



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## Effectiveness of Increasing Liquidity as a Response to Increased Repayment Risk: A Case Study

By Elizabeth A. Yeager & Freddie L. Barnard

### ABSTRACT

Volatile net farm incomes and potential for higher interest rates has strengthened the importance of managing liquidity. This paper evaluates the effectiveness of increasing liquidity levels as a means of reducing repayment risk for agricultural firms. Using a base case farming operation and three interest rate scenarios, eight potential changes in the operating situation, and two leverage levels, it was found increasing the level of liquidity was an effective means of reducing repayment risk. The management practice was found to be more effective for offsetting the adverse effects of increasing interest rates and operating expenses than for decreasing gross farm revenue and increasing leverage levels.

### Introduction

In February 2008, the Basel Committee on Banking Supervision published *Liquidity Risk Management and Supervisory Challenges*, which addresses the interaction of firm liquidity and repayment capacity, within the context of the proposed Basel III requirements for the banking industry. Principle 8 of that publication emphasizes the need for banks to actively manage intraday liquidity positions and risks and its payment and settlement obligations under what is described as normal and stressed conditions (Basel Committee on Banking Supervision, 2008). The need to manage the liquidity position of a farm and ranch operation under various interest rate scenarios and operating conditions can be just as important for farm borrowers as they consider increasing repayment obligations for debt taken on to purchase capital assets such as farm real estate.



Elizabeth A. Yeager is Assistant Professor, Purdue University and Freddie L. Barnard is Professor, Purdue University.

That need is likely to be especially relevant during the upcoming decade. That period could be characterized by higher interest rates and lower net farm incomes than have been experienced since the fall of 2006 (Henderson and Kauffman, 2013). Furthermore, the volatility of net farm income has increased for the 2007 to 2013 period, compared to the 2000 to 2006 period. Such a lending environment could lead to higher levels of repayment risk than experienced during the 2006 to 2013 period.

A major challenge for those involved in financing the purchase of capital assets, particularly real estate, during this period will be to implement measures to mitigate a potential increase in repayment risk. Durguner and Katchova found in a 2007 study that working capital to gross farm return was one of the most pertinent factors for determining the creditworthiness of a farmer in the following year. Increasing working capital to gross farm revenue could be a means to reduce repayment risk for agricultural firms. The purpose of this study is to evaluate the effectiveness of increasing liquidity levels as a means of reducing repayment risk for agricultural firms.

### Agricultural Lending Environment Projections

The Federal Reserve suggests interest rates could rise during the next decade, with that rise starting during the next two years. Some members of the Federal Reserve's Federal Open Market Committee (FOMC) have indicated fed funds rates should rise from the current target of 0 to 0.25 percent to 3 percent by 2015 (Henderson and Kauffman, 2013). The Livingston Survey (2013) supports both short- and long-term interest rates remaining low through

2013, but with unemployment rates expected to fall through 2014, there is some indication interest rates will rise in the next few years.

Since 2006, annual real returns to U.S. farm operators have increased to the highest level since 1973. However, returns are not projected to remain at those levels during the next decade. USDA projects net farm income in the U.S. to fall 20 to 25 percent below 2013 levels and to remain there over the next decade (Westcott and Trostle, 2013).

In addition, net farm incomes have become more volatile since the fall of 2006 than during the previous period. The standard deviation of net farm income from 2000 to 2006 is 15.8 billion dollars compared to 20.3 billion dollars for 2007 to 2013F (USDA, 2013). That volatility is due not only to higher, and more volatile, commodity prices, but also to production expenses that have increased every year since 2006, except 2009. Gross farm income levels and total production expenses for the agriculture sector for the 2007-2013F period are presented in Table 1. There is substantial variation across the years for gross farm income, with one year, 2009, experiencing a 9.9 percent decline from the previous year.

On the other side of the net income calculation, total operating expenses continued to increase, with three years during the 2007 to 2013 period experiencing an increase in excess of 5 percent. The result is net farm income variability for the agricultural sector that can be even more pronounced at the individual farm level.

Since principal payments for term debt are paid from net farm income, sensitivity analysis is needed on loan repayment capacity. Increased repayment risk arises because repayment schedules typically span multiple years when borrowing funds to purchase capital assets (e.g., machinery, equipment, real estate, etc.) and the operating situations can change dramatically during that period. Consequently, the repayment capacity at the inception of a loan could be strong but then deteriorate later in the repayment schedule.

One response to an increase in repayment risk for agricultural firms could be to increase liquidity, which translates into self-financing a larger portion of a firm's annual operating expenses rather than using borrowed funds to finance those expenses. A management practice of increasing liquidity enables a firm to not only react in a more timely manner to unexpected opportunities and problems, but it also helps to lessen the impact of increases in interest rates charged on operating loans.

## Methodology

### Measures

When evaluating repayment risk for funds borrowed from a financial institution, the term debt and capital lease coverage ratio can be used to represent repayment risk. The coverage ratio recommended by the Farm Financial Standards Council (FFSC) will be used in this study to represent repayment risk because of the comprehensive features of the measure and its use across the lending industry. The FFSC recognized the interaction between profitability and repayment

capacity and recommended a separate criterion be used to assess repayment capacity. That criterion includes a measure that directly incorporates farm profitability, depreciation allowance, principal payments on term debts and capital leases, non-farm income, and withdrawals for family living. Since the term debt and capital lease coverage ratio is a ratio, comparisons can be made across farms, operating situations, interest scenarios, and to comparative data for the industry.

The first step to calculate the term debt and capital lease coverage ratio is to compute the term debt and capital lease repayment capacity. Starting with net farm income from operations, total non-farm income, depreciation, interest on term debt, and interest on capital leases are added, and total income tax expense and withdrawals for family living are subtracted to obtain the term debt and capital lease repayment capacity. The repayment capacity is then divided by the sum of annual scheduled principal and interest payments on term debt and capital leases. If the intent is to evaluate the measure for the business only, total non-farm income should not be included and certain adjustments may be necessary for the portion of income taxes and family living withdrawals paid by non-farm income (Financial 2008).

The measure used in the study to represent liquidity is also recommended by the FFSC, working capital divided by gross farm revenue. Working capital is calculated by subtracting current liabilities from current assets. The difference represents the amount of current assets that are not committed to repay current liabilities and are thus free to be used

to either pay operating expenses for the upcoming production period or to serve as a “liquidity cushion” that can be used to respond to possible earnings shortfalls in the future. The measure is reported by several farm records programs and the greater the number, the stronger the liquidity position of the firm.

The liquidity levels evaluated in this study are included in the case farm by adjusting the amount of the operating loan. The initial liquidity position of the example case farm provides the initial level of working capital to gross revenue. Increasing levels of that measure are determined by calculating the amount of working capital needed to arrive at the level of working capital to gross farm revenue that is evaluated. It is then assumed the non-current assets of the case farm are reduced (i.e., sold) and the cash position of the firm increased by the corresponding amount(s). Hence, the debt-to-asset percent and the profitability of the firm remain the same as the initial operating situation, but a lower operating loan for the upcoming period is used by the firm and consequently a lower interest expense for the operating loan.

### Spreadsheet

The Purdue Financial Analysis Spreadsheet is used in this analysis. It is discussed in detail in *Farm Business Management for the 21st Century: Measuring and Analyzing Farm Financial Performance* (Miller et al., 2012). Consequently, only a general overview is presented in this paper. Guidelines provided by the Farm Financial Standards Council (Financial Guidelines, 2008) are used in the spreadsheet to prepare the financial statements and calculate financial measures.

**Accrual-adjusted Income Statement.** Accrual-adjusted net farm income is used in the spreadsheet because the benefits from using data reported on an accrual-adjusted versus a cash basis income statement have been studied and the difference has been judged by many to be unacceptable. The magnitude of the difference was reported in a 2010 article using University of Illinois Farm Business and Farm Management (FBFM) data.

The study found the median annual difference between cash net farm income reported on a Schedule F in a Form 1040, U.S. Individual Income Tax Return, and net farm income reported on an accrual-adjusted basis ranged from 52 percent to 63 percent for the period 2002-2006. When a three-year average was used the smallest difference for any of the three-year periods evaluated was 52 percent (Barnard et al., 2010).

**Repayment Capacity Analysis.** The spreadsheet is used to calculate the repayment capacity measures recommended by the FFSC. Gross farm revenue and total operating expenses for an operation can be changed in the spreadsheet and the impact on the term debt repayment and capital lease coverage ratio evaluated. Likewise, the same procedure can be used when assessing the impact of a change in interest rates. Changes in gross farm revenues, operating expenses and interest rates will be used to simulate possible changes in the macroeconomic environment during future periods of the repayment schedule for a term loan.

### Base Case Farm

A case farm is used to assess and evaluate the impact possible operating situations and interest rate

scenarios would have on repayment capacity for two levels of leverage. The base case farm is a cash grain farming operation and is used to represent the financial condition and performance of a farm or ranch operator that is considering the purchase of farm real estate that would increase the leverage of the operation. The case farm is used to conduct the analysis, but is not intended to represent a typical U.S. farm. Instead, it is used to illustrate the impact of changes in gross farm revenue, operating expenses and interest rates on repayment capacity for two leverage levels.

An example of the abbreviated balance sheet, pertinent information from the Schedule F of the form 1040, accrual-adjusted income statement and additional input data needed for the base farm are presented in Worksheets 1-3 from an article published in the 2013 Journal of the ASFMRA (Barnard et al. 2013). The values have been updated for the current base case and the interest rate charged in the base case interest rate scenario is 5 percent on all debt.

Furthermore, it is assumed the capital asset considered for purchase is farm real estate, which the operator currently cash rents from the seller at \$250 per acre. Consequently, the size of the farming operation for the operator remains the same after the purchase as the base case, so additional debt must be paid from the existing revenue-generating capacity.

Characteristics of the base case farm are:

- Total farm assets of \$2,132,523,
- Total farm debt of \$639,757,
- debt-to-asset percentage of 30.0 percent,

- working capital to gross revenue of 19.1 percent,
- net farm income of \$270,369
- current scheduled total annual principal payment is \$71,028,
- withdrawals for family living and taxes is \$115,648, with \$80,000 for family living and \$35,648 for taxes,
- depreciation allowance of \$110,000,
- annual operating loan of \$674,183 is paid at the end of the year and does not show up on the balance sheet,
- zero non-farm income, and
- term debt and capital lease coverage ratio of 2.93.

Hence, both the borrower and an institutional lender would likely feel comfortable with the initial financial condition, profitability, and repayment capacity for the base case farm.

### Operating Situations

An analysis to assess repayment risk should include possible operating situations for upcoming periods and the impact of each on farm profitability and repayment capacity. Such an analysis enables lenders and managers to not only be aware of the potential for increased repayment risk but it also enables them to be proactive by implementing risk-reducing measures.

To assess the impact of possible operating situations, eight potential operating situations are evaluated. The results will enable agricultural lenders to identify operating situations that could result in a deterioration of the measure and the extent to which that deterioration could occur.



To assess repayment capacity sensitivity for gross farm revenue, the base case amount, \$1,164,898, is decreased by five percent, \$1,106,653, and 10 percent, \$1,048,408. These operating situations are labeled situations 1 and 2, respectively. To assess repayment capacity sensitivity resulting from changes in farm operating expenses, total farm operating expenses for the base case, excluding depreciation and interest expenses, \$810,250, is increased by five percent, \$850,763, and 10 percent, \$891,275, for situations 3 and 4, respectively. Once operating expenses have been increased by the respective percentages, depreciation and interest expenses are then added to the resulting numbers to calculate total farm operating expenses for operating situations 3 and 4, \$1,023,694 and \$1,064,207, respectively.

Four additional operating situations are evaluated to represent situations in which changes in gross farm revenue and operating expenses are both detrimental to the net farm income for the farm. Those operating situations are represented by a decrease in gross farm revenue of five percent combined with operating expense increases of 5 and 10 percent for situations 5 and 6, respectively; and a decrease in gross farm revenue of 10 percent that is combined with operating expense increases of five and 10 percent for situations 7 and 8, respectively.

### **Interest Rate Scenarios**

The possibility of rising interest rates during the next decade would also have a detrimental impact on the repayment capacity for farm operations, particularly those that are more highly leveraged. To represent this possible increase, the interest rate charged on all borrowed funds is increased from

the base case scenario of five percent to a mid-level interest rate scenario of 7.5 percent, and a high-level scenario of 10 percent.

The increase to 7.5 percent is designed to represent an interest rate increase similar to that mentioned by Henderson and Kauffman (2013). The 10 percent scenario is designed to represent a more dramatic increase in interest rates, similar to the increase that occurred in the early 1980s. A measure used to represent yields on nominal Treasury securities at “constant maturity” is the constant-maturities Treasury note. The measure is interpolated by the U.S. Treasury from the daily yield curve for non-inflation indexed Treasury securities. The 20-year constant-maturities Treasury note increased from 9.89 in June 1980 to 15.13 percent in October 1981, an increase of 524 basis points (Board of Governors, 2013). The 20-year note is used because the repayment schedule for the increase in term debt is 20 years.

### **Leverage Levels**

Two levels of leverage are evaluated in the study. The first level is the base case, which has a debt-to-asset percent of 30 percent. The second level represents an increase in debt resulting from the purchase of 100 acres of farm real estate for a purchase price of \$6,398 per acre. The repayment schedule for the purchase is assumed to be equal, annual principal payments over 20 years, plus interest. Since the amount of the funds borrowed will impact financial condition and repayment capacity, the additional level of leverage is represented by borrowing \$639,757, which is double the amount of debt outstanding in the base case.

The second level of leverage, which assumes additional borrowing of \$639,757 to purchase the farm real estate, increases debt-to-asset percent from 30.0 to 46.2 percent, which will be henceforth referred to as 46 percent. This change represents a 100 percent increase in total liabilities from the base case. The entire amount is borrowed with other assets pledged as collateral to arrive at an acceptable loan-to-value percent for the lender. The changes to the base case include:

- total assets increase from \$2,132,523 to \$2,772,280 and all of the increase is in non-current assets,
- current liabilities increase from \$126,333 to \$158,321, which includes the principal payment for the additional debt,
- non-current liabilities increase from \$584,452 to \$1,192,221, which reflects the additional debt less the first annual principal payment,
- principal payments on term debts increase from \$71,028 to \$103,016, which includes the amount of the additional annual principal payment,
- cash operating expenses, excluding interest and depreciation, decrease from \$810,250 to \$785,250 due to lower cash rent (100 acres at \$250 per acre),
- operating loan amount decreases from \$674,183 to \$649,183 due to the elimination of cash rent on 100 acres,
- interest on term debt increases from \$29,223 to \$61,210 due to additional term debt, and
- interest on the operating loan decreases from \$33,709 to \$32,459 due to a lower operating loan as a result of the elimination of cash rent on 100 acres.

## Results

### Interest Rate of 5 Percent

This base case interest rate scenario assumes the interest rate charged on all existing and additional debt is at five percent. The rate is used to represent the historically low interest rates experienced since 2008. The effectiveness of increasing liquidity levels as a means to offset potential increases in repayment risk due to various operating situations in a low-interest scenario are evaluated in this scenario.

**Base Case, Debt-to-Asset of 30 Percent.** The base case for the example farm has an initial debt-to asset percent of 30.0 and working capital to gross revenue of 19.1 percent. This level of working capital to gross farm revenue will hereafter be referred to as 19 percent. A common benchmark used for the term debt and capital lease coverage ratio and a minimum for a business that is expanding or making major capital adjustments is 1.5 (Kohl and Wilson, 2004). Of course, a ratio below 1.0 indicates the payments on term debts and capital leases could not be met. As can be seen in Table 2, the term debt and capital lease coverage ratio exceeds 1.5 for all operating situations, except situations 7 and 8, with situation 8 falling below 1.0. In that operating situation, gross farm revenue would decrease by 10 percent and operating expenses would increase by 10 percent, which is the most detrimental operating situation evaluated.

Consequently, the base case, with an interest rate of five percent, could withstand the adverse effects that could result from all but one of the nine



operating situations evaluated. Even the operating situation represented by a 10 percent reduction in gross farm revenue combined with an increase in operating expenses of 10 percent resulted in a coverage ratio of 0.96. The firm is able to meet payments on term debts and capital leases, with the exception of situation 8, even though its working capital to gross farm revenue is only 19 percent.

**Borrowing \$639,757 or Increasing Debt-to-Asset to 46 Percent.** As can be seen from Table 2, the coverage ratio falls below 1.5 for six of the nine operating situations when the debt-to-asset ratio increased to 46 percent. Only the base situation, a five percent decrease in gross farm revenue and a five percent increase in operating expenses remain above 1.5. As was also the case for the base case, a 10 percent decrease in gross farm revenue combined with a 10 percent increase in operating expenses would result in a coverage ratio below 1.0. However, at the higher level of leverage, the other two operating situations that include a 10 percent adverse change in one variable combined with a five percent adverse change in the other result in the coverage ratio falling to 1.12 and 1.0 for situations 6 and 7, respectively. Hence, even in the low interest rate scenario of five percent, the repayment capacity is sensitive to adverse changes in gross farm revenue and operating expenses with the debt-to-asset ratio at the higher leverage level of 46 percent.

#### **Interest Rate of 7.5 Percent**

Increasing the interest rate from 5 percent to 7.5 percent represents the magnitude of the change in interest rates alluded to in the article by Henderson

and Kauffman (2013). This increase is possible over the next couple of years and the scenario represents a mid-level interest rate scenario.

**Base Case, Debt-to-Asset of 30 Percent.** The impact on repayment capacity for the base case with a debt-to-asset percent of 30 percent and an interest rate of 7.5 percent is somewhat similar to what the base case experienced with the five percent interest rate scenario. The coverage ratio again falls below 1.0 for only situation 8. However, in this scenario, the number of operating situations in which the coverage ratio falls between 1.0 and 1.5 increases from one to three. As was also the case for the five percent interest rate scenario, the farm borrower could meet its repayment obligations for all but one of the operating situations when the debt-to-asset percent is 30 percent.

**Borrowing \$639,757 or Debt-to-Asset of 46 Percent.** However, there is noticeable deterioration in repayment capacity for the higher leveraged solvency position when the interest rate increases from five to 7.5 percent. In this interest rate scenario, the coverage ratio falls below 1.5 for all of the operating situations, except the base situation. It falls below 1.0 in 4 of the 9 operating situations, which again are the three operating situations represented by an adverse change of 10 percent for one variable combined with an adverse change of five percent in the other, as well as the 10 percent decrease in gross farm revenue situation. Again, the operating situations represented by a five percent adverse change in one variable with the other variable remaining either constant or experiencing a five percent adverse change and a 10 percent

increase in operating expenses would result in a coverage ratio between 1.0 and 1.5.

#### **Effectiveness of Increasing Liquidity to Reduce Repayment Risk, 5 and 7.5 Percent Interest Rates.**

As can be seen from Table 3, increasing the liquidity level for the base case farm from the initial level of 19 to 50 percent, with debt-to-asset of 30 percent and a five percent interest rate increased the coverage ratio. This finding was expected, because a smaller operating loan is used to finance the farm business. Although the magnitude of the improvement in the coverage ratio for the base case was only 0.16, it was still sufficient to increase the coverage ratio from 0.96 to 1.12 for the only operating situation in which the ratio was below 1.0, situation 8. The magnitude of the increase across the nine operating situations was either 0.15 or 0.16, since the operating loan was reduced the same amount for all operating situations. So, the coverage ratio improved in the low-interest rate scenario, but only slightly.

Again, only a small improvement in the coverage ratio was found at the five percent interest rate level for a debt-to-asset level of 46 percent, with results reported in Table 4. Increasing the liquidity level for the base case resulted in an improvement in the coverage ratio of only 0.10, which is less than the improvement for the 30 percent debt-to-asset level, 0.16. The smaller impact is due to the larger magnitude of the deterioration in the ratio due to a higher amount of debt more than offsetting the increase in the ratio resulting from increased liquidity and a lower operating loan. This is because interest expense as a percentage of total operating expenses was a greater percentage

at 46 percent debt-to-asset than at the 30 percent debt-to-asset, with the interest rate at 5 percent and other operating expenses and depreciation remaining constant across the two leverage levels.

The magnitude of the improvement in the coverage ratio from increasing liquidity was greater when interest rates increased from five percent to 7.5 percent. At 30 percent debt-to-asset the magnitude of improvement in the coverage ratio was 0.20 compared to 0.15 and 0.16 when rates were at five percent. Again, the coverage ratio improved, but the improvement was not sufficient to increase the ratio to above 1.0 for operating situation 8.

When the base case was changed to represent the higher debt-to-asset level of 46 percent and the interest rate was 7.5 percent, the coverage ratio only increased from 1.56 to 1.69 for the base situation. This occurred when working capital to gross farm revenue percent is more than double the initial level, 19 percent. Also, it did not provide enough improvement in the coverage ratio to offset the deterioration in the ratio resulting from adverse effects from any of the operating situations when compared to the base case.

#### **Interest Rate of 10 Percent**

This interest rate scenario represents a dramatic increase in interest rates that would be somewhat similar to the dramatic increase in interest rates that occurred during the early 1980s. In this scenario, interest rates would double from the base interest rate scenario of five percent. The same leverage levels and operating situations are evaluated as with the previous two interest rate scenarios.

**Base Case, Debt-to-Asset of 30 Percent.** The base case for the example farm has an initial debt-to-asset percent of 30.0. As can be seen in Table 2, the coverage ratio exceeds 1.5 for only three operating situations (base, 1 and 3). It falls between 1.0 and 1.5 for three other operating situations. The coverage ratio falls below 1.0 for any operating situation that includes a 10 percent change in one variable combined with a five percent change in the other variable.

Consequently, the base case, with an interest rate of 10 percent, would experience a noticeable deterioration in repayment capacity and an increase in repayment risk if interest rates double compared to the base level of five percent. This would make farming operations with what would have been deemed acceptable levels of debt at loan inception, when interest rates were five percent, vulnerable to any appreciable changes in gross farm revenue and operating expenses if interest rates increased to 10 percent. This assumes interest rates on term debt had not been fixed at lower interest rate levels.

#### **Borrowing \$639,757 or Debt-to-Asset of 46 Percent**

If the purchase of capital assets results in an additional \$639,757 in debt and the interest rate increases from 5 to 10 percent, there is a substantial increase in repayment risk. In this interest rate scenario, the coverage ratio is below 1.5 for all of the operating situations, including the base (Table 2). It falls below 1.0 in 6 of the 9 operating situations and a five percent decrease in gross revenue and a five percent increase in operating expenses would result in coverage ratios of only 1.02 and 1.10

(Table 2), respectively. Hence, there is essentially no margin in repayment capacity to address any adverse change in the operating situation from the base case.

#### **Effectiveness of Increasing Liquidity to Reduce Repayment Risk, Interest Rate of 10 Percent.**

As can be seen from examining Tables 3 and 4, increases in the coverage ratio resulting from increasing liquidity when interest rates are 10 percent are again minimal. In the base situation for the debt-to-asset percent of 30 and 46 percent, an increase in liquidity resulted in an increase in the coverage ratio of 0.24 and 0.15, respectively. The increase in the coverage was enough to improve the ratio from below 1.0 to above 1.0 for two operating situations at 30 percent debt-to-asset (situations 6 and 7) and one situation at 46 percent debt-to-asset (situation 4).

The magnitude of the improvement in the coverage ratio for debt-to-asset of 46 percent from increasing liquidity, 0.15, was not sufficient to offset the magnitude of the deterioration in the ratio when interest rates increased from 7.5 to 10 percent, which was 0.28 (Table 4). An increase in the liquidity measure improves the coverage ratio, but again only minimally.

Consequently, the liquidity management practice of funding an increasing portion of the operating expenses internally rather than to borrow those funds increased the coverage ratio when interest rates were set at 10 percent, but the practice only partially offset the deterioration in the ratio due to higher interest rates. The deterioration in the ratio

from increasing the interest rate from five to 7.5 percent and from 7.5 to 10 percent at 30 percent debt-to-asset, 0.52 and 0.40 (Table 3), respectively; and 0.39 and 0.28 (Table 4), respectively, for 46 percent overwhelmed the improvement from increasing liquidity. The interest savings from increasing liquidity for the 30 and 46 percent debt-to-asset levels, with a 10 percent interest rate, only increased the coverage ratio 0.24 (Table 3) and 0.15 (Table 4), respectively.

### **Comparisons of the Effectiveness of Increasing Liquidity**

Although the management practice of increasing liquidity to reduce repayment risk did not completely offset the deterioration in coverage ratio that resulted from adverse operating situations, increasing interest rates, and higher levels of leverage; the practice did improve the ratio in every situation. In order to compare the effectiveness of the practice in different situations, an improvement ratio is calculated by taking the positive increase in the term debt and capital lease coverage ratio resulting from increasing liquidity, and dividing it by the absolute value of the change (deterioration) in the term debt and capital lease coverage ratio that results from either increasing the interest rate, changing the operating situation, or increasing the leverage position. Table 5 summarizes the effectiveness of increasing the level of liquidity across interest rates, operating situations and leverage levels.

For example, under the base situation with a 30 percent debt-to-asset, the term debt to capital lease coverage ratio decreased from 2.93 to 2.41,

a decrease of 0.52 (Table 2), when interest rates increased from 5.0 to 7.5 percent with a working capital to gross farm revenue of 19 percent. However, when the level of liquidity is increased from 19 to 50 percent, the term debt to capital lease coverage ratio decreases but only to 2.61, which is an improvement of 0.20 (Table 3). So the improvement due to an increase in liquidity is 0.20. The improvement ratio is calculated by dividing 0.20 by the absolute value of the original deterioration of 0.52. Thus, the improvement ratio is 0.38 or the increase in liquidity was able to account for or offset 38 percent of the deterioration caused by increasing the interest rate from five to 7.5 percent.

At both the 30 and 46 percent debt-to-asset levels of leverage, the improvement ratio for the base situation was greater for the higher interest rate scenario, 7.5 to 10 percent, than for the lower interest rate scenario, five to 7.5 percent; 0.60 compared to 0.38, and 0.54 compared to 0.33, respectively. In addition, more than one-half of the deterioration in the coverage ratio resulting from increasing interest rates is offset by increasing liquidity for all operating situations and for both leverage levels, when interest rates increased from 7.5 to 10 percent. That magnitude of improvement was only found in five of the nine operating situations at 30 percent debt-to-asset and three of the nine situations at 46 percent debt-to-asset when interest rates were increased from five to 7.5 percent. Hence, the practice was more effective for the case farm as interest rates rose to the higher interest rate level than it was at the lower interest rate level.

Evaluating the improvement in coverage ratio across operating situations when both the debt-to-asset level and the interest rate are held constant is shown in the middle section of Table 5. As can be seen by reviewing the results, the improvement ratio is higher for operating situations 3 and 4 (increases in operating expenses) compared to situations 1 and 2 (decreases in gross farm revenue) due to the interest expense savings being a greater portion of operating expenses than gross farm revenue.

A review of the 2007 to 2013F period helps to put this into perspective, gross farm revenue only decreased one out of the six years (9.9 percent in 2009), but operating expenses increased five out of the six years, with 2009 being the exception. The average increase over the five years that operating expenses increased was 4.7 percent, with the year-over-year increase ranging from 0.4 to 6.6 percent. Hence, the practice would have offset between 37 and 83 percent of the deterioration in the coverage ratio due to an increase of five percent in operating expenses across the three interest rate scenarios and both leverage levels. It would have offset between 28 and 58 percent of the five percent decrease in gross farm revenue across the three interest rate scenarios and both leverage levels. The magnitude of the improvement decreases noticeably when the decrease in gross farm revenue is 10 percent and that is combined with an increase in operating expenses of five or 10 percent (operating situations 7 and 8). That relationship held for all three interest rate scenarios and for both leverage levels. Thus, the practice was more effective as a way to offset the more common operating situation of increases in operating expenses than the less common situation of decreasing gross farm revenue.

The right-hand section of the table reports the improvement ratio as it relates to increases in leverage. As can be seen, the ratio is small relative to the results found for its use to offset higher interest expenses and the adverse effects resulting from operating situations 1-4. The improvement ratio is 0.50 for operating situations that include a 10 percent adverse change in both variables for the lowest interest rate scenario. It goes to 1.0 when a 10 percent adverse change occurs in both variables, with 7.5 percent interest rate and greater than 2.0 for the 10 percent interest rate. However, the coverage ratios at those levels deteriorated so much when debt-to-asset levels increased from 30 to 46 percent, all would still be below 1.0, even with a 50 percent working capital to gross farm revenue. Those ratios at 19 percent liquidity are only 0.48 (Table 3) and 0.41 (Table 4) at the 10 percent interest rate level for 30 and 46 debt-to-asset, respectively, and improved to 0.72 (Table 3) and 0.56 (Table 4), respectively.

In general, increasing the level of liquidity was more effective for the higher interest rate scenarios of 7.5 and 10.0 percent, than for the lower interest rate scenario of five percent. It was more effective for offsetting increases in operating expenses than decreases in gross revenue, which has been the more likely operating situation during the past six years. The effectiveness of increasing liquidity as a way to offset deterioration in repayment capacity due to increasing leverage resulted in only minimal improvement in the coverage ratio for operating situations involving an adverse change in one variable of five or 10 percent. The effectiveness was much greater for operating situations involving an adverse change of 10 in one variable combined with

a five or more percent adverse change in the other. However, the coverage ratios in those situations were all substantially below 1.0 at the 19 percent liquidity level, so the improvement was insufficient to move the ratio above 1.0.

### **Final Comments**

Volatile net farm incomes over the previous six years and the potential for higher interest rates in the next decade has strengthened the importance of managing the liquidity of a farm or ranch business. This is particularly the case when considered within the context of offsetting the adverse effects of increasing interest rates and detrimental operating conditions could have on repayment capacity.

Using a base case cash grain farming operation and three interest rate scenarios (5, 7.5, and 10 percent), eight potential changes in the operating situation

(decrease in gross farm revenue of 5 or 10 percent, increase in operating expense of 5 or 10 percent, or both), and two leverage levels (debt-to-asset percent of 30 and 46), it was found increasing the level of liquidity was an effective means of reducing repayment risk. The management practice was found to be more effective for offsetting the adverse effects of increasing interest rates and increasing operating expenses than for decreasing gross farm revenue and increasing leverage levels.

Although the results reported here only apply to the case farm evaluated, which is a cash grain operation, the results do seem to indicate increasing liquidity is one tool farm and ranch businesses can use to better position themselves to meet future challenges and opportunities in the next decade. Additional work is needed to assess the effectiveness for other enterprises.



## References

- Barnard, F. L., P. N. Ellinger and C. Wilson. (2010). "Measurement Issues in Assessing Farm Profitability through Cash Tax Returns," *Journal of the American Society of Farm Managers and Rural Appraisers*: 218-229.
- Barnard, F.L., E.A. Yeager and A. Miller. (2013). "New Features Added to the Purdue Farm Financial Analysis Spreadsheet," *Journal of the American Society of Farm Managers and Rural Appraisers*: 74-87.
- Basel Committee on Banking Supervision. (2008). *Principles for Sound Liquidity Risk Management and Supervision*, Bank for International Settlements: 25 pages.
- Board of Governors of the Federal Reserve System. (2013). "Economic Research and Data, Historical Data, Selected Interest Rates (Daily) – H15". Obtained July 15, 2013. <http://www.federalreserve.gov/releases/H15/data.htm>.
- Durguner, S. and A. Katchova. (2007). *Credit Scoring Model in Illinois by arm Type: Hog, Dairy, Beef and Grain, Selected Paper for the American Agricultural Economics Association Meeting*, Portland, Oregon: 27 pages.
- Financial Guidelines for Agricultural Producers: Recommendations of the Farm Financial Council* (Revised). (January 2008).
- Henderson, J. and N. Kauffman. (2013). "The Wealth Effect in U.S. Agriculture", *The Main Street Economist, Agricultural and Rural Analysis*, Federal Reserve Bank of Kansas City; Issue 1, 2013.
- Kohl, D. and T. Wilson. (2004). "Understanding Key Financial Ratios and Benchmarks." *Farm Credit Services Business Tools*, Produced by Northwest Farm Credit Services, Spokane, WA.
- "The Livingston Survey," (2013). Federal Reserve Bank of Philadelphia, June. Obtained July 11, 2013, [www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/2013/livjun13.pdf](http://www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/2013/livjun13.pdf)
- Miller, A., C. Dobbins, M. Boehlje, F. Barnard and N. Olynk. (July 2012). *Farm Business Management for the 21st Century: Measuring and Analyzing Farm Financial Performance*. Department of Agricultural Economics, Purdue University Cooperative Extension Service EC-712.

USDA. (2013). "Farm income/balance sheet items in constant (2005=100) dollars, 1929-2013F." *Economic Research Service U.S. Farm Income and Wealth Statistics (includes the U.S. Farm Income Forecast, 2013)*.  
<http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx>.

Westcott, P. and R. Trostle. (2013). USDA Agricultural Projections to 2022. Economic Research Service, U.S. Department of Agriculture, Outlook NO (OCE-131), February 2013,  
<http://www.ers.usda.gov/publications/oce-usda-agricultural-projections/oce131.aspx>

Table 1. U.S. Agriculture Sector, Gross Farm Income and Total Production Expenses, 2007-2013F

<u>Year</u>	<u>Gross Farm Income</u>	<u>Percent Change</u>	<u>Total Production Expenses</u>	<u>Percent Change</u>
Billions of Dollars				
2007	319.6	-----	253.7	-----
2008	347.9	8.8	269.5	6.2
2009	313.5	(9.9)	255.9	(5.0)
2010	329.4	5.1	257.0	0.4
2011	377.9	14.7	273.9	6.6
2012F	388.1	2.7	290.0	5.9
2013F	412.5	6.3	302.6	4.3

Source: USDA (2013) Farm income/balance sheet items in constant (2005=100) dollars, 1929 – 2013F

Table 2. Impact of Decreasing Gross Farm Revenue and/or Increasing Total Operating Expenses on the Term Debt and Capital Lease Coverage Ratio for Two Solvency Levels of 30 and 46 Percent, with Working Capital to Gross Farm Revenue of 19 Percent and Interest Rates of 5, 7.5 and 10 Percent

	<u>5 Percent Interest</u>		<u>7.5 Percent Interest</u>		<u>10 Percent Interest</u>	
	-----Solvency (Debt-Asset Ratio)-----					
<u>Situation</u>	<u>30 Percent</u>	<u>46 Percent</u>	<u>30 Percent</u>	<u>46 Percent</u>	<u>30 Percent</u>	<u>46 Percent</u>
Base	2.93	1.95	2.41	1.56	2.01	1.28
1	2.35	1.60	1.91	1.26	1.56	1.02
2	1.77	1.24	1.40	0.96	1.11	0.76
3	2.53	1.71	2.06	1.36	1.70	1.10
4	2.12	1.47	1.71	1.16	1.38	0.93
5	1.95	1.36	1.55	1.06	1.25	0.84
6	1.54	1.12	1.20	0.86	0.93	0.67
7	1.37	1.00	1.05	0.76	0.80	0.59
8	0.96	0.76	0.69	0.56	0.48	0.41

Situation 1 = Decrease Gross Farm Revenue by 5 percent

Situation 2 = Decrease Gross Farm Revenue by 10 percent

Situation 3 = Increase Total Operating Expenses by 5 percent

Situation 4 = Increase Total Operating Expenses by 10 percent

Situation 5 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 5 percent

Situation 6 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 10 percent

Situation 7 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 5 percent

Situation 8 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 10 percent

**Table 3. Impact of Using Two Levels of Liquidity to Respond to the Adverse Impact on the Term Debt and Capital Lease Coverage Ratio of Decreasing Gross Farm Revenue and/or Increasing Total Operating Expenses, with Interest Rates of 5, 7.5, and 10 Percent, Debt-to-Asset of 30 Percent**

	<u>5 Percent Interest</u>		<u>7.5 Percent Interest</u>		<u>10 Percent Interest</u>	
-----Working Capital to Gross Revenue-----						
<u>Situation</u>	<u>19</u>	<u>50</u>	<u>19</u>	<u>50</u>	<u>19</u>	<u>50</u>
Base	2.93	3.09	2.41	2.61	2.01	2.25
1	2.35	2.51	1.91	2.11	1.56	1.80
2	1.77	1.92	1.40	1.60	1.11	1.35
3	2.53	2.68	2.06	2.26	1.70	1.94
4	2.12	2.28	1.71	1.91	1.38	1.62
5	1.95	2.10	1.55	1.75	1.25	1.49
6	1.54	1.70	1.20	1.40	0.93	1.17
7	1.37	1.52	1.05	1.25	0.80	1.04
8	0.96	1.12	0.69	0.89	0.48	0.72

Situation 1 = Decrease Gross Farm Revenue by 5 percent

Situation 2 = Decrease Gross Farm Revenue by 10 percent

Situation 3 = Increase Total Operating Expenses by 5 percent

Situation 4 = Increase Total Operating Expenses by 10 percent

Situation 5 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 5 percent

Situation 6 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 10 percent

Situation 7 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 5 percent

Situation 8 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 10 percent

**Table 4. Impact of Using Two Levels of Liquidity to Respond to the Adverse Impact on the Term Debt and Capital Lease Coverage Ratio of Decreasing Gross Farm Revenue and/or Increasing Total Operating Expenses, with Interest Rates of 5, 7.5, and 10 Percent, Debt-to-Asset of 46 Percent**

	<u>5 Percent Interest</u>		<u>7.5 Percent Interest</u>		<u>10 Percent Interest</u>	
-----Working Capital to Gross Revenue-----						
<u>Situation</u>	<u>19</u>	<u>50</u>	<u>19</u>	<u>50</u>	<u>19</u>	<u>50</u>
Base	1.95	2.05	1.56	1.69	1.28	1.43
1	1.60	1.70	1.26	1.39	1.02	1.17
2	1.24	1.34	0.96	1.09	0.76	0.91
3	1.71	1.81	1.36	1.49	1.10	1.25
4	1.47	1.58	1.16	1.29	0.93	1.08
5	1.36	1.46	1.06	1.19	0.84	0.99
6	1.12	1.22	0.86	0.99	0.67	0.82
7	1.00	1.10	0.76	0.89	0.59	0.74
8	0.76	0.87	0.56	0.69	0.41	0.56

Situation 1 = Decrease Gross Farm Revenue by 5 percent

Situation 2 = Decrease Gross Farm Revenue by 10 percent

Situation 3 = Increase Total Operating Expenses by 5 percent

Situation 4 = Increase Total Operating Expenses by 10 percent

Situation 5 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 5 percent

Situation 6 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 10 percent

Situation 7 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 5 percent

Situation 8 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 10 percent

**Table 5. Ratio of Improvement to the Term Debt and Capital Lease Coverage Ratio Due to Increasing Liquidity from 19 to 50 Percent Divided by the Deterioration Due to Interest Rates Increasing from 5.0 - 7.5 Percent and 7.5 - 10.0 Percent, Operating Situations, and Changing Leverage Level**

Situation	Interest Rates				Operating Situations						Changing Leverage Level		
	30 Percent D/A		46 Percent D/A		30 Percent D/A			46 Percent D/A			30 to 46 Percent D/A		
	5.0 - 7.5 Percent	7.5 - 10.0 Percent	5.0 - 7.5 Percent	7.5 - 10.0 Percent	5.0 Percent	7.5 Percent	10.0 Percent	5.0 Percent	7.5 Percent	10.0 Percent	5.0 Percent	7.5 Percent	10.0 Percent
Base	0.38	0.60	0.33	0.54	N/A	N/A	N/A	N/A	N/A	N/A	0.10	0.15	0.21
1	0.45	0.69	0.38	0.63	0.28	0.40	0.53	0.29	0.43	0.58	0.13	0.20	0.28
2	0.54	0.83	0.46	0.75	0.14	0.20	0.27	0.14	0.22	0.29	0.19	0.30	0.43
3	0.43	0.67	0.37	0.58	0.37	0.57	0.77	0.42	0.65	0.83	0.12	0.19	0.25
4	0.49	0.73	0.42	0.65	0.19	0.29	0.38	0.21	0.33	0.43	0.15	0.24	0.33
5	0.50	0.80	0.43	0.68	0.16	0.23	0.32	0.17	0.26	0.34	0.17	0.27	0.37
6	0.59	0.89	0.50	0.79	0.11	0.17	0.22	0.12	0.19	0.25	0.24	0.38	0.58
7	0.63	0.96	0.54	0.88	0.10	0.15	0.20	0.11	0.16	0.22	0.27	0.45	0.71
8	0.74	1.14	0.65	1.00	0.08	0.12	0.16	0.08	0.13	0.17	0.50	1.00	2.14

Situation 1 = Decrease Gross Farm Revenue by 5 percent

Situation 2 = Decrease Gross Farm Revenue by 10 percent

Situation 3 = Increase Total Operating Expenses by 5 percent

Situation 4 = Increase Total Operating Expenses by 10 percent

Situation 5 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 5 percent

Situation 6 = Decrease Gross Farm Revenue by 5 percent and Increase Total Operating Expenses by 10 percent

Situation 7 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 5 percent

Situation 8 = Decrease Gross Farm Revenue by 10 percent and Increase Total Operating Expenses by 10 percent