Journal of Applied Farm Economics

Volume 1 | Issue 2 Article 2

2017

Short-Term Asset and Debt Choice and U.S. Corn Farm Liquidity

Sarah Stutzman
U.S. Bureau of Economic Analysis, sarah.stutzman@bea.gov

Todd Hubbs
University of Illinois, Urbana–Champaign, jhubbs3@illinois.edu

Short-Term Asset and Debt Choice and U.S. Corn Farm Liquidity

Sarah Stutzman (U.S. Bureau of Economic Analysis) and
Todd Hubbs (University of Illinois Urbana–Champaign)

ABSTRACT

The liquidity positions of U.S. corn farms over the period 2002–2013 is examined using Agricultural Resource Management Survey (ARMS) data and calculating the average annual working capital to gross revenue (WC/GR) ratio for farms within the 25th percentile, median, and 75th percentile. The relationship between liquidity and land ownership, farm size, and the composition and level of short-term farm asset and debts by category are compared across farms within the 25th, 25th–75th, and 75th WC/GR ratio percentile. We find that, on average, farms in the 75th WC/GR ratio percentile owned a greater portion of their operated acres and maintained both a lower and more consistent percentage of assets in crop inventories and a larger and variable percentage of short-term liabilities in accounts payable and term debt compared to farms in the 25th percentile. Rapid declines in farm liquidity levels and the percentage of short-term assets in crop inventories for farms in the 25th WC/GR ratio percentile between 2002 and 2013 highlights the importance of having other means to manage short-term debt obligations rather than selling crop inventories in times of falling output prices. The rise in short-term liabilities and corresponding decreases in short-term debt levels for farms within the 25th–75th and 75th WC/GR ratios during 2008–2013 indicates the importance of being able to pay off farm debt during periods of higher agricultural profits. The corresponding rise in short-term debt for farms in the 25th percentile during this same time period should be a cause for concern going forward and, with the other results of this study, highlights the need to monitor both overall farm liquidity ratios and the allocation of short-term assets and debts within categories when evaluating and seeking to improve farm liquidity levels and financial performance.

KEYWORDS

liquidity, working capital, benchmarking, ARMS, corn farms

INTRODUCTION

Liquidity, along with solvency, profitability, repayment capacity, and financial efficiency, are the five key categories on which to evaluate farm financial performance (Farm Financial Standards Council, 2016). In the current economic environment for farms, the ability to assess the liquidity position of any operation is crucial. The Farm Financial Standards Council defines liquidity as the "ability of a farm business to meet financial obligations as they come due in the ordinary course of business, without disrupting normal operations of the business" (Farm Financial Standards Council, 2016). Liquidity is important for a variety of reasons. A strong liquidity position allows the farm to meet current debt obligations without assuming additional debt or liquidating assets to meet these short-term obligations. Additionally, ample liquidity allows the farm to take advantage of investments as they come open. Finally, liquidity can also act as a financial reserve to protect against severe market moves. In times of high volatility for both input and output prices or during farm expansion, a strong liquidity position can be a key determinant in the farm's ability to thrive and/or survive.

This paper was prepared by Sarah Stutzman (in collaboration with Todd Hubbs) while she was a graduate student at Purdue University. The opinions expressed in this paper are the authors' own and should not be attributed to the Bureau of Economic Analysis, the U.S. Department of Commerce, or the U.S. government.

This essay utilizes working capital to gross revenue (WC/GR) as a benchmark to develop a deeper understanding of liquidity dynamics on corn farm operations. We utilize Agricultural Resource Management Survey (ARMS) data on corn farms from 2002–2013. Corn farms are defined as farms on which corn sales generate 50% or more of annual gross farm revenues. In particular, the relationship between liquidity positions and tenure (the portion of farmland acres owned vs. rented), farm size (annual gross value of sales) and the composition and level of short-term farm assets and debts according to category are explored. We compare both differences across time and between farms in similar time periods. While other studies have looked at the impact of farm size, age, and tenure on liquidity, this study is unique in that it connects assets and debts held within different categories with the farm's level of WC/GR over time. Other studies have not focused on this link. Focusing on this relationship allows us to explore how various categories may impact liquidity and provide early indicators of future problems.

Links between relative liquidity positions and balance sheet (assets and debt) allocation choices are made in order to provide early warning signs of possible indicators of declining farm financial health. We find that liquidity ratios fell below healthy rates for the majority of farms in the 2002 period but picked up for all but the farms within the lowest percentiles. Partially the prominence of crop inventories in current assets and their decline in value can explain this trend. This pinpoints the importance of maintaining adequate levels across all short-term asset categories, accurately evaluating the value of these assets, and maintaining access to other forms of short-term debt during times of falling output prices. We also find that total short-term liabilities, while increasing for all farms, grew at a much higher rate for farms having the lowest WC/GR ratios. While overall farms were able to maintain or reduce short-term debts and the short-term portion of term debts and improve overall liquidity, farms in the lowest WC/GR percentiles saw the average value of these liability accounts multiply.

The current ratio, working capital, and WC/GR ratio are the three recommended financial measures for evaluating the liquidity of farm businesses (Farm Financial Standards Council, 2016). All three measure some dimension related to the relationship between current assets and current liabilities. Current assets include cash and other assets easily converted to cash. Current liabilities are those debt payments expected within a year. Traditionally, working capital and the current ratio have been used as a measure of liquidity. Working capital is calculated by subtracting current liabilities from current assets. The current ratio is current assets divided by current liabilities. WC/GR measures working capital as a percentage of total farm revenue and also provides an indication of the amount of liquidity a farm has relative to farm size. This adjusts for the fact that farms with larger production levels will have larger working capital requirements due to higher expenses and greater operational cash flow needs. For comparison purposes across time, ratios such as the WC/GR measure are a better indicator of liquidity compared to absolute measures, which are likely to differ by business size (Ahrendsen & Katchova, 2012).

The larger the WC/GR ratio, the greater the liquidity available. The needed level of WC/GR will differ depending on farm size, enterprise type, market volatility, debt to asset levels, tenure status, and operating expense levels (Boehlje & Langemeier, 2015; Clark, 2012; Farm Financial Standards Council, 2016). A WC/GR level greater than 30% is considered by many to be a strong liquidity position. This level indicates a working capital level equivalent to 30% of gross farm income. Boehlje and Langemeier (2015) cite a 15–25% working capital to gross farm ratio buffer as the suggested goal, but with increasing margin pressures and uncertainty in the current agricultural economic climate, a ratio closer to 35% may be needed.

Many farms built working capital and other financial reserves during the period of relatively high returns in 2006–2012. Prices and returns are expected to be lower in the foreseeable future compared to these high points. These may lead to low or negative cash flows for certain farms (Schnitkey, 2015a). Farms with stronger liquidity positions prior to this point will have an advantage when facing declining or negative revenues. Given that a farm may be within a lower liquidity position, making movements to both increase liquidity and reallocate relative short-term debt and asset allocations among categories may be the

deciding factor in farm survival and future financial success.

PREVIOUS LITERATURE

A popular source for analyzing liquidity measurements and differences in liquidity across farms by farm characteristic or time period has been farm management association data (Schnitkey, 2015a; Zwilling et al., 2015; Zwilling & Raab, 2012). For example, Zwilling and Raab (2012), utilizing Illinois Farm Business Farm Management Association (FBFM) data for 2012 and 2011, compared working capital to gross value of farm production (WC/VFP) ratios for farms across percentiles. They find that within each percentile, WC/VFP ratios were higher for farms owning a greater portion of their acreage, older farmers, and farms producing grains as compared to livestock farms.

Exploring this link between age and WC/VFP ratios in more detail, Zwilling et al. (2015) examined working capital and current ratios for Illinois grain farms within age categories. Farms with younger operators generally had lower liquidity ratios. Across all age groups, farms saw an improvement in liquidity ratios with the growth in farm incomes during 2009—2012. With the softening of the farm economy in 2013, ratios declined for all groups, with those in the 30–39 age category suffering the largest decreases in liquidity.

Farm business management association data sets and ARMS data sets differ in their nature. Kuethe et al. (2014) compared the financial characteristics of farms in the ARMS data set with those of the FBFM, the Kansas Farm Management Association, and the Kentucky Farm Business Management Program. Their results indicate that farms belonging to farm management associations tend to have larger sales revenues compared to the average U.S. farm. In addition, crop farms as compared to livestock farms and younger operators are more likely to belong to farm management associations compared to livestock farms. This results in samples that are not necessarily representative of the farm population as a whole. This is one reason why our study, which uses a nationally representative farm data set to look at liquidity measurement, is necessary.

ARMS data provides a rich source of information on farm financial measurements. Utilizing liquidity measurements obtained from ARMS data, researchers have explored key issues including, but not limited to, the impact of government programs on agricultural performance (Kropp & Katchova, 2011), the ability of programs to serve targeted populations (Nwoha et al., 2007), and the impact of farm characteristics on farm performance for different groups (Katchova, 2010). For example, Kropp and Katchova (2011) calculated and compared the effect of direct payments on current ratios and term debt coverage ratios of beginning farmers using 2005, 2006 and 2007 ARMS data. They find that there is a positive relationship between term debt coverage ratios and direct payments and a negative relationship between program base acreage and the current ratio, though the relationship is only significant for experienced farmers.

Katchova (2010) asked how key characteristics of farming operations including age, education, farm size, crop versus livestock farm, government payments, off-farm income, and legal status impacted the probability that financial ratios for beginning and retired farms would fall below key critical zones. For farms in the 2005–2008 ARMS data, she finds that being older, being male, having a livestock farm compared to crop farm, and receiving government payments decreases the likelihood of having a current ratio below the critical zone, while owning a hobby farm or having a higher level of off-farm income increases the probability of having a current ratio below the critical level.

Nwoha et al. (2007) looked at the ability of the Farm Service Agency (FSA) to target socially disadvantaged farmers by examining the differences between key liquidity, solvency, profitability, and repayment capacity measurements for farms that received FSA loans and those that did not. They find that farms that received FSA loans had in general weaker solvency and liquidity measurements though higher debt to asset ratios.

Taking a different approach, Yeager and Barnard (2014) utilize a simulation model to ask if increasing liquidity, measured as WC/GR, could reduce the repayment risk in times of economic stress or rising interest rates. They find that increasing the level of liquidity did reduce repayment risk but that this was more effective during times of rising interest rates and operating expenses than during times of falling farm incomes.

Within the current literature, we do not find any articles that compare the current composition of short-term asset and debts and the relative strength of farm liquidity positions. Our study bridges this gap, providing insight into how the choice of asset and debts could influence relative liquidity positions over different farm business cycles.

DATA

ARMS is an annual survey of U.S. farm producers across 48 U.S. states conducted jointly by the U.S. Department of Agriculture's National Agricultural Statistics Service and Economic Research Service (USDA-ERS, n.d.). A farm is defined as an institution that sold, or would have sold, at least $1,000 of agricultural production during the year (Kuethe et al., 2014). We did not separate out retirement[1] or limited resource farms.[2]

We utilize only corn farms in this study. Within a given year, farms are classified as corn farms if more than 50% of their sales value is from corn compared to other crops. Working capital levels and liquidity ratios will vary across farm type (Clark, 2012; Ellinger, n.d.; Zwilling & Raab, 2012). Dairy farms may require lower average levels of working capital compared to grain farms due to a steadier level of cash flow throughout the year. A vegetable farm, in contrast, may have greater price variability from one week to the next and need a greater liquidity position. On a well-diversified farm, liquidity positions may be lower without any issues due to the various marketing patterns associated with different crops. Grain farm working capital levels may need to be larger given differences in the timing of planting costs and harvest revenues. By focusing on only corn farms, we control for variation in ratios due to different production types.

The survey is cross-sectional in nature. Different farms are surveyed in different years. Using the stratified sampling structure and sample weights, the survey attempts to obtain financial statistics representative of the farm population in 48 states (Kuethe at al., 2014) and allows researchers to construct representative samples of various farm population segments. We take advantage of this and use the expansion weights in our analysis. These weights assign each farm surveyed a given number of representative farms in the farm population. Sample means and variances are weighted by these measures to obtain population level estimates for corn farms.

The number of corn farms in the ARMS data and the number of imputed farms calculated using the survey weights, or the total number of corn farms represented within the sample, for a given year are provided in Table 1. As can be seen, there is a large difference in number of corn farms sampled as well as imputed farms from year to year. These changes reflect the nature of the survey. The survey was first conducted in 1996. Since then, the total number of farms surveyed has grown. Additionally, the number of farms classified as corn farms will change depending on corn prices received that year and corn acreage planting decisions. During years of lower corn prices, a smaller number of farmers will derive the majority of their income from corn compared to other crops. These

Table 1. Corn Farm Operations by Year in ARMS Data Set

Year	Number of Farm Observations	Number of Imputed Observations
2002	652	123,096
2003	360	122,988
2004	366	114,421
2005	246	88,948
2006	292	112,371
2007	546	133,733
2008	475	130,183
2009	465	127,972
2010	474	112,449
2011	1,167	159,227
2012	2,524	149,075
2013	2,419	164,524
Total	9,986	1,538,988

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Imputed observations utilize expansion weights. These are calculated by adding the expansion weights for all farms in the sample in the given year. The expansion weights indicate the number of similar farms in the U.S. farm population represented by each sample farm. The result is the number of corn farms in the U.S. farm population represented by the sample farms each year.

farms, though growing corn, are more likely to be classified as primarily producing other commodities in these years. In years of higher corn prices such as 2011–2013, a greater number of farms may be classified as corn farms than in prior years. Finally, in a given year, certain commodities are oversampled to produce the cost and return estimates for that commodity. Corn farmers were oversampled to produce cost and return estimates in 1996–2001, 2005 and 2010. In these years, we would expect the number of corn farmers to be larger than otherwise.

From ARMS we obtained farm-level estimates of annual farm gross revenue, short-term asset and debt levels by category, and the percentage of land owned versus operated for survey years 2002–2013.[3] ARMS separates short-term assets into crop inventories, livestock inventories, purchased inputs, crops grown and not harvested, and other. Other short-term assets include commodities receivable and all other short-term assets owned by the farm household not listed in the other categories including cash, bonds, certificates of deposit, savings and checking accounts, hedging accounts, government payments due, insurance indemnity payments due, balance of land contract sales, and any other farm assets not reported. Short-term debts are categorized into accrued interest, accounts payable, the current portion of term debt, and short-term debts. From this data we calculate working capital levels, defined as total short-term assets less short-term debts, and the WC/GR ratio for each farm. Summary statistics for these variables by year are provided in Tables 2A–2C. These and all subsequent figures are in nominal terms.

The Farm Financial Council Standards recommendation of using measurements taken at the same point during the production cycle since the value of the WC/GR ratio can vary over the course of the year. Within ARMS, farm assets and debts represent the dollar value as of December 31 of the given survey year. Gross sales are calculated over the period of January 1 through December 31 of the given survey year. The fact that the ARMS data is collected at the same point in time each year aids in comparing ratios over multiple years.

Table 2A. Average Working Capital, Gross Value of Sales, WC/GR Ratio and Tenure Levels by Year

Year	Working Capital ($)	Gross Value of Sales ($)	WC/GR Ratio	Tenure
2002	(1,497)	133,597	(0.78)	0.48
2003	83,139	158,575	0.73	0.53
2004	61,860	176,631	0.51	0.55
2005	96,846	180,300	0.69	0.50
2006	124,285	183,969	1.08	0.43
2007	145,183	264,412	0.71	0.56
2008	237,030	347,124	1.51	0.56
2009	178,206	309,147	0.81	0.60
2010	189,186	335,139	1.14	0.61
2011	237,703	444,538	0.71	0.79
2012	272,530	423,178	1.54	0.66
2013	205,900	544,246	0.49	0.65

WC/GR = working capital divided by gross value of sales.

Tenure = ratio of acre owned to total acres operated.

All dollar values are in nominal terms.

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized so that the mean values represent the average for U.S. corn farms.

Table 2B. Average Short-Term Assets by Year

	Short Term Assets						
Year	Crop Inventory	Livestock Inventory	Inputs Purchased	Prepaid Insurance	Crops GNH	Other	Total
2002	9,630	2,041	7,685	1,378	2,126	15,622	38,482
2003	73,498	2,299	11,986	1,591	2,095	44,355	135,824
2004	55,678	3,507	10,017	1,643	2,031	36,842	109,718
2005	85,661	3,251	14,808	2,056	3,008	35,274	144,059
2006	100,184	2,042	11,520	2,140	4,066	66,413	186,366
2007	119,578	5,231	20,912	2,744	5,079	51,591	205,135
2008	151,474	5,165	27,855	3,929	7,518	110,512	306,452
2009	136,093	5,746	25,425	3,342	4,317	82,760	257,684
2010	142,233	4,903	28,478	3,203	6,883	90,916	276,617
2011	163,037	6,857	33,674	4,363	9,000	100,761	317,692
2012	150,428	9,536	32,529	4,040	6,768	168,823	372,124
2013	139,605	8,433	35,627	4,510	6,223	123,769	318,167

Crops GNH = crops growing not yet harvested.

Other = includes commodities receivable and all other short-term assets owned by the farm household not listed in the other categories including cash, bonds, certificates of deposit, savings and checking accounts, hedging accounts, government payments due, insurance indemnity payments due, balance of land contract sales, and any other farm assets not reported.

All dollar values are in nominal terms.

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized so that the mean values represent the average for U.S. corn farms.

Table 2C. Average Short-Term Liabilities by Year

	Short-Term Liabilities				
Year	Accrued Interest	Accounts Payable	Current Portion TD	Short-Term Debt	Total
2002	3,277	6,266	10,033	20,401	39,978
2003	3,659	7,700	10,665	30,661	52,685
2004	3,708	7,546	13,144	23,460	47,858
2005	3,292	10,816	10,166	22,939	47,212
2006	4,310	9,597	13,007	35,167	62,081
2007	4,058	8,846	12,208	34,840	59,952
2008	4,791	11,630	13,848	39,153	69,422
2009	4,916	11,276	12,613	50,673	79,477
2010	5,439	12,971	15,134	53,887	87,431
2011	5,638	14,414	17,011	42,927	79,989
2012	7,031	15,380	20,470	56,712	99,594
2013	7,601	17,789	23,466	63,410	112,266

Current Portion TD = current portion of term debt.

All dollar values are in nominal terms.

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized so that the mean values represent the average for U.S. corn farms.

WC/GR RATIOS BY PERCENTILE, 2002–2013

The 25th percentile, median, and 75th percentile cutoff points for farm-level WC/GR positions are provided for each year in Chart 1. The ARMS weights are applied to the farm-level observation when calculating the cutoff percentiles, making these estimates representative of the annual values for U.S. corn farms as a whole. WC/GR ratios for farms by percentile and across time differed dramatically over the 2002–2013 survey time frame. The median WC/GC ratio ranged between a low of -0.02 in 2002 and a high of 0.65 in 2012, and the 75th percentile cutoff ranged between 0.14 in 2002 and 1.29 in 2006. With the exception of 2002, the ratio values are within the recommended 25–30% range. The cutoff WC/GR ratio for farms within the lower 25th percentile fell below the recommended range in all years regardless of the state of the farm economy.

Within our longer period and across percentiles a definite pattern emerges. Liquidity positions across percentiles weakened significantly in the early part of the 2000s and then rebounded in the latter part of the decade. This is further illustrated in Table 3, which indicates the percentage of farms below the recommended 30% WC/GR ratio. The early part of the 2000s was a period of lower corn prices and farm profitability. This is reflected in the overall low WC/GR ratios for farms as a whole and in the fact that 84% of U.S. farms were estimated to have WC/GR ratios below 30%. This rapid decline in farm liquidity levels in 2002 illustrates how a farm's liquidity position can quickly erode in response to market stress and low output prices, especially for farms having weaker initial liquidity positions.

Once prices rebounded and rose in the later part of the 2000s and early 2010s, farm liquidity levels also rose. The percentage of farms below the healthy WC/GR range fell to 31% by 2008. This corresponded with historically high levels of farm liquidity. In our data, we also observe a slight dip in these numbers as we move into 2013, though they are still above historical highs.

This large growth in liquidity levels during the latter part of the 2000s and early 2010s as well as

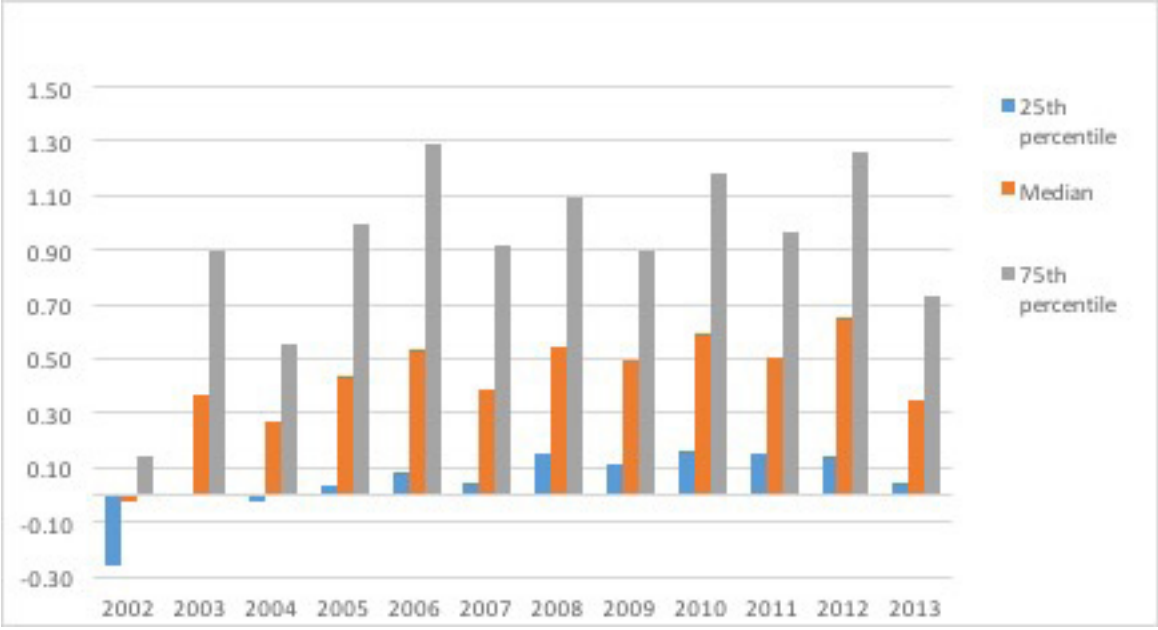


Chart 1. WC/GR Ratios for Corn Farms in the 25th Percentile, Median, and 75th Percentile

Note: ARMS data utilized. The above represent the value of the WC/GR ratio for farms at the 25th percentile, median, and 75th percentile cutoff points. Expansion weights were used when calculating the percentile cutoff points. Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Table 3. Percent of Corn Farms with WC/GR Ratios below the Recommended 30%, by Year

Year	Percent of Farms
2002	84%
2003	47%
2004	53%
2005	43%
2006	35%
2007	41%
2008	31%
2009	39%
2010	33%
2011	35%
2012	33%
2013	46%

ARMS data utilized. Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories. Expansion weights were utilized so that estimates reflect the percentage of total corn farms in the U.S. farm population with WC/GR ratios below 30%.

recent drops in farm liquidity was previously documented using farm business management association data, supporting this trend across other production types in addition to corn farms. For example, using a sample of farms from the FBFM, Schnitkey (2015a) estimated that during the period 1996–2013 farms in this sample had an average working capital level of $179 per acre between 1996 to 2006 and an average current ratio of 1.76. With revenues and farm profit margins rising in the later part of the sample, the average working capital per acre and current ratio levels of farms rose to over $700 and 2.87, respectively, by 2012. In 2013, the average farm working capital level was $637 per acre, and the average current ratio was 2.49. This is slightly below the 2012 numbers but still above the historical average.

WC/GR ratios differ across categories such as farm production type, the value of farm production, and tenure (Schnitkey, 2015a; Zwilling & Raab, 2012). By looking at only corn farms, we control for farm production type. To explore the impact of tenure and farm size on WC/GR ratios, we compare the percent of farms falling within different tenure and sales categories given their relative WC/GR percentiles.

COMPARISON OF FARMS ACROSS WC/GR PERCENTILE GROUPS

Calculating WC/GR Percentile Groups

Farms are grouped into three categories based on their WC/GR ratio percentile. These categories are (1) the bottom percentile group, comprising farms with WC/GR ratios in the bottom 25th percentile, representing the weakest liquidity position; (2) the middle percentile group, representing farms having WC/GR ratios above the bottom 25th percentile and below the top 75th percentile; and (3) the upper percentile of farms with WC/GR ratios in the 75th percentile, representing the strongest liquidity positions. The weighted 25th and 75th percentile cutoff points provided in Chart 1 are used to form these categories.

Farmland Owned versus Rented within WC/GR Percentiles

Within each percentile group, farms are classified based on the percentage of owned versus rented acres. This is important, since WC/GR ratios may differ based on land ownership versus land rental choices. Higher levels of acreage rented is generally associated with lower WC ratios (Ellinger, n.d.; Schnitkey, 2015b; Zwilling & Raab, 2012).

The ARMS data set includes a measure of tenure, or the ratio of operated acres owned divided by total acres operated. Farms renting a higher portion of their acreage will have a lower tenure measurement. To look at the impact of farmland ownership on WC/GR ratios, we utilize the tenure categories available within the ARMS data set. The five tenure categories are 0–10%, 10–25%, 25–20%, 50–75%, and 75–100% of farm-operated acreage owned. Table 4 shows the percent of farms falling within each of these tenure categories by WC/GR ratios over the sample period 2002–2013.

The percentage of acres owned is slightly higher for farms with stronger WC/GR ratios. A similar result was found by Zwilling and Raab (2012) using the FBFM database. Within our ARMS data set, this difference is most apparent when we examine farms in the lowest and highest categories of farm ownership. Within the lowest percentile, 24% of farms own less than 10% of their

Table 4. Average Percent of Corn Farms by Tenure in Each WC/GR Ratio Percentile between 2002 and 2013

Acres Owned vs. Operated	*WC/GR percentile*		
	<25%	25–75%	>75%
<10%	24%	29%	18%
10–25%	11%	13%	9%
25–50%	14%	16%	12%
50–75%	10%	12%	12%
>75%	41%	30%	49%
Total	100%	100%	100%

The above graph groups corn farms in the ARMS data by tenure status, or the percentage of operated acres owned versus rented. This is done separately for each WC/GR ratio percentile group. The numbers in the columns represent the percent of farms within that WC/GR ratio percentile falling within the indicated tenure status group. Tenure is calculated by dividing owned acres by total operated acres. ARMS expansion weights were utilized in finding the WC/GR cutoff points and the percentage of farms within each tenure category. Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

operated acres. Only 18% of farms in the highest percentile own less than 20% of their farmland. On the other side of the spectrum, 49% of farms within the highest percentile own more than 75% of their operated acres. This percentage is smaller for farms with weaker liquidity positions. Only 41% of farms in the lowest percentile and 30% of farms in the middle percentile owned more than 75% of their operated acres.

During times of falling farm revenues, having larger cash rent obligations can result in larger or more rapid declines in cash available for other expenses. This is one of the reasons why it is important for producers with high fixed costs, such as cash rents, to have a strong working capital position. This is especially true moving forward, given both declining farm revenues and the previous period of high farm rents and land prices. In an upcoming downturn, farms that pursued aggressive expansion strategies by acquiring additional acres at high cash rental rates may be the most susceptible to the largest decline in farm liquidity and resulting financial stress (Schnitkey, 2015b). For farms in the lowest WC/GR ratios percentile with a high level of rented farm acreage, evaluating current cash rental agreements and making other moves to improve liquidity measures may be prudent strategies moving forward.

Value of Farm Sales and WC/GR Percentiles

WC/GR ratios will also differ by economic size. For farms with larger sales values, the ratio will generally be lower (Ellinger, n.d.; Zwilling & Raab, 2012). To determine the distribution of farms within the ARMS data set by value of sales, we utilize a sales class categorical variable provided in the ARMS data set. This categorical variable classifies farms into the following categories according to the annual value of gross sales: less than $49,999, $50,000–$250,000, $500,000–$999,999, and $1,000,000 and above. The average percent of farms within each of these sales class categories over the 2002–2013 sample period is calculated. This is done separately for each WC/GR ratio percentile. The expansion weights are utilized to obtain nationally representative estimates. Table 5 shows the percent of farms falling within each of these categories over the sample period 2002–2013.

A greater portion of farms in the lowest sales value category, with sales less than $49,999 annually, are classified within either the lowest 25th percentile or the highest 75th percentiles. A large portion of small farms are in the lowest WC/GR ratio range. While these farms constitute a small portion of the value of the sector's agricultural production, they constitute a large number of farms. On the other hand, small farms often include farms in which farming is not the main source of income. For these farms, off-farm assets and/or income may provide additional sources of cash to meet debt obligations.

For farms in the middle range between the 25th and 75th percentiles, a greater portion fall within the middle to upper ranges of gross value of sales as compared to the lowest and highest WC/GR ratio percentiles. Farms with annual gross value of sales above $1,000,000 are less likely to be clustered in the 75th percentile of WC/GR ratios and more likely to be clustered in the middle to lower range. Large farms require greater working capital levels relative to peers due to the size of the operation.

Table 5. Average Percent of Corn Farms by Gross Value of Sales in Each WC/GR Ratio Percentile between 2002 and 2013

	WC/GR percentile		
Gross Value of Sales	<25%	25–75%	>75%
$49,999 and below	41%	25%	41%
$50,000–$249,999	36%	42%	37%
$250,000–$499,999	11%	18%	12%
$500,000–$999,999	7%	11%	7%
$1,000,000 and above	4%	5%	2%
Total	100%	100%	100%

The above graph groups corn farms in the ARMS data by sales class, or gross value of sales earned during the survey year. This is done separately for each WC/GR percentile group. The numbers in the columns represent the percent of farms within that WC/GR ratio percentile falling within the indicated sales class. Expansion weights were utilized in finding the WC/GR cutoff points and the percentage of farms within each sales class category. Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

When corn prices are high, revenue levels may disguise any weaknesses in the operation or provide incentives for expansion. The amount and terms of borrowing for large farms, especially those 4% within the lowest WC/GR category, makes these operators particularly sensitive to market volatilities. Large farms, while comprising a small portion of total U.S. farms, produce a large portion of the agricultural output. Given that the 25th percentile cutoff was below the healthy range in all years of our sample, having large farms fall within this category requires further monitoring by the operators and lenders.

COMPARING THE COMPOSITION OF SHORT-TERM ASSETS AND LIABILITIES OVER TIME AND WITHIN WC/GR PERCENTILE GROUPS

Calculating the Average Level and Percent of Asset and Debts by Category

In the subsequent sections, we compare the percentage of debts and assets held within each category and the growth in average debt levels over time for farms within each of the three created WC/GR percentile groups. To obtain these estimates, we first calculated the average levels of debts and assets in total and within each category by year. This was done separately for each WC/GR percentile group. The average level of each asset and debt category was divided by the average level of total assets or debts to obtain the representative percentage within each category. Applying the sample weights allows these figures to represent the national average level and percentage of assets and debts held within each category for the sector as a whole as opposed to the average for corn farms within our sample.

Results for Short-Term Asset Allocation by WC/GR Ratio and Year

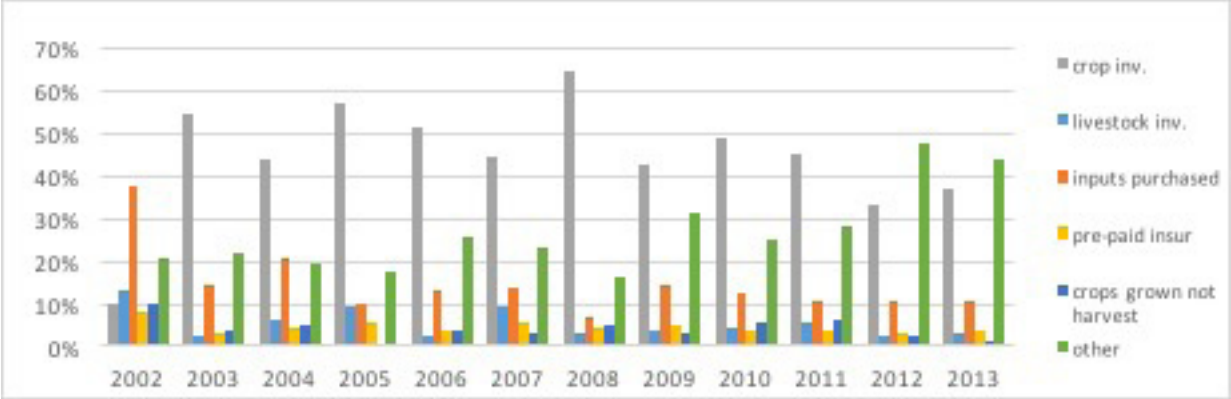
Charts 2 A–C illustrate the average percentage of short-term assets by category and WC/GR percentiles. Farms held the greatest share of their short-term assets in crop inventories, followed by other short-term assets.[4] A smaller percentage of short-term assets in purchased inputs, prepaid insurance, and crops grown but not harvested are on farm balance sheets. On average, farms within the 75th percentile in general held a smaller percentage of assets in crop inventory and a greater portion of assets in other short-term assets compared to farms within the 25th–75th percentile. Due to the large fluctuation in the level of crop inventories held by farms in the 25th percentile, it is difficult to make comparisons between the relative levels of crop inventories held by farms in this percentile compared to other percentiles outside of looking at a specific time period.

Farms in the upper 75th percentile, on average, held a smaller percentage of their short-term assets in purchased inputs compared to farms in other percentiles. Purchased inputs comprised 5–12% of the short-term assets for farms in the highest percentile, compared to 7–30% for farms in the lowest percentile and 7–30% for farms in the 25th–75th percentile.

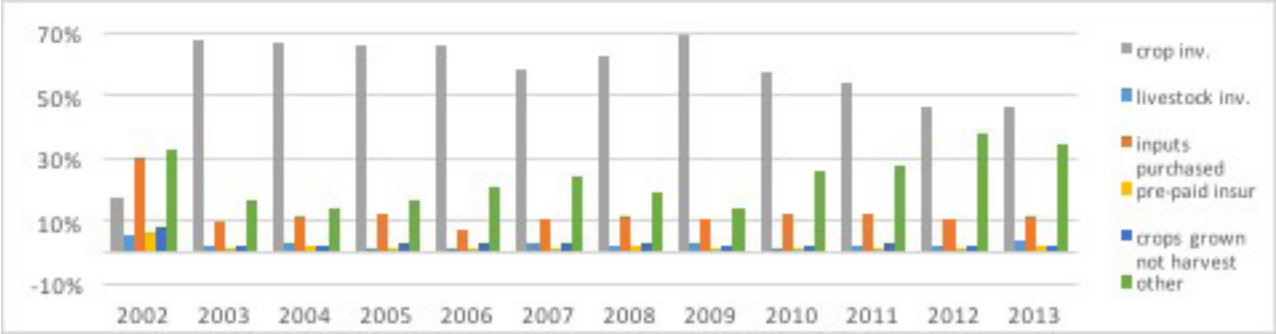
There was a greater degree of fluctuation between the percentages of short-term assets held within each category over time for farms with weaker liquidity positions. For example, over the sample period, crop inventories comprised between 31% and 60% and other assets

Charts 2 A–C. Percentage of Short-Term Assets by Category and Year in each WC/GR Ratio Percentile

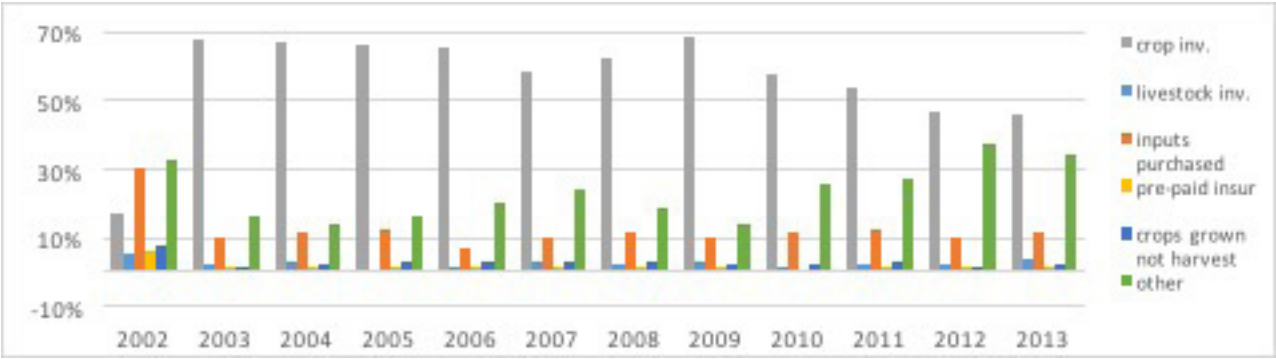
A. For Farms with WC/GR Ratios in the 25th Percentile



B. For Farms with WC/GR Ratios in the 25th–75th Percentile



C. For Farms with WC/GR Ratios in the 75th Percentile



The above graphs provide the average percent of short-term assets held in each category by year for farms within each of the WC/GR ratio percentile groups.

WC/GR = working capital divided by gross value of sales. Crop inv. = crop inventory. Asset inv. = livestock inventory. Other includes commodities receivable and all other short-term assets owned by the farm household not listed in the other categories, including cash, bonds, certificates of deposit, savings and checking accounts, hedging accounts, government payments due, insurance indemnity payments due, balance of land contract sales, and any other farm assets not reported.

The average level of short-term assets in each category is divided by the average level of total short-term assets for each WC/GR ratio percentile group to find the percentage of assets in each category. Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized in calculating the WC/GR ratio cutoff points and the average level of short-term assets within each category and in total.

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

between 27% and 57% of total short-term assets for farms in the 75th percentile. These ranges are smaller than those of farms in the 25th percentile. For farms in the 25th percentile, crop inventory comprised between 10% and 65% and other short-term assets between 16% and 48% of total short-term assets.

Farms in both the 25th and 25th–75th percentiles saw a large drop in the percentage of short-term assets held to crop inventories during the 2002–2003 period of low corn prices. In 2002, crop inventories fell to 10% of short-term assets for farms in the 25th percentile and to 17% for farms in the 25th–75th percentile. In exchange, the percentage of short-term assets held in other assets and purchased inputs increased during this time period.

Farms in the 75th percentile did not experience a significant change in the portion of their assets held in crop inventories or other short-term assets during this period compared to the rest of the sample period. One reason may be that farms with lower WC/GR have a greater need to sell inventory levels to cover short-term obligations, while farms with stronger positions are able to cover short-term obligations through the expenditure of cash, the use of short-term debt, or other means. Farms with lower working capital levels may be forced to sell at a lower price in exchange for liquid assets to pay short-term obligations. Additionally, farms with greater WC/GR may be able to adjust inventory levels to keep a greater amount of inventory on hand during times of falling prices. Capital availability to invest in storage may play a role. Farms with a greater degree of access to on- or off-farm storage can better alter the level of inventory held to take advantage of shifting prices and to maintain a constant dollar value of short-term assets held in inventory. During the later period of our sample, 2008–2013, corn prices and average revenues were significantly larger than earlier in the sample period. Over this time period, farms experienced a decrease in the percentage of assets held in crop inventories and an increase in the percentage of assets held in other short-term assets. High revenues and a strong demand for corn most likely lead to a reduction in the amount of inventory held, an increase in investment in other financial assets, and an increase in the value and/or level of accounts receivable.

Results for Short-Term Liability Allocation by WC/GR Ratio and Year

Charts 3 A–C display the percentage of short-term liabilities held within each percentile by category and year. Farmers in the 25th percentile held the largest percentage of short-term liabilities in short-term debts. This percentage ranged between 59% and 71% for the given sample period. In contrast, they held only 11–20% of short-term liabilities in current portion of term debt, 7–13% in accounts payable, and 5–7% in accrued interest.

Farmers with stronger liquidity positions held a lower portion of their current liabilities in short-term debts compared to farmers in the 25th percentile. Farmers in the 25th–75th percentile held between 41% and 61% of short-term liabilities in short-term debts, compared to between 59% and 71% for those in the lowest percentile. This percentage was between 39% and 68% for farmers in the 75th percentile. Also, farmers in these percentiles held a larger percentage of short-term liabilities in accounts payable and current portion of term debts compared to farms in the 25th percentile. For example, the current portion of term debt for farmers in the 75th percentile ranged between 15–39% and 10–46% for accounts payable.

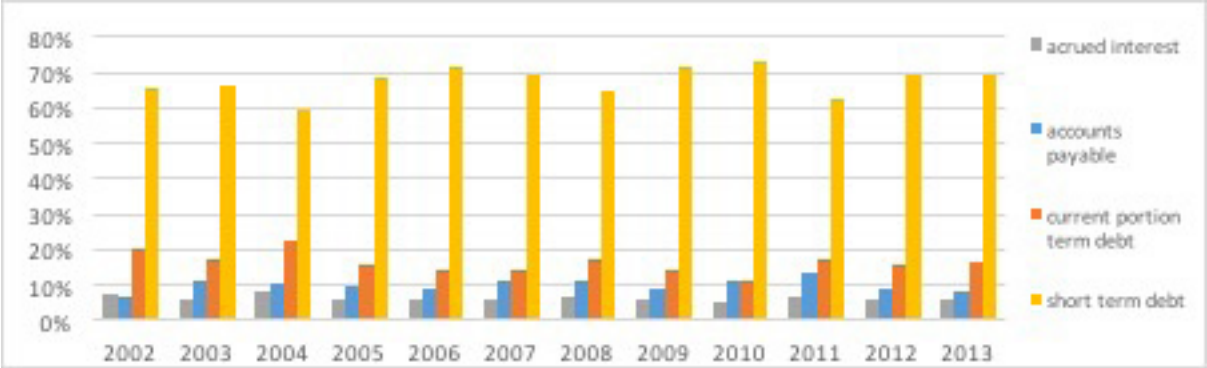
The percentage of liabilities held in short-term debt, the current portion of term debt, and accounts payable was fairly consistent over time for farmers in the lowest percentile, while these percentages fluctuated to a large degree for farmers in the upper percentile. The greater fluctuation in the portion of debt held within accounts payable and short-term debts over multiple years may indicate, among other things, a greater ability to use short-term credit from suppliers and a lower need to use short-term debt to cover operating expenses in years of lower corn prices. This could also indicate an ability to pay down term debt in years of stronger profits.

Growth of Average Annual Debt Levels over Time

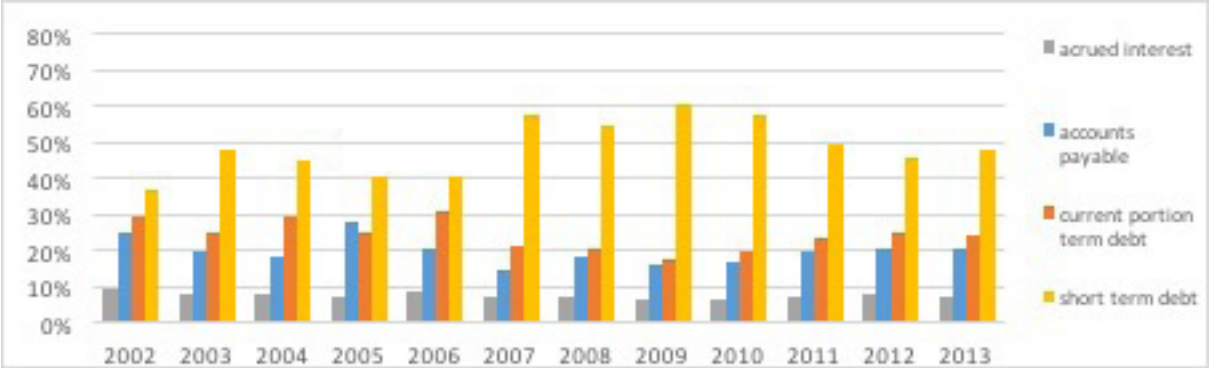
Charts 4 A–E present the average dollar value of short-term liabilities by total and by category and year within different percentiles. During the 2002–2013 sample period, the average level of total short-term liabilities increased regardless of

Charts 3 A–C. Percentage of Short-Term Liabilities by Category

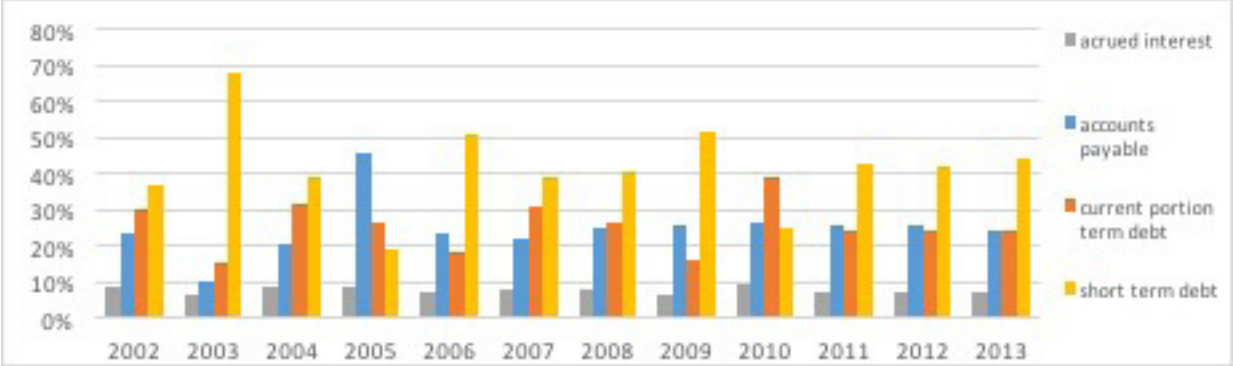
A. For Corn Farms with WC/GR Ratios in the 25th Percentile



B. For Corn Farms with WC/GR Ratios in the 25th–75th Percentile



C. For Corn Farms with WC/GR Ratios in the 75th Percentile



The above graphs provide the average percent of short-term liabilities held in each category by year for farms within each of the WC/GR ratio percentile groups.

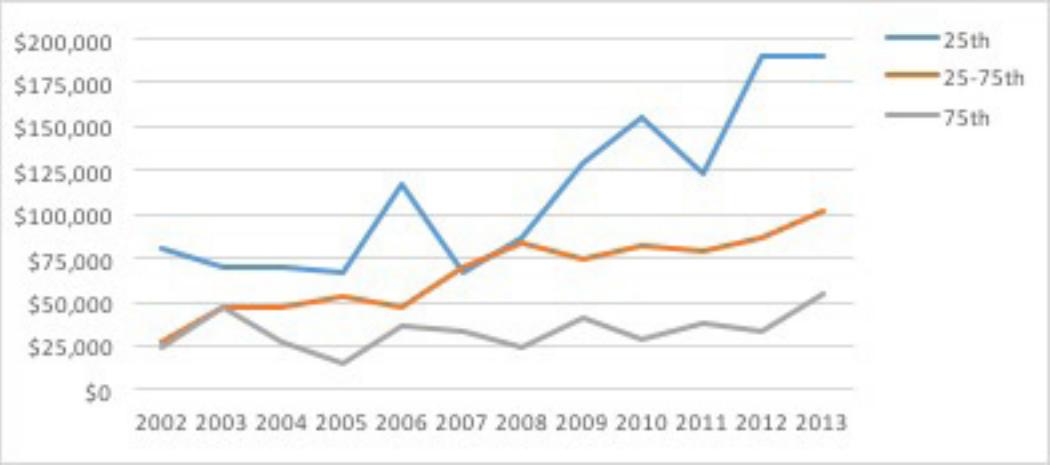
WC/GR = working capital divided by gross value of sales.

The average level of short-term liabilities in each category is divided by the average level of total short-term liabilities for each WC/GR ratio percentile group to find the percentage of assets in each category. Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized in calculating the WC/GR ratio cutoff points and the average level of short-term liabilities within each category and in total.

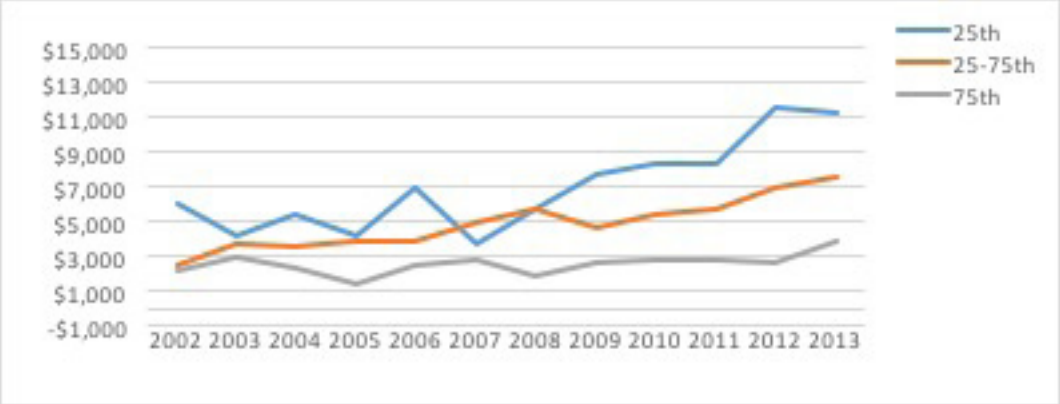
Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Charts 4 A–E. Average Annual Levels of Total Short-Term Liabilities and within Each Category by WC/GR Ratio Percentiles

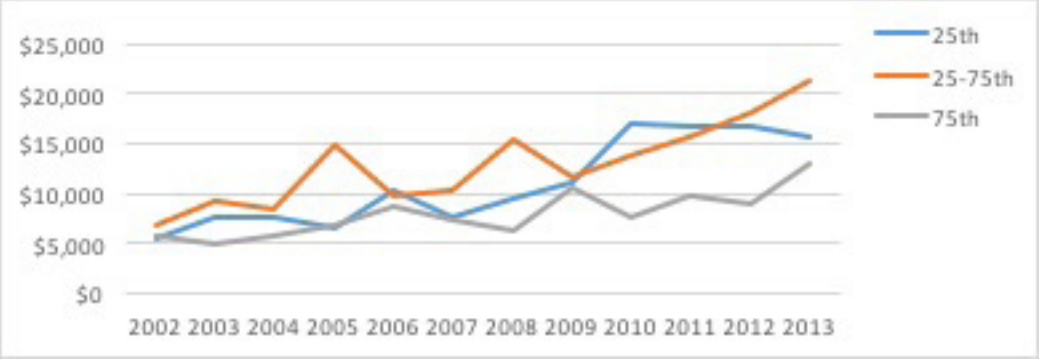
A. Total Short-Term Liabilities



B. Accrued Interest

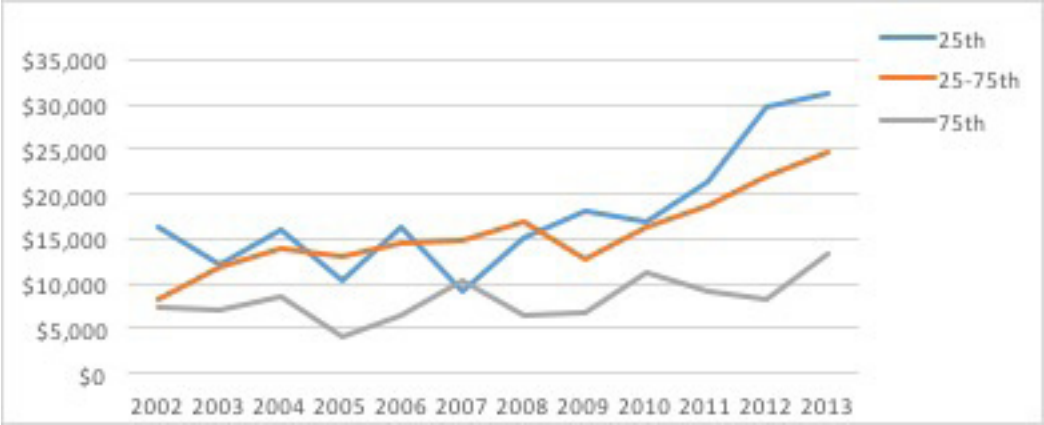


C. Accounts Payable

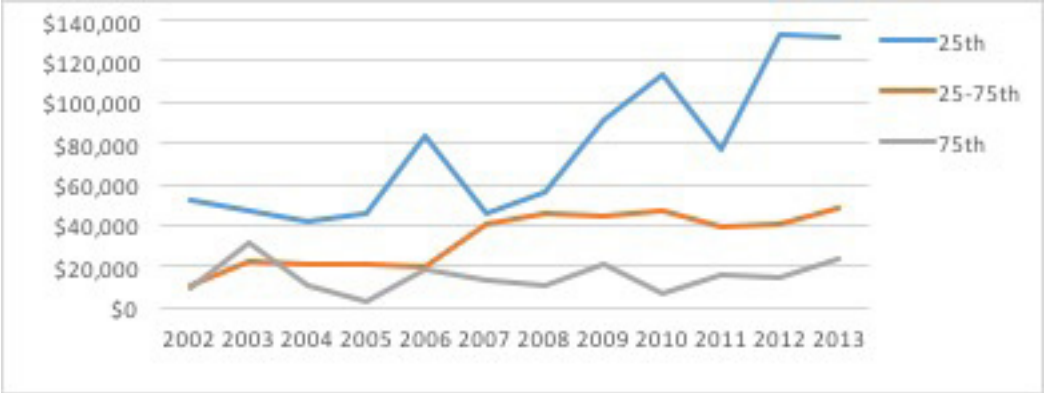


Charts 4 A–E. Average Annual Levels of Total Short-Term Liabilities and within Each Category by WC/GR Ratio Percentiles (*continued*)

D. Short-Term Portion of Term Debt



E. Short-Term Debt



The above graphs provide the average level of short-term liabilities, total and by category, for farms by WC/GR ratio percentile. WC/GR = working capital divided by gross value of sales

25th = farms having WC/GR ratios below the 25th percentile. 25th–75th = farms having WC/GR ratios above the 25th and below the 75th percentile. 75th = farms having WC/GR ratios above the 75th percentile.

All dollar values are in nominal terms.

Corn farms are defined as farms earning 50% or more of gross sales from corn as opposed to other crop or livestock categories.

Expansion weights, indicating the number of similar farms in the U.S. farm population represented by each sample farm, were utilized in calculating the WC/GR ratios and the variable means so that the mean values represent the average level for U.S. corn farms falling within that WC/GR ratio percentile.

the WC/GR percentile. Farmers in the 25th percentile experienced both the largest increase in total short-term liabilities and the greatest relative increase in the average value of short-term debts. In 2002, for example, farmers in the 25th percentile had $80,818 of short-term liabilities, with $5,568 in accounts payable, $16,395 in current portion of term debt, and $52,813 in short-term debts. By 2013, short-term liabilities were $189,791. The average level of accounts payable and short-term debts had roughly tripled in nominal terms to $15,665 and $131,626 by 2013, respectively. The current portion of term debt had roughly doubled in nominal terms to $31,181 by 2013.

The average debt held in accounts payable and current portion of term debt increased at a similar but slightly smaller rate during the sample period for farmers in the 25th–75th percentile. Within

this percentile, the average level of accounts payable grew roughly threefold in nominal terms, from $6,890 in 2002 to $21,267 in 2013. The current portion of short-term debt grew from $8,273 in 2002 to $24,699 in 2013.

The average level of short-term liabilities of farmers in the 75th percentile grew at a significantly smaller rate compared to farmers in the 25th percentile. The average level of total short-term liabilities for farms in the 75th percentile increased from an average of $23,962 in 2002 to $53,918 in 2013. Accounts payables increased 2.5-fold in nominal terms, from $5,692 in 2002 to $12,968 in 2013, and short-term debts roughly tripled in nominal terms, from $8,865 in 2002 to $23,821 in 2013. Farmers in the 75th percentile saw the smallest increase in average short-term debt and the short-term portion of current debts compared to other percentiles. Average short-term debts and the current portion of term debt increased from $8,865 and $7,299 in 2002 to $23,821 and $13,264 in nominal terms by 2013. For farmers in the 25-75th and 75th percentiles, short-term debt levels peaked in 2008 and then proceeded to decrease between 2010 and 2012. Periods of high corn prices and relative incomes may have allowed farmers to pay down debts taken as the farm economy improved or to invest without taking on additional debt. In contrast, the 25th percentile did not see the same reduction in average short-term debt levels post-2008 as did farmers within the other percentiles. Short-term debts instead remained, on average, at their higher 2008 levels.

CONCLUSION

The data presented for corn farms over the 12-year sample period gives an indication of how quickly an operations liquidity position can deteriorate. The dominant position of crop inventory in the current asset category helps to explain the fleeting nature of a farm's liquidity position. When evaluating the liquidity of the farm, special attention needs to be paid to the quality of working capital assets. "Grain in bin is a good asset but its quality for working capital may be subject to physical deterioration or price risk" (Davis, 2014). If corn prices fall quickly over a period, the current asset level can abruptly decline relative to the liability account. Strategies to address this risk include investing in good stored grain marketing and developing a strong marketing plan for crop inventories.

The data present a nuanced picture of current liabilities over the various percentiles. While farms with a weak liquidity position have increased the accounts payable and short-term debt levels on average over time, the relative liquidity position has strengthened. As indicated by many farm financial analysts, the level and portion of debt held in accounts payable appears to be a good indicator of possible farm fragility. This should be monitored, in conjunction with liquidity positions, to evaluate the farm's ability to withstand potential unexpected financial stress.

NOTES

1. Farms in which primary operators identify their main occupation as retirement.

2. Limited resource farms were a farm typology classification based on low gross farm sales and low operator household income in both the current year and previous year within ARMS. Since the classification procedure was inconsistent with other ARMS farm typologies, it was dropped as a separate category in 2005 (Hoppe & McDonald, 2013).

3. In 2002 the core version of the ARMS questionnaire was integrated with the Census of Agriculture. We choose to utilize survey years 2002–2013 to reflect this as well as illustrate the difference in farm liquidity levels across a wide range of economic conditions during periods of low, average, and high corn prices.

4. Other short-term assets include commodities receivable and all other short-term assets owned by the farm household not listed in the other categories including cash, bonds, certificates of deposits, savings and checking accounts, hedging accounts, government payments due, insurance indemnity payments due, balance of land contract sales, and any other farm assets not reported.

REFERENCES

Ahrendsen, B. L., & Katchova, A. L. (2012). Financial ratio analysis using ARMS data. *Agricultural Finance Review*, *72*(2): 262–272.

Boehlje, M., & Langemeier, M. (August 2015). Working capital: What is it and do you have enough? Center for Commercial Agriculture, Purdue University, https://ag.purdue.edu/commercialag/Pages/Resources/Finance/Financial-Analysis/Working-Capital-Enough.aspx.

Clark, E. High profits boost working capital. (October 18, 2012). Ag Web, http://www.agweb.com/article/high_profits_boost_working_capital/.

Davis, J. B. (February 23, 2014). Check your working capital to revenue ratio. IGROW SDSU Extension Service, http://igrow.org/agronomy/profit-tips/check-your-working-capital-to-revenue-ratio/.

Ellinger, P. (n.d.). Comparative analysis: Guidelines for liquidity and solvency measures. FarmDoc, Department of Agricultural and Consumer Economics, University of Illinois at Urbana–Champaign, http://www.farmdoc.illinois.edu/finance/Issues/Analysis2.PDF.

Farm Financial Standards Council. (2016). Financial guidelines for agricultural producers: Recommendations of the farm financial standards council. Farm Financial Standards Council, http://www.ffsc.org/index.php/guidelines/.

Hoppe, R., and McDonald, J. (2013). Updating the ERS farm typology. USDA-ERS Economic Information Bulletin 110.

Katchova, A. (2010). Structural changes in US agriculture: Financial performance of farms in transition. Paper prepared for presentation at the 114th EAAE Seminar "Structural Change in Agriculture," Berlin, Germany, April 15–16, 2010.

Kuethe, T. H., Briggeman, B., Paulson, N. D., & L. Katchova, A. L. (2014). A comparison of data collected through farm management associations and the Agricultural Resource Management Survey." *Agricultural Finance Review, 74*(4): 492–500.

Kropp, J. D., & Katchova, A. L. (2011). The effects of direct payments on liquidity and repayment capacity of beginning farmers. *Agricultural Finance Review*, *71*(3): 347–365.

Nwoha, O. J., Ahrendsen, B. L., Dixon, B. L., Settlage, D. M., & Chavez, E. C. (2007). FSA direct loan targeting: Successful and financially necessary? *Agricultural Finance Review*, *67*(1): 35–53.

Schnitkey, G. (2015a, June 9). "Working capital: Preserve it or use it? *Farmdoc Daily* (5): 106. Department of Agricultural and Consumer Economics, University of Illinois at Urbana–Champaign, http://farmdocdaily.illinois.edu/2015/06/working-capital-preserve-it-or-use-it.html.

Schnitkey, G. (2015b, October 6). Significant reductions in working capital likely in 2015 on grain farms. *Farmdoc Daily* (5): 184. Department of Agricultural and Consumer Economics, University of Illinois at Urbana–Champaign, http://farmdocdaily.illinois.edu/pdf/fdd061015.pdf.

USDA-ERS. (n.d.). ARMS farm financial and crop production practices. U.S. Department of Agriculture, Economic Research Service, https://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/.

Yeager, E. A., & Barnard, F. L. (2014). Effectiveness of increasing liquidity as a response to increased repayment risk: A case study. *Journal of the ASFMRA*, https://www.asfmra.org/wp-content/uploads/2014/06/400-Barnard.pdf.

Zwilling, B., & Raab, D. (2012, September 21). Farm liquidity: Working capital to value of farm production. FarmDoc Daily, Department of Agricultural and Consumer Economics, University of Illinois at Urbana–Champaign, http://farmdocdaily.illinois.edu/2012/09/farm-liquidity-working-capital.html.

Zwilling, B., Krapf, B., & Raab, D. (2015, May 15). Changes in working capital. FarmDoc Daily (5): 90, Department of Agricultural and Economics, University of Illinois at Urbana–Champaign, http://farmdocdaily.illinois.edu/pdf/fdd150515.pdf.