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Determinants of Net Changes in Farm Real Estate Debt

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Supply and demand equations for explaining net changes in farm real estate debt by lending institutions are presented. Capital appreciation, net farm plus nonfarm income, and the ratio of money balances to gross production expenses are used to explain changes in demand. Changes in supply are measured by the yield differential between farm and nonfarm investments and availability of mortgage funds. Elasticity estimates indicate that demand is more sensitive to changes in income than to capital appreciation, while supply is sensitive to changes in yield differentials.

Key words: Farm real estate debt; demand; supply; capital appreciation; income; yield differential; supply availability.

From 1947 to 1969, farm real estate debt increased from about $5 billion to over $27 billion. Annual net changes in farm real estate debt over this period ranged from a low of $0.1 billion in 1947 to over $2.3 billion in 1965. The purpose of this paper is to measure factors underlying net changes in farm real estate debt. The results are exploratory and represent the author's hypotheses on what variables and estimation techniques best explain such changes. Others may wish to test alternative variables or estimation techniques. The presentation is intended to stimulate interest in quantifying specific relationships and to serve as potential input to future research.

Conceptually one can classify loans secured by farm real estate according to the following purposes: (1) Purchases or improvements of farm real estate assets, (2) purchases or improvements of non-real-estate assets, operating expenses, etc., and (3) nonfarm uses. The determinants of borrowing for the second and third purposes may differ substantially from those for the first. Existing data series do not allow one to adequately disaggregate loans secured by farm real estate by purpose. However, based on available evidence, it is assumed here that loans secured by farm real estate are in fact used primarily for the purchase or improvement of farm real estate assets.[1] Therefore, the following discussion relates only to determinants of borrowing for this purpose.

The determinants of net changes in farm real estate debt can be grouped in two broad categories—those affecting the supply of funds available to farm borrowers, and those affecting the demand for funds by farm borrowers.[2] A change in total debt may result from either a change in price (interest rate) or from other factors such as a change in income. From published data, one cannot generally distinguish which factors are causing changes in the level of debt outstanding. However, considerable information about supply and demand factors can be gained by examining current knowledge about the nature of the demand for real estate funds and the groups supplying funds to the farm sector.

Background

Five distinct groups supply farm mortgage funds to the farm sector: the Farmers Home Administration (Government agency), Federal Land Banks (borrower cooperative), life insurance companies, commercial banks, individuals and other. From 1947 through 1969, the amount of real estate loans outstanding to the Farmers Home Administration never exceeded 4 percent of all such loans and was as low as 1.8 percent in 1969. Federal Land Banks held about 20 percent of farm mortgage loans in 1947. The figure dropped to 15 percent in the early 1950's, and by the late 1960's had increased to about 22 percent. Life insurance companies increased their share of farm mortgage loans from about

[1] All debt owed to production credit associations, regardless of whether it was secured by farm real estate, is excluded in references to "real estate debt" and "loans secured by farm real estate."

[2] Under this classification scheme explicit reference to several items is not made. For example, prepayments, loan extensions and loan defaults all affect the level of loans outstanding. These items are implicitly included in reference to demand related variables since they are primarily determined by income.

18 percent in 1947 to approximately 25 percent in 1957. Since 1957 the percentage has generally declined and because of recent monetary conditions this decline has accelerated. Banks and individuals have held relatively constant proportions of the total, approximately 14 and 40 percent respectively.[3]

The relative elasticities of supply for the five groups are expected to vary substantially. The supply curve of direct farm ownership loans of the Farmers Home Administration may be considered nearly perfectly inelastic in the short run because "the volume of direct lending by Farmers Home Administration is influenced more by the volume of funds appropriated rather than by supply and demand conditions" (*3*).[4] Over time, however, congressional appropriations may respond to past demands. Federal Land Banks (FLB) acquire funds though the sale of debentures on the national money markets. Since FLB acquisition of funds is small in relation to total money market demand, the supply of funds available to them, and hence to their member borrowers, might be considered perfectly elastic. Restricted supply to member borrowers is a clear possibility, however, as evidenced by the "voluntary" restrictions of 1966. Little is known about the relative elasticities of supply for other lenders.

The elasticity of net demand for farm mortgage funds has received little empirical estimation. Melichar (*6*), Brake (*1*), and Heady and Tweeten (*4*) have projected capital stocks and/or flows to 1980. However, these studies have not included estimates of elasticity of demand. A study by Hesser and Schuh (*5*) for 1921-59 found the demand for gross flows of farm mortgage funds to be elastic with respect to the rate of interest; but gross flows include refinancing of existing debt. While refinancing may be elastic with respect to interest rates, Hesser and Schuh point out that net flows (as used in this paper) are likely to be much less elastic. Also, a study by Montgomery (*7*) for 1946-68 estimated the own price elasticity for gross flows to be -0.6. These estimates are on an aggregate gross flow basis while the analysis which follows is intended to provide estimates on net flows and on an institutional basis.

A Model for Estimating Net Changes

The demand for farm real estate debt is hypothesized to be *primarily* a function of the cost of borrowing, capital appreciation, net farm plus nonfarm income, and the ratio of money balances to gross production expenses.[5] Changes in quantity demanded (supplied) are a function of price. The true cost of borrowing (return from lending) includes the interest rate on new loans, service charges, and some factor to reflect losses (gains) from compensating balances and other forms of rationing.

Data for these implicit costs (returns) are generally not available. Therefore, interest rates are used as a proxy for the true cost (return) of borrowing (lending). Further, data on the interest rate on new loans for the entire time period studied are available only for Federal Land Banks, while for other institutions available data reflect the average interest rate on all loans outstanding. One alternative is to use the average interest rate on loans outstanding as a proxy for the interest rate on new loans. However, since real estate loans may be outstanding for extremely long periods, sporadic movements in rates on new loans would result in a much more moderated movement in average rates. A second alternative, and the one used in this paper, is to use the rate on new loans by Federal Land Banks as a proxy for the rate on new loans by other institutions. This implicitly assumes that lending institutions are extremely sensitive to rates charged by competitors and will react accordingly.

The level of capital appreciation represents current or future returns to investment in real estate. Since capital appreciation also provides increases in equity which can be used as collateral for additional borrowing, it is expected to show a positive relationship with changes in farm real estate debt. Net farm plus nonfarm income is also expected to show a positive relationship since net farm income is a measure of current returns to the factors of production and perhaps forms the main basis for expected future returns, while nonfarm income may provide a greater base for debt expansion. Money balances held by the farm sector may be used to repay debt, purchase farm or nonfarm assets and services, or meet farm production expenses. If the ratio of money balances to gross farm production expenses is high, then repayment of debt or purchases on a cash basis are more likely to occur than if the ratio is low. Therefore, one might expect a negative relationship between the ratio of money balances to gross farm production expenses and net changes in real estate debt.

[3] Calculated from data in Agricultural Finance Review Supplement, Vol. 30, January 1970, p. 2.

[4] Italic numbers in parentheses indicate items in References, p. 8.

[5] Other determinants of the demand for farm mortgage funds include availability of substitutes for the purchase of land (renting land), the rate of technical progress, liquidity preferences of borrowers, etc. However, due to the lack of information to adequately measure these factors, they have not been included here.

Changes in supply are hypothesized to be primarily a function of the spread between yields on investments in farm mortgages and nonfarm investment alternatives as well as the quantity of loanable funds available for investment. As the total quantity of loanable funds increases, one would expect the supply to the farm sector to increase, other things equal. Likewise, as the spread between returns on investment in farm mortgages and nonfarm investments increases, one would expect the quantity of funds supplied to the farm sector to increase, and vice versa. Commercial banks and life insurance companies generally select among alternative investments on the basis of comparative default risk, liquidity, and rate of return. Since measures of differences in liquidity and default risk are not readily available, only differences in rate of return will be tested here.

The specific form of the model tested in this paper and the estimation procedures used are presented below:

Equation			*Estimation procedure*
(1.1)	$Q_{DFLB} = f(X_1, X_2, X_3, X_4)$	demand	OLS
(2.1)	$Y_1 = f(Y_2, X_1, X_2, X_3)$	demand	2SLS
(2.2)	$Y_1 = f(Y_2, X_5, X_6)$	supply	
(3.1)	$Y_3 = f(Y_4, X_1, X_2, X_3)$	demand	2SLS
(3.2)	$Y_3 = f(Y_4, X_7, X_8)$	supply	
(4.1)	$Y_5 = f(Y_6, X_1, X_2, X_3)$	demand	2SLS
(4.2)	$Y_5 = f(Y_6, X_9, X_{10})$	supply	

(5.1) $Q_{DFHA} = Q_{SFHA} = Z$

(5.2) $Q_{DTOTAL} = Q_{DFLB} + Y_1 + Y_3 + Y_5 + Q_{DFHA}$

where

Q_{DFLB} = Demand for Federal Land Bank loans measured as the annual net change in farm real estate debt owed to Federal Land Banks.

Y_1 = Demand and supply of commercial bank loans measured as the annual net change in farm real estate debt owed to commercial banks.

Y_2 = A proxy for the interest rate paid (received) on commercial bank farm mortgage loans measured as the interest rate on new loans by FLB's.

Y_3 = Demand and supply of life insurance company farm mortgage loans measured as the annual net change in farm real estate debt owed to life insurance companies.

Y_4 = A proxy for the interest rate paid (received) on life insurance company farm mortgage loans measured as the interest rate on new loans by FLB's.

Y_5 = Demand and supply of individual and other loans measured as the net change in farm real estate debt owed to individuals and others.

Y_6 = A proxy for the interest rate paid (received) on individual and other farm mortgage loans measured as the interest rate on new loans by FLB's.

$Q_{DFHA} = Q_{SFHA}$ = Demand and supply of Farmers Home Administration loans measured as the net change in farm real estate debt owed to the Farmers Home Administration.

Q_{DTOTAL} = Aggregate demand for farm mortgage loans measured as the net change in real estate debt owed to all sources.

X_1 = Annual level of capital appreciation, defined as the annual change in farm real estate assets, less capital improvements.

X_2 = Annual net farm plus nonfarm income.

X_3 = Ratio of money balances to gross production expenses expressed as a percentage. Money balances are measured as the stock of demand deposits and currency of the farm sector on hand, January 1.

X_4 = Interest rate on new loans by Federal Land Banks.

X_5 = Spread between the average interest rate on commercial bank farm mortgage loans and the yield on Aaa bonds.

X_6 = Stock of time deposits held at country member banks, January 1.

X_7 = Spread between the average interest rate on life insurance company farm mortgage loans and the yield on industrial bonds.

X_8 = Total annual investments made by life insurance companies.

Table 1.—Regression estimates of net changes in farm real estate debt outstanding for major lending institutions[a]

Equation		R^2 [b]
(1.1)	$Q_{DFLB} = 280.3 + \underset{(7.0)}{5.05X_1} + \underset{(9.9)^{**}}{19.84X_2} - \underset{(6.7)^{**}}{17.01X_3} - \underset{(64.6)}{3.53X_4}$	0.83
(2.1)	$Y_1 = -16.64 + \underset{(65.6)}{3.35Y_2}$ [c] $+ \underset{(5.4)}{7.14X_1} + \underset{(8.4)}{11.29X_2} - \underset{(6.5)}{4.75X_3}$	.64
(2.2)	$Y_1 = -366.2 + \underset{(43.0)}{4.58Y_2} + \underset{(40.0)^{**}}{128.37X_5} + \underset{(0.002)^{**}}{0.009X_6}$	.84
(3.1)	$Y_3 = 2491.2 - \underset{(72.0)^{**}}{337.23Y_4} + \underset{(5.9)}{3.99X_1} + \underset{(9.1)^{**}}{22.28X_2} - \underset{(7.1)^{**}}{36.93X_3}$	.71
(3.2)	$Y_3 = -1632.5 + \underset{(80.4)^{**}}{272.50Y_4} + \underset{(60.0)^{**}}{386.91X_7} + \underset{(0.004)}{0.005X_8}$	.78
(4.1)	$Y_5 = 604.7 - \underset{(139.6)}{17.37Y_6} + \underset{(9.7)^{**}}{20.45X_1} + \underset{(16.2)}{16.09X_2} - \underset{(12.4)^{*}}{20.00X_3}$	.82
(4.2)	$Y_5 = -1637.7 + \underset{(397.9)}{82.20Y_6} + \underset{(79.0)^{**}}{216.47X_9} + \underset{(0.008)}{0.010X_{10}}$	.79

[a]Numbers in parentheses below the regression coefficients are standard errors with * and ** indicating the coefficient is significant at the 10 percent or 5 percent level respectively.

[b]R^2's in the equations estimated by two-stage least squares are presented for the intuitive appeal they may possess, not for hypothesis testing. See Dhrymes (2, p. 240-260) for further discussion on this point.

[c]The variable has the theoretically incorrect sign on the regression coefficient.

X_9 = Spread between the average interest rate on individual and other farm mortgage loans and the yield on 3- to 5-year U.S. bonds.

X_{10} = Value of farm real estate assets, January 1.

Z = A predetermined variable which represents congressional appropriations for FHA direct lending.

The model was estimated in linear form by ordinary least squares (OLS) or two-stage least squares (2SLS) when appropriate. Annual data for 1947-69 were used. In equations estimated by two-stage least squares, endogenous variables are designated by a Y, while exogenous variables are designated by an X. In all cases, both supply and demand equations are normalized on the quantity variable rather than on the price variable. Results of the estimations are presented in table 1.

Equation 1.1 represents the demand equation for Federal Land Bank loans. A supply equation was not estimated since this institution is a borrower cooperative and the quantity supplied is primarily determined by the quantity demanded. Results of the statistical estimation indicate that all variables have the expected signs. The regression coefficients for capital appreciation and the rate of interest are not significant at the usually acceptable levels.

Equations 2.1 and 2.2 represent the demand and supply equations respectively for net changes in farm real estate debt held by commercial banks. The two equations represent a simultaneous system and were estimated by two-stage least squares. Both equations are overidentified by the order condition and both satisfy the rank condition for identifiability. Estimation of the demand equation did not result in any statistically significant regression coefficients.[6] For variables X_1 through X_3—demand shifters—all coefficients have the

[6]The rank condition was evaluated on the basis of the structure of the model prior to estimation. One can also evaluate the rank condition after estimation: "With probability equal to one minus the level of significance of the test the rank condition does not hold" (2, p. 295). Using this criterion, the probability that equation 2.2 is not identified by the rank condition is 0.16.

theoretically correct signs, while the coefficient for interest rate is theoretically incorrect. However, one would not reject the hypothesis that the regression coefficient on the interest rate variable was zero.

Equation 2.2 represents the supply function for commercial banks. The spread between yields on farm and nonfarm investments is measured by the difference between the average interest rate on commercial bank farm mortgages and the yield on Aaa bonds. Conceptually, the spread between returns on farm mortgages and short-term (less than 1 year) placements may also affect supply. However, preliminary analysis indicated that variables of this nature added virtually nothing to the explanatory power of the equation. For this reason, and to avoid problems of multicollinearity among variables, the spread between returns on farm mortgages and short-term placements was excluded from the supply equation for commercial banks.

Melichar (*6*) has stated that one of the primary determinants of a bank's ability to lend is the level of its deposits. Therefore, time deposits held in country member banks were included as an explanatory variable.[7] As the level of time deposits increases, one would expect investments in farm mortgages to increase. Estimation of equation 2.2 resulted in the theoretically correct signs on all coefficients. Regression coefficients for both the spread between the yield on farm and nonfarm investments and the level of time deposits were statistically significant at the 5 percent level. The regression coefficient for the interest rate variable was insignificant.

Results of equation 2.1 and 2.2 suggest that net changes in farm real estate debt held by commercial banks are more strongly explained by the supply variables tested than the demand variables tested. R^2 of 0.84 for equation 2.2 is substantially above the 0.64 obtained for equation 2.1.

Equations 3.1 and 3.2 represent the demand and supply equations for farm real estate debt held by life insurance companies. The equations represent a simultaneous system. Both equations are overidentified by the order condition, and both satisfy the rank condition. For the demand equation, all regression coefficients have the theoretically correct signs, and all except the coefficient for capital appreciation are significant at the 5 percent level or less. The supply function for life insurance companies is estimated by equation 3.2. The yield differential between farm and nonfarm investments is measured by the spread between the average interest rate on life insurance company farm mortgage loans and the yield on industrial bonds.[8]

The total annual investments of life insurance companies were used to measure the availability of funds. All coefficients have the theoretically correct sign and coefficients for the yield differential and the interest rate are significant at the 5 percent level or less. As with commercial banks, the supply factors tested appear to be more important than demand factors for explaining net changes in real estate debt.

Estimates of the supply and demand equations for farm real estate debt held by individuals and others are presented by equations 4.1 and 4.2 respectively. The equations satisfy the rank and order conditions for identification. For the demand equation, all coefficients have the theoretically correct signs. The coefficient for capital appreciation is significant at the 5 percent level while the coefficient for ratio of money balances to gross production expenses is significant at the 10 percent level. The sign on the regression coefficient for the interest rate is theoretically correct, but one would fail to reject the hypothesis that the coefficient was zero.

Equation 4.2 represents the supply equation for individuals and other. The spread between the average interest rate on farm mortgage loans by individuals and the yield on 3- to 5-year U.S. bonds was used to measure the yield differential between farm and nonfarm investments. The primary source of farm mortgage funds from individuals and other arises out of farmland sales under seller mortgages and land contracts. Therefore the total value of farm real estate was used to measure the potentially available supply of funds from this source. All coefficients have the theoretically correct signs, although the yield differential was the only variable with a coefficient significant at the 5 percent level or less.

Equation 5.1 was not estimated since congressional appropriations are the primary determinant of the quantity of FHA direct loans. Equation 5.2 is an identity equation which merely indicates that aggregate demand is the summation of the demands for farm real estate debt held by the various lending institutions. By using the estimated values for a given institution, one can estimate aggregate demand. For example: $\hat{Q}_{DTOTAL} = \hat{Q}_{DFLB} + \hat{Y}_1 + \hat{Y}_3 + \hat{Y}_5 + Q_{DFHA}$ where

[7] Several alternative measures of supply availability from commercial banks were also tested. In one run, the level of total reserves of country banks was used instead of time deposits. The resultant regression coefficient had the right sign, but was statistically insignificant. Using the level of time deposits held by the farm sector at commercial banks, rather than the level of time deposits held by all sectors at country member banks gave results very similar to those reported in equation 2.2. Including demand deposits with time deposits did not improve the results.

[8] The spread between returns on farm mortgages and short-term placements was not included for the same reasons cited in the discussion of the supply equation for commercial banks.

^ indicates the value is an estimate. Since the estimate of Y_1 may, for example, overstate the true value of Y_1, while the estimate of Y_3 may understate the true value of Y_3, the error in estimates can be partially or completely offset by aggregation. Thus, in general, the aggregate estimate obtained in this fashion will be better than if no offsetting errors occur. A comparison of residual errors over the time period studied indicated that offsetting errors occurred approximately 50 percent of the time.

Structural Elasticity Estimates

The preceding discussion has focused on the relationships between supply and demand equations for a given institution. One can also compare results across institutions by examining elasticity estimates to determine the responsiveness of supply and demand to changes in selected variables.[9] For commercial banks, the regression coefficient on interest rate in the demand equation (hence the own price elasticity of demand estimate) had the theoretically incorrect sign and was insignificant. The own price elasticity of demand estimates for Federal Land Banks and individuals and other were −0.10 and −0.22 respectively, indicating a very inelastic demand for farm mortgage funds from these sources. The own price elasticity of demand for life insurance company farm mortgage loans, however, was estimated at −8.37, indicating a very elastic demand.

These estimates do not confirm or deny the hypothesis of a highly inelastic demand at the aggregate level, but they suggest that elasticities of demand do vary from one institution to the next. However, due to the low significance levels on regression coefficients, one can place little reliance on the estimated elasticities of demand for Federal Land Banks and individuals and other. Nevertheless, the suggestion remains that elasticities computed at the aggregate level may be of limited value for a given institution concerned with setting its pricing policies or reacting to the policies of other institutions.

Own price elasticity of supply varied substantially from one institution to the next. The own price elasticities of supply estimated were 0.16 for commercial banks, 6.76 for life insurance companies, and 1.05 for individuals and others. However, due to the low significance levels on regression coefficients, one can place little reliance on the estimated elasticities of supply for commercial banks and individuals and other. A perfectly elastic supply was assumed for Federal Land Banks.

[9] All elasticity estimates reported here are computed from structural equations and are estimated at the arithmetic mean.

All demand equations contained capital appreciation, net farm plus nonfarm income, and the ratio of money balances to gross production expenses. The elasticity estimates for capital appreciation were 0.10, 0.23, 0.09, and 0.24 for the demand equations for Federal Land Banks, commercial banks, life insurance companies, and individuals and other, respectively. These estimates are fairly uniform across all lenders and indicate that a 10 percent increase in the level of capital appreciation would lead to a 1 to 2 percent net increase in real estate debt. But it should be noted that no statistical significance attaches to three of the four regression coefficients upon which the elasticity estimates are based.

The income elasticities of demand were estimated at 2.28, 1.72, 1.64, and 0.85 for life insurance companies, Federal Land Banks, commercial banks, and individuals and other, respectively. These estimates appear to fall into an explainable pattern. In general, life insurance company and Federal Land Bank farm mortgage loans have a much longer maturity than either commercial bank or individual loans.

One possible reason why elasticity estimates are larger for life insurance companies and Federal Land Banks is that as income increases, farm borrowers may become more confident of future income earnings, thereby undertaking loans with a longer maturity which are typically offered by these two institutions. Likewise, as income falls, confidence may decline and loans with a longer maturity will be in less demand than loans with a shorter maturity. Another possible explanation for the relationships among income elasticity estimates is that financial intermediaries (life insurance companies, Federal Land Banks, and commercial banks) may give more emphasis to income in evaluating potential loans than do individuals. Farm borrowers realizing this situation would be more willing to seek loans from financial intermediaries as income increases. Again, it must be noted that only the coefficients for Federal Land Banks and insurance companies were statistically significant.

The elasticity estimates for the ratio of money balances to gross production expenses were −1.88 for Federal Land Banks, −0.88 for commercial banks, −4.80 for life insurance companies, and −1.34 for individuals and other. Three of the four estimates are based upon statistically significant coefficients. Thus, increases in gross production expenses coupled with lower levels of money balances can be an important factor in explaining increases in real estate debt.

Supply shift variables include some measure of the yield differential between farm and nonfarm investments as well as some measure of the availability of funds. The elasticity estimates on the yield differential were 1.42 for life insurance companies, 1.38 for commercial banks,

and 0.81 for individuals and other. The relationships among these results are expected since life insurance companies and commercial banks can quite easily transfer funds from one alternative to the next, whereas individuals may need to retire or change occupations to supply funds under a land contract, for example. All three elasticity estimates are derived from statistically significant regression coefficients.

Due to the nature of the variables used in measuring supply availability, caution must be taken in comparing elasticities across institutions. For commercial banks, the elasticity with respect to time deposits was estimated at 2.06. The implication is that as the farm sector increases its holdings of time deposits at commercial banks, the supply of farm mortgage funds forthcoming from banks should increase substantially. For life insurance companies, the estimated elasticity for total investments is 0.54. This implies that life insurance companies tend to increase holdings of farm mortgages about one-half as fast as total investments, other things equal. In recent years, however, "other things" have not been equal. The spread between the yield on farm and nonfarm investments has changed rapidly and this has accounted for significant changes in life insurance company lending to agriculture. The elasticity of real estate value for individuals and other was estimated at 0.30, indicating that the supply of farm mortgage funds from this source does not increase in equal proportion to increases in real estate value.

Interactions Among Lending Institutions

There appear to be at least two forms of simultaneity that could be considered in connection with this study. Previously only the simultaneous determination of supply and demand for a given institution was considered. A second form of simultaneity can result from interactions among lending institutions. The percentage of all farm mortgage loans supplied by Federal Land Banks, life insurance companies, commercial banks, and individuals and other has ranged from 96 to 98 percent over the last 20 years. This suggests that in terms of net changes in debt, the actions (lowering equity requirements, for example) of one lending institution may affect the market share and hence the net change in debt to one or more of the other lending institutions. What is not so clear, however, is the relative importance of the market share factor compared with that of supply and demand changes in determining net changes in farm real estate debt for a given institution.

Several additional systems of simultaneous equations were tested using two-stage least squares. The model presented previously was adapted to include the net change in farm real estate debt for one or more institutions as independent variables. Thus the entire model was simultaneous, rather than just the supply and demand equations for a given institution. Generally speaking, the inclusion of the net change in real estate debt for a given institution as an independent variable resulted in a positive sign on the associated regression coefficient. Frequently the coefficient was insignificant. The results, while not conclusive, do suggest that while competition among institutions may have some effect, expansion or contraction of supply or demand appears to be more important in determining net changes in real estate debt. It should be remembered that net changes in debt were used as the measure of supply and demand. If one measured supply and demand on the basis of gross annual flows, the results could differ.

Summary and Implications

The preceding discussion has focused on the estimates of supply and demand equations for explaining net changes in farm real estate debt. A highly inelastic own price elasticity of demand was obtained for three of four lending institutions, albeit the estimates are based on insignificant regression coefficients. Estimates of own price elasticity of supply indicate an elastic supply for life insurance companies and individuals, but an inelastic supply for commercial banks. Supply from Federal Land Banks was treated as perfectly elastic by assumption. Own price elasticities of supply and demand for farm mortgage funds are key items in determining the expected impact of monetary policy (which affects interest rates) on the level of farm real estate debt in the farm sector. The elasticity estimates presented above suggest that in general, the impact of interest rate changes will vary by lending institution and that the greatest impact may be on supply rather than demand. Further research is needed to make definitive statements on this point.[10]

Estimated elasticities of demand shift variables indicate that net changes in real estate debt are much more sensitive to changes in income than to capital appreciation. These estimates have implications for the effects of Government price support programs on the level of real estate debt. If a support program results in higher income, this may lead to an increase in debt in greater proportion than the increase in income. If the benefits of the support program could be "capitalized" into the value of land with no effect on net income, then the

[10] Among other things, one would want to reexamine the specification of variables and the scope of the model presented here, which is an initial effort.

increase in real estate debt would very likely be even greater. However, portions of the increased net income due to a support program may be offset by capitalization of land values, because higher land values can lead to higher total interest payments if land is purchased with borrowed funds, higher rent payments if land is rented, higher property taxes, etc. Therefore, the overall impact of the support program on changes in real estate debt depends in part on the rate of capitalization and the effect of capitalization on net income. In addition, one would want to know the effect, if any, of the support program on money balances and production expenses.

The spread between yields on farm and nonfarm investments and some measure of available funds were generally found to be important supply-related variables. The fact that commercial banks and life insurance companies respond to yield differential has important implications for the farm sector. To maintain adequate supplies of funds from these sources, farm borrowers will need to compete effectively with nonfarm borrowers. In recent years the spread between the yield on life insurance company farm mortgage loans and nonfarm investments has declined rapidly. The result has been a decline in farm mortgage lending by life insurance companies. If this trend on the yield differential were to be reversed, one might expect life insurance companies to again expand farm mortgage loans, provided adequate funds are available. It was also shown that the supply of farm mortgage funds from commercial banks is very responsive to the level of time deposits. Thus research is needed on the effects of policy variables on the level of time deposits. Research of this nature will lead to a better understanding of the supply response of commercial banks.

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