GROWING IN DEBT:
THE 'FARM CRISIS' AND PUBLIC POLICY

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ABSTRACT

U.S. farms, and with them agricultural lending institutions, are currently experiencing their most severe stress since the 1930s. As international trade in farm products has expanded, so has the sensitivity of farm incomes to fluctuations in domestic and world economic conditions. Thus, while price stabilization, acreage reduction, and related policies in place since the 1930s were relatively successful in stabilizing farm income during the 1950s and 1960s, they are likely to be less effective in achieving this goal in the future.

Our analysis of state-level panel data indicates that disruptions in agricultural credit markets can have real effects on farm output. That finding is consistent with the conventional wisdom that, unlike credit markets for large firms or for firms for which monitoring is less costly, agricultural financial markets require close customer arrangments. Local financial institutions, for which such relationships are best developed, are often unable for institutional reasons to diversify their loan risks either within agriculture or across other geographically separated activities. The deviations from perfect markets indicate an economic rationale -- in addition to the usual political, social, and national defense rationales -- for government intervention in agricultural credit markets. Our empirical evidence supports the view that maintaining customer relationships in agricultural finance is important. Because of the Farm Credit System's ability to pool agricultural loan risks nationally and its access to national capital markets, it will continue to be an important lender in agricultural credit markets.

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U.S farms, and with them agricultural lending institutions, are currently experiencing their most severe stress since the 1930s. From 1980 to 1984, the average real value of U.S. farmland dropped by 29 percent. This sharp decline has been most pronounced in the corn and wheat belts; in Nebraska, for example, the real value of farmland is half what it was in 1980. The erosion in the value of equity has had the effect of increasing the leverage of many farm borrowers. Delinquent loans have increased substantially, hitting 7.5 percent of total loans at small agricultural banks by mid-1985.

Agricultural bank earnings are down and bank failures are up: In 1983, seven of the insured commerical agricultural banks failed, while in 1984 and 1985, this figure rose to 32 and 68 respectively. Agricultural bank failures accounted for 41 percent of the insured commercial banks that failed in 1984; in every quarter since, agricultural bank failures have accounted for more than half of total bank failures. In addition to these banks that have failed, the fragility of agricultural banking in general has risen substantially. For example, in 1984, over 20 percent of total agricultural loans outstanding at banks were to borrowers with a debt-equity ratio in excess of 70 percent and a negative cash flow. Another major farm lender -- the Cooperative Farm Credit System (FCS) -- has suffered similar portfolio deterioration and now faces an imminent threat of insolvency, though recent legislation provides for stop-gap assistance from the federal government. Total outstanding farm loans likely to default have been estimated at between $80 and $100 billion.[1]

This paper provides evidence supporting the argument that credit markets are an important element in the propagation of shocks in the farm sector.[2] We emphasize potential imperfections in agricultural credit markets based on "agency" and "information" considerations. A central message is that localized customer borrowing relationships, rather than the use of impersonal debt and equity markets, are important in agricultural finance. Reliance on local relationships is further complicated by restrictions on the ability of those intermediaries to diversify risks. Hence deflationary shocks disturb the balance sheets of both borrowers and lenders, and can have real effects through fluctuations in credit availability.

When loans are made with imperfect information on the part of the lender, the availability of credit necessary to finance operations depends on the health of local financial intermediaries, on farmers' cash flow, and on the collateral available to secure loans. Reduction in available credit due to increased borrower leverage, reduced cash flow, and increased bank vulnerability have amplified the recent troubling developments of increased foreign agricultural output and capacity, real exchange rate appreciation, and (except for 1983) years of large harvests. Both anecdotal evidence and research discussed below suggest that efficient farm producers may find themselves going bankrupt, reducing investment and maintenance expenditures, or selling out to farmers or land speculators with greater access to loanable funds.

The current economic upheaval in the U.S. farm sector -- dramatic reductions in farm incomes and land values, increased farm agglomeration, a wave of farm bankruptcies, and farm bank failures

unprecedented since World War II -- raises important questions
concerning public expenditures on domestic agriculture. While it is
widely recognized that current agricultural programs (mainly dating from
the 1930s) are poorly suited to addressing the problems of the 1980s,
there is much less consensus about which new policy directions are
likely to be the most efficient. Careful consideration of agricultural
credit markets is important when evaluating these new directions.

Plan of the Paper

The paper is organized as follows. To put the current farm
situation in perspective, we begin with a brief review of postwar U.S.
agricultural market conditions. Next we discuss the effects of credit
supply restrictions on farm production. In our empirical work, we
examine a panel data base from farm income statements and balance sheets
at the state level covering approximately the last decade. We find
economically significant effects of changes in collateral value, debt-
service burdens, and the availability of credit from commercial banks on
farm output.

The importance of local customer relationships in farm lending
suggests roles for government intervention. To provide a framework for
realistic policy analysis, we discuss salient features of the
institutions of farm finance, in particular reviewing recent
developments in commercial banks, the Farm Credit System, and the
Farmers Home Administration, three major lenders. Our empirical results
suggest that the institutional setting in agriculture credit markets is
important both for the short-run and long-run viability of efficient

farms. This importance suggests a need for a reevaluation of the current emphasis on agricultural price and incomes programs.

A Review of U.S. Postwar Agricultural Conditions

U.S. AGRICULTURE IN PERSPECTIVE

Six facts serve to place U.S. agriculture in perspective.

1. For most of the postwar period, farming has been a declining sector when expressed as a percentage of the gross national product.

2. Total farm income in 1984 was $160 billion, or about 4.4 percent of GNP.

3. Productivity growth in the industry has been phenomenal; for example, over the period from 1955 to 1984, the U.S.D.A. measure of total output per hour of farm labor has increased fivefold and average crop production per acre has increased by 75 percent.

4. Farm production and government assistance are unevenly divided among farmers. In 1985, half of all farms had total sales under $10,000 per year, produced roughly 3 percent of farm output, and received 7 percent of federal cash payments to farmers. The largest 112,000 (roughly the top 5 percent) had sales in excess of $200,000, produced half of total output and received 22 percent of federal cash payments. Farms in between -- with annual sales between $10,000 and $200,000 --

were responsible for 48 percent of total farm output and receive 71 percent of federal cash payments. Expenditures on price supports and acreage-reduction programs in 1986 are projected to amount to between $26 billion and $30 billion -- a per-farmer average of between $11,000 and $12,500.[3]

5. As of June 30, 1985, roughly 50 percent of the loan portfolio of the Farmers Home Administration, a major governmental lender, was delinquent. At both the Farm Credit System and commercial banks, on December 31, 1984, approximately 21 percent of all outstanding debt was to farmers having both negative cash flow and a debt-equity ratio of more than 70 percent.[4]

6. The current crisis is highly crop- and region-specific. Farms producing cash grains, general livestock, or dairy products account for the overwhelming majority of financially stressed farms, and these farms are concentrated in the Corn Belt and Northern Plains states.

Postwar economic conditions of U.S. agriculture can conveniently be divided into three distinct periods.[5] The 1950s and 1960s were years of growing real farm incomes, although this growth lagged well behind the growth of overall U.S. economic activity. The 1970s saw a dramatic reversal of this trend of relative decline, with rising commodity prices and sharply expanded exports leading to increasing farm incomes. During this decade, farmers expanded production and assumed substantial amounts of new debt to finance this expansion. Finally, during the 1980s farm prices declined and, faced with an appreciating dollar, exports fell

sharply. Accordingly, farm incomes, and with them farmland values, declined at rates unprecedented in the postwar period. This sharp decline in income, coupled with the high levels of debt acquired during the expansion of the 1970s, has led to a sharp decline in the ability of farmers to meet their debt obligations and to the corresponding rise in farm bank failures.

These patterns are illustrated in Tables 1 and 2, which contain selected series describing farm income and the balance sheet of the farm sector. Relative to aggregate economic activity, farming has been on the decline throughout the postwar period. This decline was slow but continual through the 1950s and 1960s: In 1954, agricultural income was 8.3 percent of GNP; by 1970, this fraction had dropped to 5.4 percent. Over this same period, farm income increased by only 0.6 percent annually. With the exception of 1958, between 1954 and 1970 the rate of return on farming activities fluctuated between 1.0 and 6.3 percent.

This prolonged period of steady decline was reversed with the increase in farm exports and the rise in relative commodity prices during the 1970s. Between 1970 and 1979, real U.S. agricultural exports more than doubled and real gross farm income rose at an annual rate of 4.1 percent. The return on farm assets and the value of farm equity rose, reflecting the improved market conditions. Nationally, real farm equity rose by 74 percent and real farmland values rose by 88 percent from 1971 to 1980. These increases were most pronounced in the West and Middle West; between 1976 and 1980 alone, land values rose by 53 percent in Indiana, 49 percent in Minnesota, and by 46 percent in Wisconsin and Iowa.[6] Backed by this increased "paper value" of farmland, real farm debt rose by a total of 65 percent from 1971 to 1980, compared to the 21.3 percent from 1961 to 1970.

This expansion halted abruptly in the 1980s as interest rates rose, the dollar appreciated, the Soviet grain embargo had its effect on U.S. farmers, and commodity prices fell. From 1979 to 1983, the agricultural sector suffered an **absolute** as well as a **relative** decline that was largely unanticipated by agricultural borrowers and lenders. The U.S. experienced a loss in market share in many crops during the 1980s. Farm income as a fraction of GNP dropped from 5.8 percent to 4.2 percent, and aggregate real farm income fell in each year from 1980 to 1984. The previous trend of increasing equity values also reversed as land prices fell;[7] real national farm equity in 1984 was only 72 percent of its peak in 1980. With the fall in farm income and equity values came increased payments on the debt accrued during the 1970s and the lowest levels of investment in buildings and machinery since the early 1960s.

CHANGING VOLATILITY OF FARM INCOMES

The increased volatility of farm incomes during the 1970s and 1980s is summarized in the first columns of Table 3. Combining the expansion of the 1970s with the contraction of the 1980s, real farm income since 1973 grew at a slightly slower rate than it did from 1954 to 1972. In addition, throughout the postwar period farm income has been volatile; as a comparison, the standard deviations of the growth rate in real national income were 2.79 percent for 1954-1972 and 3.76 percent for 1973-1984, respectively. However, the most striking feature of this row of Table 3 is the dramatic increase in the volatility of farm income, with the standard deviation of annual growth rates almost tripling.

This increased volatility of farm income since 1973 has also been associated with an increase in the comovements of agricultural income with U.S. aggregate economic conditions. This increased sensitivity is reflected in the regressions reported in the remaining rows of Table 3, in which the growth rate in farm income is regressed against the contemporaneous and lagged values of the growth rates of various income aggregates. Two features of this changing relationship between movements in farm incomes and in various economic aggregates are evident from these regressions. First, while the multiple correlation between farm income and lags of national income was only 3 percent for the 1954-1972 period, after 1973 this correlation rose to 55 percent. Second, fluctuations in the various aggregates were associated with very different changes in farm incomes in the two periods. For example, in the early period, the cumulative change in real farm income associated with a one percent change in real national income was only 0.27 percent, while in the later period this cumulative change was about 3 percent.

As has been discussed extensively elsewhere, the changing relationships elaborated above reflect an increased importance of world trade and of the exchange rate in determining domestic commodity prices and therefore farm incomes. Indeed, while farm exports constituted only 14.5 percent of agricultural cash receipts in 1970, by 1980 this fraction had jumped to 29.5 percent. To the extent that the U.S. continues to compete in international agricultural markets, this markedly increased sensitivity of agricultural incomes to world economic fluctuations seems likely to persist.

This increased sensitivity is important. When the prices received by farmers were relatively stable, agricultural income risk was likely

to be uncorrelated with risk in other major sectors in the economy
(i.e., since weather would be the dominant source of fluctuations in
farm output). As shown in Table 3, however, agricultural incomes have
become more highly volatile, and fluctuations in farm incomes are
becoming more highly correlated with income fluctuations in other
sectors (because of the increased volatility of interest rates and
exchange rates). This change need not be of critical importance if
farmers are able to diversify risk by holding part of their net worth in
assets whose returns perform differently given fluctuations in interest
rates and exchange rates. However, for reasons we discuss in detail
later, farmers' wealth is held almost exclusively in farm-specific
capital (e.g., farmland). Hence, individual farmers are bearing more
significant risks of income fluctuations.[8]

PUBLIC POLICIES TOWARD AGRICULTURE

Public policies have evolved over the last fifty years or so
through commodity programs and credit-market programs, the second
category of which we take up later in the paper. The foundation of
federal farm commmodity programs has been price supports and concomitant
acreage-reduction efforts. The latter were implemented through a set of
incentive programs put in place in the 1960s, by which time it had
become clear that, since the support price was effectively a floor
price, farmers who chose not to reduce their acreage reaped the benefit
of both higher production and higher prices. The support and acreage-
reduction programs were not overly costly in the 1970s, as rapid
expansion and market price increases took place.

By the 1980s, world farm prices declined, and more farmers chose to participate in government commodity programs. The budgetary costs were increased by expansion of agricultural productive capacity abroad (particularly in grains in Argentina and the European Economic Community). The 1981 farm bill was predicted to cost $11 billion over the ensuing four years, but actually cost $63 billion. The Reagan Administration's 1983 Payment-In-Kind program attempted large acreage reductions at a huge budgetary cost of $30,000 per commercial farm in 1983. Discussions of "bailouts" have figured prominently in 1985 and 1986 legislative efforts.[9]

Agricultural Credit Markets and Farm Production

Is the crisis in agricultural credit markets merely a symptom of the recent adverse shocks farmers have suffered, or do credit channels play a role in propagating exogenous adverse shocks? Does the availability of credit per se provide an additional influence on agricultural income and investment?

To motivate empirical work which addresses these questions, we begin with a simple model of links between credit markets and farm output. Suppose that domestic farm output Q^S is determined according to a production function defined over a set of inputs (chosen before production takes place) subject to random disturbances (e.g., the weather). The associated derived demands for inputs and financing depend on expected returns on investment R (i.e., expected prices and yields) and on the shadow price of funds i^s.[10] Individual farmers invest until the expected return on the margin just equals the shadow price of funds.

The shadow price of funds involves much more than the loan interest rate; even casual observation of existing loan contracts reveals the importance of requirements for collateral, debt-service, and other "non-price" covenants. Three aspects of credit market imperfections are of particular relevance here—(i) the importance of collateral and projected cash flow for obtaining loans (and the attendant problems associated with reductions in the value of collateral), (ii) agency problems limiting the ability of individual farmers to raise new capital externally, and (iii) problems of credit rationing given lenders' imperfect information about borrowers' conditions.[11] We discuss these in turn below; they certainly need not be mutually exclusive.

First, collateral requirements provide a way for lenders to overcome their limited information about the ability of individual farmers to pay back loans. Since the large volatility in farm cash receipts implies nontrivial probabilities of default, lenders will receive either the total repaid principal plus interest or, if the farmer defaults, the value of the collateral plus any additional recoverable cash flow. That is, lenders can be thought of as maximizing their gross return ρ, which is related to the loan interest rate r according to

$$(1) \qquad \rho = \min[R + C, (1+r)L],$$

where L is the loan amount and C is the borrower's collateral. Deterioration of borrowers' collateral or in the projected ability to service existing debts out of current cash flow exacerbates the information problems in the loan market (see discussion below). Were

collateral substantial enough, it might be possible to approximate loan contracts equivalent to those that could be written were the lenders fully informed, since only those borrowers confident of not losing their collateral (i.e., the less risky of the potential borrowers) would seek loans.

Particularly important for agriculture, farmers' collateral is composed largely of an industry-specific asset, farmland. Fluctuations in the value of farmland are, of course, highly positively correlated with realizations of returns on farming projects. The risk of default is even more substantial than in the case wherein the value of collateral is fixed and independent of project returns.[12] Hence the ability to service debt out of projected cash flow is an important additional consideration for the lender. Another channel through which cash flow influences credit availability is the surplus funds of individual farmers who lend to neighbors and relatives since reduced cash flow restricts the supply of private intermediation capital. These private sources of funds accounted for 34 percent of total farm debt in 1984.

Consideration of collateral and cash flow can also be justified institutionally by appealing to the criteria which lenders actually use in deciding upon loans. For example, until 1971 Federal Land Banks were effectively limited to loaning no more than 50 percent of the market value of real estate for which the loan was taken. In 1971, this limit was increased to 85 percent. However, since member banks recognized that loaning up to this limit was risky, this greater discretion in terms of debt-equity ratios led to an increased emphasis on the cash flow of the applicant.[13] In addition, cash-flow analysis and real

estate appraisal have always figured prominently in the loan supply decisions of commercial banks and in the Farmers Home Administration's evaluation of a potential borrower's "Farm and Home Plan."

Second, for credit restrictions to individual borrowers to have aggregate real effects, it must be the case that individual projects are imperfect substitutes. There are several channels through which a lack of farm credit could have these aggregate effects. A farm that suffers foreclosure and is not brought back into operation -- or, even more dramatically, a for sale farm on which standing crops are not harvested -- will, of course, result in an aggregate drop in planted acreage and production. More subtely, a lack of credit can result in decreased productivity by forcing the sale of farm equipment, by reducing maintenance in building and equipment, by reductions in fertilizer or seed qualities, or by shifting to suboptimal crop or feed mixes to reduce operating expenses. Each of these channels result in output losses on specific farms. Since the farmland can, of course, only be farmed at any one time by a single operator, credit restrictions can in theory result in aggregate reductions in output.

Because of the complexity of modern farming operations, these and similar subtle changes in production can be difficult to monitor by outside parties. This difficulty of monitoring can result in losses of efficiency arising from dissociating farm ownership from farm management or, more generally, from "agency" problems.[14] Attempts to raise collateral levels by mergers of existing farm operations by owner-operators would not be useful so long as debt-equity ratios are similar across farmers. One possible alternative solution is, of course, to take on new equity from nonfarmers. Potential agency costs are the

likely explanation of why this option has historically been seldom used.[15]

Third, theoretical research involving models of loan markets in which information (between borrowers and lenders) is imperfect has shown that the loan interest rate and the shadow price of credit are not equivalent. Agricultural projects correspond to such "information-intensive" investments to the extent that monitoring of projects (and associated treatment of the land) and returns is difficult. In these information-intensive credit markets, credit rationing to some borrowers is likely.[16]

In the simplest possible model, no information problems exist, and the competitive equilibrium involves the agricultural credit markets clearing through adjustments in the rate of interest. However, when agricultural borrowers have private information about their project returns, lenders cannot distinguish the riskiness of individual projects, so that adverse selection will lead to credit rationing in a credit-market equilibrium in which loan contracts specify only the interest rate.[17] Again, with a nonzero probability of default, lenders consider the potential for loan repayment as well as the interest rate to be charged when assessing the profitability of a loan. Past some critical level of the interest rate, high-quality borrowers will either seek loanable funds elsewhere or will leave the market for credit. As a result, banks will find themselves with a preponderance of borrowers who have a high probability of default.

A corollary to agency arguments is that changes in the ability of lenders specializing in monitoring information-intensive projects--here commercial banks--to supply credit can have real effects. The present

situation in agricultural banking is serious. There were more failures
in 1985 than in any year since the 1930s; approximately two-thirds of
these were in rural areas. In addition, rural and agricultural banks
have constituted an increasing fraction of failed banks; 70 percent of
bank failures in 1985 were in rural banks, up from 34 percent in 1983,
and more than 55 percent (a total of 68) were in agricultural banks, up
from 16 percent in 1983. Conditions in heavily agricultural areas were
more stark. Fully three-fourths of agricultural banks failures occurred
in the Corn Belt and Plains states; no agricultural banks failed in the
Northeast.[18]

A number of potential concerns arise here (we discuss these in more
detail later). First, limitations on branch banking impede loan
diversification, making farm banks particularly vulnerable to changes in
local conditions. Second, a recent evaluation of farm bank failures by
Gregory Gajewski[19] notes that banks taking over failed banks tend to be
more conservative than average, making a smaller proportion of funds
available for loans. Furthermore, the F.D.I.C. has had difficulty
finding suitable banks willing to take over failed rural banks. While
the F.D.I.C. was unable to obtain an acceptable bid to take over failed
banks (and therefore used the "payoff" method of liquidation) in only 33
out of 239 bank failures over the period from 1983 to 1985, fully 24
such closings occurred in rural banks. These rural payoff closings were
concentrated in such agricultural states as Kansas, Nebraska, Oklahoma,
and Texas. From the perspective of credit supply constraints these
failures are particularly worrisome since local commercial banks have
specialized in making and monitoring information-intensive loans
(exploiting their customer relationships); the recent increase in bank
failures is likely to disrupt the availability of credit to farmers.

Based on these credit-market imperfections, we emphasize four potentially important components of the shadow price of credit to agricultural borrowers — the interest rate charged (r), the value of farm real estate (RE) as collateral, the projected debt-service burden (DS) measured as the ratio of interest payments relative to cash receipts, and disruptions in the availability of information-intensive credit measured by bank failures (FAILS). That is, the shadow price of funds in period t-1 is

$$(2) \qquad i^s_{t-1} = f(r_{t-1}, \ RE_{t-1}, \ _{t-1}DS_t, \ FAILS_{t-1}),$$

The proper model, is, of course, for investment. As we do not have data on investment, we consider a reduced-form equation for farm output:[20]

$$(3) \qquad Q^s_t = f(_{t-1}R_t, \ r_{t-1}, \ RE_{t-1}, \ _{t-1}DS_t, \ FAILS_{t-1}).$$
$$\qquad\qquad\quad (+) \quad\ (-) \quad\ (+) \quad\quad (-) \quad\quad (-)$$

where $_{t-1}R_t$ represents the expectation of R_t (the total return on the farm project) at time t-1 and where the predicted signs underscore the variables.[21]

Empirical Evidence on Credit Supply Restrictions in U.S. Agriculture

TEST OF CREDIT EFFECTS ON FARM OUTPUT

Macroeconomic time-series data are not likely to be particularly useful for testing the impact of proxies for credit supply restrictions

on farm output and income, because they cannot permit consideration of the large variation across farmers in terms of crop mix (and hence expected prices to be received), debt-service capability, collateral, and situations in local credit markets. An alternative would be to examine microeconomic data on individual borrower-lender relationships over time. While data on individual borrowers would permit estimation of microeconomic features of credit supply restrictions, such data would not, however, permit measuring directly the net aggregate effect of credit rationing, on aggregate agricultural supply. As an intermediate step, we constructed a panel data base on farm income statements and balance sheets and commercial bank performance at the state level covering 24 states (including all of the principal agricultural states)[22] from 1977 to 1984.

Observations in this panel data set consist of state-level totals or averages for a given year. For example, the real estate variable is the value of farmland in the state as of January 1 of the year in question. Given these data, we estimate equations of the form

$$(4) \quad Q^s_{it} = f(_{t-1}R_{it}, \; r_{it-1}, \; RE_{it-1}, \; _{t-1}DS_{it}, \; FAILS_{it-1}, \; \bar{X}_i, \; \bar{Z}_t),$$

where i and t denote the state and year, respectively, and X and Z denote a set of fixed state and time effects. The dependent variable used in the econometric work is a quantity index, constructed as the (logarithm of the) quotient of state cash receipts from marketings and a state-specific commodity price index.

No expected price term per se appears in our estimation of (4). Variables describing the demand for agricultural output will in general

appear in any reduced-form equation. Rather than attempting to model

annual aggregate demand shifts, we have included dummy variables for

each year in our regression equations. Expected price changes are

captured by the year dummies, which reflect changes in aggregate

economic activity and the exchange rate, and by the state fixed effects,

which capture state-level variation in the crop mix.

As we do not have data on farm interest rates state by state, no

loan interest rate is included directly (because of the inclusion of the

fixed time effects). Collateral is measured by the log of (constant-

dollar) real estate values, and debt-service burdens are proxied by the

ratio of interest payments to total cash flow (including government

payments and nonfarm income). The bank failures measure is the total

number of bank failures in that state in that year. As another proxy

for supply restrictions we include net loan chargeoffs as a percentage

of total loans at agricultural banks in that state in that year.

In addition to the specification in (4), we also considered various

interactions with the debt-service variable to test whether (i) effects

of debt service on credit availability vary according to initial

leverage (as measured by the debt-equity ratio D/E), and whether (ii) given

levels of debt-service burdens are more severe for farms of moderate

size (FS) than for large farms. For this second interaction, we define

FS as the fraction of output produced in each state by farms of moderate

size (specifically, with total sales of between $40,000 and $100,000

dollars in 1982). The farm-size variable is a proxy for the

distribution of debt burden within a particular state. Given that large

farms tend to have higher than average debt-equity ratios (see the

discussion below), a high proportion of moderate-sized farms in a given

state indicates a more even distribution of debt across farmers, and hence less vulnerability in the aggregate to shocks which increase the debt-equity ratio.

Our estimation strategy is designed to avoid two potential pitfalls that would arise were one to use ordinary least squares in an attempt to identify the credit supply effects embodied in the theoretical relationship (3). First, persistent differences in crop and livestock mixes (and thus in credit requirements as inputs to production functions) across states could lead to spurious significance of the credit variables; we avoid this potential problem by estimating the regressions using fixed state effects. Second, because of the obvious potential simultaneity of credit demand and the supply of output, we estimate our output equations using two-stage least squares. We used as instruments lagged endogenous variables and their interactions with survey responses of agricultural bankers indicating whether their expectations were for increased or decreased loan demand in the next quarter.[23] The latter is designed to capture pure demand effects. Though not reported here, our results are robust to the use instead of lagged values of the independent variables.

Our two-stage least squares estimation results using fixed state and time effects appear in Table 4. The estimated regression coefficients and their t-statistics are reported in the first six columns. The seventh and eighth columns contain the F-statistics (and their p-values) for tests that the credit supply variables equal zero, and the final three columns contain measures of the serial correlation present in the residuals. The Box-Pierce Q statistics and the estimated serial correlation coefficients indicate slight but statistically

significant serial correlation in the residuals, which is unsurprising since we omitted some variables (e.g., factor prices) either because they were unavailable or because they were not germane to this investigation. The reported standard errors have been adjusted to correct for this serial correlation.[24]

Several patterns in these results are of particular interest. The impact on output of changes in collateral values or in the local provision of information-intensive credit (as measured by real estate values and commercial bank failures, respectively) have the expected sign and are precisely estimated. Increases in debt-service burdens (interest payments relative to cash receipts) are associated with reductions in output, though the coefficient is in some cases imprecisely measured. As one would expect, given levels of debt-service burdens have a more substantial effect when debt-equity ratios are high (although this effect is not statistically significant).[25]

Local bank failures reduce output (through restricting the available supply of credit); we discuss this point in more detail later in the context of regulatory restrictions on commercial bank lending. Estimated coefficients on the loan-chargeoffs measure are never statistically significantly different from zero, though their inclusion sharpens the precision of the estimates of the effects of the debt-service variable. While the coefficient on the bank failures variable may seem large at first glance, it is important to note that it is a discrete proxy for many continuous and persistent changes (for example in the quality of bank loan portfolios).

Debt-service burdens have a less severe impact for medium-sized farms than for other farms. If credit constraints are less relevant for

borrowers with "deep pockets" and if the large farms in our sample became large because of higher-than-average leveraging, then, for a given statewide average debt-service ratio, the more moderate-sized farms will have less binding credit constraints. This interpretation of the coefficient on DS*FS is consistent with the high debt-equity ratios of large and moderate sized farms in the boom years of the 1970s presented in Table 5.

ISSUES OF INTERPRETATION

There are, of course, issues of interpretation of any empirical results attempting to separate credit supply and demand effects. For example, in addition to serving as collateral, land values will tend to reflect market expectations of future farm cash flows, thus agricultural prices.[26] If, however, agricultural prices for particular commodities are common across states, if expectations of prices are similar across states, and if each state's crop mix is relatively stable over time, than, as argued above, fixed state and time effects will capture both expected prices and realized agricultural demand.

A possible confusion between supply and demand effects arises in the debt-service measure, where high values of debt service may indicate sanguine expectations. Here, the demand-side effect leads one to expect a positive coefficient, which is opposite to the negative coefficient implied by the credit-supply effect and the negative coefficients estimated by two-stage least squares reported in Table 4.

Finally, there is independent evidence of credit supply restrictions on the part of commercial banks. Results from quarterly

surveys of credit conditions at commercial banks by the regional Federal Reserve Banks (Chicago, Kansas City, Dallas, Minneapolis, and Richmond)[27] indicate a marked decline in 1982 in the number of banks reporting a "higher" availability of funds for new farm loans and a substantial increase in the percentage of banks reporting that higher collateral would be required relative to loan size.

Another possible explanation for our empirical results not involving credit rationing is that farm output declines result in bank failures, and that farm output is serially correlated. According to this interpretation, the bank-failures variable might spuriously be capturing this dependence in farm output. To check for this possibility, we examined the time series relationship between the credit variables and the output variable. In both a bivariate model of bank failures and log output and a trivariate model of bank failures, the logarithm of loan chargeoffs, and the logarithm of output, the output variable failed to Granger-cause the banking variables at a 15 percent level. (Both models included state and time fixed effects.) In contrast, as expected, real farm income does Granger-cause bank failures at the 5 percent level in both the bivariate and trivariate models, although the link from farm income to loan chargeoffs is, somewhat surprisingly, weaker. Taken together, these results suggest that this alternative explanation will not explain the results in Table 4, despite the link between current farm income and the future viability of agricultural banks.

Financial Variables and the Trend Toward Larger Farms

An important characteristic of U.S. agriculture in the postwar
period has been a trend toward larger and more productive farms. Farm
size statistics are reported in intervals of nominal dollars (e.g. the
number of farms with sales between $20,000 and $39,999). We have
deflated these nominal dollar values using the farm price index to
compute selected farm size statistics in 1984 dollars.[28] These
statistics are reported in Table 6. By 1984 real sales of farms had
risen to a level almost three times that of 1960, with the fastest rate
of growth occurring in the 1960s.

The literature on farm production suggests two reasons for
increasing farm sizes. The most important is surely the tremendous
increase in productivity in agriculture (in terms of output per acre)
over the period. Technological advances tend to increase the minimum
scale for efficient farming operations, although this minimum efficient
scale necessarily varies across crop mixes. A detailed review of the
evidence concerning the minimum efficient scale for farming operations
is given by Bruce Hall and Phillip Le Veeen.[29] Most of the studies they
review suggest that the long run average-cost curve is "L-shaped," so
that most of the benefits of technology are achieved by modestly sized
farms of from 100-320 acres (depending on the crop). These studies
suggest that the technological advantages of very large farms are
relatively small in relation to farms of moderate size. This evidence
is echoed for cash grain farms in Illinois by Philip Garcia, Steven
Sonka, and Man Yoo.[30] In addition to these considerations related to
the physical production process, several authors have argued that the

realization of managerial economies and economies of scope require
moderate farm size.[31]

The second explanation for increased economic viability of larger
farms is that farmers have differential access to credit, depending on
cash-flow histories and collateral. This would lead growth to occur
with a disproportionate expansion of the farms of the "credit-worthy."
Though Hall and Le Veeen note the possibility that financial factors
could lead to an increase in farm size, they do not present any
empirical evidence on this point. Indirect evidence of the importance
of access of credit for farm investment comes from the work of Linda Lee
and William Stewart. Credit constraints may lead farmers to reduce
long-run investments that would otherwise maintain the quantity or
quality of the topsoil and land.[32] Lee and Stewart present empirical
evidence in support of an effect of farm income on soil conservation;
they conclude that large farms or farms with significant uncommitted
cash flows were more active in soil-conservation practices.[33] One would
expect credit supply effects to be especially pronounced for investments
which require a relatively long time horizon -- like soil conservation
-- since short-run credit supply restrictions increase the effective
discount rates of constrained borrowers.

Modeling links between such credit variables as collateral, debt-
service ratios, or debt-equity ratios and farm agglomeration is
problematic because of the multiplicity of potential relationships.
First, a farmer who expects increased product demand (or increased
productivity) will be tempted to expand his operation. While a farmer's
prediction of more severe debt-service burdens in the future may enter
negatively into his decision to enter into new loan contracts, the

observed debt service and debt-equity ratios in the next period will reflect these new loans. Thus increased DS and D/E would be associated with increased expansion of output and of farm sizes, an explanation consistent with the expansion of output and debt in the 1970s.

A second reason that increased debt service and debt-equity ratios might lead to increased farm size is that, as these variables increase, more farmers are exposed to the risk of failure. Depending upon the size of the failed farms and their disposition (i.e., whether they are subdivided and sold as smaller farms or are sold to already large and expanding enterprises), the effect of farm failures could either be to increase or to decrease average farm size.

While increasing average farm size may reflect the increasing productivity of all existing farmers, a widening of differences in farm size among farmers indicates differences in the ability or desire to grow, providing evidence consistent with the importance of credit availability. Table 6 shows that aggregate farm size growth occurred primarily through an expansion of the very largest farms. The fraction of income of farms of moderate size (with real sales between $50,000 and $150,000) fell from 1960 to 1984. Over this period, while mean farm sales and the sales of the ninetieth percentile tripled, median farm sales grew by only 23 percent. Thus the increase in the average scale of production has not been accomplished through proportional increases in all farms' output; rather, the variance of farm size has increased dramatically along with the mean.

Public Policy and the Farm Crisis

MAKING POLICY IN THE CURRENT INSTITUTIONAL SETTING

Existing forms of credit intermediation offer special challenges

and opportunities for interventions designed to alleviate stress in

credit markets. Such institution-specific recommendations require a

brief survey of the existing terrain. The principal institutional

lenders have been commercial banks, the Farm Credit System, the Farmers

Home Administration, and life insurance companies; the relative

importance of each is documented in Table 7. We review the current

status and special attribute of the first three below.[34]

Commercial Banks

Commercial agricultural banks -- those with greater than the

national average of 16 percent of their loan portfolio in agriculture --

suffer as agricultural borrowers find it increasingly difficult to meet

their obligations.[35] Furthermore, recent trends, along with the high

leverage and low cash flow of many agricultural borrowers indicate that

private bank failures and concomitant agricultural bank credit scarcity

are unlikely to abate over the next few years.[36]

The concentration of bank vulnerability is important because

banking in farm states is restricted by prohibitions on interstate entry

and, typically, by unit-banking laws. Branch-banking restrictions

operate to increase banks' vulnerability to failure -- by restricting

bank size and the ability to diversify loan risks -- and to accentuate

the consequences of bank failures by limiting the entry of alternative intermediaries. The scope for improvement through branching and diversification is demonstrated by the robust performance of California banks. California leads the country in total agricultural production and has had a higher than average percentage of troubled agricultural loans. The percentage of agricultural loans with non-accrual status in 1984 was 8.4 for California and 4.7 for the rest of the country. The agricultural loan delinquency rate for 1984 was 13.1 percent in California, compared to the national average of 8.9 percent. Net chargeoffs as a percentage of agricultural loans was 6.1 percent in California and 1.8 percent in other states.[37] At the same time, California accounted for only one of the 68 agricultural bank failures in 1985. This is because large banks, which account for most of agricultural lending in California, held only 3 percent of their portfolio in agricultural production loans.[38]

Further evidence for the scope for improvement through branch banking comes from the distribution of troubled banks. In 1985, 36.4 percent of U.S. agricultural banks had a proportion of non-performing loans of less than 2 percent, while the national average was 4.5 percent and only 30.5 percent of agricultural banks had ratios in excess of 5 percent. Similarly, 39 percent of agricultural banks show a rate of return to equity of less than 5 percent, while 50 percent show a greater than 10 percent rate of return.[39] Presumably, branch banking would lead to a more even distribution of losses on agricultural loans among banks, and prevent as many banks from crossing the failure threshold. In addition, it would allow banks with a lower proportion of loan losses to enter markets occupied by troubled banks.

The Farm Credit System

The Cooperative Farm Credit System (FCS) is a nationwide network of financial institutions owned by borrower stockholders. It is divided into twelve districts and is comprised of twelve Federal Land Banks, twelve Federal Intermediate Credit Associations, and thirteen Banks for Cooperatives (including a central Bank for Cooperatives). The Federal Land Banks finance mortgages through more than 400 Federal Land Bank Associations; the Federal Intermediate Credit Associations finance production loans through nearly as many Production Credit Associations.

Until recently the FCS has functioned as a loose confederation of decentralized organizations with most discretionary authority in the hands of district-level management, though funds have been raised by the national-level Farm Credit Funding Corporation. One of the main results of the current financial stress has been a change toward greater centralization in lending policy. To this end, national organizations have been created or redesigned under the Farm Credit Amendments Act of 1985. The Farm Credit Administration (FCA) regulates the districts more closely and from a separate arm's-length position; the new Farm Credit Capital Corporation has authority to allocate funds among districts in order to shore up the relatively weak units with the surplus of the relatively strong units; the new Farm Credit Corporation of America (FCCA) acts as a research and advisory arm of the FCS.[40]

The troubled condition of the FCS largely parallels that of commercial banks; commercial banks have roughly the same proportion of debtors in each cash-flow/debt-equity class.[41] Like commercial banks, FCS intermediaries have experienced a growing rate of loan delinquency

and threats of default. Portfolio quality varies greatly among FCS districts.[42] Though districts varied up through June 1983 with respect to the ratio of "untroubled" to total loan items at Federal Land Banks, all districts reported in excess of 92 percent. By December 1985, six districts had fallen below 85 percent. Much of this variation in Land Bank performance reflects relative degrees of diversification in regional economics.[43]

For our purposes, it is important to consider the ability of the FCS to function as an effective localized provider of agricultural credit, particularly when local banks may be vulnerable to fluctuations in farm income because of institutional restrictions on their ability to diversify risks. The FCS enjoys advantages over commercial banks both through an implicit government commitment to its debtholders and through a cooperative national network for spreading risk and merging troubled associations. At the same time, three specific features of FCS organization and rules -- the method of arriving at interest rates on loans, cooperative stock ownership by borrowers, and the potential incompatibility of local and national goals -- create problems of coordination and portfolio management.

Loan interest rate policy and cooperative ownership together have encouraged relatively good borrowers to leave the FCS recently. Interest rates are set on an average-cost rather than a marginal-cost basis. Loan interest rates reflect the average interest cost on outstanding FCS bonds, operating expenses and past loan losses. When bond interest rates fall and losses from the past rise -- as they did in the last two years -- average cost exceeds marginal cost. By pricing at average cost, therefore, the FCS encourages borrowers who can retire

debt or refinance it at competing institutions to do so, while at the
same time it places unwarranted stress on borrowers who remain in the
system.[44]

The cooperative nature of the FCS creates a further incentive for
borrowers who can withdraw to choose to do so. Upon taking out an FCS
loan, borrowers must purchase between 5 and 10 percent of the funds
borrowed in FCS stock. When the loan is repaid, these funds -- or a
lesser amount if loan losses have reduced shareholders' equity to below
par value -- are reimbursed to borrowers; it is not possible to enjoy a
capital gain on FCS stock. The threat of future equity losses leads
borrowers in vulnerable districts to repay their loans prematurely in
order to withdraw capital before expected portfolio losses are realized;
it also encourages borrowers in relatively financially healthy districts
to repay their loans before the impending consolidation of FCS stock
eliminates the distinctions among districts' equity positions. The
combined effect of high interest rates and expected capital losses --
due to average cost pricing and cooperative ownership -- on early "pay-
downs" has been large.[45] Presumably, the borrowers leaving the FCS are
among those of the highest quality. Thus average-cost pricing and
cooperative ownership act to weaken further the FCS portfolio during the
current crisis.

Finally, the potential incompatibility between national - and
district-level objectives has created problems of coordination both in
the past and during the current period of transition toward
centralization. Policies which are advantageous from a national
perspective -- loan interest rate differentials across borrowers of
different riskiness, for example -- may be resisted in troubled

districts which see a benefit to keeping rates their borrowers pay lower than true marginal cost, and which do not have as strong an incentive to protect the system's capital since they will be net recipients of a capital transfer in any case. At the same time, districts with relatively healthy balance sheets may be encouraged to lend more freely today, before the new Capital Corporation has a chance to implement its program of inter-district capital transfers.

Farmers Home Administration

The Farmers Home Administration (FmHA) is the "lender of last resort" for farmers. The FmHA provides direct loans of various types-- including Farm Ownership Loans (FO), Farm Operating Loans (OL), Economic Emergency Loans (EE), and Economic Disaster Loans (ED)--as well as loan guarantees on loans made by other lending institutions. Applicants for credit must own or operate a "family-sized" farm, not so big that it requires a large proportion of hired labor, nor so small as to be considered a "rural residence." Further requirements are that the applicant (i) has been refused credit from another lending institution; (ii) has sufficient experience as a farmer; (iii) be "creditworthy" (recent bankruptcy, delinquency, or a history of slow payments would be evidence of a lack thereof); and (iv) demonstrate a need to rely on farm income.[46]

Credit supply restrictions to troubled borrowers in local loan markets need not be binding if government credit sources are sufficiently generous. Funding limits for the various FmHA programs are set by Congress, though these limits have only recently acted as binding

constraints on FmHA lending. Typically, in the past, when funding limits for qualified borrowers were reached in a particular program, Congress increased funding or the Secretary of Agriculture transferred funds from one program to another. Since some loan programs had unlimited "entitlement" status (e.g., the Emergency Disaster Program, ED) the power to transfer funds from one to another effectively gave the Secretary of Agriculture an unlimited amount of lending authority. For example, in fiscal year 1985, the Secretary transferred $1.7 billion from the ED program to the direct OL program and $460 million from the ED program to the guaranteed OL program.

Two recent developments have made current congressional lending limits a binding constraint on FmHA activity. First, the volume of FmHA loan requests has risen markedly since 1984, as borrowers who previously depended on the FCS and commercial banks find themselves unable to secure credit without FmHA assistance--either in the form of a direct loan or a loan guarantee; total loans increased nearly 10 percent during fiscal 1985 to a level of over $29 billion. Second, the entitlement-loan-program loophole has been eliminated by the Food Security Act of 1985, which placed a ceiling of $1.3 billion on the ED program.

The portfolio of the FmHA has suffered in recent years more than any other lending institution. By June 30, 1985, roughly 50 percent of FmHA loan principal was in delinquent loans, of which a majority have been delinquent for more than three years. As of December 1984, 40 percent of the FmHA borrowers had debt-equity ratios of greater than 70 percent and negative cash flow--twice the figure for commercial banks and the FCS.[47] Presumably, this reflects the poorer initial quality of FmHA borrowers. An additional explanation for so high a proportion of

loan delinquencies is the court-enforced moratorium on many FmHA
foreclosures from 1983 through 1985. The FmHA was forced to adopt
uniform, detailed standards for informing borrowers of their rights and
options, which include applying for rescheduling, or a five-year payment
deferral.

Loan standards are tightening at the FmHA. The FmHA will only
allow rescheduling or deferral in cases where the farmer can demonstrate
long-run viability. By the end of fiscal 1985, the FmHA had received
108,710 applications for assistance by borrowers; 29,196 of these were
granted a rescheduling, 15,794 were granted a debt set-aside, and 21,539
were rejected for reasons of inadequate cash flow.[48] Jerry Hansen of the
Center for Rural Affairs estimates that of the more than half of the
65,000 adverse action notices sent out by the FmHA so far this year will
end in foreclosure.

Several factors point to a growing tightening of FmHA credit
availability in the future as well. As discussed above, congressional
limits will become a binding constraint on total lending for the first
time. Moreover, in November 1985, the FmHA adopted tighter eligibility
requirements for operating loans: Previously less attention was placed
on the applicant's ability to service other loans; after November 1985,
a farmer who cannot pay off other debts in addition to the operating
loan were not to be granted credit. This change, combined with the
simultaneous increase in foreclosures will force many farmers who
previously had qualified for FmHA forebearance to leave farming.

Conclusions

The findings presented here suggest two implications concerning agricultural policy. First, as international trade in farm products has expanded, so has the sensitivity of farm incomes to fluctuations in domestic and world economic conditions. Thus, while the price stabilization, acreage reduction, and related policies in place since the 1930s were relatively successful in stabilizing farm income during the 1950s and 1960s, these programs will most likely be less effective in achieving this goal in the future.

Second, our analysis of the state panel data indicates that disruptions in agricultural credit markets can have real effects on farm output. This finding is consistent with the conventional wisdom that, unlike credit markets for large firms or for firms for which monitoring is less costly, agricultural financial markets require close customer arrangements. Local financial institutions, for which such relationships are best developed, are often unable (for institutional reasons) to diversify their loan risks (within agriculture and across other geographically separated activities). The deviations from perfect markets indicate an economic rationale -- in addition to the usual political, social, and national defense rationales -- for government intervention in agricultural markets. Our empirical evidence supports the view that customer relationships in localized credit markets are important in agriculture. Because of its ability to pool agricultural loan risks nationally and its access to national capital markets, the Farm Credit System will continue to be an important lender in agricultural credit markets.

Notes

1. These summary statistics are drawn from papers by Emanuel Melichar and George Irwin, Dallas Batten and Michael Belongia, and Emanuel Melichar. Emanuel Melichar and George D. Irwin, "Conditions of Rural Financial Intermediaries" (Invited paper, American Agricultural Economics Association Meetings, Ames, Iowa, August 6, 1985). Dallas S. Batten and Michael Belongia, "Monetary Policy, Real Exchange Rates, and U.S. Agricultural Exports" (Mimeograph, 1985); Emanual Melichar, "Agricultural Banks under Stress," Federal Reserve Bulletin (July 1986).

2. This view of supply-side failures in credit markets as being an important determinant of economic activity has received increasing attention (see for example Ben Bernanke, Alan Blinder, and Benjamin Friedman). However, empirical attempts to ascertain the role of credit constraints in determining economic activity have been confined to historical data pertaining to the National Banking Era (in Charles Calomiris and Glenn Hubbard) or to the Great Depression (in Ben Bernanke). While these historical analyses are suggestive, more relevant to the issues raised in current deregulatory and farm policy debates would be an investigation of the quantitative importance of credit-supply effects on output that might have arisen over the past several years in the farm sector. Ben S. Bernanke, "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," American Economic Review, vol. 73 (June 1983), pp. 259-76. Alan S. Blinder, "Credit Rationing and Effective Supply Failures," Working Paper 1619 (National Bureau of Economic Research, May 1985). Benjamin M. Friedman, "The Relative Stability of Money and Credit 'Velocities' in the United States: Evidence and Some Speculations," Working Paper No. 645 (National Bureau of Economic Research, November 1981). Charles W. Calomiris and R. Glenn Hubbard, "Price Flexibility, Credit Rationing, and Economic Fluctuations: Evidence from the U.S., 1879-1914," Working Paper 1767 (National Bureau of Economic Research, December 1985).

3. See D. Harrington and A. Manchester, "Profile of the U.S. Farm Sector," Agricultural-Fund Policy Review. (U.S.D.A. AER 530, 1985).

4. Internal Memorandum, Farm Credit Corporation of America, July 11, 1986.

5. For reviews of problems of financial distress in U.S. agriculture during the interwar period, see Lee Alston and Albert Hart. Alston in particular notes a pattern similar to that experienced in recent years. An agricultural boom in cash crops occurred after World War I, accompanied by a large increase in mortgage debt to finance expansion. Land values fell subsequently in the mid-1920s and 1930s as expectations changed. The combination of high levels of debt service and restrictions of credit to agricultural borrowers led to the highest levels of foreclosure rates ever experienced in U.S. agriculture. Indeed, James Stock argues that high leveraging, heavy debt-service burdens, and the associated risk of foreclosure were central to the agrarian unrest movements before World War I. Lee J. Alston, "Farm Foreclosures in the United States During the Interwar

Period," <u>Journal of Economic History</u>, vol. 43 (December 1983), pp. 885-903. <u>Albert G. Hart, Debts and Recovery, 1929-1937</u> (New York, Twentieth Century Fund, 1938). James H. Stock, "Real Estate Mortgages, Foreclosures, and Midwestern Agrarian Unrest, 1865-1920," <u>Journal of Economic History</u>, vol. 43 (March 1983), pp. 89-105.

6. "Farm Real Estate Market Developments: Outlook and Situation Report" (Economic Research Service, U.S.D.A., August 1984).

7. In addition to reflecting the decline in the relative price of agricultural commodities, the decline in farm land values in the 1980s may well have been exacerbated by the general reduction in inflation. For example, Martin Feldstein has shown that the relative price of land (and of other nondepreciating real stores of value) will increase with inflation in the presence of unindexed taxes on capital income. Martin Feldstein, "Inflation, Tax Rules, and the Prices of Land and Gold," <u>Journal of Public Economics</u>, vol. 14 (December 1980), pp. 309-18.

8. The analysis follows the general discussion of the allocation of risk, by William Brainard and F. T. Dolbear. We emphasize that farmers rely heavily on localized loan markets, often with limited potential for diversification (e.g., because of branching restrictions on commercial banks). William C. Brainard and F. T. Dolbear, "The Allocation of Social Risk," <u>American Economic Review</u>, vol. 61 (May 1971), pp. 360-70.

9. For a recent review of U.S. agricultural policies, see Elmer W. Learn, Philip L. Martin, and Alex F. McCalla, "American Farm Subsidies: A Bumper Crop," <u>The Public Interest</u>, no. 84 (Summer 1986), pp. 66-78.

10. We implicitly assume that all investment is financed by debt. Later we discuss potential agency problems with equity finance; see also the reviews in Ben Bernanke and Mark Gertler and in Bruce Greenwald and Joseph Stiglitz. Ben S. Bernanke and Mark Gertler, "Financial Efficiency, Collateral, and Business Fluctuations" (Mimeograph, Princeton University, 1986). Bruce C. Greenwald and Joseph Stiglitz, "Information, Finance Constraints, and Business Fluctuations" (Mimeograph, Princeton University, 1986).

11. These credit-market imperfections are likely to apply to many types of small businesses. There are reasons, however, to believe that they may be relatively more severe for farmers. First, farmers are subject to much greater income volatility than the typical proprietor. Second, the production process in agriculture is very capital (land)-intensive, and a large minimum investment is required -- much larger than for a typical small business with similar sales. Third, the nature of the production process works against farmers with respect to cash flow: (i) there is a long period between the purchase of inputs and the sale of output; and (ii) short-run variable costs are a small portion of total costs.

12. This argument relates well to discussions of "debt-deflation" episodes, in which wealth is redistributed from entrepreneurs to savers, with associated declines in the ability to obtain loans to finance productive investments. See the initial propostion in Irving Fisher; examples of subsequent empirical analysis include Bernanke and Calomiris and Hubbard. Irving Fisher, "The Debt-Deflation Theory of Great Depressions," Econometrica, vol. 1 (October 1933), pp. 337-57. Bernanke, "Nonmonetary Effects." Calomiris and Hubbard, "Price Flexibility."

13. Personal communication, James M. Schurr, Senior Vice President, Credit Standards, Farm Credit Corporation of America.

14. Given asymmetries of information, contractual arrangements between borrowers and lenders cannot produce the same level of mutual benefit as would have been possible with costless information or costless aligning of the incentives of the parties to perform. See the general discussion of agency considerations in Michael Jensen and William Meckling and in Kenneth Arrow. Michael Jensen and William Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure," Journal of Financial Economics, vol. 3 (October 1976), pp. 305-60. Michael Jensen and William Meckling, "Rights and Production Function: An Application to Labor-Managed Firms and Codetermination," Journal of Business, vol. 52 (October 1979), pp. 464-506. Kenneth J. Arrow, "The Economics of Agency," in John W. Pratt and Richard J. Zeckhauser (ed.), Principals and Agents: The Structure of Business (Boston, Harvard Business School Press, 1985).

15. A general discussion of constraints on equity financing is given by Bruce Greenwald, Joseph E. Stiglitz, and Andrew Weiss and by Nicholas Majluf and Stewart Myers. Tenure arrangements separating land ownership from farm operations can also discourage soil conservation (reducing future output) through short-term leases or inequitable sharing of the costs and benefits of conservation investments. See the discussion in S.V. Ciriacy-Wantrup and in Linda Lee and William Stewart. Bruce C. Greenwald, Joseph E. Stiglitz, and Andrew Weiss, "Informational Imperfections in the Capital Market and Macro-Economic Fluctuations," American Economic Review, vol. 74 (May 1984), pp. 194-200. Nicholas S. Majluf and Stewart C. Myers, "Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have," Journal of Financial Economics, vol. 13 (June 1984), pp. 187-221. S.V. Ciriacy-Wantrup, Resource Conservation (Berkeley, University of California Press, 1963). Linda K. Lee and William H. Stewart, "Landownership and the Adoption of Minimum Tillage," American Journal of Agricultural Economics, vol. 65 (May 1983), pp. 256-63.

16. See for example Dwight Jaffee and Thomas Russell, "Imperfect Information and Credit Rationing," Quarterly Journal of Economics, vol. 90 (November 1976), pp. 651-66; Joesph E. Stiglitz and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information," American Economic Review, vol. 71 (June 1981), pp. 393-410; Bernanke, "Nonmonetary Effects;" N. Gregory Mankiw, "Credit

Allocation and Financial Collapse," Quarterly Journal of Economics, vol. 101 (August 1986), pp. 455-70. Charles W. Calomiris and R. Glenn Hubbard, "Imperfect Information, Multiple Loan Markets, and 'Credit Rationing'" (Mimeograph, Northwestern University, 1986).

17. An important contribution of Stiglitz and Weiss is that imperfect information can limit the number of loans a "bank" will make; that is, "credit rationing" occurs in the sense that, within a class of observationally equivalent borrowers, not all receive loans. Stiglitz and Weiss, "Credit Rationing."

18. Gregory Gajewski, "Rural Bank Failures: Not a Problem--So Far" (Mimeograph, Economic Research Service, U.S.D.A., 1986).

19. Gajewski, "Rural Bank Failures." See also "Agricultural Conditions and the Prospects for Farm Banks," F.D.I.C. Banking and Economic Review (March 1986), pp. 3-9.

20. There is evidence in the literature for credit effects on such long-term investments as soil conservation. We discuss this point later.

21. The ability of fluctuations in credit availability to affect producers' incomes depends, of course, on the sensitivity of total demand (including net foreign demand) to changes in price. Appreciation of the dollar and expansion of agricultural capacity abroad have made the total demand for U.S. farm goods substantially price-elastic. Reductions in farm output because of credit restrictions are thus likely to result in lower farm incomes.

22. The data used are not available prior to 1977. Our sample includes all states that were either among the top 20 states in total farm cash receipts in 1982, or among the top 10 states in wheat cash receipts in 1982, or both, with the exception of Florida, whose crop share changed sufficiently over the sample period to make the assumption of our fixed effects model questionable. To this group we added South Dakota, leaving the following 24 states in our sample: Arkansas, California, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Dakota, Texas, Washington, and Wisconsin. Because data on loan chargeoffs were not available for North Carolina and Washington, the regressions involving this variable used only 22 states.

23. We use an annual average of a quarterly time series of survey responses of agricultural bankers to indicate whether their expectations were for increased or decreased loan demand in the next quarter. The expectations data were taken from the Agricultural Credit Conditions Survey of the Federal Reserve Bank of Minneapolis.

24. The correction entailed estimating the mean temporal error covariance matrix for each state, and then using this estimate to compute the adjusted coefficient covariance matrix.

25. Our results with respect to credit variables are robust to using constant-dollar cash receipts as the dependent variable and to including the (state-specific) relative prices of farm products as an additional regressor, although this price variable formally should not enter the reduced-form specification.

26. This long-run perspective must be qualified, of course, to the extent that liquidity constraints raise the discount rate for calculating the present value of land.

27. These data are summarized in Emanual Melichar, Agricultural Finance Databook (Board of Governors of the Federal Reserve System, July 1985).

28. Distributions for aggregate U.S. farm sales and income were constructed from data on the number of farms with sales or income in various nominal ranges, which were deflated by the farm price index and then used to estimate lognormal distributions. Sales and income data are from Economic Indicators of the Farm Sector, National Financial Summary (U.S.D.A., 1984), Tables 27 and 30. The farm price index is from the Economic Report of the President (Council of Economic Advisers, 1986).

29. Bruce F. Hall and E. Phillip Le Veeen. "Farm Size and Economic Efficiency: The Case of California," American Journal of Agricultural Economics, vol. 65 (May 1983), pp. 256-63. See also the earlier discussion in Kenneth R. Krause and Leonard R. Kyle, "Economic Factors Underlying the Incidence of Large Farming Units: The Current Situation and Probable Trends," American Journal of Agricultural Economics, vol. 52 (December 1970), pp. 748-63.

30. Philip Garcia, Steven T. Sonka, and Man Sik Yoo, "Farm Size, Tenure, and Economic Efficiency in a Sample of Illinois Grain Farms," American Journal of Agricultural Economics, vol. 64 (February 1982), pp. 119-23.

31. See, for example, the essays in Wes Jackson, Wendell Berry, and Bruce Coleman (eds.), Meeting the Expectations of the Land (San Francisco, North Point Press, 1984).

32. A good discussion of the costs of poor soil conservation practices can be found in David Pimentel, et al., "Land Degradation: Effects on Food and Energy Resources," Science, vol. 194 (October 8, 1976), pp. 149-55. In the 1930s, poor soil conservation practices were thought by life insurance company lending agents to accompany credit constraints for farmers; see the discussion in Archibald M. Woodruff, Jr., Farm Mortgage Loans of Life Insurance Companies (New Haven, Yale University Press, 1937).

33. Linda K. Lee, "The Impact of Landownership Factors on Soil Conservation," American Journal of Agricultural Economics, vol. 62 (December 1980), pp. 1070-76.

34. Participation by life insurance companies in agricultural credit markets (primarily in real estate mortgages) has declined both

absolutely and relatively since the mid-1960s, in part because of the increased involvement of the Farm Credit System in farm lending. This decline has intensified in recent years, as might be expected from an analysis of lenders' relative efficiency in monitoring information-intensive loans in bad times. Life insurance companies also sharply curtailed their lending in the 1930s in response to both the deflation in farm prices and the centralization of loan administration; see the discussion in Woodruff. Woodruff, Farm Mortgage Loans.

35. Sixty-eight agricultural banks failed in 1985, most of them small relative to surviving agricultural banks and non-agricultural banks. Failed agricultural banks had average total assets of $21 million, which is two-thirds the average for agricultural bank assets and one-eighth the average size for all commercial banks. Vulnerable agricultural banks -- those with past-due and non-performing loans greater than total capital -- rose from 240 at the end of 1984 to 332 at the end of 1985. Net chargeoffs as a percentage of total loans at agricultural banks increased from an average of 0.21 in the 1970s to 0.32 in 1980, 0.69 in 1982, 1.22 in 1984, and 2.12 in 1985. The rate of return on equity for agricultural banks as a group declined from an average of 14 percent in the 1970s to 11 percent in 1983, 9 percent in 1984, and 6 percent in 1985. See Emanuel Melichar, "Agricultural Banking Experience, 1985" (Mimeograph, Board of Governors of the Federal Reserve System, March 8, 1986).

36. See Melichar, "Agricultural Banks," pp. 437-8. Melichar estimates that two-fifths of farms' bank debt is in danger of default.

37. Melichar, "Agricultural Banking Experience, 1984" (Mimeograph, Board of Governors of the Federal Reserve System, March 20, 1985), pp. 27, 40.

38. Melichar, "Agricultural Banks," p. 440.

39. Melichar, "Agricultural Banks," p. 447.

40. The movement toward centralization corresponds to a commitment from Congress to allow the use of public funds to support the FCS, under a complex formula involving the participation of the FCA, the Secretary of the Treasury, and Congress. Thus at the same time Congress has acted to reassure FCS bondholders (and perhaps stockholders) of a government commitment to back FCS bonds, it has created legislation to coordinate internal self-help and to centralize decisionmaking in a way which makes the system more accountable to Congress. The effect of congressional action on bondholder confidence is illustrated by the changes in the yield spread between six-month Treasury and FCS securities. The spread rises from roughly zero from January through June of 1985 to around twenty basis points in July and August, then rises to a peak of around eighty basis points for September through November, and falls sharply in December, with the passage of the Farm Credit Amendments Act of 1985. Since then the spread has fallen and maintained itself at a level of approximately twenty basis points (through July 1986).

41. See Agricultural and Credit Outlook, 1986 (Farm Credit
    Administration, 1986).

42. For example, the Springfield, Baltimore, and Texas districts show
    very low percentages of non-accrual loans (under 2 percent), while
    the Louisville, St. Louis, St. Paul, Omaha, Wichita, and Spokane
    districts all have non-accrual loans in excess of 10 percent. Non-
    accrual loans either: (i) are over 90 days contractuallly past due
    and inadequately secured, or (ii) have been classified as a "loss"
    or uncollectible with respect to all principal and interest due.
    The districts show greater similarity with respect to the percentage
    of their overall portfolios deemed of "acceptable" quality--that is,
    loans not classified as "loss," "problem," or "vulnerable." Because
    the percentage of loans not deemed acceptable is a reasonable
    predictor of future non-accrual loans, one would expect the
    currently most troubled districts to continue to experience high
    relative stress, with the addition of the Sacramento district to the
    list of relatively high future losses.

43. The Springfield and Baltimore districts enjoy a relatively diverse
    economic base which better sustains farm land values and offers
    greater off-farm employment opportunities during bad times for
    agriculture. Still, it seems not all of the differences among
    districts' FLB portfolio quality in 1985 can be attributed to
    different incidence of shocks. In 1979, at the end of the boom
    period, the six districts with below-average ratios of performing
    unmatured principal-to-total loan items were: Louisville, St. Louis,
    Omaha, Wichita, Texas, Sacramento, and Spokane. With the exception
    of Texas and Sacramento, these districts also show below-average
    portfolio quality in 1985. Though such comparisons are not
    conclusive, they suggest that relatively liberal loan qualification
    standards may have played a part in the adverse recent experiences
    of some Land Banks.

44. Average-cost pricing has created a widening interest rate
    differential between FCS intermediaries and their marginal-cost-
    pricing competitors. For example, in June 1986, interest rates on
    flexible-rate Federal Land Bank mortgages ranged from 11.5 to 12.5
    percent, while insurance companies and commercial banks typically were
    charging rates on mortgages in the range of 10 to 10.5 percent--
    adjusting for mortgage fee differentials (see the Crittenden Ag
    Financing Newsletter, various issues, 1986).

45. Estimated pay-downs for the first five months of 1986 for all twelve
    districts totaled $1.6 billion--roughly 2.7 percent of total FCS
    loans. District surveys indicate that the primary reason given for
    these pay-downs was high interest rates; the majority of borrowers
    who withdrew from the FCS switched to competing institutions. Loan pay-down
    data were provided by Robert Jensen of the Farm Credit
    Corporation of America.

46. The farmer's credentials--including a "Farm and Home Plan"--are
    examined by local county supervisors whose decisions are approved on
    a pro-forma basis by county committees. The Farm and Home Plan

contains information on current debts and assets, as well as historical and projected cash flow. Loan qualification standards are the same for direct as for guaranteed loans.

47. Memorandum, Farm Credit Corporation of America, July 11, 1986.

48. Agriculture and Credit Outlook, 1986. p. 40.

Table 1. Farm Income, Borrowing, and Investment[a]

Year	Gross Income[b]	Total Return from Assets[b,c]	Net Borrowing[b]	Interest on Debt[b]	Capital Buildings[b]	Expenditure Machinery[b]
1950	123.7	46.7	5.3	2.2	3.4	12.2
1951	134.5	42.5	6.0	2.4	3.4	12.1
1952	129.0	-10.8	2.7	2.6	3.4	10.5
1953	115.0	-14.6	-1.3	2.5	3.2	11.2
1954	113.2	14.1	2.8	2.6	3.0	9.5
1955	109.4	13.7	4.7	2.7	2.9	9.4
1956	109.1	25.5	2.6	2.9	2.9	8.1
1957	108.1	19.2	4.3	3.0	2.8	8.2
1958	119.0	49.0	5.8	3.2	2.7	10.0
1959	112.8	5.5	7.1	3.6	3.5	10.7
1960	113.6	6.7	3.4	3.9	3.7	8.6
1961	117.3	28.5	5.1	4.1	3.5	8.7
1962	120.7	20.4	7.6	4.4	3.8	9.5
1963	121.7	22.9	8.4	4.9	3.9	10.4
1964	116.5	24.1	7.8	5.2	3.9	11.0
1965	126.5	38.8	10.5	5.7	4.0	11.9
1966	133.6	28.6	9.3	6.1	4.1	12.8
1967	130.0	17.8	8.0	6.7	4.6	13.9
1968	128.3	10.2	4.3	6.9	4.2	11.9
1969	133.6	7.2	6.1	7.2	4.2	11.3
1970	133.0	8.2	5.6	7.6	4.5	11.7
1971	134.6	36.3	10.1	7.7	4.4	11.1
1972	149.3	83.3	11.9	8.1	3.9	12.6
1973	198.3	146.9	18.7	9.2	5.3	16.0
1974	177.3	35.9	15.7	10.3	6.2	15.5
1975	167.9	94.5	16.2	10.7	6.6	15.2
1976	162.3	109.7	18.5	11.7	6.6	16.7
1977	160.9	57.6	22.9	12.9	7.0	16.8
1978	176.5	120.6	23.4	14.5	7.7	18.8
1979	191.6	87.9	32.4	17.0	7.6	19.4
1980	171.4	10.6	18.8	19.3	6.4	15.7
1981	176.4	-61.4	17.7	21.7	5.3	13.8
1982	159.4	-59.9	7.8	22.8	4.0	10.5
1983	143.5	-23.2	3.4	21.0	3.4	10.1
1984	161.7	-96.3	-1.4	21.5	3.0	9.5

[a] The information in the table was obtained from Tables 112 and 122 in Emanual Melichar, Agricultural Finance Databook (Board of Governors of the Federal Reserve System, July 1985).

[b] All amounts are in billions of 1984 dollars.

[c] The return on assets includes capital gains (or losses) on assets.

Table 2. Synopsis of Farm Balance Sheet and Rates of Return[a]

Year	Assets	Debt	Equity	Total Rate of Return to Assets[c]	Total Rate of Return to Equity
1950	445.5	44.3	401.1	10.5%	11.7%
1951	473.1	45.1	428.0	9.0	9.8
1952	482.5	49.0	433.5	-2.2	-2.9
1953	463.5	51.9	411.6	-3.2	-4.0
1954	460.3	54.1	406.3	3.1	2.9
1955	467.3	56.3	410.9	2.9	2.9
1956	478.0	57.8	420.2	5.3	5.8
1957	489.0	58.3	430.7	3.9	4.2
1958	517.2	63.6	453.5	9.5	10.3
1959	535.9	68.7	467.2	1.0	0.7
1960	533.2	70.9	462.3	1.3	0.9
1961	543.1	75.5	467.6	5.2	5.3
1962	558.8	81.7	477.1	3.7	3.6
1963	573.4	88.5	484.9	4.0	4.0
1964	587.4	94.5	492.8	4.1	4.1
1965	611.3	101.3	510.1	6.3	6.9
1966	634.4	107.7	526.7	4.5	4.8
1967	652.4	113.6	538.8	2.7	2.7
1968	660.8	117.3	543.5	1.5	1.5
1969	663.3	119.0	544.3	1.1	1.0
1970	658.9	118.5	540.4	1.2	1.0
1971	668.8	120.9	548.0	5.4	6.0
1972	714.0	127.4	586.7	11.7	13.6
1973	798.8	133.9	664.9	18.4	22.2
1974	822.1	136.5	685.9	4.4	5.6
1975	844.2	141.8	702.4	11.2	13.0
1976	927.4	152.6	774.9	11.8	13.6
1977	993.0	167.7	825.3	5.8	6.5
1978	1,071.8	182.5	889.3	11.3	13.5
1979	1,159.9	194.8	965.2	7.6	9.1
1980	1,185.6	200.5	985.1	0.9	1.0
1981	1,140.6	203.7	937.0	-5.4	-7.4
1982	1,065.0	210.0	854.9	-5.6	-8.6
1983	1,002.1	109.6	792.5	-2.3	-4.7
1984	911.9	200.7	711.2	-10.6	-15.7

Note: Columns 2–4 are headed "- - - Farm Balance Sheet[b] - - -"

[a] The information in the table is taken from Table 101 in Emanuel Melichar, Agricultural Finance Databook (Board of Governors of the Federal Reserve System, July 1985).

[b] All figures are in billions of 1984 dollars.

[c] The total rate of return is the sum of the income rate of return and real capital gains.

Table 3. Volatility and Cyclical Sensitivity of Farm Income

---Summary Statistics---   ---Regression Results---

$$\Delta\ln \text{ Farm Income}_t = a + b_1 \Delta\ln X_t + b_2 \Delta\ln X_{t-1}$$

| | 1954-1972 | | 1973-1984 | | 1954-1972 | | 1973-1984 | |
Series	Growth Rate	Standard Deviation	Growth Rate	Standard Deviation	$b_1 + b_2$	R^2	$b_1 + b_2$	R^2
Gross Farm Income	1.38%	4.53%	0.67%	12.10%	---	---	---	---
National Income	3.31	2.79	2.65	3.76	0.27	0.03	3.03	0.55
Employee Compensation	3.69	2.40	3.24	2.58	0.05	0.01	3.63	0.46
Corporate Profits	1.90	11.40	0.39	16.62	0.04	0.07	0.55	0.34
Merchandise Exports[b]	4.51	7.68	5.68	13.29	-0.06	0.21	0.23	0.55

[a]Source: Authors' calculations. The right-hand variables in each regression are the growth rate of X_t and its lag, where X refers to the series noted in the first column on the corresponding line. All series are in 1972 dollars.

[b]The series excludes military aid shipments.

Table 4. Estimated Effects of Indicators of Credit Variables on Farm Output[a]

Dependent variable = log(Q)

Equation	log(RE)[b]	Fails_{-1}	(Chargeoffs)_{-1}	DS[b]	DS*(D/E)[b]	DS*FS[b]	Regression Statistics[c] -- F-tests -- Exclude All — All	but RE	r_1	r_2	Q(7)
1.	0.342 (3.40)	-0.011 (-2.37)	---	-1.27 (-1.57)	--- ---	--- ---	5.00 (.0026)	2.83 (.0626)	.15	-.18	12.27 (.078)
2.	0.333 (3.24)	-0.011 (-2.38)	---	-1.11 (-0.94)	-0.27 (-0.59)	--- ---	3.80 (.0060)	2.33 (.0789)	.15	-.18	19.74 (.006)
3.	0.425 (4.20)	-0.011 (-2.37)	---	-3.46 (-2.94)	--- ---	8.82 (2.73)	5.57 (.0004)	4.26 (.0067)	.10	-.19	10.74 (.150)
4.	0.434 (4.06)	-0.010 (-2.29)	---	-2.99 (-2.28)	-0.69 (-1.48)	10.20 (3.03)	4.51 (.0001)	3.83 (.0057)	.09	-.18	10.21 (.176)
5.	0.30 (2.66)	-0.011 (-2.33)	2.68×10^{-3} (0.69)	-1.44 (-1.45)	--- ---	--- ---	3.74 (.0062)	2.47 (.0640)	.14	-.18	12.10 (.097)
6.	0.30 (20.61)	-0.011 (-2.36)	3.67×10^{-3} (0.92)	-1.16 (-0.89)	-0.29 (0.57)	--- ---	3.07 (.0113)	2.41 (.0517)	.14	-.18	11.94 (.103)
7.	0.39 (3.52)	-0.011 (-2.78)	2.00×10^{-3} (0.56)	-3.61 (-2.78)	--- ---	8.93 (2.64)	4.51 (.0001)	3.78 (.0058)	.10	-.19	9.837 (.198)
8.	0.40 (3.54)	-0.010 (-2.40)	4.26×10^{-3} (1.15)	-3.05 (-2.21)	-0.77 (-1.52)	10.35 (2.91)	4.02 (.0001)	3.34 (.0067)	.08	-.19	8.978 (.254)

[a] Fixed time and state effects are not reported. Equations were estimated by two-stage least squares. t-statistics corresponding to corrected standard errors are in parentheses.

[b] Variables taken as endogenous in 2SLS estimation.

[c] r_1 and r_2 respectively refer to the first and second autocorrelations of the residuals. p-values for the tests appear in parentheses.

Table 4 (continued)

Variable definitions:

Q = Cash receipts from farm marketings/P

DS = INT/INC

D/E = Debt/Equity

where:

Cash receipts from farm marketings: Economic Indicators of the Farm Sector:
    State Income and Balance Sheet Statistics, U.S.D.A., 1984, Table 4.

P = a price index constructed by weighting an annual series of national commodity
    prices by the quantity of output produced in 1980 for the five agricultural
    products of each state with the greatest sales in 1980. The annual price data
    from 1977 to 1984 were obtained from various tables in U.S.D.A., Agricultural
    Statistics, 1985. The cash receipts for the top five products in each state in
    1980 was taken from Table 2 of Economic Indicators of the Farm Sector. The
    products used to construct this index were: cattle, dairy, soybeans, corn,
    wheat, hogs, broilers, cotton, eggs, tobacco, hay, rice, turkeys, grapes,
    potatoes, oranges, sorghum, apples, forestry, tomatoes, green peas, sugar beets,
    barley, dry beans, and peanuts. "Nursery and greenhouse products" were excluded
    because of ambiguities associated with the price for these products.

RE = the average real value (deflated by the GNP deflator) of farmland in the state,
    as of January 1, obtained from Farm Real Estate Market Developments, U.S.D.A.,
    1984.

F = the number of F.D.I.C. board actions (liquidations and forced acquisitions and
    mergers) pertaining to commercial banks in each state in each year, collected
    from Annual Reports of the FDIC, 1977-1984.

Loan Chargeoffs = net loan chargeoffs as a percentage of total loans at agricultural
    banks in each state in each year, taken from Emanuel Melichar, "Agricultural
    Banking Experience, 1985" (Mimeograph, Preliminary Data Appendix, Tabulated
    March 8, 1986), Table E.7.

INT = total interest payments on debt, collected from Economic Indicators of
    the Farm Sector: State Income and Balance Sheet Statistics (U.S.D.A.,
    1980, Tables 11-12; and 1984, Tables 25-30).

INC = gross income of the state farm sector, taken from Economic Indicators of
    the Farm Sector: State Income and Balance Sheet Statistics, (U.S.D.A.,
    1980, Table 4; and 1984, Table 5).

FS = the fraction of total sales in 1982, by state, generated by farms with sales
    per farm falling between $40,000 and $99,000 (1982 dollars), collected from the
    1982 Census of Agriculture, Table 3.

Debt = the estimated market value of total farm debt as of January 1 from Economic Indicators of the Farm Sector: State Income and Balance Sheet Statistics (U.S.D.A., 1984, Tables T43-T44).

Equity = the estimated market value of total farm equity as of January 1 from Economic Indicators of the Farm Sector: State Income and Balance Sheet Statistics (U.S.D.A., 1984, Table B2).

Table 5.   Debt-Asset Ratios by Value of Sales Class

Value of Sales Class (Current Year Dollars)	1975	1976	1977	1978
>$100,000	27.6%	25.3%	25.2%	22.7%
40,000-99,999	18.5	17.6	18.1	19.8
20,000-39,999	14.6	15.0	14.0	15.8
10,000-19,999	9.6	11.9	12.2	14.8
5,000- 9,999	6.6	7.3	7.4	9.1
2,500- 4,999	7.6	5.5	5.6	9.0
<2,499	3.3	4.7	4.2	6.3
All	15.8	15.7	15.7	16.7

[a] Data are taken from Economic Indicators of the Farm Sector: National Financial Summary, (U.S.D.A., 1980).

Table 6. Trends in Real Sales Per Farm[a]

Year	Distribution of Sales Per Farm (Thousands 1984 $'s)			Number of Farms (Thousands)		Fraction of Income from Farms with Sales of $50,000-150,000
	Mean	Median	90%	Total	$50,000-150,000	
1960	22.7	7.8	51.5	3963	322	29.2%
1961	24.4	8.1	55.9	3825	334	29.3
1962	25.8	8.2	60.1	3692	339	29.4
1963	28.0	8.6	66.2	3572	351	29.7
1964	29.2	8.9	69.2	3457	351	29.8
1965	30.4	8.8	71.3	3356	344	29.3
1966	32.2	8.7	73.8	3257	337	28.9
1967	34.6	9.4	79.9	3162	347	28.7
1968	35.9	9.4	81.9	3071	340	28.7
1969	37.7	7.7	81.6	3000	304	25.2
1970	39.5	7.8	84.8	2949	304	24.7
1971	41.2	7.9	89.5	2902	304	24.3
1972	43.7	7.9	93.2	2860	303	23.8
1973	44.7	7.7	101.9	2823	300	24.4
1974	45.0	7.8	104.9	2795	301	24.6
1975	48.3	9.2	109.6	2521	293	24.8
1976	51.1	9.6	115.2	2497	298	24.2
1977	52.1	9.8	117.8	2456	296	24.1
1978	55.8	10.3	124.7	2436	302	23.6
1979	57.4	9.6	120.7	2432	291	23.7
1980	59.2	9.8	127.7	2433	296	23.5
1981	58.8	10.2	136.8	2434	302	23.5
1982	63.6	11.4	156.5	2401	314	22.5
1983	60.3	11.5	159.2	2370	311	22.7
1984	61.0	11.6	159.5	2328	308	22.9

[a] Source: authors' calculations. The mean is total real farm marketings divided by the number of farms. The median and ninetieth percentile point of distribution of farm sales (in 1984 dollars), the number of farms with sales between $50,000 and $150,000, and the fraction of gross income generated by farms with sales between $50,000 and $150,000 (in 1984 dollars) were estimated assuming that sales per farm is lognormally distributed. All deflation was done using the farm price index from the Economic Report of the President (Council of Economic Advisors, 1986).

Table 7. Total Outstanding Farm Debt by Lender[a]

Year	Total (Billions of 1984 dollars)[b]	% Held by Banks	% Held by Life Insurance Cos.	% Held by Farm Credit System	% Held by Farmers Home Administration
1950	22.7	50.2	18.2	22.8	8.8
1951	24.7	51.9	18.5	21.5	8.2
1952	27.9	53.5	18.4	20.9	7.2
1953	29.2	52.0	19.3	21.0	7.6
1954	28.1	48.0	21.9	21.6	8.5
1955	29.1	47.5	22.2	21.5	8.7
1956	31.5	47.7	22.1	22.0	8.1
1957	32.2	45.1	22.9	23.7	8.3
1958	34.4	44.6	21.9	25.1	8.4
1959	37.2	45.6	20.5	26.0	7.8
1960	41.2	46.2	20.2	27.0	7.4
1961	43.2	45.4	19.4	27.8	7.5
1962	46.0	44.1	19.0	28.2	8.7
1963	50.2	44.9	18.4	27.9	8.8
1964	55.1	45.2	18.5	28.2	8.6
1965	58.8	44.0	19.2	28.1	8.6
1966	63.6	43.1	19.3	28.8	8.9
1967	69.1	42.5	18.8	30.0	8.6
1968	72.6	42.1	18.1	31.2	8.6
1969	73.5	41.7	17.7	31.8	8.8
1970	74.6	41.1	16.7	33.5	8.7
1971	75.6	41.2	15.3	34.9	8.6
1972	79.2	42.2	13.8	35.7	8.2
1973	82.7	43.4	12.6	36.1	7.9
1974	88.4	44.1	11.5	37.1	7.3
1975	90.8	41.9	10.8	40.3	7.1
1976	96.2	40.6	10.2	41.6	7.6
1977	102.4	40.8	9.9	42.1	7.2
1978	109.5	39.6	10.3	41.7	8.1
1979	115.2	38.0	10.7	41.5	9.8
1980	126.2	34.3	10.4	42.0	13.3
1981	127.9	31.5	10.0	44.0	14.4
1982	133.3	29.2	9.1	46.2	15.5
1983	134.5	30.1	8.5	46.1	15.2
1984	132.4	31.8	8.3	44.9	15.0
1985	129.6	32.5	8.0	43.7	15.8

[a] All figures are taken from Emanuel Melichar, Agricultural Finance Databook, (Board of Governors of the Federal Reserve System, July 1985).

[b] Debt figures exclude loans made by "individuals and others."

APPENDIX

CHANGING CONDITIONS IN U.S. AGRICULTURAL MARKETS

(SELECTED SUMMARY TABLES)

Table. A1. U.S. Share of World Agricultural Production

Out of World Trade, U.S. Share of:

Year	Exports[b]	Wheat[a] Acres	Wheat[a] Output	Soybeans[a] Acres	Soybeans[a] Output	Oats[a] Acres	Oats[a] Output	Tomatoes[a] Acres	Tomatoes[a] Output	Corn[a] Acres	Corn[a] Output	Oranges[a,c] Output	Seed Cotton[a] Acres	Seed Cotton[a] Output
1970	$ 7,980	8.4%	11.6%	49.0%	66.4%	23.1%	24.0%	9.6%	17.4%	21.6%	40.4%	28.6%	13.8%	17.6%
1971	8,020	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	9,400	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	16,738	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	19,030	-	-	-	-	-	-	-	-	-	-	-	-	-
1975	17,410	12.3	16.4	50.2	60.6	17.5	19.5	10.9	21.8	23.6	45.4	25.1	11.5	-12.8
1976	17,379	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	16,857	11.6	14.3	47.3	60.5	18.4	21.3	8.4	17.3	24.2	46.8	24.3	16.3	20.2
1978	19,600	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	21,234	11.0	13.5	56.2	69.3	15.1	17.5	7.4	15.2	23.2	48.2	21.6	16.1	20.0
1980	23,092	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	22,137	13.7	16.6	53.7	62.8	14.2	16.8	6.7	12.6	24.0	46.1	22.7	16.2	20.4
1982	17,649	13.2	15.5	53.8	64.6	16.0	19.1	6.9	14.3	23.4	46.7	17.1	11.7	15.6
1983	16,764	10.8	13.3	51.8	56.0	14.0	15.7	6.8	13.6	17.6	30.5	19.4	9.0	10.2
1984	17,000	11.7	13.5	51.4	56.3	12.9	15.8	6.7	13.9	22.4	43.3	15.1	11.8	14.5

[a]Figures are taken from various issues of the United Nations Food and Agricultural Organization Production Yearbook.

[b]Export figures are nominal exports deflated by the GNP deflator, 1972 = 1.00. Data are from the Economic Report of the President, 1986.

[c]Acreage data were not available for oranges.

Table A2. Indicators of Financial Stress in Agriculture[a] (percent)

	1979	1980	1981	1982	1983	1984	1985
Loan Volume Delinquency	2.9%	NA	NA	3.9%	3.7%	4.5%	5.3%
Bank Finance Discontinued	3.8	4.5	2.9	3.3	2.9	3.4	4.5
Loaned up to Practical Limit	29	27	NA	32	28	32.8	36.7
Farmers Who Went out of Business	NA	2.1	NA	2.2	2.3	3.6	4.8
Farmers Who Went Through Bankruptcy	NA	NA	NA	0.8	1.1	2.6	3.8

[a]Source: American Bankers Association Midyear Farm Credit Surveys, _Agricultural Banker_, various issues.

Table A3. Six-Month Yields on FCS and Treasury Securities (Percent)[a]

Year	Month	FCS	T-Bills	Spread (Basis Points)
1985	January	8.60%	8.60%	0
	February	9.04	9.02	2
	March	9.05	9.00	5
	April	8.31	8.31	0
	May	7.67	7.59	8
	June	7.58	7.57	1
	July	7.28	7.10	18
	August	7.75	7.52	23
	September	8.16	7.39	77
	October	8.42	7.64	78
	November	8.39	7.61	78
	December	7.63	7.45	18
1986	January	7.65	7.44	21
	February	7.57	7.34	23
	March	6.83	6.59	24
	April	6.64	6.48	16
	May	6.81	6.64	17
	June	6.43	6.28	15
	July	6.31	6.05	26

[a]Source: Wall Street Journal, various issues.

Table A4. Farm Credit System Portfolio Quality[a]

FCS District	Percentage Non-Accrual Loans (Amount) May 1986	May 1985	Dec. 1984	Percentage of Portfolio Deemed of "Acceptable" Quality May 31, 1986 FLB	PCA	BC	FCS
Combined	10.18	3.46	2.20	81.6	67.5	84.0	79.1
Central Bank for Cooperatives	0.39	0.00	0.00	–	–	90.3	90.3
Springfield	1.46	0.43	1.04	87.6	83.7	98.0	87.0
Baltimore	1.45	1.18	0.90	91.3	80.4	80.0	88.3
Columbia	7.53	1.81	1.68	85.3	77.5	91.7	84.1
Louisville	13.68	3.59	3.03	81.4	78.2	70.5	79.5
Jackson	7.66	2.95	2.97	84.2	75.1	89.1	83.0
St. Louis	10.47	2.81	2.41	87.5	57.1	82.3	82.5
St. Paul	10.72	3.72	2.44	74.3	66.6	74.3	72.4
Omaha	18.71	3.68	2.48	75.0	46.0	68.6	70.7
Wichita	13.46	4.75	3.12	79.8	56.2	62.6	75.3
Texas	1.98	0.40	0.43	93.5	78.6	87.9	89.4
Sacramento	6.42	3.18	2.07	76.4	56.2	94.3	71.0
Spokane	14.39	3.69	3.18	83.1	67.1	73.9	79.8

[a]Constructed from Annual Report of the Cooperative Farm Credit System, various years, and various internal memoranda of the Farm Credit Administration.

Table A5. Federal Land Bank Portfolio Quality[a] (Percentage of "Good"[b] loans)

Year	1977[c]	1978[c]	1979[c]	1980[c]	1981[c]	1982[c]	1983[c]	1984[d]	1985[d]
District									
Combined	96.5%	96.6%	95.8%	95.3%	94.8%	93.7%	93.4%	92.0%	85.9%
Springfield	96.3	96.7	97.4	97.8	97.1	96.8	97.3	96.4	97.2
Baltimore	97.3	97.5	97.7	97.5	97.4	97.0	97.2	96.7	96.2
Columbia	95.8	96.2	96.6	96.2	95.8	94.9	94.3	94.2	91.3
Louisville	96.4	96.5	95.1	94.5	93.8	92.5	92.4	91.6	82.7
New Orleans/ Jackson	96.6	96.8	95.9	94.4	95.1	94.0	93.0	91.0	88.4
St. Louis	97.0	97.0	95.6	95.2	94.5	93.4	93.1	91.4	84.7
St. Paul	97.8	97.8	97.4	96.9	96.2	95.0	94.8	92.7	83.6
Omaha	97.0	96.8	94.8	94.3	93.7	92.2	92.0	90.0	78.2
Wichita	96.0	95.9	95.7	95.0	94.2	92.8	92.0	89.9	82.0
Texas	95.8	95.9	94.8	94.5	94.3	94.1	94.5	94.2	94.2
Sacramento	96.3	95.6	94.6	94.6	94.2	92.8	92.7	91.4	88.2
Spokane	96.3	96.2	95.4	94.8	94.4	93.5	92.4	91.5	84.5

[a]Source: Constructed from Annual Reports of the Cooperative Farm Credit System, various years, and various internal memoranda of the Farm Credit administration.

[b]Percentage of loan items which do not represent unmatured extensions, delinquent principal, loans in process of foreclosure or closing, or accrued interest receivable.

[c]Measured June 30 of year.

[d]Measured December 31 of year.

Table A6. Commercial-Sized Farm Operators Cross Classified by Debt-to-Debt-to-Asset Ratios and Return on Equity or Assets by Equity Levels[a,b,c]

	Debt-to-Asset Ratios (%)			All Debt/Asset Categories
	>70	40 to 70	<40	
Equity J $50,000 **Return on Equity** **Under − 15%**				
Number	8	17	17	42
Debt	4.7	5.6	1.7	12.0
Assets	5.9	10.3	9.4	25.6
−15 to 5%				
Number	4	33	163	200
Debt	1.8	12.0	17.1	31.0
Assets	2.4	23.1	148.1	173.5
Over 5%				
Number	10	60	245	315
Debt	5.2	15.7	16.9	37.8
Assets	6.7	30.0	120.4	157.1
Equity F $50,000 **Return on Assets** **Under 5%**				
Number	18	3	2	23
Debt	7.3	0.1	0.0	7.4
Assets	6.0	0.2	0.0	6.3
Over 5%				
Number	36	8	11	55
Debt	10.3	0.4	0.0	10.7
Assets	8.1	0.7	0.0	9.2
Overall				
Number	76	121	437	634
Debt	29.3	33.9	35.8	99.1
Assets	29.0	64.4	278.2	371.7

[a]Source: Agricultural Credit Outlook, 1986 (Farm Credit Administration), Table 11.

[b]All numbers are in thousands; all dollar amounts are in billions.

[c]Commercial-sized farms are defined as those with sales of $40,000 and over.

Table A7. USDA Survey Data on Farm Borrowers[a]

	Debt-to-Asset Ratios				
	>100%	70-100%	40-70%	<40%	All Debt-Asset Categories
Debt of All Operators ($ billion)	13	15	27	22	77
Debt of Operators Reporting Negative Cash Flow ($ billion)	16	19	40	46	120

[a]Source: _Financial Characteristics of U.S. Farms_ (U.S.D.A., 1985).

Table A8. FmHA Loans and Guarantees — Authorized and Made
         (Millions of Current Dollars)

	FY 1982	FY 1983	FY1984	FY 1985
Direct Operating Loans				
Authorized	$1325	$1460	$1810	$1920
Made	1204	1685	1960	3600
Operating Loan Guarantees				
Authorized	50	50	100	650
Made	47	51	111	1107
Direct Farm Ownership Loans				
Authorized	700	700	625	650
Made	658	730	659	652
Farm Ownership Loan Guarantees				
Authorized	125	75	50	50
Made	4	20	42	67
Emergency Disaster Loans	2173	566	1052	490
Economic Emergency Loans	---	---	309	---

[a]Source: Personal communication with Cala Fsasz, Farmers Home Administration.

[b]Whenever actual loans or guarantees exceed authorized amounts, the balance was transferred from the Emergency Disaster Fund.