FACTORS AFFECTING FSA LOAN GUARANTEE USE AND LOSS CLAIMS AMONG COMMERCIAL BANKS IN ARKANSAS

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The Farm Inventory-Cash Flow Relation, Heterogenous Characteristics, and the Boom-Bust Cycle

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Introduction

Several economists have noted that manufacturers' inventory investment (disinvestment) accounted for a large share of the change in GNP from business cycle troughs (peaks) to peaks (troughs).[2] This important relation has spawned an extensive inventory investment literature. Several early studies attempted to explain inventory investment with financial variables.[3] These studies found that interest rates, liquidity, and credit availability had little or an uncertain effect on inventory behavior which indicated that monetary policy instruments would not be effective in reducing inventory fluctuations-- and thus dampening business cycles.

In emphasizing the inventory-financial relation, Kuznets (1964) took greater care in specifying financial variables and lag structures than previous studies.[4] Kuznets estimated that a one-time dollar increase in cash flow increased manufacturers' inventories by 3.5 to 5 dollars and that inventory sensitivity to changes in cash flow were approximately 7 to 16 times as large as responses to equivalent changes in external finance.

A 30-year hiatus occurred before significant improvements were made on Kuznets' study by Carpenter et al. (1994) and Kashyap et al. (1994). These studies were an extension of a broader credit rationing literature in which panel data are utilized to find evidence that firm investment displays excessive sensitivity to movements in internal financial variables.[5] An

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2 See, e.g., Stanback (1962), and Blinder and Maccini (1991).

3 For a summary of this literature see the introduction in Kuznets (1964).

4 In particular, Kuznets used a broader measure of internal funds--cash flow. Pre-Kuznets studies used the quick ratio (the ratio of cash plus government securities to current liabilities) as a measure of "liquidity" or internal funds.

5 These studies posit that shifts in financial variables will affect firm investment behavior if financial markets are imperfect. Financial markets are thought to be imperfect due to asymmetry of information between borrowers and lenders, and financial hierarchies in which internal funds have a cost advantage over debt and equity financing. The bulk of these studies investigate the link between capital investment and financial variables with Q theory or Euler equation

important finding of these studies is that the investment of firms which are thought to be a priori credit constrained are found to be more sensitive to movements in financial variables than the investment of unconstrained firms--a major theoretical prediction of capital market imperfections. The sensitivity of investment to internal funds is further found to be more important during periods of economic downturn than during periods of "normal" business activity. The finding of different magnitudes on the cash flow coefficient across different classes of firms overcomes the problem that cash flow may be proxying for expectations about future investment opportunities--an important criticism of Kuznets' study.

Noting that: 1) financing constraints are important for a large portion of the economy, 2) cash flow is procyclical and tends to lead the cycle, and 3) inventories bear a disproportionate share of internal financial fluctuations due to low adjustment costs, Carpenter et al. examine whether inventory investment is sensitive to shifts in cash flow. Using quarterly COMPUSTAT panel data their results support the view that firms absorb cash flow shocks through changes in inventory investment and that this effect is more important for small firms than for large firms. They further find that cash flow's effect on inventory investment is not uniform across business cycles (from peak to peak). Following a similar approach, Kashyap et al. find that the inventory investment of firms without access to public bond markets is sensitive to cash flow fluctuations during recessions which are caused in part by tight monetary policy. However, the relation between internal funds and inventory investment is much weaker during periods of looser monetary policy.

Small, closely-held firms with poor access to public debt and equity markets should be among the most credit constrained, yet few good data sets are available to test the inventory-finance relation for this class of firms. The current study extends the inventory-finance literature to just such a group of firms--U.S. farms. Farms are prime candidates for credit rationing, have a high percentage of assets held in inventories, and have recently experienced a boom-bust cycle.[6]

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approaches. For Q theory examples see Abel and Blanchard (1986); Fazzari et al. (1988); Himmelberg (1991); Gilchrist (1991); Hoshi et al. (1991); Chirinko and Schaller (1993); and Gilchrist and Himmelberg (1995). For Euler equation examples see Hubbard and Kashyap (1992); Whited (1992); and Hubbard et al. (1995).

6 Farms, in particular, may suffer from credit restrictions due to large fluctuations in net worth and profitability caused by limited diversification opportunities and supply shocks, the importance of debt as a source of investment funds due to a lack of well developed equity markets, high monitoring costs, the long lag between the purchase of inputs and the sale of outputs, and the capital intensive nature of production agriculture. Hence, even transitory downturns in the farm economy may worsen the financial positions of both farms and agricultural lenders, resulting in higher borrowing costs (see Calomiris et al. (1986), and Hubbard and Kashyap (1992)). Agricultural lending is further complicated by information-intensive localized customer-borrowing relationships, rather than impersonal debt and equity markets, and by regulatory restrictions on small agricultural and Farm Credit System banks which prohibits them from diversifying their lending portfolios.

Specifically, we test the following hypotheses: 1) whether farm inventory investment is sensitive to fluctuations in cash flow, 2) whether the relationship between inventory investment and cash flow is homogeneous across different classes of farms, and 3) whether the relationship between inventory investment and cash flow is homogeneous across farm business cycles.

The following section reviews recent farm business cycles. Subsequent sections provide the empirical inventory investment model, and discuss the farm-level panel data set and regression results.

Recent Farm Business Cycles

The U.S. farm sector has recently experienced a boom-bust cycle. Led by high grain and oilseed prices, agriculture boomed from 1973 to 1980. As shown in Figures 1 and 2, in response to higher prices, production, cash flow, and inventory were at high levels from 1973 through 1980--in comparison to subsequent years.[7] As the residual claimant to net income, the value of farm real estate (principally land) began to increase sharply (Figure 3). From 1973 to 1980 the value of U.S. agricultural real estate increased from less than $900 billion (1992 dollars) to nearly $1.4 trillion--a 55% increase.[8] Because about three-quarters of farm assets is composed of real estate, net worth increased in lock-step with real estate values. Backed by the sharp rise in cash flow and net worth, farms expanded and replaced old machinery--heavily financed by new debt. As noted in Figure 4, U.S. farm real estate debt increased from just over $105 billion in 1973 to over $150 billion in 1980. Non-real estate debt responded similarly, increasing from just over $90 billion in 1973 to a peak of just over $130 billion in 1979. In spite of the run up in debt, the debt to asset ratio nominally increased due to the large increase in real estate values.

As export demand weakened in the early 1980s due to a stronger dollar, grain and oilseed prices fell sharply which in turn caused production, cash flow, and inventories to decline sharply from their 1979 highs. Between 1979 and 1986 production decreased $83 billion or nearly 30%. Farm inventories declined by nearly $89 billion in the same period--107% of production's decline.[9] Falling profitability led to sharply declining land prices in the 1981 to 1986 period. By 1986 real land values would be substantially below their 1973 levels, having fallen from $1.3 trillion to less than $700 billion. Although farmers worked to reduce debt, sharply falling land

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7 All data in Figures 1 to 4 are taken from USDA (1994). Production is measured as cash and non-cash income plus the change in inventories. Cash flow is measured as the sum of net cash income, the change in loans outstanding, the net change in other financial assets, and net rent paid to non-operator landlords less capital expenditures. Inventories include livestock and crop inventories only. Livestock inventories include breeding livestock. Real estate encompasses land and non-residential buildings.

8 All dollar amounts are in 1992 dollars except where otherwise indicated.

9 Estimated by authors from data in USDA (1994).

values pushed up debt to asset ratios.[10] Falling land prices led to debt depreciation, farm foreclosures and bank failures. In the 1981 to 1986 period 184 "agricultural banks" failed which accounted for over 40% of all U.S. bank failures in the latter two years (Kliesen and Gilbert (1996)).

In 1987 a recovery began which increased production, cash flow, and inventories. From 1986 to 1990 farm production increased from \$194.8 to \$215.3 billion--a \$20.5 billion increase. In the same period inventories increased \$21.8 billion or 106% of the change in production. The most important factor leading to recovery may not have been the increase in commodity prices--which were modest--but the stabilization of land prices. This allowed farms to reduce their debt to asset ratios as they continued to pay down debt. In spite of the recovery, another 115 agricultural banks failed in 1987 and 1988.

Investment Model

The farm inventory investment model employs the flexible accelerator principle, but parameterizes the target inventory and the unanticipated terms with variables that are relevant to agriculture.[11] The inventory function specification for farm j in period t is

$$I_{jt} - I_{jt-1} = \delta(I^*_{jt} - I_{jt-1}) + \theta(E_{t-1}Y_{jt} - Y_{jt}) + \Sigma\omega_i(E_{it}P_{ijt+1} - P_{ijt}) + \lambda CF_{jt} + e_{jt} \quad (1)$$

where, $I_{jt} - I_{jt-1}$ is inventory investment, I^*_{jt} is the ending period target stock of inventories (made at the beginning of the period), I_{jt-1} is the actual beginning period inventories, $E_{t-1}Y_{jt}$ is the forecasted physical level of production, Y_{jt} is the actual physical level of production,, $E_{it}P_{ijt+1}$ is the forecasted future price of commodity I, P_{ijt} is the price of commodity I, and CF_{jt} is cash flow or the availability of internal finance.[12] The error term, e_{jt}, may contain fixed farm and time effects, as well as random errors.

The first right-hand-side explanatory term in equation 1 is denoted as "anticipated" inventory investment and the second two terms as "unanticipated" inventory investment (Blinder and Maccini (1991)). The model assumes a two-step decision-making process. Initially, it is assumed that the farm makes an inventory decision at the beginning of the year based on the gap

10 Interestingly, Figure 4 clearly shows that non-real estate debt peaked in 1979, while real estate debt peaked two years later in 1981. This would support the argument that short-term debt and the assets financed by them are more sensitive to shifts in internal finance than long-run debt and capital assets.

11 For further discussion of the flexible accelerator model as applied to inventories, see, e.g., Carpenter et al. (1995), Blinder and Maccini (1991), and Kuznets (1964).

12 For the micro-foundations of farm inventory models see, e.g., Bobst and Davis (1987); Brennan (1958); Helmberger and Weaver (1977); Helmberger and Akinyosoye (1981); and Rucker et al (1984).

between actual inventories and target ending year inventories. The speed of adjustment is given by the parameter δ. During the course of the year this decision is revised based on production shocks and changes in future price expectations.[13,14]

The model for the target stock of inventories is represented by

$$I^*_{jt} = \alpha_j + \alpha_1 E_{t-1} Y_{jt} + \Sigma \alpha_{2i} E_{it-1} P_{ijt} + n_{jt}, \quad (2)$$

where n_{jt} is a random error term. A fixed farm effect, α_j, is also added which captures farm-specific effects on inventories which are thought to be slow to change.[15] There are two opposing effects on producers' inventory decisions due to changes in prices. An increase in prices can cause producers to expect higher prices in the future, which leads them to increase inventories in order to take advantage of higher future prices. On the other hand, a price increase encourages producers to sell inventories immediately in order to profit from the current high price. Similarly, a decrease in price may induce producers to hold inventories in hopes of higher future prices. On the other hand, falling prices may lead producers to dispose of inventories because they fear that prices will continue to fall in the future.

Physical production and prices are forecasted with simple autoregressive models:

$$E_{t-1} Y_{jt} = \beta_j + \beta_1 Y_{jt-1} + \beta_2 Y_{jt-2} + w_{jt} \quad (3)$$

$$E_{it} P_{ijt+1} = \gamma_{ij} + \gamma_{1i} P_{ijt} + \gamma_{2i} P_{ijt-1} + z_{jt}, \quad (4)$$

where β_j and γ_{ij} are fixed farm effects, and w_{jt} and z_{jt} are error terms.

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13 Production shocks are largely driven by weather. Weather causes variability in crop yields and in feed and forage availability for livestock. Other production shocks may be animal disease and crop pests.

14 The typical price pattern for annual storable crops is for the price to rise throughout the marketing year (harvest to harvest) as a function of the cost of storage. If producers correctly anticipate future prices and hence store the "correct quantity" the price will rise from a low point at harvest by just enough to cover storage costs from harvest time to subsequent points in the marketing year. These price changes must be sufficient to induce some to sell and others to continue holding the commodity. If crop inventories do not have on-farm uses, they can be sold at any time with the only loss being future income foregone due to potential price increases because crops are finished products. There are no stock out costs because crop commodities are fungible.

Economic theory suggests that livestock producers base their inventory decisions on their expectations of future livestock and feed prices, and pasture and self-produced feed availability. The latter indicates that current and future stocks of land are important determinants of livestock production and thus inventories.

15 For further discussion and motivation see Blinder (1982), and Carpenter et al. (1995). For production agriculture this may include the management skills and preferences of the farm operator, physical endowments of the operation, government programs, and available family labor.

Substituting equations 2, 3 and 4 into 1 yields the inventory investment regression equation:

$$I_{jt} - I_{jt-1} = -\delta I_{jt-1} - \theta Y_{jt} + \Sigma(\omega_i\gamma_{1i} - \omega_i)P_{ijt} + \beta_1(\delta\alpha_1 + \theta)Y_{jt-1} + \beta_2(\delta\alpha_1 + \theta)Y_{jt-2}$$
$$+ \Sigma(\delta\alpha_{2i}\gamma + \omega_i\gamma_{1i})P_{ijt-1} + \Sigma\alpha_{2i}\gamma_{2i}P_{ijt-2} + \lambda CF_{jt} + \mu_j + \mu_t + u_{jt}, \quad (5)$$

where μ_j is the linear combination of fixed farm effects, μ_t controls for time shocks, and u_{jt} is the linear combination of stochastic error terms.

As a result of equation (4) being substituted into (1) twice, once current and once lagged, a moving average component is added to the error term. This implies that generalized least squares would be the efficient estimator although least squares is still consistent. Because the sample is a panel, there are most likely problems of heteroscedasticity. We compensate for this latter problem by estimating the coefficients by OLS and using Whites heteroscedasticity consistent estimator of the least squares covariance matrix. Thus, we essentially ignore the problems induced by the moving average process on the assumption that heteroscedasticity is the more important problem and that given the panel nature of the data, and the other hypothesized sources of random error, n_{jt} and w_{jt}, the bias induced by the moving average component of the z_{jt} is minor and can be ignored.

Data

The data consist of 417 farms which were continuously enrolled in the Kansas Farm Management Association (KFMA) program over the 1973 to 1992 period.[16] Typical KFMA farms are larger than average Kansas farms, thus the results should be considered as representative of Kansas full-time farm operators or commercial farms.[17] The KFMA takes steps to insure that the data are complete and accurate. These include: 1) the survey is not retrospective, because operators record events as they occur; 2) the use of standardized forms and accounting procedures; and 3) the process is supervised and reviewed by KFMA staff.

Kansas farm inventories are composed of feeder livestock, forage, soybeans, grain, and non-commodity inventories. Livestock inventories are primarily composed of cattle, but some quantities of sheep, chickens, and hogs are also present. Kansas is the largest U.S. producer of wheat. Other grains grown in substantial quantities are corn and sorghum. Non-commodity inventories are primarily composed of petroleum products, seed, fertilizer, and livestock feed.

Unlike large publicly-held firms which are listed on stock exchanges and have bond ratings, there are no readily available criteria to place farms into a priori credit constrained and

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16 See Langemeier (1990) for a description of variables and accounting procedures.

17 See Featherstone et al. (1992) for a comparison of KFMA and Department of Commerce census farms.

non-constrained groups. Here, farms are split according to asset size, debt to owned asset ratios, and livestock to total inventory ratios. Small farms are thought to have less access to debt financing than large farms, presumably because they lack the necessary collateral to back up their borrowing and lack sufficient cash flow to service additional debt. The inventories of high debt farms should be more sensitive to cash flow because external lenders may be more reluctant to lend to them due to low collateral levels and higher risk. Similarly, the inventory investment of livestock farms should be more sensitive to cash flow because they are more dependent on short-term borrowing and disinvestment in production inputs (feeder and breeding livestock, and feed) is more reversible than disinvestment in crop production inputs (land and machinery).

Two models--one representing the upper one third of the farms and the other representing the lower one-third of the farms--are estimated for each of the three credit constraining criteria. The middle one-third of the farms are omitted in an attempt to obtain greater differences among sample splits. Equal sample sizes are used in order to avoid any potential test bias associated with sample size. Splits are based on pre-sample farm means for 1973 and 1974. See Table 1 for sample split details. The models are then estimated using 1975 to 1992 data. Separate models are also estimated for the 1975 to 1980 "boom period", the 1981 to 1986 "bust period," and the 1987 to 1992 "recovery period". A priori it is expected that inventory investment will be the least sensitive to fluctuations in cash flow during the boom period and the most sensitive during the bust period.

Summary statistics for the full sample and the six farm classes are reported in Table 1. The typical large farm had almost three times the owned assets of small farms, $1.43 million versus $480 thousand. In operating assets (owned assets plus the value of leased land) this relation was about two to one, $2.1 million for large farms versus $1.0 million for small farms. This two to one relation also held for cash flow and sales. The inventories of large farms were nearly 2.7 times those of small farms, $90 thousand versus $239 thousand, however. Large farms also had lower debt to owned asset ratios, older operators, and had a higher percentage of their inventories in livestock than small farms.

High debt farms had mean debt to owned asset ratios which were nearly four times those of low debt farms, 0.491 versus 0.131. In spite of similar assets (both owned and operating), high debt farms had considerably lower cash flow than low debt farms due to higher interest payments. Mean sales for high debt farms--in spite of the similarity in assets-- were significantly higher than those for low debt farms, $344 thousand versus $240 thousand. High debt farms had a higher proportion of inventories in cattle than low debt farms and on average their operators were about four years younger than low debt operators.

The typical crop farm had over 87% of its inventories in storable crops, while the typical livestock farms had about 60% of its inventories in livestock. As noted previously, typical crop farms tended to have lower owned assets than livestock farms, $844 thousand versus about $1 million. However, the two farm types had nearly identical levels of operating assets, about $1.5 million. In spite of lower owned assets than livestock farms, crop farms had higher mean cash flows, $79 thousand versus $53 thousand.[18] Mean operator age is about the same, and as expected, crop farms have lower debt to owned asset ratios than livestock farms, 0.27 versus 0.33.

As noted by the standard deviations in Tables 1 and 2, variables tend to have high variability--with standard deviations frequently exceeding the means. Of particular interest is the standard deviation for inventory investment which is up to 20 times larger than the mean. This indicates that inventory (dis)investment is highly variable and can have a major influence on contemporary sales and cash flow. This is supported by the fact that inventories are typically about one-half the level of sales, so that a substantial disinvestment (investment) in inventories can substantially increase (decrease) sales and net cash income.

Regression Results

Equation (5) is estimated by ordinary least squares for each sample split. Standard errors are corrected for heteroscedasticity using White's method. Prices include those for wheat, sorghum, soybeans, and slaughter cattle. The model assumes that all farms receive the same prices.[19] Because sales equals production plus the change in inventories, disinvesting (investing) in inventories will substantially increase (decrease) cash flow. For that reason a negative relationship would be expected between cash flow and inventory investment. This relationship also suggests a simultaneous relationship between contemporary cash flow and inventory investment. To avoid this problem, cash flow is lagged by one period--assuming that it is the internal funds that are brought into the period that affect inventory investment decisions. Normally in a panel data model such as this, fixed time effects would be added. The fixed time effect dummy variables, μ_t, are excluded because they are highly collinear with the price variables. The prices account for the main time shocks to production agriculture--supply and demand shocks. We allow the value of land inventories to proxy for physical production Y_{jt} because it is impossible to measure physical production with a single statistic for multiple output farms.

Inventories, farm land inventories, and cash flow are measured in U.S. dollars and are scaled by the farm's beginning of year operating assets to control for heteroscedasticity. Commodity prices are deflated with the USDA's cost of production index. The model allows us

18 Cash flows do not account for payments to operators for their equity in the operation. Most of this equity is in the form of land. Since crop farms tend to be more land rich than livestock farms, they tend to have higher equity and thus higher cash flows. This, however, says nothing about the relative profitability of crop versus livestock operations.

19 This may not be an unreasonable assumption given that agricultural commodities are fungible, farms are price-takers, and commodity prices have been shown to be temporally and spatially linked by the cost of storage and transportation, respectively.

to test for the sensitivity of inventories to fluctuations in cash flow once beginning inventories, production (land inventories), and commodity prices are controlled for.

Tables 2, 3, and 4 present regression results for total inventories in which the sample is split by owned assets, debt to owned asset ratios, and livestock to total inventories ratios, respectively. The coefficients on the lagged inventory investment variables are always negative, highly statistically significant, and are reasonably robust across models. The magnitudes of the coefficients indicate that adjustment speeds from actual to the desired stock of inventory ranges from 45 to 76 percent per year. Farm land inventory is another important explanatory variable which explains inventory investment. The time t land inventory coefficient is positive for all regressions and statistically significant for all regressions except for small asset and crop farms in the recovery period, and livestock farms in the bust period. This supports the notion that inventory levels are closely tied to production levels.

Price coefficients are neither consistently of the same sign nor statistically significant. Of the coefficients which are statistically significant at least at the 10% level, over two-thirds are positive. Prices tend to be more statistically significant in the non-bust farm business cycles and for farm classes which are thought to be less a priori credit constrained. This would appear to indicate that farms may have to clear financial hurdles before prices become an important factor in inventory decision-making.

Here, the main focus of interest is the cash flow variable. The null hypothesis H_o: $CF_x = CF_y$ is formally tested. Test statistics and p-values are reported in Table 5. Consistent with expectations, the small farm cash flow coefficients reported in Table 2 are positive and statistically significant for all three farm business cycles and is lowest in the boom period at 0.13, increases to 0.42 in the bust period, and is at an intermediate level at 0.31 in the recovery period. The large farm cash flow coefficient is only statistically significant during the bust period in which it has a magnitude of 0.31. Consistent with expectations, the small farm cash flow coefficient is larger than the large farm coefficient for all three farm business cycles. However, only in the recovery period are the differences between the small and large farm coefficients statistically significant. The bust and recovery small farm coefficients are statistically larger than the boom coefficient, but there is no statistical difference between the bust and recovery period coefficients. The large farm bust period coefficient is statistically larger than the bust and recovery coefficients. There is not statistical difference between the bust and recovery large farm coefficients.

The cash flow results for the low and high debt farms in Table 3 are also consistent with a priori expectations. The cash flow coefficient is positive and statistically significant in all farm business cycles for high debt farms. The magnitude of the high debt cash flow coefficient is highest during the bust period at 0.34, followed by the recovery period at 0.23, and the lowest during the boom period at 0.15. The low debt cash flow coefficient is only positive and statistically significant during the bust period. The low debt cash flow coefficients are substantially lower than the high debt coefficients for all periods. There is no statistical difference in magnitude among the three high debt coefficients. Among the three low debt coefficients only the boom and bust coefficients are statistically different. The low and high debt coefficients are only statistically different during the boom period.

Table 4 indicates that the inventory investment of livestock farms is consistently more sensitive to cash flow than the inventory investment of crop farms. The livestock cash flow coefficients are positive and statistically significant for all three farm business cycles. The livestock farm cash flow coefficient is lowest in the boom period at 0.11, but contrary to expectations the recovery period coefficient at 0.41 is higher than the bust period coefficient at 0.31. The crop farm cash flow coefficient is always smaller than the livestock farm coefficient, and is not statistically significant in any of the three farm business cycles. This confirms the notion that the inventory of firms with enterprises that are dependent on short-term debt or whose disinvestment in capital is readily reversible is more sensitive to shifts in internal funds than the investment of farms with the opposite characteristics. The livestock coefficients are greater than the crop coefficients in all three business cycles. Only in the bust and recovery periods are the crop coefficients of statistically different magnitudes. The bust and recovery livestock coefficients are statistically greater than the boom coefficient. However, there is no statistical difference between the bust and recovery livestock coefficients.

Livestock farms have higher debt to owned asset ratios than crop farms. There appears to be little difference in mean assets among the two farm types, however. In order to insure that farm type is not proxying for debt levels, crop and livestock farms are further split by debt to owned asset ratios. The same debt to owned asset ratio cut off points were used as in Table 3. Results--not reported here--are consistent with previous results. Among the crop farm splits, the cash flow coefficient is positive and statistically significant only for the bust business cycle high debt farms. The high debt livestock farm cash flow coefficients are positive and statistically significant for all three farm business cycles. The high debt livestock farm cash flow coefficients have the largest magnitude of any cash flow coefficients previously reported. These results indicate that the inventory investment of high debt livestock farms is the most sensitive to fluctuations in cash flow.

The data were also split by the age of the principal operator in the same manner as the other splits. "Young" operators are less than 40.5 years of age and "old" operators are greater than 48.5 years of age. Theoretical models of capital markets under asymmetric information suggest that finance constraints are more likely for those who find it difficult to credibly communicate private information about their assets and investment opportunities. Thus, a priori, older operators are expected to have better access to credit and their investment should be less sensitive to fluctuations in cash flow.

Operator age does not appear to be an important factor in determining the sensitivity of inventories to internal finance. The cash flow coefficient was statistically significant only for old operators during the bust period and young operators in the recovery period. The results suggest that credit rationing based on the inability (ability) of younger (old) operators to credibly communicate private information is unimportant.[20] In fact the above results indicate that private information is being properly conveyed to lenders.

To check the robustness of the inventory-cash flow relation, several alternative specifications of the model are estimated. The other specifications include: 1) adding the annual binary dummy variables to the base model, 2) substituting the value of production for the value of land in the base model, 3) as in 2, but estimating with 2SLS because of the potential endogeneity of production, and 4) a simple sales accelerator model. The estimated cash flow coefficients are reported in Table 6. For ease of reporting only the cash flow coefficients are reported. The results are generally robust across model specifications.

Summary and Conclusions

Given the relatively small sizes of typical U.S. farms, their capital intensive nature and the lack of available external funding sources, cash flow is an important source of investment funds. The purpose of the current study is to test the sensitivity of farm inventory investment to shifts in cash flow. Farm inventories should be sensitive to shifts in cash flow because inventory disinvestment is readily reversible, and inventories are a significant portion of assets. Furthermore, the study seeks to ascertain whether the relation between cash flow and inventory investment is homogeneous across different classes of farms and across farm business cycles.

To test whether farm inventories are sensitive to shifts in internal funds a panel data set of 417 Kansas farms is used. The data are available from 1975 to 1992 which conveniently contains a 1975 to 1980 boom period, a 1981 to 1986 bust period, and a 1987 to 1992 recovery period. In addition to estimating models over the three farm cycles, the data are split based on owned assets, debt to owned asset ratios, and livestock to total inventory ratios. Cash flow, commodity prices, beginning inventory, and farm land inventory variables are used to explain inventory investment.

Results indicate that: 1) farms absorb shocks to internal finance by adjusting inventories; 2) the inventory investment of small farms, livestock farms, and high debt farms are more sensitive to fluctuations in cash flow than the inventory investment of large farms, low debt

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20 These results may be explained not because of the invalidity of the hypothesis, but because of the distribution of the farm operator population and intergenerational farms. The age of operators tends to be skewed to age 35 and up. Here, to be included in the young operator split, farmers had to be less than 40.5 years old based on the 1973-74 mean. In reality the young farmers were older than this during the sample period and not well distributed--being skewed to the right. In addition, farms tend to be intergenerational. Young operators have a difficult time beginning farming without major family support. It is likely that young farmers worked with their fathers (or even grandfathers) before becoming the principal operator. Due to this, it is likely that much of the reputation of the son may have been passed on from the father (and even grandfather) and that of the farm as an ongoing concern. Family reputation is important in small homogeneous farm communities--see Allen and Lueck (1992b).

farms, and crop farms; and 3) inventory investment is more sensitive to cash flow during the 1981 to 1986 bust and 1987 to 1992 recovery periods than the 1975 to 1980 boom period. An another interesting finding is that in inventory decision-making, prices may only become a consideration after financial hurdles are cleared.

In general, more emphasis has been placed on increasing the volume of loanable funds through interest rate and money supply policies than stabilizing and increasing cash flow as a source of loanable funds. This notion is particularly relevant for U.S. agriculture in which the Farm Credit System was created by an act of Congress to serve a specific clientele which was thought to be particularly deficient in loanable funds. Currently, the Farm Credit System--a government sponsored enterprise-- is responsible for about 25% of the farm loan volume. This study indicates that increasing the quantity of loanable funds to small businesses as the main policy tool may need to be reconsidered. Specifically, increasing the quantity of loanable funds may need to be combined with policies that affect the quantity and variability of cash flows such as the schedule of depreciation allowances, taxes, income assurance plans, and for agriculture, crop insurance. Our study also indicates that policy instruments should be oriented to small and high debt firms, and firms with a high percentage of short-term assets in which disinvestment is readily reversible-- particularly during periods of farm business downturns.

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Table 1. KFMA Farm Summary Statistics for Full Sample and Farm Classes

Variable	1975-92 Full Sample	1975-92 Small Asset	1975-92 Large Asset	1975-92 Low Debt	1975-92 High Debt	1975-92 Crop Farm	1975-92 Livestock Farm
Cash flow($)	62.8	44.6	80.9	91.9	36.3	78.6	52.9
	(93.5)	(60.2)	(124.4)	(110.3)	(80.4)	(93.8)	(107.3)
Inventories($)	152.3	90.0	239.4	132.3	159.9	116.5	197.4
	(180.7)	(157.6)	(213.5)	(150.4)	(227.3)	(123.7)	(240.4)
Owned Assets($)	893.0	480.3	1435.1	880.1	847.3	844.4	1013.3
	(716.1)	(272.6)	(925.3)	(662.0)	(809.3)	(648.6)	(881.2)
Operating Assets ($)	1472.3	1033.8	2107.3	1346.2	1497.6	1478.1	1515.4
	(963.8)	(613.6)	(1144.4)	(845.0)	(1103.4)	(971.4)	(1031.3)
Sales($)	293.8	198.9	422.5	240.0	343.6	264.2	368.2
	(322.2)	(325.7)	(353.7)	(222.2)	(447.8)	(195.7)	(469.3)
Operator Age	52.5	50.1	53.6	54.6	50.3	52.6	53.0
	(10.9)	(9.5)	(11.8)	(11.1)	(10.9)	(11.1)	(11.4)
Debt/Asset	0.296	0.346	0.271	0.131	0.491	0.286	0.332
	(0.288)	(0.342)	(0.252)	(0.167)	(0.330)	(0.319)	(0.292)
Livestock Invent/A_{t-1}	0.365	0.313	0.413	0.319	0.422	0.126	0.600
	(0.301)	(0.294)	(0.303)	(0.288)	(0.321)	(0.200)	(0.242)
$Invent_t/A_{t-1}$	0.209	0.177	0.243	0.200	0.218	0.160	0.266
	(0.196)	(0.196)	(0.211)	(0.179)	(0.236)	(0.155)	(0.248)
$Land_t/A_{t-1}$	0.725	0.756	0.714	0.699	0.742	0.746	0.703
	(0.336)	(0.459)	(0.275)	(0.234)	(0.283)	(0.482)	(0.254)
$Cashflow_{t-1}/A_{t-1}$	0.054	0.053	0.048	0.081	0.034	0.067	0.044
	(0.074)	(0.063)	(0.071)	(0.093)	(0.061)	(0.080)	(0.078)
$\Delta I_t/A_{t-1}$	0.008	0.008	0.010	0.006	0.010	0.005	0.011
	(0.096)	(0.089)	(0.106)	(0.078)	(0.119)	(0.084)	(0.121)
N	7506	834	834	834	834	834	834

Note: Dollar amounts are in thousands of 1992 dollars. A_{t-1} is the beginning period of operating assets (owned assets plus leased land). Standard deviations are in parenthesis. Small asset farms are the lower one-third of 417 Kansas farms in which mean 1973-74 owned assets are < $480,480. Large asset farms are the upper one-third of 417 Kansas farms in which mean 1973-74 owned assets are > $748,072. Low debt farms are the lower one-third of 417 Kansas farms in which mean 1973-74 debt to owned asset ratios are < 0.177. High debt farms are the upper one-third of 417 Kansas farms in which mean 1973-74 debt to owned asset ratios are > 0.377. Crop farms are the lower one-third of 417 Kansas farms in which mean 1973-74 livestock to total inventory ratios are < 0.147. Livestock farms are the upper one-third of 417 Kansas farms in which mean 1973-74 livestock to total inventory ratios are > 0.410.

Table 2. Regressions of Farm Inventory Investment by Owned Asset Size and Farm Business Cycles

Independent Variable	1975-80 Boom Small Asset	1975-80 Boom Large Asset	1981-86 Bust Small Asset	1981-86 Bust Large Asset	1987-92 Recovery Small Asset	1987-92 Recovery Large Asset
I_{jt-1}	-0.75766 (14.163)	-0.61173 (15.267)	-0.51044 (11.788)	-0.57615 (13.532)	-0.64749 (13.993)	-0.66403 (14.226)
$LAND_{jt}$	0.06237 (4.451)	0.06541 (5.247)	0.04145 (2.600)	0.07060 (7.386)	0.00509 (0.897)	0.17844 (8.339)
$LAND_{jt-1}$	-0.01492 (1.059)	-0.01793 (1.433)	-0.00036 (0.021)	-0.04027 (2.753)	-0.03844 (2.104)	-0.05113 (2.767)
$LAND_{jt-2}$	-0.00420 (0.523)	-0.00812 (0.980)	-0.01761 (1.137)	-0.01915 (1.301)	-0.01687 (0.699)	0.02555 (1.479)
CF_{jt-1}	0.13444 (2.4542)	0.02871 (0.525)	0.42236 (4.222)	0.30679 (3.214)	0.31019 (3.322)	0.03341 (0.382)
$PWHEAT_t$	-0.11862 (1.035)	-0.25557 (2.258)	0.10412 (0.594)	-0.06623 (0.456)	-0.09553 (0.202)	0.03467 (0.068)
$PWHEAT_{t-1}$	-0.13088 (1.072)	-0.10093 (0.906)	-0.01385 (0.079)	-0.05854 (0.421)	0.80015 (1.396)	0.46028 (0.791)
$PWHEAT_{t-2}$	-0.12822 (1.142)	-0.03868 (0.349)	0.01473 (0.096)	-0.19178 (1.489)	0.04935 (0.148)	0.33172 (0.864)
$PSORG_t$	-0.00048 (0.041)	-0.00243 (0.021)	-0.20528 (1.525)	-0.26860 (2.335)	0.35500 (1.200)	0.84491 (2.512)
$PSORG_{t-1}$	0.27823 (2.163)	0.30682 (2.385)	-0.10197 (0.825)	0.32534 (2.910)	0.04074 (0.115)	-0.03618 (0.084)
$PSORG_{t-3}$	0.11236 (1.204)	0.19542 (2.051)	-0.08950 (0.774)	0.38622 (2.918)	-0.32054 (1.003)	0.01160 (0.029)
$PBEANS_t$	-0.01378 (0.412)	-0.01863 (0.512)	0.04483 (1.220)	-0.00452 (0.107)	-0.42698 (1.123)	-0.19986 (0.442)
$PBEANS_{t-1}$	0.01107 (0.351)	-0.02055 (0.626)	0.01293 (0.376)	0.05484 (1.168)	0.15521 (0.454)	-0.68435 (1.109)
$PBEANS_{t-3}$	0.01766 (0.731)	-0.01975 (0.863)	0.05025 (1.250)	-0.00210 (0.048)	0.30316 (0.847)	-0.53645 (1.308)
$PCATTLE_t$	0.00154 (0.280)	0.01723 (2.557)	0.00296 (0.536)	-0.07138 (2.532)	0.05259 (1.471)	0.25898 (0.931)
$PCATTLE_{t-1}$	0.00338 (1.130)	0.00421 (1.291)	-0.00296 (0.570)	-0.00298 (0.655)	0.07798 (0.852)	0.03053 (0.333)
$PCATTLE_{t-2}$	0.00163 (0.547)	0.00589 (1.536)	-0.00167 (0.255)	-0.01027 (1.707)	-0.09371 (1.401)	0.00938 (0.068)
Adj. R^2	0.2796	0.3988	0.1392	0.2859	0.2194	0.2615

Note: The dependent variable is inventory investment ($\Delta I_{jt}/A_{jt-1}$). All equations are estimated by OLS with fixed farm effects. Standard errors are corrected for heteroscedasticity using White's method. T-ratios are in parenthesis. For sample split criteria see Table 1.

Table 3. **Regressions of Farm Inventory Investment by Debt to Owned Asset Ratio and Farm Business Cycles.**

Independent Variable	1975-80 Boom Low Debt	1975-80 Boom High Debt	1981-86 Bust Low Debt	1981-86 Bust High Debt	1987-92 Recovery Low Debt	1987-92 Recovery High Debt
I_{jt-1}	-0.65338	-0.71902	-0.46184	-0.59173	-0.47350	-0.66244
	(17.182)	(14.954)	(11.426)	(13.747)	(11.753)	(14.525)
$LAND_{jt}$	0.06532	0.08389	0.05249	0.04787	0.05726	0.13636
	(6.237)	(5.686)	(4.703)	(4.244)	(3.032)	(6.653)
$LAND_{jt-1}$	-0.00495	-0.03230	-0.02412	-0.02486	-0.03573	-0.03891
	(0.490)	(2.011)	(1.671)	(1.476)	(1.628)	(2.208)
$LAND_{jt-2}$	-0.00328	-0.02208	-0.00799	-0.02844	-0.00149	0.01655
	(0.517)	(2.169)	(0.593)	(1.757)	(0.066)	(0.919)
CF_{jt-1}	-0.06150	0.14770	0.19465	0.33840	0.07957	0.22835
	(1.241)	(2.759)	(2.539)	(3.668)	(0.845)	(2.649)
$PWHEAT_t$	-0.00185	-0.16044	-0.10464	0.21206	0.38936	-0.08414
	(0.018)	(1.319)	(0.837)	(1.053)	(0.938)	(0.141)
$PWHEAT_{t-1}$	-0.19071	-0.04699	-0.08491	-0.05181	-0.47444	-0.09129
	(1.760)	(0.384)	(0.687)	(0.260)	(0.951)	(0.133)
$PWHEAT_{t-2}$	0.01548	-0.10899	-0.07963	-0.17249	0.16816	-0.01677
	(0.156)	(0.907)	(0.699)	(0.984)	(0.561)	(0.039)
$PSORG_t$	-0.27748	0.02716	-0.04967	-0.24332	0.04618	0.66550
	(2.798)	(0.211)	(0.470)	(1.655)	(0.178)	(1.734)
$PSORG_{t-1}$	0.26611	0.25691	0.18417	0.08062	-0.23805	0.03181
	(2.430)	(1.809)	(1.885)	(0.593)	(0.738)	(0.067)
$PSORG_{t-2}$	0.21294	0.13921	0.17923	0.09385	-0.20372	0.18798
	(2.507)	(1.453)	(1.502)	(0.712)	(0.696)	(0.430)
$PBEANS_t$	0.02185	-0.01866	0.02315	0.05758	-0.87331	0.16365
	(0.661)	(0.512)	(0.695)	(1.340)	(2.377)	(0.344)
$PBEANS_{t-1}$	-0.01519	-0.02216	0.00189	-0.03613	0.10998	0.25304
	(0.501)	(0.643)	(0.048)	(0.917)	(0.236)	(0.581)
$PBEANS_{t-2}$	-0.02927	-0.01622	0.01169	0.03799	0.05728	0.26475
	(1.511)	(0.633)	(0.329)	(0.811)	(0.179)	(0.583)
$PCATTLE_t$	0.01290	0.00799	-0.01583	0.00193	-0.07985	-0.01462
	(2.193)	(1.328)	(0.643)	(0.305)	(0.381)	(0.302)
$PCATTLE_{t-1}$	0.00571	0.00113	0.00241	-0.00162	0.18177	-0.05549
	(1.735)	(0.381)	(0.608)	(0.277)	(2.314)	(0.507)
$PCATTLE_{t-2}$	0.01231	0.00105	-0.00040	0.00013	-0.19692	0.00243
	(3.365)	(0.346)	(0.074)	(0.018)	(1.834)	(0.030)
Adj. R^2	0.3958	0.3639	0.1390	0.2449	0.1783	0.2614

Note: The dependent variable is inventory investment ($\Delta I_{jt}/A_{jt-1}$). All equations are estimated by OLS with fixed farm effects. Standard errors are corrected for heteroscedasticity using White's method. T-ratios are in parenthesis. For sample split criteria see Table 1.

Table 4. Regressions of Farm Inventory Investment by Farm Type and Farm Business Cycles.

Independent Variable	1975-80 Boom Crop	1975-80 Boom Livestock	1981-86 Bust Crop	1981-86 Bust Livestock	1987-92 Recovery Crop	1987-92 Recovery Livestock
I_{jt-1}	-0.62070	-0.68333	-0.54833	-0.57579	-0.49181	-0.63375
	(15.401)	(14.127)	(14.249)	(12.417)	(13.839)	(12.399)
$LAND_{jt}$	0.04874	0.10242	0.08469	0.03153	0.00912	0.13585
	(4.071)	(7.087)	(11.447)	(1.643)	(1.648)	(5.951)
$LAND_{jt-1}$	0.00368	-0.04016	-0.02201	-0.040459	-0.03627	-0.03114
	(0.305)	(2.518)	(1.863)	(1.986)	(2.777)	(1.168)
$LAND_{jt-2}$	-0.00551	-0.03369	-0.01144	-0.03182	0.02710	0.01560
	(0.839)	(2.755)	(0.982)	(1.669)	(2.092)	(0.531)
CF_{jt-1}	-0.04694	0.10599	0.08041	0.31247	-0.15290	0.40662
	(0.797)	(1.938)	(1.074)	(3.076)	(1.572)	(4.582)
$PWHEAT_t$	-0.12562	-0.07503	-0.15527	0.32268	0.87072	0.46948
	(1.200)	(0.574)	(1.308)	(1.662)	(2.119)	(0.781)
$PWHEAT_{t-1}$	0.09363	-0.18758	-0.15224	-0.00103	0.423445	0.13823
	(0.869)	(1.445)	(1.293)	(0.005)	(0.831)	(0.194)
$PWHEAT_{t-2}$	-0.15945	-0.12952	-0.11204	-0.03490	-0.13072	0.34777
	(1.638)	(1.047)	(1.061)	(0.207)	(0.419)	(0.825)
$PSORG_t$	-0.11452	0.08554	0.06369	-0.28115	0.84216	0.21550
	(1.085)	(0.615)	(0.681)	(1.823)	(3.152)	(0.523)
$PSORG_{t-1}$	0.16629	0.40324	0.08095	-0.00144	-0.41288	0.45723
	(1.533)	(2.563)	(0.896)	(0.010)	(1.224)	(0.954)
$PSORG_{t-2}$	0.14990	0.11311	0.10660	0.03942	-0.56760	0.48622
	(1.945)	(1.094)	(1.131)	(0.285)	(1.850)	(1.087)
$PBEANS_t$	0.01245	0.02779	0.06342	0.00575	0.24825	-0.49984
	(0.469)	(0.700)	(2.064)	(0.128)	(0.716)	(1.026)
$PBEANS_{t-1}$	-0.02823	-0.01903	0.02336	-0.06766	0.13322	-0.27622
	(1.143)	(0.486)	(0.860)	(1.687)	(0.419)	(0.647)
$PBEANS_{t-2}$	-0.01902	-0.03268	0.03240	-0.00356	-0.00221	-0.40849
	(1.018)	(1.099)	(0.941)	(0.072)	(0.007)	(0.931)
$PCATTLE_t$	0.00735	0.00254	-0.00331	0.00894	0.05679	0.01506
	(1.606)	(0.376)	(0.822)	(1.393)	(1.607)	(0.316)
$PCATTLE_{t-1}$	-0.00185	0.00277	-0.00056	-0.00081	-0.10125	0.14974
	(0.728)	(0.877)	(0.141)	(0.133)	(1.295)	(1.277)
$PCATTLE_{t-1}$	0.00335	-0.00119	0.00464	-0.00239	0.04806	-0.13970
	(1.448)	(0.357)	(1.055)	(0.334)	(0.821)	(1.663)
Adj. R^2	0.3204	0.3996	0.3103	0.1591	0.2326	0.2472

Note: The dependent variable is inventory investment ($\Delta I_{jt}/A_{jt-1}$). All equations are estimated by OLS with fixed farm effects. Standard errors are corrected for heteroscedasticity using White's method. T-ratios are in parenthesis. For sample split criteria see Table 1.

Table 5: Test Statistics and P-values for Ho: $CF_x = Cf_y$.

	Boom Large	Bust Small	Bust Large	Recovery Small	Recovery Large
Boom Small	1.366 (0.172)	2.838 (0.005)		1.624 (0.105)	
Boom Large			2.528 (0.012)		0.046 (0.963)
Bust Small			0.836 (0.403)	0.820 (0.413)	
Bust Large					2.112 (0.035)
Recovery Small					2.163 (0.031)

	Boom High Debt	Bust Low Debt	Bust High Debt	Recovery Low Debt	Recovery High Debt
Boom Low Debt	2.868 (0.004)	2.402 (0.017)		1.326 (0.185)	
Boom High Debt			1.343 (0.178)		0.671 (0.502)
Bust Low Debt			1.198 (0.2313)	0.948 (0.343)	
Bust High Debt					0.872 (0.384)
Recovery Low Debt					1.165 (0.244)

	Boom Livestock	Bust Crop	Bust Livestock	Recovery Crop	Recovery Livestock
Boom Crop	1.903 (0.057)	1.357 (0.182)		0.093 (0.352)	
Boom Livestock			1.791 (0.074)		2.882 (0.004)
Bust Crop			1.840 (0.066)	1.902 (0.056)	
Bust Livestock					0.699 (0.485)
Recovery Crop					4.249 (0.000)

Note: The t-values are obtained by differencing the two estimated coefficients of interest and dividing by the square root of the sum of the two variances less twice the covariance. See Gujarati (1988), pg. 227 for details. Since the coefficients come from two different equations, it is assumed that the covariances are equal to zero.

Table 6. **Robustness of Cash Flow Coefficients.**

	1975-80 Boom	1975-80 Boom	1981-86 Bust	1981-86 Bust	1987-92 Recovery	1987-92 Recovery
	----------------Value of Land and Prices with Annual Dummy Variables------------------					
Small/large Assets	0.12961 (2.348)	0.04391 (0.717)	0.42345 (4.206)	0.33081 (3.502)	0.32305 (3.401)	0.04035 (0.462)
Low/High Debt	-0.06260 (1.261)	0.14019 (2.609)	0.21081 (2.744)	0.34783 (3.800)	0.07907 (0.838)	0.22221 (2.562)
Crop/ Livestock	-0.05921 (1.002)	0.09654 (1.759)	0.12464 (1.650)	0.30844 (3.023)	-0.14555 (1.491)	0.41744 (4.691)
	-------------------Production and Prices w/o Annual Dummy Variables------------------					
Small/large Assets	0.07639 (1.556)	0.08623 (0.781)	0.49555 (5.419)	0.45862 (4.857)	0.35372 (4.151)	0.12826 (1.709)
Low/High debt	-0.03376 (0.796)	0.15519 (3.029)	0.25272 (3.739)	0.38619 (4.268)	0.26255 (2.935)	0.26846 (3.583)
Crop/ Livestock	-0.03535 (0.684)	0.11992 (2.362)	0.21066 (2.677)	0.37353 (4.048)	-0.04722 (0.530)	0.38710 (5.003)
	---------------2SLS Production and Prices w/o Annual Dummy Variables----------------					
Small/large Assets	0.11512 (2.238)	0.11091 (2.145)	0.46878 (4.724)	0.38203 (3.470)	0.31621 (3.660)	0.06008 (0.705)
Low/High Debt	-0.00408 (0.092)	0.15525 (2.771)	0.22816 (3.194)	0.33581 (3.678)	0.25140 (2.596)	0.25221 (3.122)
Crop/ Livestock	0.04158 (0.729)	0.11911 (2.028)	0.07814 (0.645)	0.37734 (3.861)	-0.17027 (1.837)	0.42787 (5.181)
	----------------------------Sales with Annual Dummy Variables----------------------------					
Small/large Assets	0.06393 (1.067)	0.16695 (2.665)	0.42826 (4.051)	0.47517 (4.328)	0.33845 (3.343)	0.22586 (2.585)
Low/High Debt	0.01466 (0.235)	0.18194 (3.130)	0.21533 (2.369)	0.33679 (3.392)	0.44220 (3.896)	0.31346 (3.696)
Crop/ Livestock	-0.05382 (0.735)	0.15102 (2.587)	0.08227 (0.896)	0.38108 (3.498)	-0.08542 (0.866)	0.52816 (5.967)

Note: The dependent variable is inventory investment ($\Delta I_t/A_{it-1}$). All equations are estimated by OLS except where noted. For OLS models standard errors are corrected for heteroscedasticity using White's method. T-ratios are in parenthesis. All models include fixed farm effects. All non-dummy variables are dated time t, t-1, and t-2 (except cash flow which is dated t-1). For description of sample splits see Table 1. 2SLS estimates uses two lags of the value of land as instruments.

Appendix

Inventories-Include the ending year inventories of grain, soybeans, hay and forage, feed, beef feeders, sheep feeders, hog feeders, poultry, fuel and oil, and livestock-crop supplies. Breeding livestock is not included because it is considered production capital. All inventories are valued at a fair market price.

Value of land-Each farm reports the number of operating acres of irrigated crop land, non-irrigated crop land, and pasture. The Kansas Board of Agriculture (Schlender) reports annual per acre land values for irrigated crop land, non-irrigated crop land, and pasture land for nine statistical district. Land values are estimated by multiplying the reported acreage by the district price and summing across land types.

Owned Assets-The sum of ending-year **Inventories**, owned land, stock of motor vehicles and machinery, breeding livestock, non-residential buildings, and cash on hand. The depreciable capital stock is built up using the perpetual inventory method. The depreciation rate is estimated for each farm from the means of actual depreciation taken. The relative price of depreciable capital is corrected for the presence of depreciation allowances and the investment tax credit estimated from the farm data set for each farm and each year.

Operating Assets-The sum of **Owned Assets** and leased land. The farm data set reports owned acres, leased acres, and total operating acres by land type. This enables the value of owned and leased land to be estimated. Each land type--regardless of ownership--is given the same per acre valuation within the statistical reporting district.

Cash flow-The sum of gross farm income minus cash operating costs and depreciation.

Prices-Annual average prices as reported in *Kansas Farm Facts*. Per bushel wheat, sorghum, and soybean prices are reported by each of nine agricultural statistical districts in Kansas. The per CWT beef prices are an annual average for the entire state of Kansas.

Sales-The sum of cash commodity sales and custom machine work.

Production-The sum of **Sales** and the change in **Inventories**

Figure 1.US Farm Production, Cash Flow, and Inventories

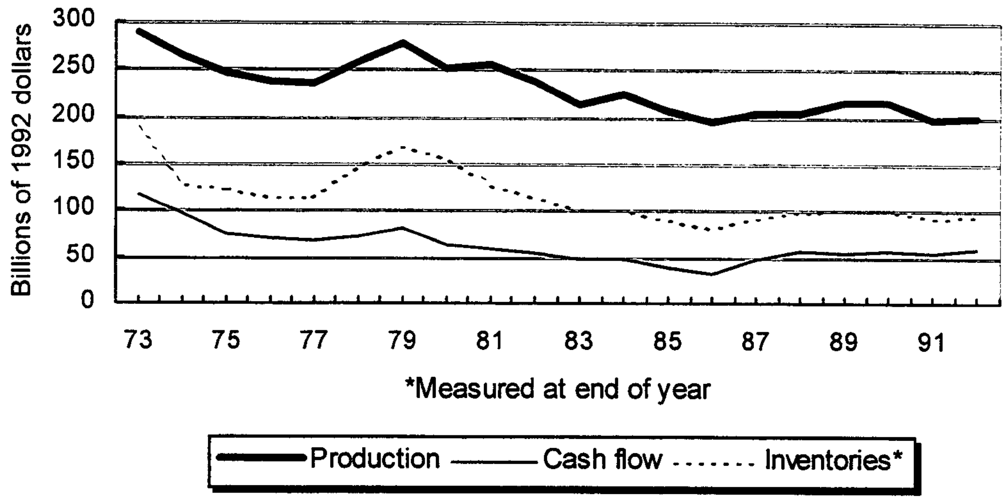

Figure 2.US Farm Production, Cash Flow, and Inventories Normalized by owned assets

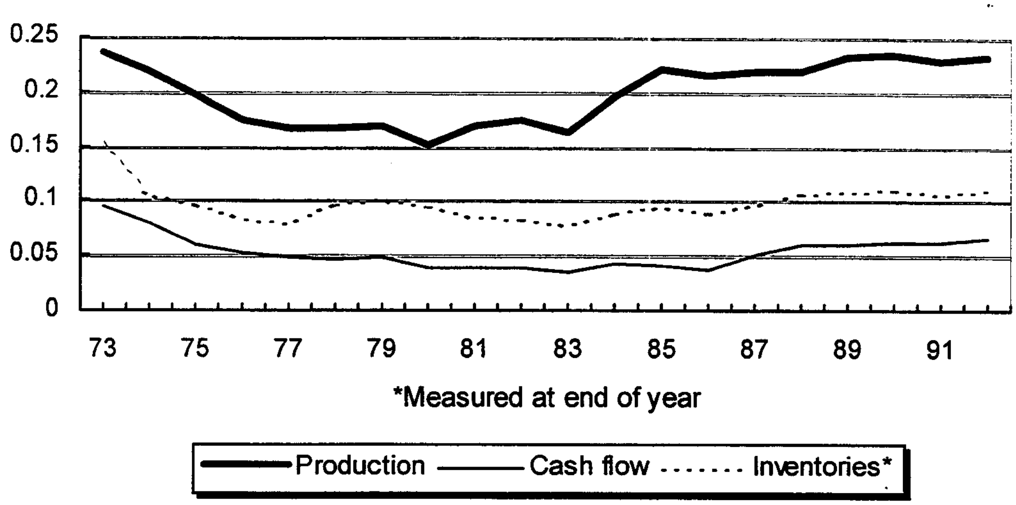

Figure 3.US Farm Net Worth and Value of Real Estate

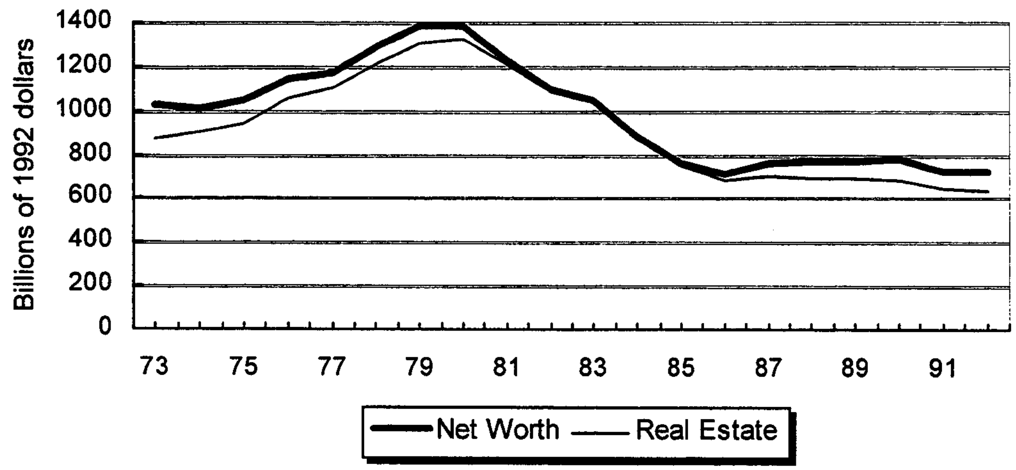

Figure 4.US Farm Debt and Debt-to-Asset Ratio