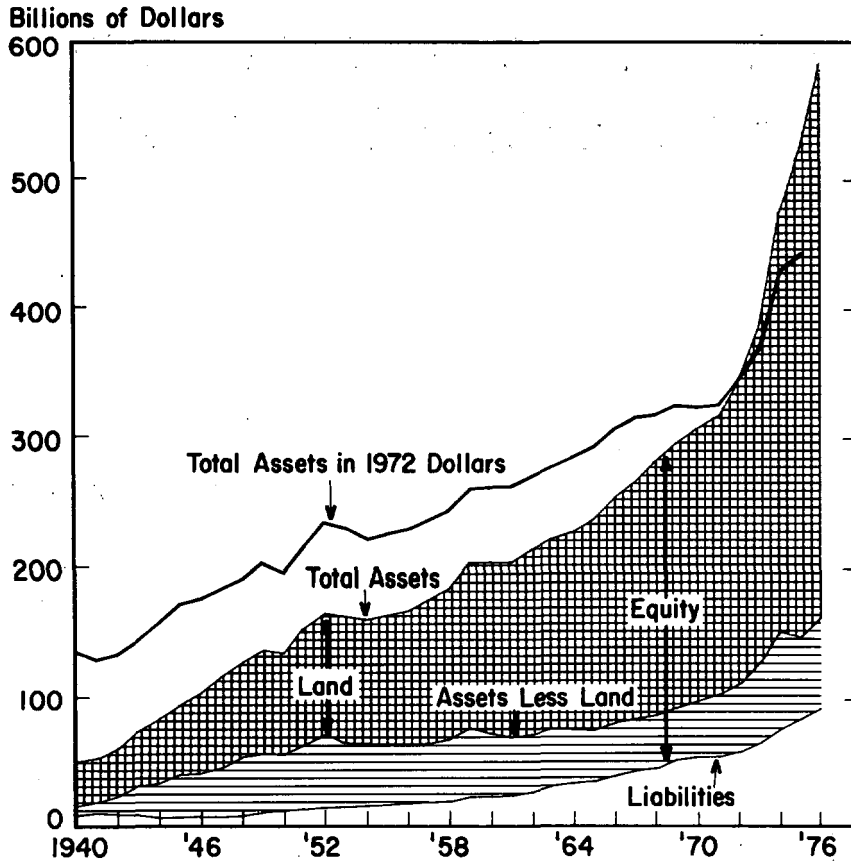
Many variables may affect farm real estate values. For practical purposes, however, it is necessary to reduce the number of factors to be considered in any analysis. Furthermore, variables considered must be consistent with economic theory and adequate data must be available to test the impact of the variables selected on farm real estate values. Another constraint concerns the statistical relationships among the variables considered. For example, if explanatory variables are too closely related (correlated), it may be necessary to let one serve as a proxy variable explaining its own effect, as well as the effect of the others, in the statistical analysis. Finally, using only a few variables believed to have major impact on farm real estate values simplifies the analysis and interpretation of the results.

The following variables are often considered to be major determinants of farm real estate values.

Inflation

Chart 2—in which the indexes charted have 1940 base values of 100—indicates the movements of indexes of farm real estate values

Chart 1
BALANCE SHEET OF FARMING SECTOR



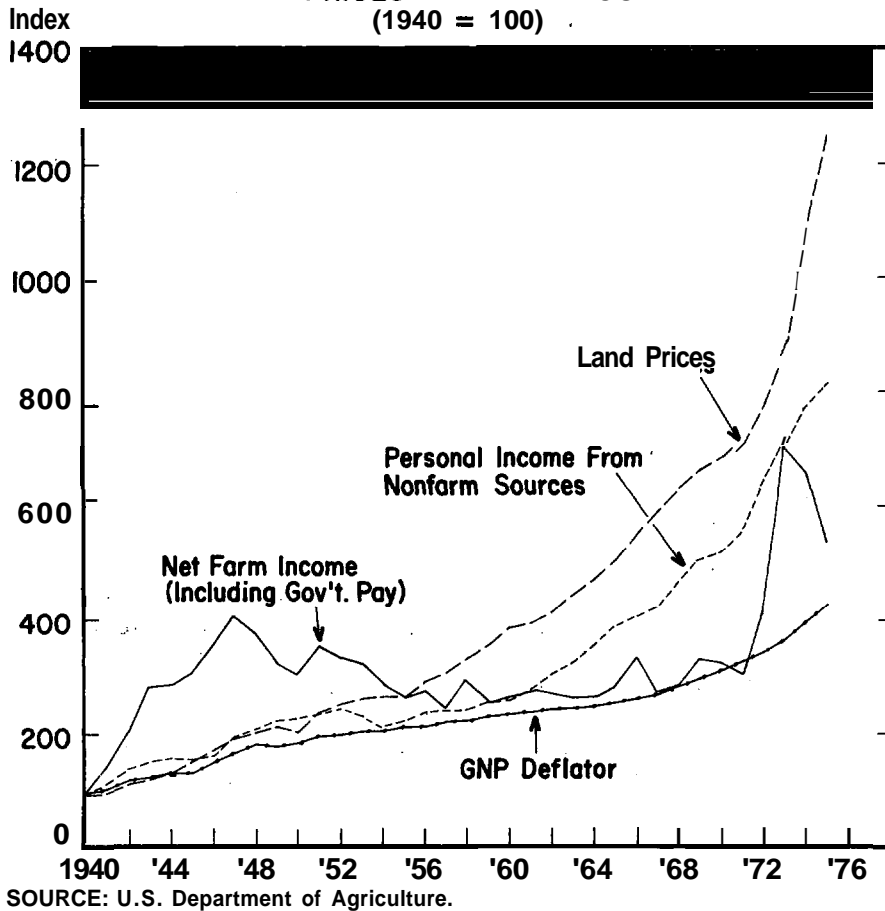
SOURCE: U.S. Department of Agriculture (USDA).

and the implicit price deflator for GNP during the 1940-76 period.¹ With the exception of 1940 through 1944, the farm real estate price index has been above the GNP deflator index and since 1955 has risen at an increasingly faster rate. Those who contend that land is a good hedge against inflation appear to be correct. Except for a few relatively short periods of time, farm real estate price changes have generally

moved in the same direction as the GNP deflator since 1925. Percentage land price changes have often been greater, however, both on the up and down sides, than percentage changes in the GNP deflator. Correlation analysis of the two indexes indicates a correlation coefficient—adjusted for autocorrelation—of .37 (on a scale of 0 to 1.0) and one that differs significantly from zero. While this does not mean that 37 per cent of farmland price increases are due to inflation—correlation does not imply causation—it does mean that the indexes have exhibited approximate harmony over the past half century.

¹ The implicit price deflator for gross national product (GNP), which adjusts nominal gross national product data for inflation, is the broadest measure of change in the general price level.

Chart 2
LAND PRICES AND FARM INCOME
 (1940 = 100)



Farm Income

The value of land is ultimately determined by the value of products produced on the land or uses to which the land can be put (coal mining, urban development, recreation, etc.).² Farm real estate values maintained a fairly stable relationship to farm income trends from the mid-1920's to the mid-1950's. Since then, however, farmland values have increased at an

increasingly rapid rate that has outstripped increases in net farm income—except during the 1971-73 period when rapid increases in farm income were accompanied by rapid increases in land values.

A partial explanation for this apparent paradox may be found in the trend of personal income of the farm population from nonfarm sources (Chart 2). This index has increased at a rate almost comparable to the rate of increase in land prices from 1961 to 1975—land prices increased 225 per cent and personal income from nonfarm sources increased 199 per cent. By 1975, personal income of the farm

² Marvin Duncan, "Farm Real Estate Values," Federal Reserve Bank of Kansas City *Monthly Review* (January 1977), pp. 13-20.

population from nonfarm sources totaled \$22.7 billion and was equal to the realized net income from farming. When inventory adjustments were included, however, net income from farming totaled \$25.6 billion. Income from nonfarm sources has enabled many farm families—particularly new entrants—to meet the cash flow requirements of farm real estate purchases.

Government Payments

Government payments to farmers have been a factor in farm income since the mid-1930's. In 1935, these payments accounted for almost 7.5 per cent of cash receipts to farmers. However, such payments declined in importance until 1955, when they accounted for less than 1 per cent of cash receipts. Beginning in 1956, that proportion rose again, reaching a range of 6 per cent to 7.3 per cent of cash receipts in the late 1960's and early 1970's, before declining to very low levels after 1973.

Farm real estate values have increased because of the lowered **risk** level in farming resulting from the income maintenance aspects of government farm programs. It has been suggested that capitalization of farm program benefits into land values quite directly leads to the need for more benefits—resulting in higher land values and again the need for more **benefits**.³ Others note that the proportion of the payments actually capitalized into land values is moderated because of uncertainty over the duration of such **payments**.⁴ Thus, future buyers of farm real estate need not lose all the additional income flowing from government payments if an appropriate discount rate is used in determining the property value.

³ Walter E. Chryst and John F. Timmons, "The Economic Role of Land Resource Institutions in Agricultural Adjustment," *Dynamics of Land Use: Needed Adjustment* (Ames: Iowa State University Press, 1961), pp. 252-77.

⁴ Robert D. Reinsel and Ronald D. Krenz, *Capitalization of Farm Program Benefits into Land Values* (Economic Research Service, U.S. Department of Agriculture, October 1972).

Capital Gains

With the exception of only 3 years since 1950, holders of farm real estate in the aggregate have enjoyed capital appreciation of that asset (Chart 3). The annual rate of capital appreciation has been as high as 25.2 per cent. In fact, when the rates of income earnings of **land**⁵ are compared to the capital appreciation rates, the latter could be expected to have had a more profound impact on farm real estate value changes than the former. Thus, expectation of capital appreciation can result in increased farm real estate values.

Alternative Investment Opportunities

Rational investors make investments that are expected to maximize their total net return over time. Both annual rates of return and rates of capital appreciation must be considered. When returns are higher in agricultural investments than elsewhere, it is reasonable to expect asset prices in the farm sector to be bid up relative to prices of nonfarm assets. Conversely, higher rates of return outside of agriculture would cause investors to shift out of agricultural investments. Between 1940 and 1975, rates of return on common stocks, for example, were below the total rates of return on farm real estate about half the time (Chart 3). On balance, increased profitability of alternative investment opportunities should have a depressing effect on farm real estate values as funds that formerly bid for real estate are invested elsewhere.

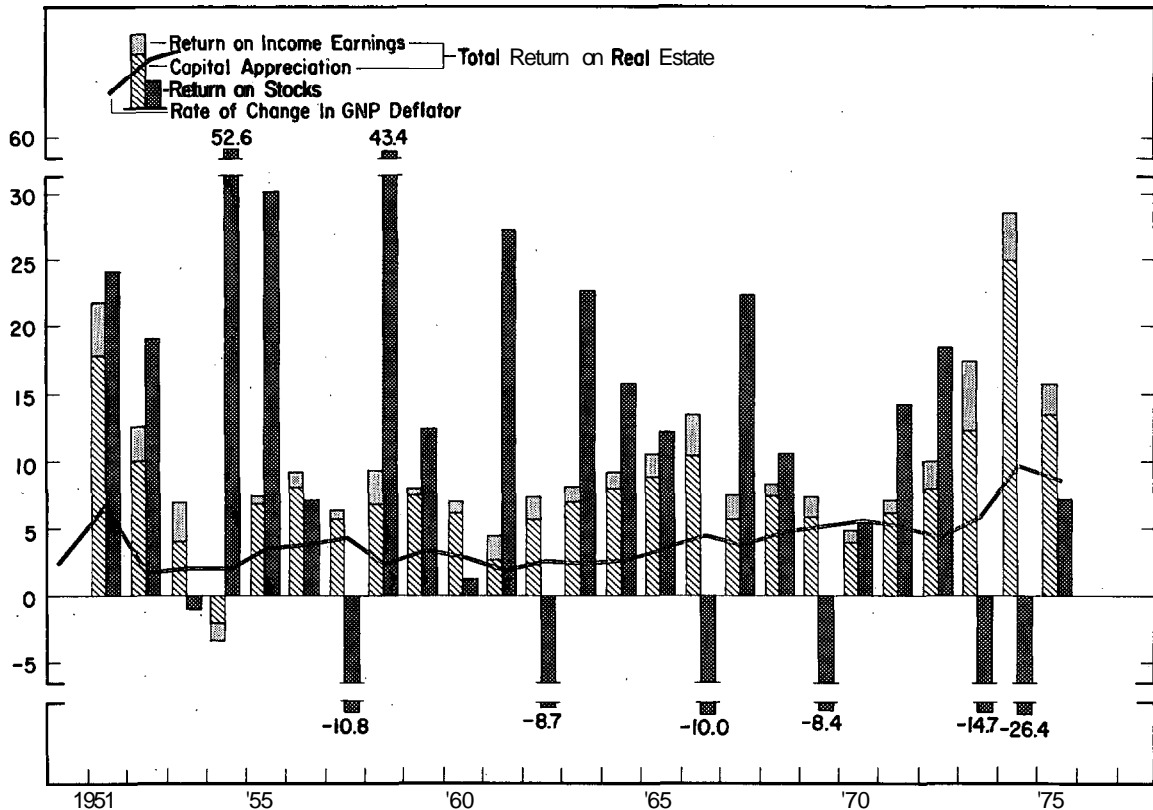
Transfers of Farmland

The total number of voluntary farmland transfers is generally taken to represent the supply of farmland on the market during a given time. Farm enlargement demand and the demand for nonfarm uses imply increasing

⁵ Income earnings of land is realized gross farm income including government payments less production costs, family labor costs, and a management charge of 10 per cent of cash receipts.

Chart 3
RATES OF RETURN ON FARM REAL ESTATE AND COMMON STOCKS

Per Cent



SOURCES: U.S. Department of Agriculture.

The common stock return is based on the Standard and Poor's Composite Index and is from Roger G. Ibbotson and Rex A. Sinquefeld, "Stocks, Bonds, Bills, and Inflation: Year-by-Year Returns (1926-1974)," *The Journal of Business* (January 1976), pp. 11-47. Gross farm income less production costs, costs of family labor, and a management charge (10 per cent of cash receipts) divided by the total value of farm real estate yields the rate of return on income earnings.

competition for the available farmland. Thus, a decrease in voluntary transfers (supply) should increase the sale price of farmland.

Farm Enlargement

Land purchases by farmers and ranchers to increase the size of their operations have been a persistent and important factor affecting farm real estate values. A remarkably constant stream of new technology has enabled farmers

and ranchers to handle ever increasing acreage with less manpower. While this technology has generally reduced the per unit cost of production it has frequently been available only in large, discrete units such as four-wheel drive tractors. Thus, to achieve the potential efficiencies resulting from technology, it has often been necessary to expand the scale of farm and ranch enterprises. Average farm size in the United States increased from 145 acres in 1926 to 206

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acres in 1950. By 1975, the average farm size had increased to 387 acres. Since 1940, farm size and farm real estate values have both increased—almost without hesitation.

From the individual operator's point of view, technology which reduces costs and increases output enables him to pay higher prices for land needed to expand his operation. However, when many farmers and ranchers follow this strategy they frequently find aggregate output has increased as a result of widespread adoption of the new technology. Because demand is inelastic for most agricultural products,⁶ product prices may decline enough to cause lower gross revenues per acre than prevailed before the adoption of new technology. Thus, technology alone should then result in decreasing land prices. However, as population and per capita income increase, demand for farm products increases. Furthermore, government farm programs support farm income levels and reduce uncertainty associated with agricultural production. Thus, increasing demand, along with the interaction of technology and government farm programs, makes farm enlargement profitable—adding upward thrust to farm real estate values.

MODELS OF FARM REAL ESTATE VALUES

Researchers have used a variety of approaches in formulating econometric models of farm real estate values ranging from very simple single equation models with few explanatory variables to complex multiequation models employing sophisticated statistical techniques for their solutions. A brief discussion of three different models for predicting land prices offers insight into the approaches used.⁷

Tweeten and Nelson explained 95 per cent of the variation in land prices during the 1923-63

⁶ For a given level of demand, a production increase of a given percentage results in a product price decline such that gross revenue is lower than before the production increase.

period, using a five equation model that posited land price as a function of land in farms, farm transfers, the number of farms, last year's net farm income, rate of return on nonfarm investment, and last year's land price.⁸ They concluded that farm enlargement pressure was the most important cause of increase in farmland values during the 1950-63 period. This model has good predictive qualities: A simplified one equation version of the model—using 1925-75 data—explained 98.8 per cent of the variation in land prices during that time period.

Herdt and Cochrane developed a simultaneous equation model of the farm real estate market in an effort to explain rising farmland prices in the face of constant income per acre.⁹ They hypothesized that technological advance played an important role in the price increases. Study results indicated that technology (the USDA productivity index), the ratio of prices paid to prices received, and the general price level were primary determinants of farmland prices.

Robert Reinsel, using a different approach, predicted land price as a function of U.S. population and the money supply (including time deposits).¹⁰ The model explained 99.8 per cent of the variation in land prices from 1947-70. Reinsel concluded that inflationary pressures in the economy and increased population pressures were the dominant factors

⁷ Apparently, neither Tweeten and Nelson nor Herdt and Cochrane corrected for possible serial correlation in their model solutions. Reinsel used a generalized least squares approach to correct for serial correlation in his model solution.

⁸ Luther G. Tweeten and Ted R. Nelson, *Sources and Repercussions of Changing U.S. Farm Real Estate Values* (Technical Bulletin T-120, Oklahoma State University, April 1966).

⁹ Robert W. Herdt and Willard W. Cochrane, "Farm Land Prices and Farm Technological Advance," *Journal of Farm Economics* (May 1966), pp. 243-63.

¹⁰ Robert D. Reinsel, "The Aggregate Real Estate Market" (Unpublished Ph.D. Thesis, Michigan State University, 1973), pp. 107-36.

affecting farm real estate values. **Although** the model accurately predicts land price, it cannot explain the impact of other important determinants of land values.

**A SIMPLE MODEL OF THE FARM
REAL ESTATE MARKET**

A single **equation** econometric model of the farm real estate market at a national level has been constructed. Although the model is primarily a predictive one, it also has some capability to explain the impact of certain explanatory variables generally agreed to be important determinants of value. Additionally, some insight into the more important questions currently being raised about farm real estate can be gained by analyzing the model results.

It is reasonable to expect that farmers and ranchers, as well as nonfarm investors, determine what they will bid for farm real estate based on an expected level of realized net income, capital gains, or returns on alternative investments. For this model, the expected values are based on a weighted average of the actual values for the past 3 years." Table 1 indicates the variables used in the model. All variables, except voluntary transfers (**T**) and average farm size (**F**), are adjusted for inflation using the GNP price deflator. Thus, the real impact (inflation adjusted) of the explanatory variables on farm real estate values can be **determined**.¹²

Model Results¹³

The empirical results of the land price model are summarized in Table 2. Equation 1 is solved using 1929-75 data. Equation 2 is solved using 1937-75 data in order to include the impact on

11 Expected value = $\frac{3V_{t-1} + 2V_{t-2} + V_{t-3}}{6}$

12 The model is of the form:

$$P = \beta_0 + ENFI/A + EPINF/A + GPL/A + Cge + Se + T + F.$$

13 The reader who is not interested in the detailed econometric findings may wish to go directly to the Summary and Conclusion section, p. 11 of this article.

**Table 1
IDENTIFICATION OF VARIABLES
USED IN MODEL***

<u>Designation</u>	<u>Description</u>
P	Value of land per acre
ENFI/A	Expected farm operators' realized net farm income/acre
EPINF/A	Expected personal income of the farm population from nonfarm sources/acre
GPL/A	Government payments/acre
Cge	Expected return—earnings plus capital gains—on farm real estate
T	Voluntary transfers of farmland per 1,000 farms
Se	Expected returns on common stock
F	Average farm size (acres)†

*All monetary variables and common stock returns are deflated by the **GNP** price deflator. Expected values, where used, are calculated from deflated values.

†This variable represents farm enlargement pressures.

land prices of nonfarm **income sources** of the farm population. All **regression** coefficients for the explanatory variables have the expected signs, with the possible exception of government payments (**GPL/A**).

Government payments (**GPL/A**) has a statistically significant coefficient in equations 1 and 2. However, the coefficient sign is negative, meaning an increase in the size of government payments is associated with a decrease in the price of land. Since government payments is usually considered to be an income component, a positive coefficient sign is normally expected. The negative relationship can be partially

Table 2
ESTIMATED FARM REAL ESTATE VALUE EQUATIONS

Eqtn. No.	Data Period	\bar{R}^2	S.E.	D.W.	Rho ^a	β_0	Variables								
							ENFI/A	EPINF/A	GPL/A	Cge	Cge60-75	Se	T	T42-49	F
1	1929-75 level of significance ^b	.989	4.211	1.912	.930	-95.813	1.381 †		-8.131 ‡	.078	.706 †	-.047	-.084	.062	.669
2	1939-75 level of significance	.991	4.025	1.826	.808	-75.163	1.239 ‡	3.066 §	-7.857 §	-.312	.963 †	-.001	-.127	.089	.522

^a A generalized least squares (Cochrane-Orcutt) procedure was used to correct for the first order serial correlation. Rho (ρ) is the correcting factor in the general regression equation of the form $Y = X\beta + \sum_t + \rho\sum_{t-1}$.

- ^b 'significant at 1% level
 †significant at 5% level
 ‡significant at 10% level
 §significant at 20% level.

explained by looking at the (GPL/A) and land value data series, adjusted for inflation. Apparently, the variability in government payments during the periods for which equations 1 and 2 are solved—compared to the continued increase in land values—results in a negative relationship. This is particularly evident in the latter part of the data period, when government payments fell to low levels as land values were increasing rapidly.

The most important determinants (statistically significant) of farm real estate values are found to be farm enlargement pressures (F) and expected realized net farm income (ENFI/A). Capital gains expectations were significantly greater during the 1960-75 period (Cge60-75) than previously. Expected personal income by farmers from nonfarm sources (EPINF/A) is a significant determinant in equation 2—but at a lower level of significance. The highly significant positive coefficient for farm enlargement (F) in both equations indicates that variable continues to be a very important factor in explaining increased land values.

The model solutions (Table 2) indicated that expected returns on common stock (Se) and voluntary transfers of farmland (T), though statistically insignificant, are of the expected negative sign. Improved returns from stocks will

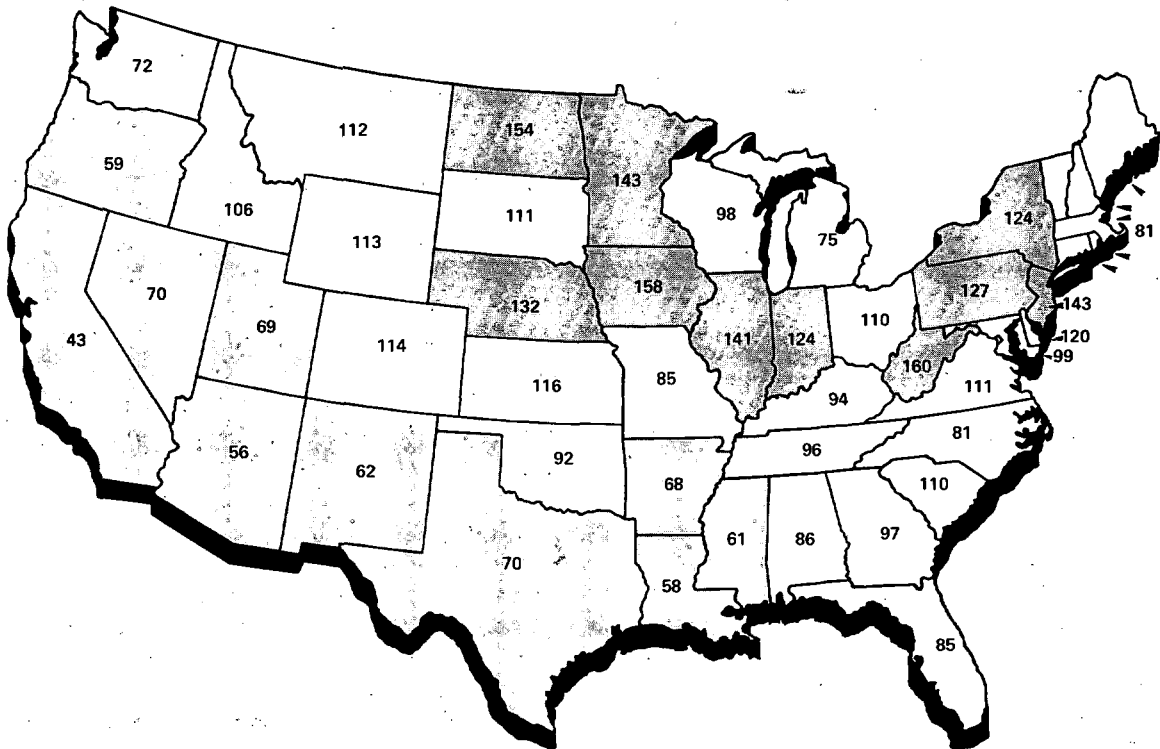
bid investment funds away from land. Increased supply of farmland for sale, indicated by more transfers, can be expected to result in a lower equilibrium price for farmland. The (T42-49) variable accounts separately for a period of unusually large voluntary farm transfers and rising land values and had been expected to have a positive sign. Despite the positive sign, the net impact of farm transfers between 1942 and 1949 (adding the coefficients for T and T42-49) is still negative.

The elasticities¹⁴ for the variables in equation 2 were calculated using 1975 data. A 1 per cent increase in the value of each variable in the equation would be expected to change land price by the following percentage value:

ENFI/A	=	+0.23
EPINF/A	=	+0.23
GPL/A	=	-0.01
Cge	=	-0.04
Cge60-75	=	+0.13
Se	=	0.00
T	=	-0.02
F	=	+0.90

¹⁴ $e = \beta \frac{x}{y}$ where β is the regression coefficient, x is the independent variable, and y is the dependent variable.

**PER CENT CHANGE IN AVERAGE VALUE PER ACRE
OF FARM REAL ESTATE, MARCH 1991-FEBRUARY 1996**



BASED ON INDEX NUMBERS OF AVERAGE VALUE PER ACRE.

SOURCE: U.S. Department of Agriculture.

Generally, most of the same variables important in determining national land values are assumed to be important at a state level, also. However, increases in state land values (Chart 4) will reflect the profitability of agriculture within each state, as well as the impact of such variables as government payments, expected capital gains, and farm enlargement pressures.

SUMMARY AND CONCLUSION

Population and income growth in the United States have increased demand for agricultural products and nonfarm uses of land, providing support for higher farm real estate values.

Increases in land **value** have also more than kept pace with changes in the general price level (as measured by the GNP deflator). In general, the view that farm real estate is a good hedge against inflation is not unreasonable.

Analysis of real **changes—i.e.**, with the impact of inflation **removed—in** farm real estate values indicates farm enlargement pressure, farm income, and capital gains expectations continue to be the most important determinants of land prices. Farm enlargement pressure has been a major determinant for at least 35 years. As long as present trends in agricultural technology continue, farm enlargement pressure

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will provide an upward thrust to farm real estate values.

Increases in farm real estate values continue to outpace increases in realized net farm income. This situation presents a particularly difficult barrier to new entrants into farming who must amortize large land indebtedness out of **current** earnings. However, income to farm families from nonfarm sources has been steadily increasing and now is approximately equal to realized net farm income. Consequently, nonfarm income provides an increasingly important cash flow source to service farm real estate debt.

The increased importance, since 1960, of capital gains expectations in determining farm real estate values is not surprising. However, those who expect capital gains to validate land purchase decisions should realize that (1) such expectations do not provide cash flow to service the real estate debt, (2) capital gains may be realized only by sale or refinancing of the land, and (3) present capital gains expectations may be based on short-term farm income and price inflation experience that may not be supported in the future.

On balance, farmland and rangeland will continue to be good long-term investments when realistically priced and when a purchaser can

realistically expect to generate a cash flow sufficient to service the real estate debt—as well as other production costs, debt service, and living expenses. It is quite likely, however, that the rate of increase in farm real estate values (both nominal and real) will decrease substantially over the next few years as a result of lower rates of price inflation, possible reductions in net farm income, and probable reductions in capital gains expectations. While long-term declines in farm real estate values are unlikely—unless the U.S. economy experiences price deflation—short periods of very low capital appreciation or even absolute price declines in some areas (such as major grain producing areas of the Great Plains and the Middle West) are distinct possibilities. On the other hand, **large-scale** government subsidies for farmers or a return of weather-induced world crop shortfalls would support present land values. Those circumstances would also prevent, or at least moderate, the substantial slowdown in the rate of increase of farm real estate values that market forces appear to dictate. As a result of the uncertain future, farm real estate lenders may increasingly rely on the income earning capacity of land as a measure of collateral value, rather than the previously popular comparable sales approach to determining value.