Rating the Financial Health of U.S. Production Agriculture using Synthetic Credit Rating Methods

Christine Wilson[3], Mitch Morehart[2], Allen Featherstone[1], Charlie Hallahan[2], Kenneth Erickson[2], Michael Harris[2] and Robert Williams[2]

[1] Contact Author, Department of Agricultural Economics, Kansas State University, 313 Waters Hall, Manhattan, Kansas 66506-4011

Phone: 785.532.4441, Fax: 785.532.6925, Email: afeather@ksu.edu

[2] United States Department of Agriculture, Economic Research Service, Washington, DC

[3] Department of Agricultural Economics, Kansas State University

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[1] Department of Agricultural Economics, Kansas State University, Manhattan, Kansas

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Introduction

The financial health of the agricultural economy has been excellent for the past couple of years with farm income at record levels. However, the overall U.S. economy has experienced a credit crisis, the largest recession since the Great Depression, and instability in input prices. Although the U.S. farm sector has been largely shielded from the downturn in the economy, it may not be long before the agricultural sector enters a downturn. In fact, livestock farms are already beginning to experience stress. Recent articles in the *Wall Street Journal* (May 19, 2009) and *The New York Times* (May 26, 2009) have indicated that traditional and organic dairies are financially vulnerable. It was reported that a Wisconsin dairy farmer cashed out his IRA to purchase inputs this spring. This leads to the question, "What is the frequency of these cases by farm type and geographic region?"

The last major downturn occurred in the early 1980s when farm bankruptcy issues dominated the news. During that crisis, USDAs measurement of financial stress classified farms into four distinct categories (favorable, marginal solvency, marginal income, and vulnerable) based on a farm's income and solvency position. However, since the 1980s, lending institutions serving agriculture have moved to credit scoring models that provide more specificity in measuring risk.

Objectives

This paper will analyze the probability of default for USDA ARMs farms over time using the method proposed by Featherstone, Roessler, and Barry (2006). Specifically, methods will be applied to estimate the probability of default for each ARMS farm. With this new information, the results will be aggregated to geographic region, and product type to assess the farm sector's financial health.

Data and Methods

This study used farm-level data from USDA's Agricultural Resource Management Survey (ARMS).

Credit scores are found using financial data from each farm. Each farm in the ARMS data is viewed as a potential borrower. This allows us to assess the risk that a loan will enter default status. After assessing the risk of farm and assigning an appropriate credit rating, we are able to determine the riskiness of the sector by aggregating the individual farms.

The farm record data used for this study are expected to provide an accurate representation of the financial data received by a lender from a borrower. These data are obtained from ARMS and are used to calculate the probability of default and the corresponding score for each farm. The probability of default for each loan in the sample is calculated from an equation derived from a binary logit regression using actual loan origination data.

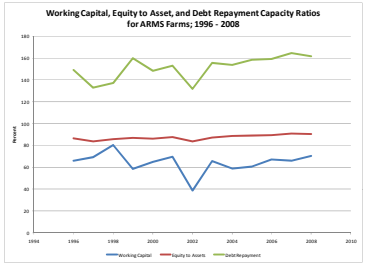
Definition of the Variables

Capital Debt Repayment Capacity (CDRC) – This variable is used to determine repayment capacity. It measures 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 (WCD) and capital asset replacement (CAR). 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.

Owner Equity Percentage (OE) – This provides a measure of a borrower's solvency. This ratio is calculated by dividing net worth by total assets. In this analysis, the OE will be restricted between 0 and 100%.

Working Capital Percentage (WC) – This ratio measures a firm's liquidity position as it relates to its revenue. It is calculated by dividing working capital by the adjusted gross income. Working capital is the result of current assets minus current liabilities. Adjusted gross income is gross receipts minus purchases for resale. This ratio is used to make sure the borrower has sufficient liquidity.

The above variables are graphed below from 1996 to 2008.



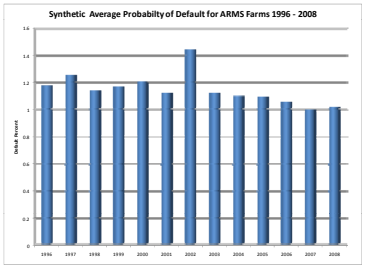
Measuring Probability of Default

The variables above were used to calculate the probability of default.

$$\ln\frac{\text{probabilty of default}}{(1-\text{probabilty of default})} = -2.3643 - 0.00135(\text{CDRC}) - 0.0217(\text{OE}) - 0.00399(\text{WC})$$

$$\text{probabilty of default} = \frac{(e^{XB})}{(1+e^{XB})}$$

Probability of Default Results



The probability of default ranged from 1.00 (2007) to 1.44 (2002) and averaged 1.15 from 1996 to 2008. From 2002 though 2007, the probability of default declined before increasing in 2008.

Convert Probability of Default to Synthetic Credit Ratings

The probability of default for each farm was mapped into a S&P credit rating using the table below.

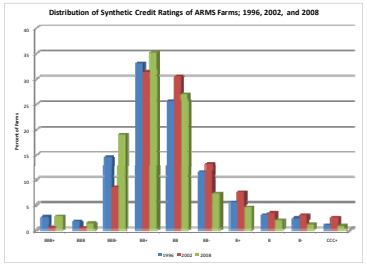
The Mapping of S&P Credit Ratings to KMV EDF Values[1]	
S & P Rating	KMV EDF Value (%)
AAA	(0.00, 0.02]
AA+	(0.02, 0.03]
AA	(0.03, 0.04]
AA-	(0.04, 0.05]
A+	(0.05, 0.07]
A	(0.07, 0.09]
A-	(0.09, 0.14]
BBB+	(0.14, 0.21]
BBB	(0.21, 0.31]
BBB-	(0.31, 0.52]
BB+	(0.52, 0.86]
BB	(0.86, 1.43]
BB-	(1.43, 2.03]
B+	(2.03, 2.88]
B	(2.88, 4.09]
B-	(4.09, 6.94]
CCC+	(6.94, 11.78]
CCC	(11.78, 14.00]
CCC-	(14.00, 16.70]
CC	(16.70, 17.00]
C	(17.00, 18.25]
D	(18.25, 20.00]

[1] Source: Lopez 2002

Synthetic Credit Ratings

One way to think of credit models is to relate them to a well-known benchmark such as Standard and Poor's (S&P). Relating a farm's creditworthiness to the rating classes used by S&P benefits the research in several ways. The S&P model has been established, used, and validated in the marketplace and the use of its classes provides a consistency in the marketplace. This consistency allows the researcher the ability to compare results across studies. Since the S&P model is one of the most commonly used, policymakers will have a better grasp of what the ratings indicate.

The largest percentage of ARMS farms have credit ratings of BB+ and BB. Approximately 90% or more of ARMS farms have credit ratings from BBB- to B+.



Conclusions

The probability of default was estimated for USDAs farms from 1996 to 2008. Since 1996, the probability of default has generally trended down expect in 2002 when the financial condition of farms deteriorated. Future research will examine differences among geographic and farm type.

References

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

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K-STATE Kansas State University

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