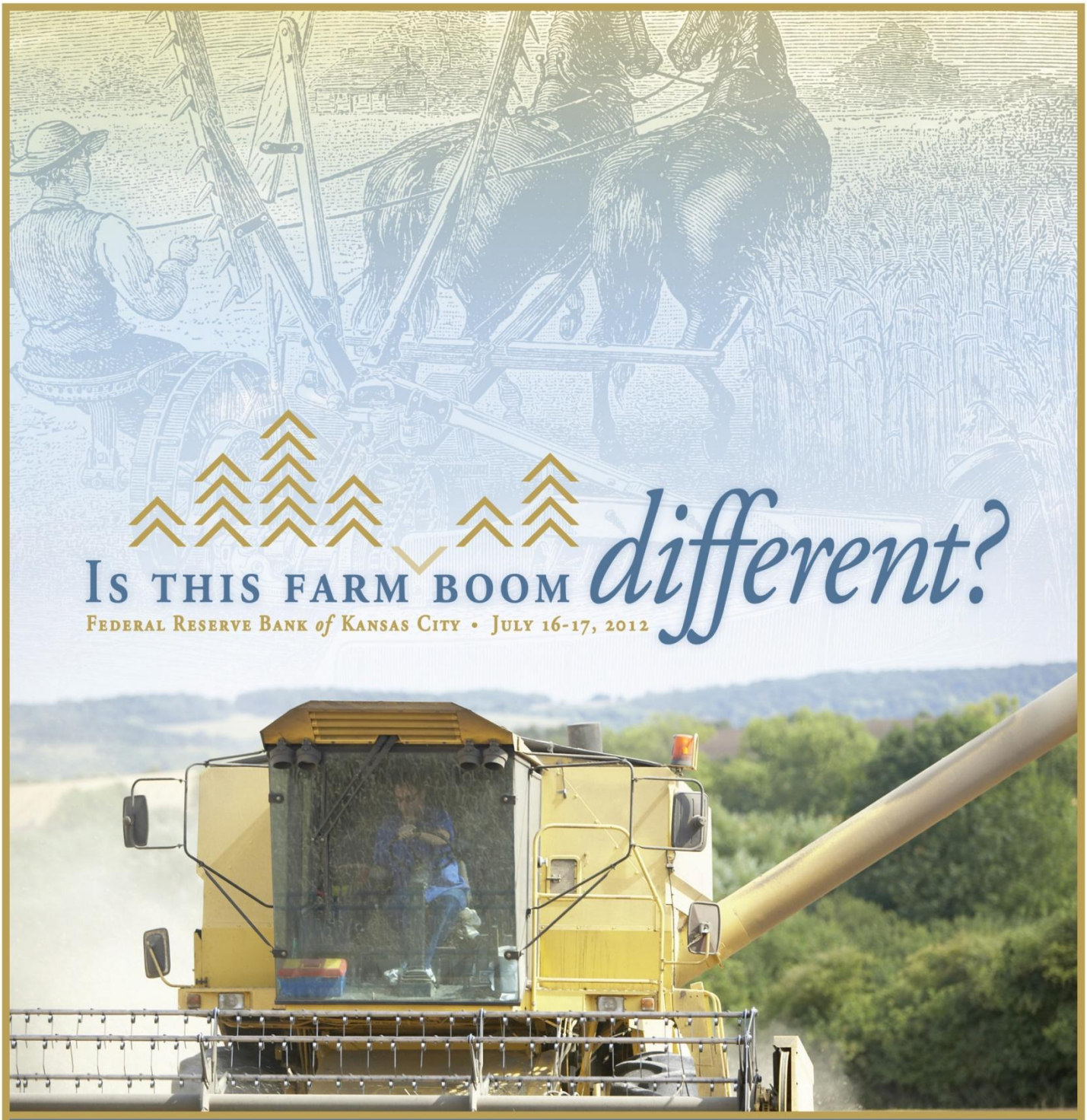


Is this farm boom *different?*

Federal Reserve Bank *of* Kansas City • July 16-17, 2012

A Symposium Sponsored by
the Federal Reserve Bank of Kansas City
July 16-17, 2012

Session 3: Who Leveraged the Farm?

Who Leveraged the Farm?

Dr. Allen Featherstone

Professor, Kansas State University

Agricultural farmland was susceptible to two boom-bust cycles in the last century (1900s) and two other boom-bust cycles in the 1800s (Featherstone and Baker, and Melichar). Since the last agricultural land boom-bust (bubble) cycle from 1973 to 1986, a volume of literature has arisen that examines the characteristics that can lead to a boom-bust cycle (Schurle et al., 2012). Major themes in this literature indicate that not all explosive movements are bubbles (Hunter et al., 2003), that bubbles can occur when investors are trying to behave rationally (Shiller, 2000), and that bubbles can occur without uncertainty, speculation, or irrational behavior (Smith et al., 1988). Kindleberger (1978) identified three stages for the development of an asset bubble: 1) an economic shock that justifies higher prices and reflects structural change outside the experience of most investors, 2) the increased use of leverage and speculative instruments due to rising investor confidence, and 3) a herding effect where demand increases because prices are increasing.

The purpose of this paper is to examine the leverage condition of the sector, the second of Kindleberger's three conditions. The discussion will examine research from the most recent agricultural land boom-bust period that examined defaulted real estate loans from the 1970s and 1980s. Next the leverage situation and the corresponding probability of default in the 1970s and will be compared to the year-end 2010 situation using Kansas Farm Management Association (KFMA) farms. The financial situation at the national level using year-end 2010 data from the Agricultural Resource Management Survey (ARMS) is examined to understand potential differences between the financial situation in Kansas and nationally. Finally, the paper will conclude by examining the precursory conditions that could lead to a debt crisis and agricultural land boom-bust cycle similar to that which occurred in the 1980s.

Lessons from the Defaulted Loans in the 1980s

The most comprehensive analysis of the impact of debt on the financial crisis of the 1980s is a study by Featherstone and Boessen (1994). They examined the loan loss severity of 457 defaulted mortgages originated by Equitable Agribusiness, a division of The Equitable. Several important findings may be of value for comparing the current situation to the last boom-bust cycle. According to Featherstone and Boessen, the original loan balance on the defaulted loans was in excess of $161 million with an average effective rate of interest of 11.04 percent. The average origination loan to value ratio was 60.7 percent with a standard deviation of 10.1 percent. The average years of loan performance before default was 5.6 years with a standard deviation of 2.5 years.

Table 1 presents a schematic of the origination/default matrix for these loans. Roughly 75 percent of the loans that defaulted were originated from 1977 through 1980, the four years before the peak of nominal land values. Roughly 81 percent of the loans defaulted between 1983 and 1986, the four years before the end of the bust. Of the loans originated from 1977 through 1980 by Equitable Agribusiness, 10.9 percent defaulted. Thus, while a substantial amount of loans defaulted, it was a subset of all loans originated.

Table 1:
Comparison for Origination and Default Year for 457 Defaulted Equitable Agribusiness Loans

Origination	Default Year													
Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1991	Total
1967	-	-	-	-	-	-	-	-	1	-	-	-	-	1
1972	-	-	-	-	-	-	1	-	-	-	-	-	-	1
1973	-	-	1	-	-	-	-	-	1	-	-	-	-	2
1974	-	1	-	-	-	-	-	-	2	1	-	-	-	4
1975	-	-	1	-	-	2	1	-	1	1	-	-	-	6
1976	-	-	-	1	1	3	5	6	4	-	-	-	-	20
1977	1	-	3	1	6	7	12	25	14	4	-	2	-	75
1978	-	-	2	2	5	10	11	27	27	5	1	-	-	90
1979	-	-	1	1	4	9	19	23	27	3	2	-	-	89
1980	-	-	1	-	10	9	13	28	22	8	1	-	-	92
1981	-	-	-	1	4	3	3	14	4	1	-	-	-	30
1982	-	-	-	-	-	-	-	2	1	-	-	-	-	3
1983	-	-	-	-	-	-	5	10	7	2	-	-	1	25
1984	-	-	-	-	-	-	1	4	6	2	-	1	-	14
1985	-	-	-	-	-	-	-	1	2	2	-	-	-	5
Total	1	1	9	6	30	43	71	140	119	29	4	3	1	457

Source: Featherstone and Boessen (page 255)

Loans that defaulted in the last boom-bust cycle were made in a relatively short period of time and did not have an excessively high loan to value ratio (Featherstone and Boessen). Roughly one out of six loans that defaulted during the last land boom bust cycle had an origination loan to value ratio of less than 50 percent. The nominal interest rate on those loans (11.04%) was certainly much higher than current conditions (6.13% for 2009 and 2010, Agricultural Finance Databook). In addition, the loans made during the 1970s and 1980s were mostly variable interest rate products.

The real cost of borrowing for farmers is half of what it was during the last half of the 1970s. After adjusting for the average inflation rate during 1977 through 1980 period, the real cost of borrowing on those defaulted mortgages was 2.41 percent. Using the 6.13 percent average interest rate from Federal Reserve Tenth District for 2009 and 2010 (Agricultural Finance Databook and the personal consumption expenditures index from the St. Louis Federal Reserve Bank, the average real interest rate was 4.71% for 2009 and 2010. Thus while, the nominal cost of borrowing is 4.91 percent lower than those loans originated from 1977 to 1980 period, the real cost of borrowing is 2.3 percent higher compared to the 1977 to 1980 period.

Comparing the 1970s with the Current Situation

This section provides a discussion of the leverage and default situation over time using Kansas Farm Management Association (KFMA) farms. Each KFMA farm is viewed as a new potential borrower whether they currently borrow or not and uses a synthetic credit scoring model to estimate a default probability that is used to produce a pseudo Standard and Poor's (S&P) ranking. The synthetic credit scoring model was estimated from a sample of performing and defaulted farm loans by Featherstone, Roessler and Barry (2006) assuming each borrower was a new borrower to assess the probability that a loan will enter default status based on information available at loan origination. By using this model to assess the risks of each farm and assigning a synthetic credit rating, the riskiness of the KFMA farms from 1973 through 2010 can be compared systematically.

As discussed in Brewer et al. (2012), one way to think of credit models is to relate

them to a well-known benchmark such as S&P credit ratings. The S&P credit ratings are designed to provide relative rankings of creditworthiness including default likelihood, payment priority, recovery, and credit stability. The S&P basic ratings range from excellent (AAA) to poor (C). Debtors classified in the C rating classes are substantial risks and generally depend on positive economic conditions to be able to meet financial commitments. The D rating indicates default.

The farm record data were obtained from KFMA and used to calculate the probability of default and the corresponding credit rating for each farm. The synthetic probability of default for each farm is calculated using the approach suggested by Featherstone, Roessler, and Barry (2006). The equation for calculating probability of default is as follows:

$$ln(\text{probability of default}/[1-\text{probability of default}]) = -2.3643 - 0.00135(\text{Repayment Capacity Percentage}) - 0.0217(\text{Owner Equity Percentage}) - 0.00399(\text{Working Capital Percentage}) \quad (1)$$

This equation was estimated by Featherstone, Roessler, and Barry using 157,853 loans from the Seventh Farm Credit District portfolio from 1995 through 2002 to determine the ability of financial performance ratios to predict the probability of default for customers of the Seventh Farm Credit District using loan origination data.

Following Brewer et al., the KFMA data were used to calculate the yearly financial ratios (Owner Equity Percentage, Working Capital Percentage, and Capital Debt Repayment Capacity) for each farm and used to estimate the probability of default for the individual farms using equation (1). Each farm is then assigned a credit rating based upon its probability of default for each year.

Estimates of the probabilities of default from S&P rating categories were matched with those default probabilities determined by Lopez (2002); who used KMV, a company that created and provided software to Moody's and S&P to determine the probabilities of default of their portfolios. The KMV methodology determines the estimated default frequency and categorizes it based on that company's individual risk classes. The data used to construct Lopez's grid are year-end 2001 information.

Definition of Variables

Following Featherstone, Roessler, and Barry, the probability of default is a function of three key financial variables: Capital Debt Repayment Capacity (CDRC), Owner Equity Percentage (OE), and Working Capital Percentage (WC).

CDRC is used to determine repayment capacity by measuring the ability of the borrower to repay principal and interest on term loans by comparing their cash flow to their debt requirements. The larger the ratio, the greater their ability to meet repayment needs. CDRC is calculated by dividing repayment capacity by the sum of annual principal and interest payments on term loans, working capital deficiency and capital asset replacement. Repayment Capacity is the result of net farm income from operations plus non-farm income plus term interest plus depreciation minus income taxes minus family living expenses minus non-farm expenses.

OE provides a measure of a borrower's solvency. This ratio is calculated by dividing net worth by total assets. In this analysis, the OE is restricted to be between 0 and 100 percent.

WC measures a firm's liquidity position as it relates to its revenue. It is calculated by dividing working capital by a measure of adjusted gross income. Working capital is calculated as current assets minus current liabilities. Adjusted gross income is gross receipts minus purchases for resale.

Data were obtained from the KFMA for the years of 1973 through 2010. The accrual KFMA data were used to estimate the ratios to be used in the probability of default analysis. The variables used include: farm identifier, year, gross farm income, economic depreciation, total expenses, net farm income, cash interest paid, income taxes, unpaid family and operator labor, non-farm wage, average current assets, average breeding livestock value, average non-current accounts receivable, average machinery and equipment, average buildings and improvement, average owned land value, average total assets, average current liabilities, average intermediate liabilities, average long-term liabilities, value of production, total acres, irrigated crop acres, non-irrigated crop acres, pasture acres, capital managed, and average net worth (Langemeier, 2003).

An adjustment was used to convert Kansas Farm Management data on machinery and land into a consistent market value series (Dumler, Kastens, and Dhuyvetter, 2001).

Who Leveraged the Farm?

Not all farms report data during every year. Therefore, only farms that provided two consecutive years of data were used in the study. For instance, if a farm provided data for 1995, 1996, and 1997, then the change in the farm's financial position (migration) from 1995 to 1996 and from 1996 to 1997 could be studied. Therefore, the number of observations varied for each two year period from 1973 through 2010.

Financial Comparisons

The average probability of default for KFMA farms has fallen since 2002 when the average default probability was 2.90 percent (Figure 1). At the end of 2010, the default probability was 1.83% and was at the lowest level since 1979 when it was at 1.68%. Only four years, 1973, 1974, 1975, and 1979 had a lower default probability than 2010. While the average default probability is low, there is a distribution around that probability. Because during the last farm crisis only a subset of the loans made defaulted, it is important to examine the vulnerable tail of a distribution in addition to the average value. That vulnerable tail can be a driver of falling land values as farmland is released to the market to be purchased by other farmers.

Figure 1:
Average Default Probability of Kansas Farm Management Association Farms (1973 to 2010)

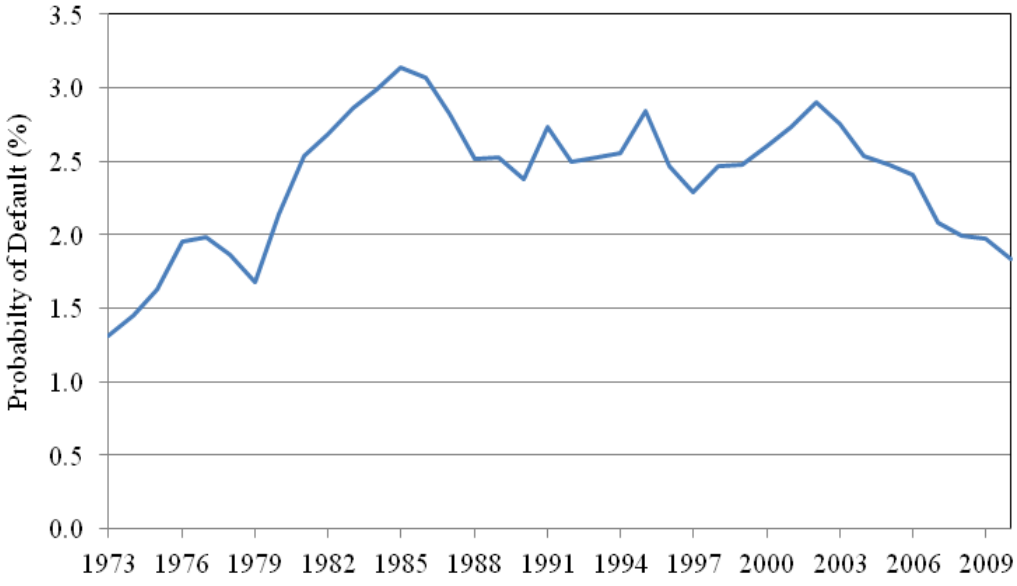
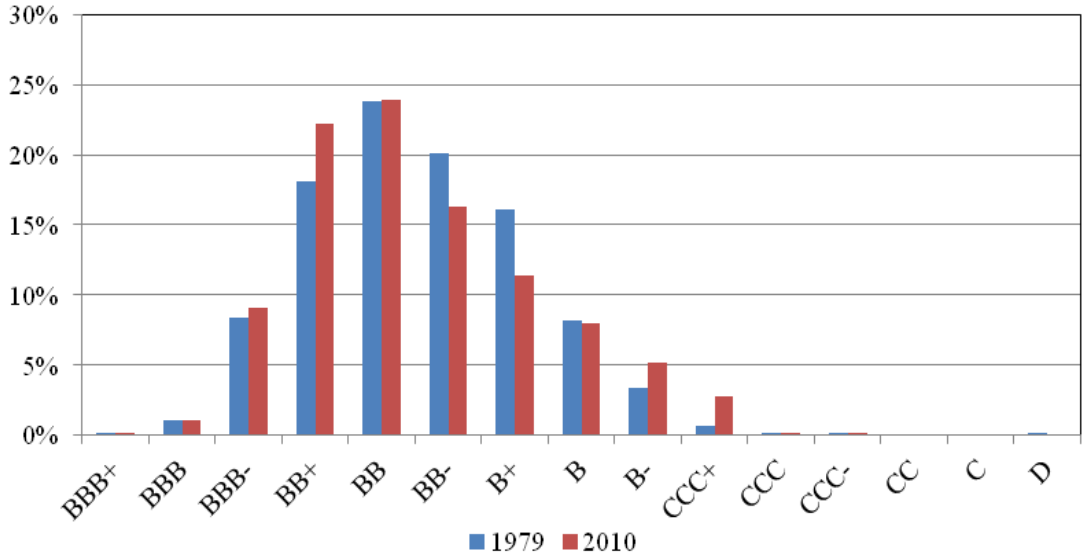


Figure 2 illustrates the distribution of the default probability for 2010 and 1979. There were 1,263 farms analyzed in 2010 and 1,932 farms analyzed in 1979. Farms that are rated below BB- have an expected default frequency of 2.03 percent or higher. In 2010, this represented 27.4 percent of the farms and in 1979, 28.6 percent of the Kansas farms. Farms that are rated below B have an expected default frequency of 4.09 percent or higher. In 2010, this represented 8.1 percent of the farms while in 1979, this represented 4.3 percent of the farms. Thus, while the average default probability is nearly the same in 1979 and 2010, the percentage of farms with lower credit quality is higher at the end of 2010 than in 1979.

Figure 2:
Distribution of Pseudo S&P Credit Quality of
Kansas Farm Management Association Farms
1979 and 2010

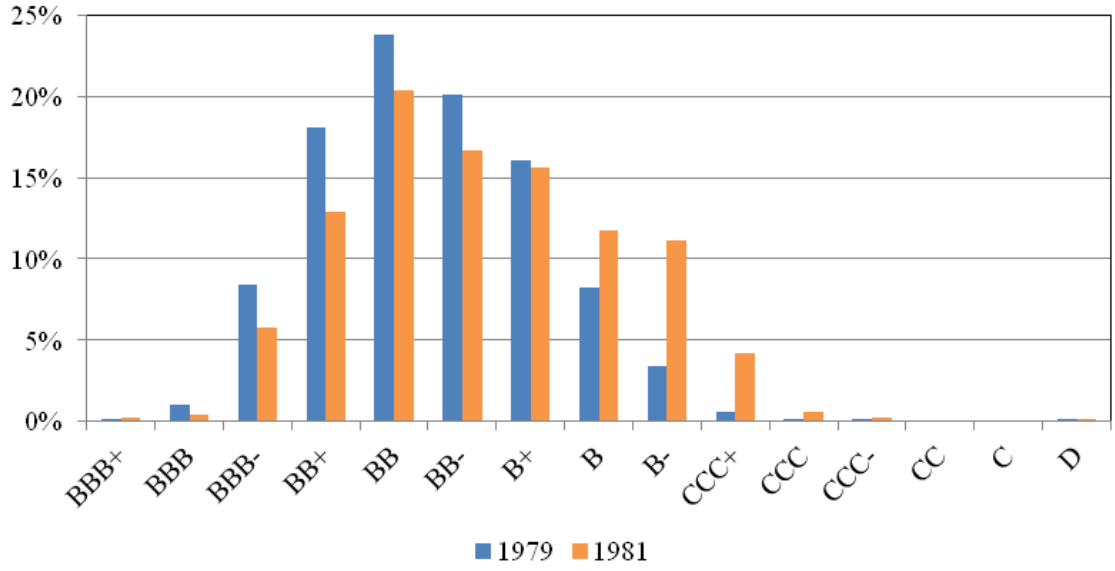


The quality of credit can change quickly. From 1979 to 1981[1], the average default probability increased from 1.68 percent to 2.54 percent (Figure 1). The distribution of farms that had above a 2.03 percent probability of default increased from 27.4 percent in 1979 to 43.5 percent in 1981 and the distribution of farms that had a probability of default greater than 4.09 percent increased from 4.3 percent of the farms in 1979 to 16.2

[1] There were 1,973 farms analyzed in 1981.

percent of the farms in 1981 (Figure 3). Thus, the financial situation of Kansas farms changed much over that two-year period.

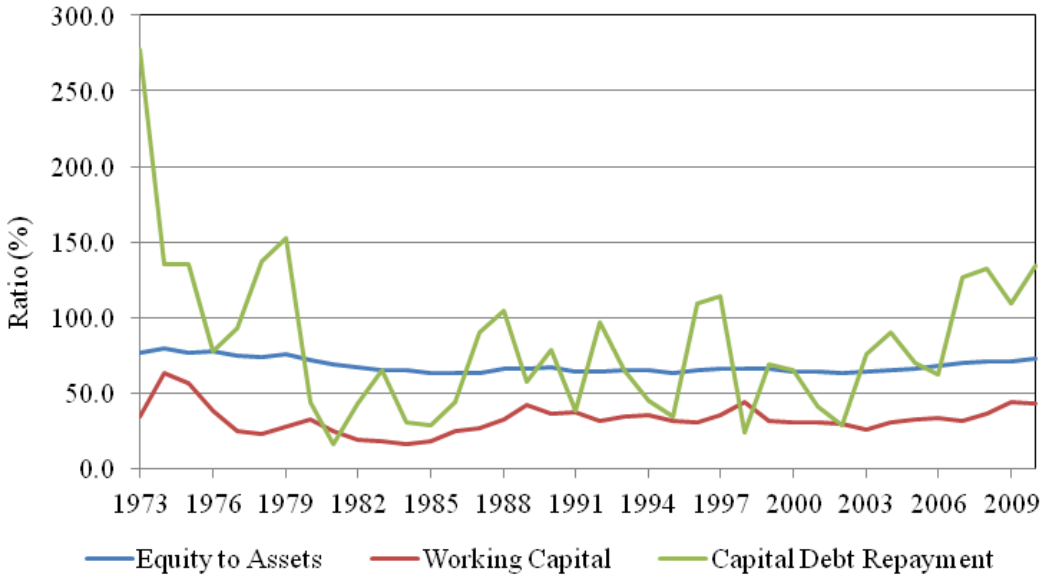
Figure 3:
Distribution of Pseudo S&P Credit Quality of
Kansas Farm Management Association Farms
1979 and 1981



The probability of default is a function of three component factors from equation 1, the owner's equity percentage (leverage), the working capital percentage (liquidity), and the capital debt repayment capacity. Featherstone, Roessler and Barry (2006) found that changes in leverage have larger effects on changes in the probability of default than liquidity which have larger effects than the capital debt repayment capacity. Figure 4 examines the component ratios from 1973 through 2010. The equity to assets ratio and the working capital percentage ratios have been fairly consistent during the period. The maximum equity to assets ratio occurred in 1979 (79.4%) and the minimum occurred in 1986 (63.0%). The maximum working capital percentage occurred in 1974 (63.3%) and the minimum occurred in 1984 (16.4%). The maximum capital debt repayment capacity occurred in 1973 (277.0%) and the minimum occurred in 1981 (16.3%). The 2010 levels were 73.2 percent for the equity to assets ratio, 43.5 percent for the working capital percentage, and 134.6 percent for the capital debt repayment capacity ratio. During 1979, the equity to assets ratio was 75.4%, the working capital percentage ratio was 27.5 percent, and the capital debt repayment capacity ratio was 152.8 percent. Equity to assets

was higher, the working capital percentage was lower, and the capital debt repayment capacity was higher in 1979 than 2010.

Figure 4:
Working Capital, Equity to Asset, and Debt Repayment Capacity Ratios for KFMA Farms, 1973 to 2010



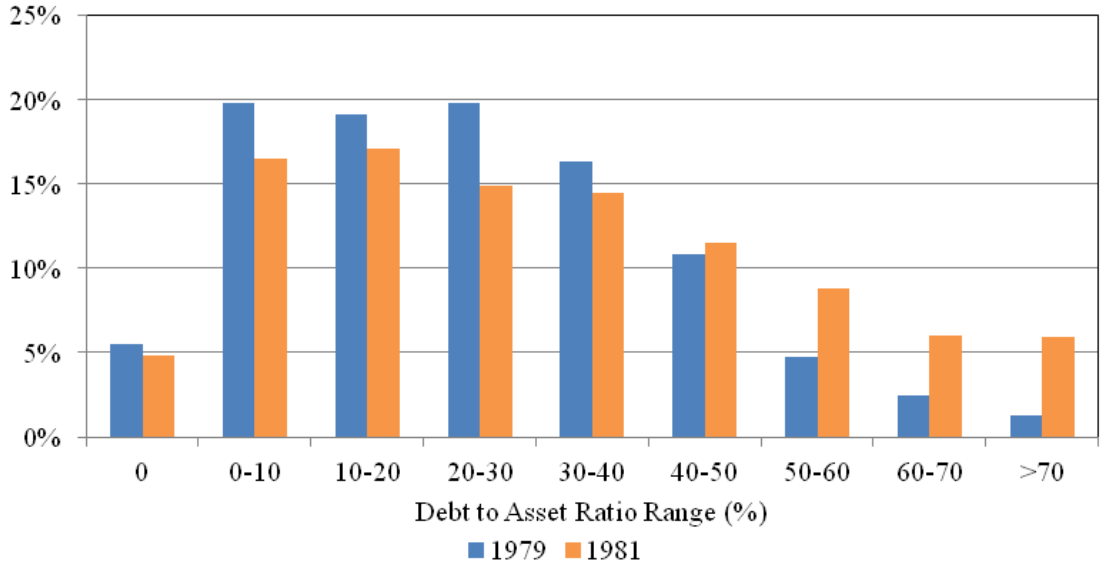
While the debt to assets position in 2010 is low from a historical Kansas perspective, it was lower in 1979 than it is in 2010. To further compare the situation in 1979 and 2010, Figure 5 compares the distribution of the debt to asset ratios[2]. The mean debt to asset ratio in 1979 was 24.6 percent and was 26.8 percent in 2010. While the mean debt to asset ratio is similar in 1979 and 2010, the percentage of farms with more than 40 percent debt to assets in 1979 was 19.4 percent and was 25.6 percent in 2010. The percentage of farms with more than 70 percent debt to assets in 1979 was 1.3 percent in 1979 and 5.9 percent in 2010. Thus, the distribution of farms with fairly high debt to asset ratios is higher in 2010 than in 1979.

As discussed above, the quality of credit can change quickly. From 1979 to 1981, the equity to asset ratio fell from 75.4 percent to 69 percent, the working capital percentage fell from 27.5 percent to 24.6 percent, and the debt repayment capacity fell

[2] The debt to asset ratio is 1 minus the equity to asset ratio.

from 152.8 percent to 16.3 percent (Figure 4). Thus, the two major drivers of the increased default probability and the land boom-bust cycle were an increase in the use of debt relative to equity and a dramatic decrease in the debt repayment ratio. The equity to asset ratio continued to fall to 63.0 percent in 1986 when land values also stabilized. The distribution of farms that had more than 40 percent debt to assets increased from 19.4 percent in 1979 to 32.2 percent in 1981 and the distribution of farms that had more than 70 percent debt to assets increased from 1.3 percent of the farms in 1979 to 5.9 percent of the farms in 1981 (Figure 5). Thus, the leverage situation of Kansas farms changed much from 1979 to 1981.

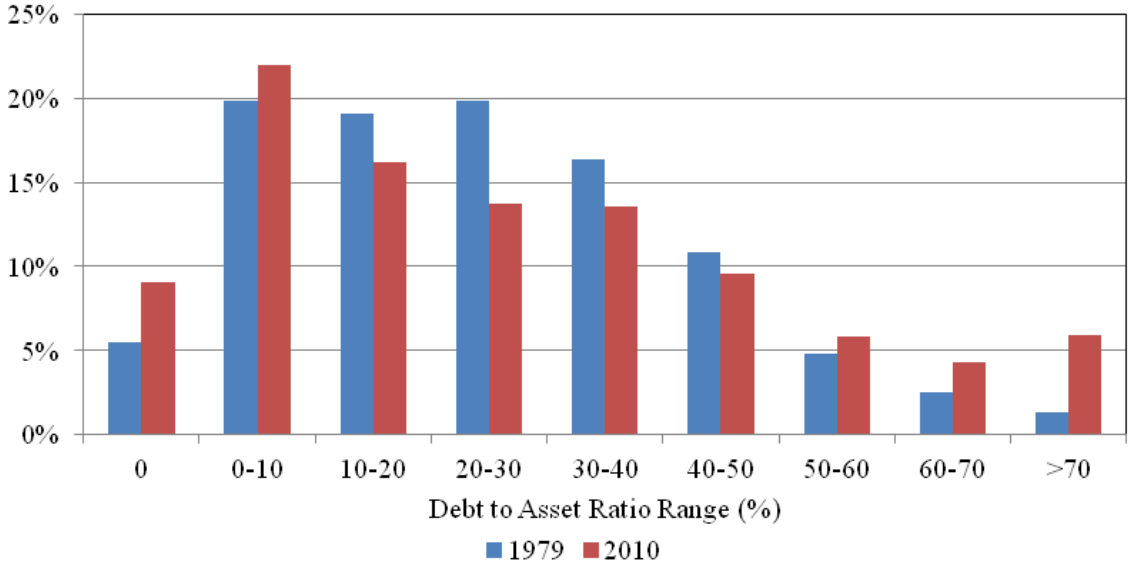
Figure 5:
Distribution of Debt to Assets Ratio of
Kansas Farm Management Association Farms
1979 and 1981



The crisis in the 1980s originated from a precipitous drop in income and an offsetting increase in the cost of debt that decreased the capital debt repayment capacity from 152.8 percent to 16.3 percent in two years. This initiated a decline in land values that exacerbated the crisis. A comparison of the current situation on Kansas farms with the situation in 1979 allows one to make several important conclusions. First, the probability of default was lower in 1979 than it is during 2010. Second, the leverage

situation in 1979 is comparable to that in 2010, on average, although there is a higher percentage of farms with more than 40 percent debt to assets and more than 70 percent debt to assets in 2010, than in 1979 (Figure 6). The farms with more than 70 percent debt to assets in 2010 more closely match the percentage in 1981 than 1979. However, while the leverage situation is comparable to 1979, the agricultural sector may not necessarily undergo the same outcome as in the early 1980s.

Figure 6:
Distribution of Debt to Assets Ratio of
Kansas Farm Management Association Farms
1979 and 2010



Understanding the U.S. Situation

While it would be ideal to have performed the previous analysis using national numbers, data are not available for the same type of analysis back through the previous boom-bust cycle. However, more recent data are available to partially understand whether the situation in Kansas is similar to that nationwide. Brewer et al. (2012) examined the probability of default using Agricultural Resource Management (ARMS) Farms from 1996 through 2010. The probability of default was calculated for each farm observation and then pooled. The range of farm observations was 9,573 in 1996 to 21,578

in 2010. The ARMS is a stratified statistically drawn sample to be representative of U.S. farms though larger farms are sampled at a heavier rate to ensure representativeness.

The average working capital, equity to assets and capital debt repayment ratios for the U.S. indicate that from 1996 to 2010, the equity to assets ratio remained steady, the debt repayment capacity ratio increased, and the working capital percentage increased over the time period (Figure 7). This resulted in a probability of default that was lower than that for Kansas Farm Management Association farms, although the general trend between the default probabilities exhibited a similar pattern (Figure 8). The correlation between the USDA numbers and the Kansas Farm Management Association numbers was 0.73 numerically confirming the general trend in Figure 8.

Figure 7:
Working Capital, Equity to Asset, and
Debt Repayment Capacity Ratios for ARMS Farms
1996-2010

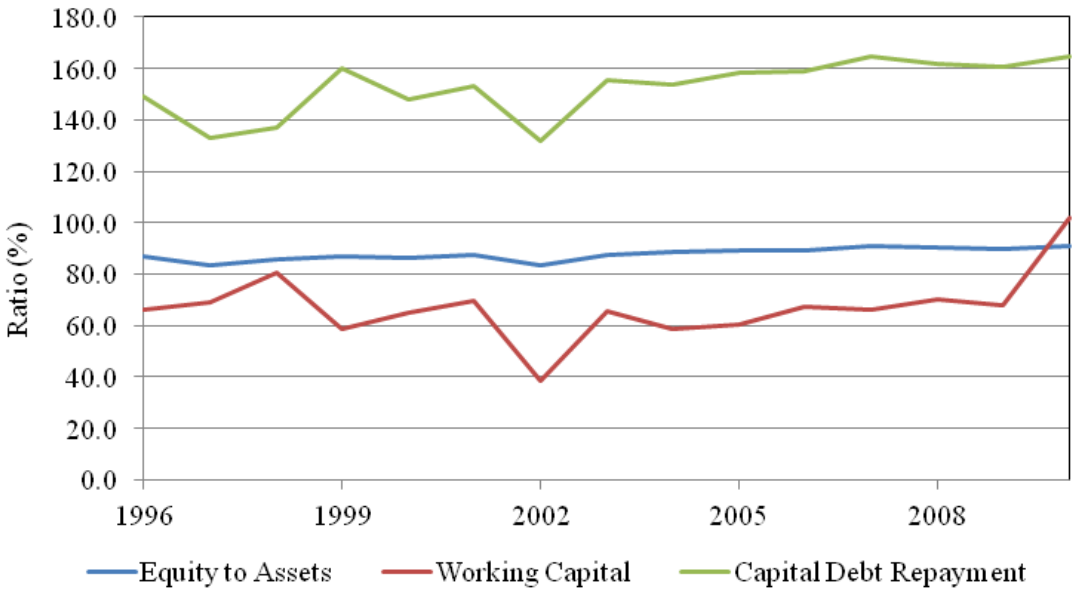


Figure 8:
Average Default Probability for
ARMS Farms and Kansas Farm Management Association Farms
1996 to 2010

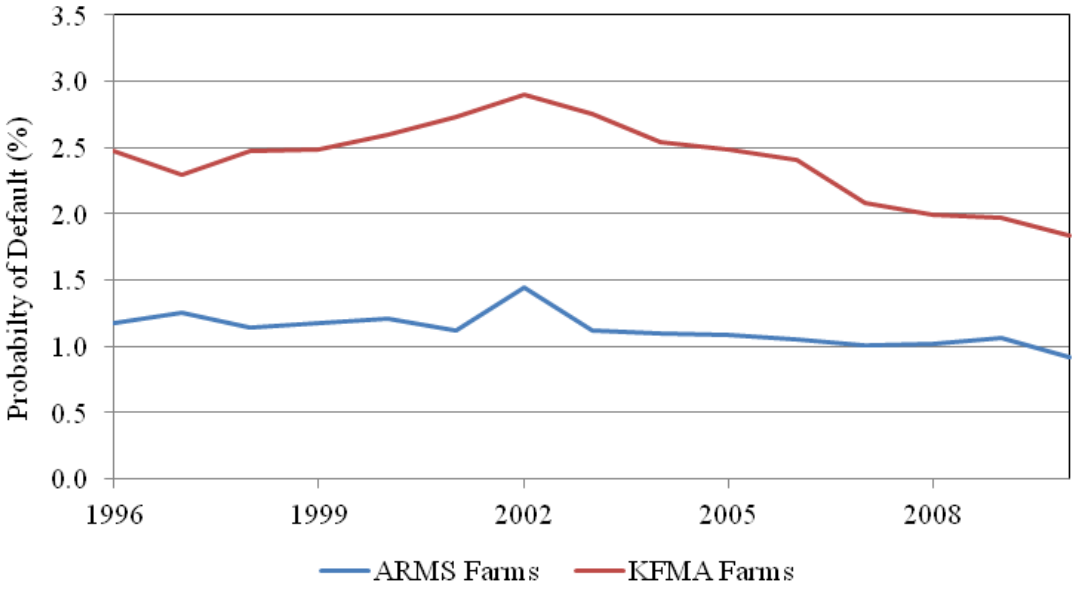
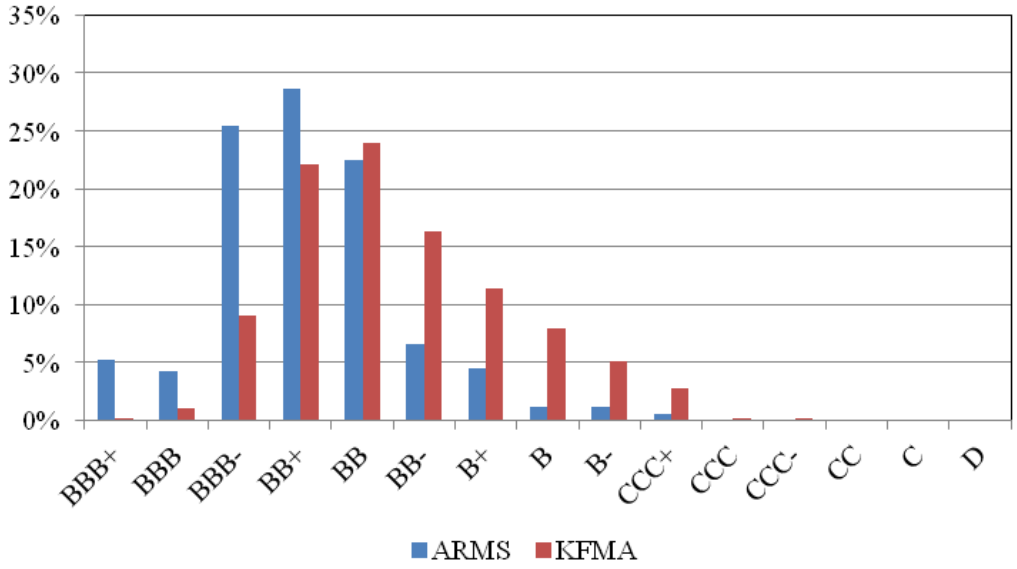


Figure 9:
Distribution of Pseudo S&P Credit Quality of
ARMS and Kansas Farm Management Association Farms
2010



The distribution of the probability of default between the ARMS farms and the KFMA farms are compared for 2010 (Figure 9). Farms that are rated below BB- have an expected default frequency of 2.03 percent or higher. In 2010, this represents 27.4 percent of Kansas farms and 7.3 percent of the USDA ARMS farms. Farms that are rated below B have an expected default frequency of 4.09 percent or higher. In 2010, this represented 8.1 percent of the Kansas farms while this represented 1.6 percent of the USDA ARMS farms. Thus, it appears that the USDA ARMS farms have a lower probability of default than the KFMA farms.

Figure 10:
Average Probability of Default by Sales Class for USDA ARMS Farms
1996-2010

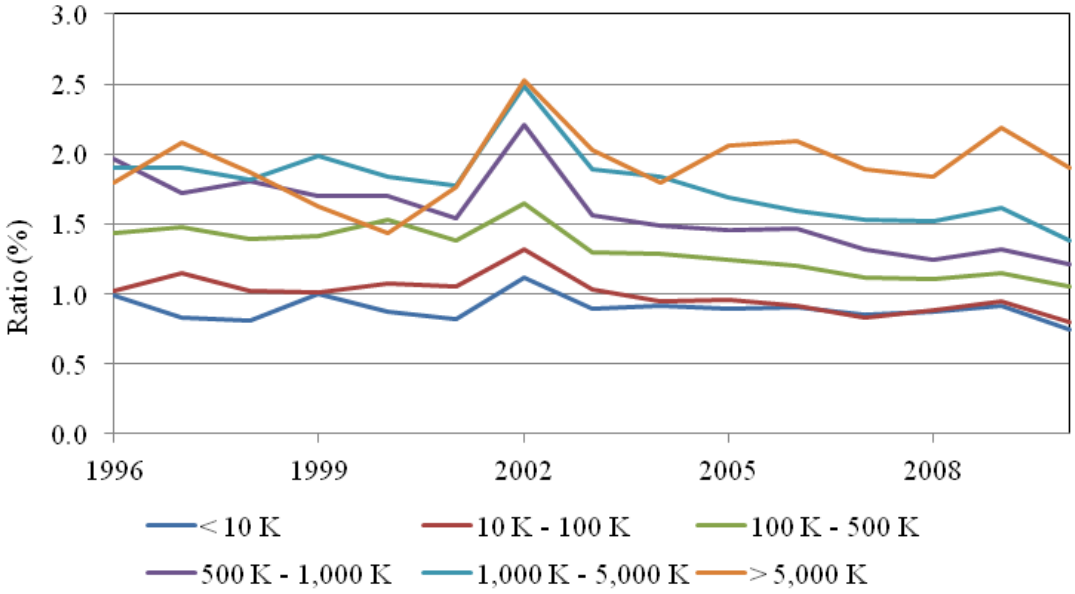


Figure 10 shows the probability of default for all ARMS farms by sales class from Brewer et al. The probability of default has generally decreased for each of the sales classes except for those farms with sales of more than $5 million which increased slightly from 1996 through 2010. More importantly, the farms that are most vulnerable are those in the larger sales class. The probability of default for KFMA farms by sales class does not illustrate the consistent pattern that the USDA numbers illustrate (Figure 11).

Figure 11:
Average Probability of Default by Sales Class for KFMA Farms
1996-2010

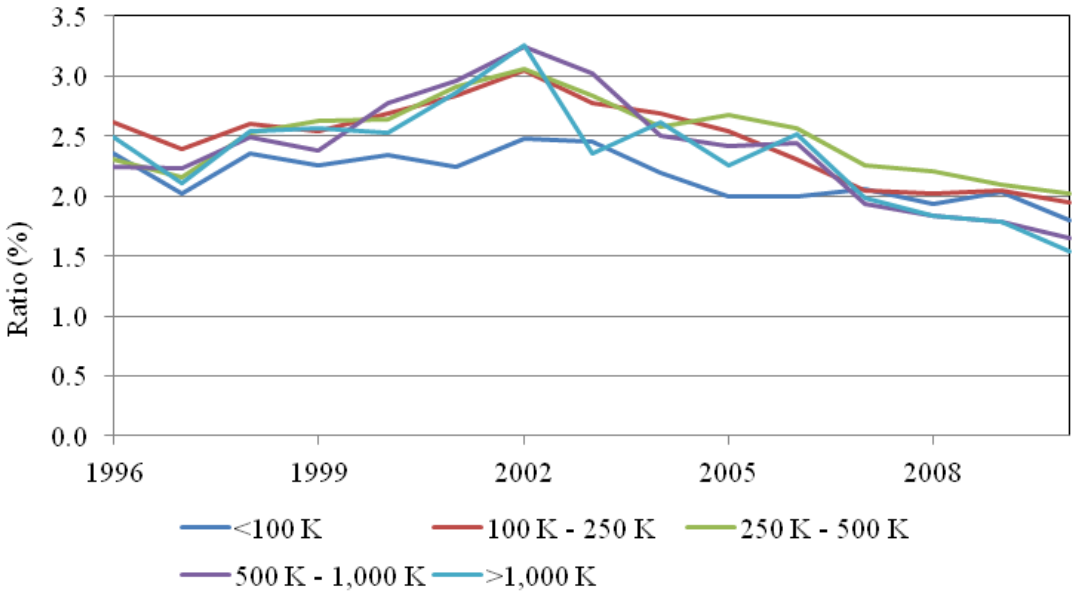


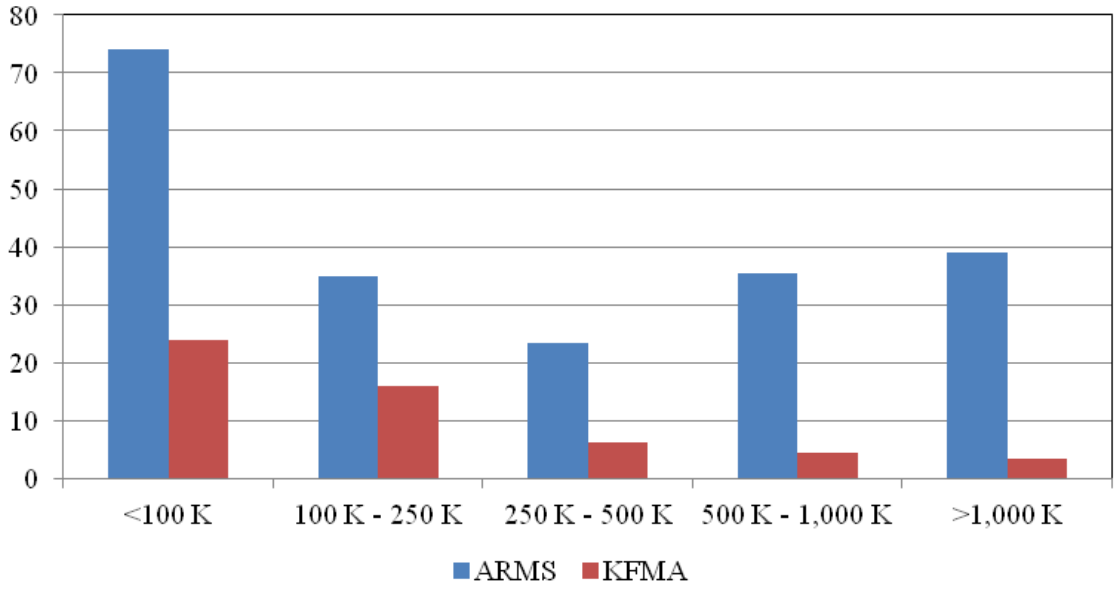
Table 2. Debt to Asset Ratio by Sales Class for USDA ARMS Farms for Kansas and Kansas Farm Management Association Farms

	All	<100 K	100 K - 250 K	250 K - 500 K	500 K - 1,000 K	>1,000 K
			USDA ARMS Farms for Kansas			
2003	16.0	12.4	14.4	10.6	25.0	22.1
2004	18.0	9.8	17.9	32.1	9.7	24.4
2005	15.2	9.1	12.2	15.5	19.6	29.8
2006	15.4	6.3	15.6	15.8	18.4	31.5
2007	13.2	8.3	11.8	12.7	17.2	21.3
2008	11.2	4.2	10.8	10.9	15.5	13.6
2009	15.2	7.1	10.4	12.6	20.2	26.8
2010	12.4	7.5	9.9	11.9	13.5	19.0
			Kansas Farm Management Farms			
2003	36.5	27.1	36.6	40.5	44.4	43.2
2004	35.2	25.0	35.8	38.7	39.8	44.4
2005	33.3	21.6	33.0	38.2	37.3	40.6
2006	29.1	20.8	25.3	32.4	31.7	35.5
2007	30.0	22.9	25.6	33.3	32.3	35.6
2008	29.6	22.7	25.6	32.5	31.1	33.1
2009	28.7	22.7	26.1	30.9	29.3	31.9
2010	26.9	20.9	25.3	31.5	29.0	32.0

Source: USDA ARMS

The probability of default for all ARMS farms is lower than that for KFMA farms. This leads to questions on whether Kansas farms differ from U.S. farms as a whole or whether there are other issues. Table 2 examines the difference in debt to asset ratios for the KFMA farms and the USDA ARMS farms. The debt to asset ratios are substantially higher for the Kansas Farm Management Association farms than for the USDA ARMS farms. This pattern occurs across all size groups.

Figure 12:
Comparison of the Percentage of ARMS Farms and KFMA Farms in Kansas without Debt
2010



To further investigate whether there is a systematic difference between the KFMA farms and the ARMS farms, the percentage of farms without debt were compared for the ARMS farms and the KFMA farms in Kansas (Figure 12). There is a substantially higher percentage of farms without debt captured in the ARMS sample than in the KFMA sample. When adjusting for this difference, the debt to asset ratios are more comparable but the KFMA farms have a slightly higher debt to asset ratio. Whether this is a systematic difference between the methods used to collect debt in the KFMA process with the ARMS process is not fully resolved. Knuth (2012) indicated that the financial position of Farm Credit Services of America borrowers had an average debt to asset ratio of 34 percent to 35 percent from 2009 to 2011. The average leverage ratio for farm businesses in Nebraska for 2010 was 10.2 percent with the highest average being 18.2 percent for farms with over $1 million in sales (USDA ERS, 2012). The average leverage ratios for farm businesses in Iowa was 10.3 percent with the highest average being 17.3 percent for farms over $1 million in sales (USDA ERS, 2012). However, a study by Micheels and Ellinger in Illinois found that the level of farm assets are not statistically different from ARMS farms but the level of debt was significantly less on ARMS farms for Illinois.

Precursors to a Debt Crisis and Boom-Bust Cycle

The section will consider precursors to a debt crisis or conversely actions to take to avoid a debt crisis. In addition, this section will discuss differences that exist in the current situation compared to those that were in place at the beginning of the previous boom-bust cycle. The previous boom-bust cycle began with a dramatic fall in the ability to repay debt (CDRC falling from 152.8 percent to 16.3 percent from 1979 to 1981 on KFMA farms caused by a decrease in net farm income through a falling value of farm production (15.7 percent on KFMA farms from 1979 to 1981) and increasing interest payments (65.3 percent increase from 1979 to 1981 on KFMA farms). The decrease in the value of farm production and the increase in interest rates made it apparent that the agricultural land values at that time could no longer be supported (Featherstone and Baker, 1987). Falling land values combined with the increased debt and increased interest rates exacerbated the bust phase.

Given the 2010 Capital Debt Repayment Capacity of 134.6 percent are there factors that could cause this factor to drop precipitously? An increase in interest rates and a decrease in the value of farm production can lead to a change in the ability to repay debt leading to an increase debt to asset ratio and ultimately to falling land values. However, it can be argued that the agricultural economy may be better insulated from those issues than in the late 1970s due to the use of fixed interest rate debt and crop insurance that may provide a revenue floor[3].

From 1979 to 1981, interest payments increased by 65.3 percent for Kansas farms. It is important to understand that the debt to asset ratio for KFMA farms in 2010 (26.9%) is similar to that in 1979 (25.0%). The average debt outstanding for KFMA farms at the end of 2010 was $152,697 in short term debt and other current liabilities, $108,750 in intermediate debt, and $153,473 in long-term debt. The average interest payment $20,356 resulted in an average rate of 5.1 percent[4]. However, there are some marked differences between the structure of lending in 2010 and 1979 due to the use of fixed rate products.

[3] It should be noted that the revenue floor is a short-term floor and not a long-term floor depending on the market price of commodities when the insurance contract is set.
[4] This rate was calculated taking the interest paid by the average debt during the year.

Table 3 provided a breakdown in Farm Credit System debt securities outstanding from year-end 2006 through May 31, 2012. The amount of total Farm Credit debt at par value financed by fixed rate bonds has remained about 50 percent since the end of 2006. According to Davis (2012), as of May 2012, the percentage of farm real estate volume financed by fixed interest rate products fund 83.3 percent of Farm Credit Services of America's real estate portfolio. The situation is different for non-real estate bank loans where 71.3 percent of loans have a floating interest rate (Agricultural Finance Databook). For KFMA farms with debt, Brewer found that banks held an average of 54.2 percent of KFMA debt and that the Farm Credit System held 31.0 percent of KFMA debt. Using the information above, a rough measure indicates that 48.6 percent of KFMA farm debt was financed by fixed rates at the end of 2010. Thus, roughly 50 percent of farm debt in Kansas is susceptible to variable interest rates. Therefore, an increase in interest rate would only affect 50 percent of the debt load immediately. However, the debt load could begin to shift if farmers have difficulty in making scheduled repayments over time.

Table 3: Fixed Rate Farm Credit System Debt Securities Outstanding, December 2006 through May 2012

	Fixed Rate Non-Callable Bonds	Fixed Rate Callable Bonds	Total Outstanding	Percent Fixed
	---------- $ billion ----------			
12/31/2006	32.4	37.7	134.1	52.3%
12/31/2007	36.6	42.8	154.1	51.5%
12/31/2008	43.0	43.8	176.3	49.2%
12/31/2009	41.7	39.9	176.1	46.3%
12/31/2010	40.9	45.8	187.5	46.2%
12/31/2011	44.0	46.4	183.5	49.3%
5/31/2012	46.0	50.3	187.6	51.3%

Source: Federal Farm Credit Funding Corporation

The second aspect that could decrease the capital debt repayment capacity either alone or in conjunction with an increase in interest payments is a drop in crop revenue. The value of farm production decreased from 1979 through 1981 by 15.7 percent on KFMA farms. To obtain a 15.7 percent drop in the value of farm production, crop

revenue would need to fall by an estimated 21.4 percent on the average KFMA farm[5]. Using Enterprise Data from the 2010 crop year, the average Kansas price received for non-irrigated corn, wheat, and soybeans was $4.44, $5.04, and $11.45 per bushel, respectively (Langemeier and Herbel, 2012). To obtain a 21.4 percent decrease in crop revenue, crop prices received by Kansas farmers would need to fall to roughly $3.49, $3.96, and $9.00 for corn, wheat and soybeans, respectively. Some have argued that current revenue insurance products offer a potential floor on the crop income side. However, it is important to understand that these products only protect revenue within the season. For example, Kansas wheat prices for revenue insurance purposes are set based on the August 15 to September 14 price for the July futures contract, and corn in set based on the February average of the December futures contract. Thus if prices fall, the amount of revenue protected using crop insurance will also fall. Is there a floor from the target price system in the previous Farm Bill?[6] The 2010 to 2012 target prices are $4.17 for wheat, $2.63 for corn and $6.00 for soybeans (USDA ERS, 2012). Thus, prices could fall by 21.4 percent or more before program payments begin to offset the loss of revenue.

Table 4: Sensitivity of 2010 Average KFMA Farms to 1979 to 1981 Decreases in Revenue and Increases in Interest Payments

	2010	65.3% Interest Increase	15.7% Crop Revenue Decrease	Both	Both w/o Government Payments
Value of Farm Production	534,070	534,070	450,293	450,293	426,583
Government Payments	23,710	23,710	23,710	23,710	0
Livestock Income	119,375	119,375	119,375	119,375	119,375
Crop Income	390,985	390,985	307,208	307,208	307,208
Expenses w/o Interest	356,932	356,932	356,932	356,932	356,932
Interest	20,356	33,649	20,356	33,649	33,649
Total Expenses	377,289	390,582	377,289	390,582	390,582
Net Farm Income	156,782	143,489	73,004	59,712	36,001
Capital Debt Repayment Capacity	154.20%	139.60%	62.20%	47.60%	21.57%

Table 4 illustrates the potential impact of a decrease in crop revenues and/or an increase in interest payments similar to those that occurred from 1979 to 1981. The

[5] The fall in crop revenue must be higher than the value of farm production due to livestock revenue and government payments.

[6] It is unclear at this point what the new Farm Bill will have in the final version for target prices, if any.

second column illustrates the situation at the end of 2010 for the average Kansas farm. The Capital Debt Repayment Capacity calculated from the average dollar amounts is 154.2 percent, which differs from the average stated above of 134.6 percent that is calculated from the average of the Capital Debt Repayment capacity across farms. Column three illustrates an increase of 65.3 percent in interest payments. This would cause the capital debt repayment capacity to fall to 139.6 percent. Column four illustrates a 15.7 percent decrease in the value of farm production caused by decreasing crop revenue. This results in a fall in the Capital Debt Repayment Capacity to 62.2 percent. The fifth column represents a combination of interest payment increases of 65.3 percent and a decline in the value of farm production of 15.7 percent, resulting in a fall in the Capital Debt Repayment Capacity to 47.6 percent. The final combination is the result of the both scenarios with the added elimination of $23,710 of direct farm payments; resulting in a 21.6 percent Capital Debt Repayment Capacity measure. Thus, a repeat of the situation that occurred from 1979 to 1981 could result in a substantial reduction in the repayment capacity of KFMA farms. It should be noted that there will be a distribution around these estimates with a number of KFMA farmers in a more precarious situation.

Featherstone and Baker (1987) found that the last two agricultural land boom-bust cycles were driven by different factors. The most recent one (1970s to 1980s) was more driven by income factors. The previous one (1920s and 1930s) was driven by interest rates. Schurle et al. (2012) recently estimated a model of land prices for Kansas and Illinois. They found that nominal cash rent and the real (inflation-adjusted) interest rate were important drivers of land values since 1967 with increases in cash rents increasing land values and increases in real interest rates decreasing agricultural land values. Table 5 reports the regression estimates from Schurle et al. Using these estimates, the elasticity for a percentage change in land values due to a percentage change in cash rents is much greater than a percentage change in real interest rates using 2010 values. The elasticity for a change in cash rents is 1.31 in Kansas and 1.15 in Illinois. The elasticity for a change in interest rates is -0.04 in Kansas and -0.06 in Illinois. Thus, a substantial increase in the real interest rate would need to occur for land values to be affected substantially. While a number of agricultural land mortgages are made at a fixed rate, the expectations model for land indicates that the adjustment in land values will

occur from an increase in interest rates, although the cash flow affect will be mitigated until any fixed rate mortgages are retired. A more likely scenario for falling land values would occur from a drop in income generating potential causing cash rents to decrease leading to a fall in land values.

Table 5. Nominal Land Price Forecast Model for Kansas and Illinois (1967 – 2010)

Variable	Estimate	Standard Error	t Statistic
		Kansas Model	
Intercept	-242.19	66.82	-3.62**
Nominal Cash Rent	28.30	1.69	16.74**
Inflation Rate	-239.82	568.11	-0.42
Real Interest Rate	-1702.26	572.42	-2.97**
R-Squared	0.94		
Standard Error	85.16		
		Illinois Model	
Intercept	-345.93	238.75	-1.45
Nominal Cash Rent	29.77	1.60	18.61**
Inflation Rate	-2164.75	2332.65	-0.93
Real Interest Rate	-11150.84	2311.40	-4.82**
R-Squared	0.95		
Standard Error	347.37		

** - Significant at the 5% level of significance
Source: Schurle et al. (2012)

A decrease in income from the land or an increase in interest rates both would exert negative pressure on land values. Macroeconomic theory would suggest that an increase in real interest rates would tend to decrease income in markets that are dependent on exports. The regression model estimated by Schurle et al. (2012) indicates that for 2010, the land value is 14.4 percent and 6.2 percent above that predicted by the model; possibly indicating some additional market speculation or a potential bubble. According to Knuth (2012), buyers of Iowa agricultural land are between 73 percent and 82 percent farmers from 2008 through 2011. Thus, a fall in land values would primarily be felt by farmers and their lenders.

Concluding Thoughts

The agricultural sector is coming off several years of record income. However, the farmland, which makes up a substantial portion of a farmer's balance sheet, is

susceptible to boom-bust cycles. Is the agricultural sector setting itself up for another bust? Is this boom different? This paper examined one of the conditions for a bust, namely the leverage condition of the cycle. The following conclusions are drawn from this paper:

1) The average loan to value ratio for a portfolio of defaulted mortgages from the last boom-bust cycle was 60 percent. Currently, lenders are lending up to 65 percent of loan to value.

2) The average loan performance on defaulted loans from the last boom bust cycle was 5.6 years. Thus, there is a lag of years before loans default. Examining the historical underwriting conditions of one's portfolio is important in addition to considering current underwriting standards.

3) The average real cost of borrowing on those defaulted mortgages discussed above in the last bust was 2.41% which is lower than the current average real cost of borrowing of 4.71%.

4) Most buyers of farmland are other farmers and the average is not what will drive any bust, but the tails (margin). The average is affected to what happens in the tails (margin).

5) At the end of 2010, an estimate of the average probability of default is slightly higher than it was in 1979 for a set of Kansas farms.

6) The debt to asset ratio is **higher** for a set of Kansas farms in 2010 compared to those in 1979. In addition, there are a higher percentage of Kansas farms with more than 40 percent debt to assets and 70 percent debt to assets in 2010 compared to 1979.

7) A significant drop over two years in the ability to repay debt lead to the financial crisis and the drop in land values in the 1980s. Similar percentage changes in the value of farm production and interest payments coupled with an elimination of direct farm payments can result in a similar drop in repayment capacity.

8) Revenue insurance or farm programs will likely not cushion that size of drop across years.

9) The use of fixed rate loan products will mitigate some of the cash flow issues but would not affect nor prevent a fall in farmland values.

10) Revenue drops will more likely lead to a fall in land prices than an increase in interest rates but they tend to occur together.

The farm sector is currently in excellent shape from a leverage and credit perspective. Will leverage drive another bust cycle? Leverage will likely not be the cause of a bust cycle but it certainly can exacerbate the falling of land values if farmland values begin to fall.

References

Agricultural Finance Databook, https://www.kansascityfed.org/research/indicatorsdata/agfinance/, Last accessed June 22, 2012.

Brewer, B.E. 2012. Determinants of Lender Choices and Banking Strategy for Kansas Farmers, Unpublished M.S. Thesis, Department of Agricultural Economics, Kansas State University

Brewer, B.E., C.A. Wilson, A.M. Featherstone, M. Harris, K. Erickson, and C. Hallahan. 2012. Measuring the Financial Health of U.S. Production Agriculture. *Journal of American Society of Farm Managers and Rural Appraisers*, 75(No. 1):178-93.

Davis, Bill. Senior Vice President – Chief Credit Officer, Farm Credit Services of America, Personal Communication, June 22, 2012.

Dumler, T., T. Kastens, K. Dhuyvetter. 2001. Converting KMAR Machinery Investment Data to a Market Value Series. Staff Paper, Kansas State University.

Featherstone, A.M. and T.G. Baker. 1987. An Examination of Farm Sector Real Asset Dynamics from 1910-1985. *American Journal of Agricultural Economics*, 69:532-546.

Featherstone, A.M. and C.R. Boessen. 1994. Loan Loss Severity of Agricultural Mortgages. *Review of Agricultural Economics*, 16:249-258.

Featherstone, A.M., L.M. Roessler, and P.J. Barry. 2006. Determining the Probability of Default and Risk Rating Class for Loans in the Seventh Farm Credit District Portfolio. *Review of Agricultural Economics*, 28(Spring):4-23.

Featherstone, A.M. and T.G. Baker. 1987. An Examination of Farm Sector Real Asset Dynamics: 1910-85." *American Journal of Agricultural Economics,* 69(August):532-46.

Federal Farm Credit Funding Corporation, 2012. The Farm Credit System. http://www.farmcreditfunding.com/farmcredit/serve/public/pressre/finin/report.pdf?assetId=205074. June, (Last accessed June 22, 2012).

Hunter, William C., George G. Kaufman, and M. Pomerleano. 2003. *Asset Price Bubbles: Implications for Monetary, Regulatory and International Policies*. Cambridge: Massachusetts Institute of Technology.

Kindleberger, Charles P. 1978. *Manias, Panics, and Crashes: A History of Financial Crisis*. New York: Basic Books.

Knuth, Jim, 2012, The Land Market – A Lender's Perspective, The Iowa Land Expo, Des Moines, IA, January 20.

Langemeier, M.R. and K.H. Herbel. 2012. 2010 Enterprise Profit Center Summary. http://www.agmanager.info/KFMA/Enterprise/2010/Enterprise_2010.pdf, Last accessed June 23, 2012).

Langemeier, M.R. 2003. Kansas Farm Management SAS Data Bank Documentation Staff Paper 03-02, Department of Agricultural Economics, Kansas State University.

Lopez, J.A. 2002. The Empirical Relationship Between Average Asset Correlation, Firm Probability of Default and Asset Size. Working Paper 2002-05, Federal Reserve Bank of San Francisco, San Francisco, CA, 2002. http://www.frbsf.org/publications/economics/papers/2002/index.html, (Last accessed June 23, 2012).

Melichar, E. 1984. A Financial Perspective on Agriculture. Federal Reserve Bulletin 70:1-13.

Micheels, E.T. and P.N. Ellinger. 2008. A Re-examination of the Representativeness of State-level Data Sources. Department of Agricultural and Consumer Economics, University of Illinois, at Urbana-Champaign, Urbana, IL.

Schurle, B., C.A. Wilson, A.M. Featherstone, H. Remaury, and J. Harmon. 2012. Asset Bubbles, Inflation, and Agricultural Land Values. *Journal of American Society of Farm Managers and Rural Appraisers*, 75(No 1):135-47.

Shiller, Robert J. 2000. *Irrational Exuberance*. Princeton: Princeton University Press.

Smith, Vernon L., Gerry L. Suchanek, and Arlington W. Williams. 1988. Bubbles, crashes, and endogenous expectations in experimental spot asset markets. *Econometrica* 56 (5): 1119–51.

St. Louis Federal Reserve Bank, http://research.stlouisfed.org/fred2/, Accessed June 25, 2012.

USDA ARMS. 2012. ARMS Farm Financial and Crop Production Practices: Tailored Reports, http://www.ers.usda.gov/Data/ARMS/app/default.aspx?survey_abb=FINANCE, Accessed June 25, 2012

USDA ERS. 2012. Farm and Commodity Policy: Program Provisions: Counter-Cyclical Payments, http://www.ers.usda.gov/briefing/FarmPolicy/CounterCyclicalPay.htm, Accessed June 25, 2012.