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Evaluating financial stress and performance of beginning farmers during the agricultural downturn

Ani L. Katchova and Robert Dinterman
*Department of Agricultural, Environmental, and Development Economics,
The Ohio State University, Columbus, Ohio, USA*

Abstract

Purpose – The purpose of this paper is to examine the financial performance and stress of beginning farmers in the USA with emphasis on the agricultural downturn experienced since 2013.

Design/methodology/approach – Using the US Department of Agriculture's Agricultural Resource Management Survey (ARMS) data, probit models are estimated to study the personal and farm characteristics that affect whether or not the financial ratios fall into critical zones as defined by the Farm Financial Standards Council. The financial ratios involve liquidity, solvency, profitability, efficiency, and repayment capacity.

Findings – Beginning farmers are at a greater risk of financial stress on average, with higher likelihood of financial stress in liquidity and efficiency. Further, the recent agricultural downturn has negatively affected liquidity, solvency, and profitability for farmers while repayment capacity does not appear to be affected. During the downturn, beginning farmers are better positioned than the general farming population with respect to liquidity and repayment capacity.

Originality/value – This paper applies current lending practices to a nationally representative sample of farms over a time of changing economic conditions for the agricultural sector.

Keywords Financial ratios, Financial stress, Financial performance, Beginning farmers, Critical zone

Paper type Research paper

During this decade, the US agricultural population has been experiencing a major structural change due to population dynamics. Half of all current farmers are expected to retire and be replaced by new and beginning farmers. Beginning farmers, by definition, have been operating a farm business for ten or fewer years. Approximately 20.3 percent of family farms are currently classified as beginning farms in 2015 according to the US Department of Agriculture's (USDA) Agricultural Resource Management Survey (ARMS). Recent research has demonstrated that current estimates of the number of new farm entrants may be as much as double what has previously been thought (Katchova and Ahearn, 2017). Understanding the needs of beginning farmers and their financial condition and stress is important to ensure sustainability of the agricultural sector. Policymakers and various universities and organizations have responded to the needs of beginning farmers by offering educational programs and financial capital to help new farmers transition into agriculture. In addition, USDA programs have offered assistance to beginning farmers and ranchers since the 1992 Agricultural Credit Improvement Act (Katchova and Ahearn, 2016). The Agricultural Act of 2014 has given beginning farmers special provisions with crop insurance programs, Farm Service Agency loan programs, and the CRP's Transition Incentive Program.

Recent trends of declining farm incomes and commodity prices since 2013 have brought concerns that the agricultural downturn may significantly affect farmers' repayment capacity. In contrast to the 1980s farm crisis which had debt-to-asset ratio in excess of 20 percent, current levels of the debt-to-asset ratio in the farming economy are at historical lows unseen since the 1950s. From 2000 until 2015, the debt-to-asset ratio has hovered between 11 and 15 percent. Farmers are in a strong equity position and have been

throughout the agricultural downturn – but cash flow is of particular importance and points to potential issues with liquidity and repayment capacity. Especially vulnerable are beginning farmers who experience significant challenges securing financing to acquire capital and operating profitable businesses while reducing financial, production, price, legal, and human resources risks.

Understanding the predictors of financial performance and financial stress can help structure and target educational programs to better address the needs of beginning farmers. Previous studies on beginning farmers have considered various aspects of financial performance, including profitability (return on assets), marginal income and solvency criteria, and net farm income per dollar assets (Ahearn and Newton, 2009; Franks, 1998; Mishra *et al.*, 2009). This study extends previous analyses to cover all five major financial categories including liquidity, solvency, profitability, efficiency, and repayment capacity based on Farm Financial Standards Council recommendations. Analyzing all financial indicators will give lenders, policymakers, and educators a better indication of the overall financial health as well as the successful farm strategies that can help beginning farmers transition into agriculture and have satisfactory financial performance.

The objective of this study is to analyze the predictors of financial performance of beginning farmers especially following the agricultural downturn and compare their performance to the rest of the farming population. While lenders and educators are interested in the general financial performance of beginning farmers, they are even more concerned about financial stress when one of the financial ratios exceeds a critical value which can result in financial stress expressed as inability to meet payment obligations (delinquencies). Therefore, the analysis here concentrates on predicting financial performance in the context of financial stress, measured as critically high or low financial ratios depending on the ratio.

The data are from the ARMS by the USDA from 2005 to 2015. ARMS is a stratified random survey which is representative of the entire farming population, and further allows for results to be representative of all beginning farmers in the USA. The survey includes detailed information on the financial condition of farmers making it possible to calculate financial ratios and classify them based on the level of acceptable and critical values of financial performance. Probit models are estimated to determine the factors affecting financial performance with a specific concern for how beginning farmers differ from the rest of the farming population. Instead of using a continuous dependent variable, the five financial ratios are classified as being in the critical zone or not. The classification of financial ratios is consistent with current lender practices to determine the creditworthiness of their applicants, as outlined in Ahrendsen and Katchova (2012). In addition, the mapping of continuous variables to binary helps correct for the skewed nature and undefined variables that arise from the financial ratios. Several factors are used as additional control variables which influence a farm's financial performance, including operator characteristics such as age, education, and household size as well as farm characteristics such as farm size, crop/livestock type, and the legal status of the farm.

Results indicate that beginning farmers are more likely to experience financial stress across all financial measures examined and that the recent agricultural downturn has impacted current farmer's liquidity, solvency, and profitability while leaving repayment capacity unchanged. Of further note, beginning farmers are better positioned in terms of repayment capacity and liquidity when examining heterogeneous effects for beginning farmers during the agricultural downturn.

Recent studies

As the current farming population continues to age, current farmers will eventually exit and be replaced by new entrants. Policymakers have shown an increasing interest in the next

generation of farmers – generally seen as beginning farmers which are defined as principal operators with 10 or fewer years of experience – and as such, place focus on their financial performance and access to land. Indeed, the Aggie Bond program was established in the 1980s as a way to provide beginning farmers access to capital (Williamson and Katchova, 2013). The characteristics of beginning farmers as well as their dynamic financial performance is of concern as they will eventually replace the agricultural production of current farmers.

Using 2007 ARMS data, Ahearn and Newton (2009) identify that beginning farmers face higher startup costs and lack access to land (to purchase or rent) in comparison to the general farming population. In addition, the demographics of beginning farmers is distinct from the general farming population as beginning farmers tend to be younger, non-white, female, more educated, and operate smaller farms. Furthermore, Kauffman (2013) states that given the higher capital requirements and stringent lending standards, young and beginning farmers may face difficulties in obtaining high levels of land ownership due to restricted access to credit.

Williamson (2017) constructs a synthetic panel of ARMS from 1999 to 2014 via age cohorts in order to track beginning farmer's financial standing. Similarly to Katchova and Ahearn (2016), Williamson (2017) finds a marked contrast in the growth of financials for farmers under the age of 45 and those above. Beginning farmers under the age of 45 experience rapid growth in the expansion of production as measured through gross cash income and expenses. Beginning farmers are found to have higher debt-to-asset and asset turnover ratios while maintaining higher profitability.

Katchova and Ahearn (2016) correct for the potential confounding of cohort and year effects by linking the 2002, 2007, and 2012 Agricultural Censuses to track individual farms across time. Their study largely confirm the Ahearn and Newton (2009) findings while also identifying a stark difference within beginning farmers. Beginning farmers that enter farming prior to 35 years of age have a higher trajectory for growth as measured by operated acres. The growth rate for operated acreage declines with age and around 55 the projected growth rate is effectively zero. The study also identifies that younger farmers are more likely to rent their land.

Kropp and Katchova (2011) demonstrate that government policy affects the financial standing of beginning farmers differently than experienced farmers. For experienced farmers, they find that statistically significant relationships as direct payments are positively related to their term debt coverage ratio and that base acres is negatively related to current ratio. These relationships are not present for beginning farmers.

Ahrendsen and Katchova (2012) link the financial measures and critical values recommended by the Farm Financial Standards Council with those in ARMS. They demonstrate the benefits of using a dichotomous indicator of financial stress as opposed to an aggregate ratio for a population as outliers have the potential to be masked in a mean or median even though those are the farmers most at risk. Missing within this literature is a more comprehensive analysis of beginning farmers across multiple financial ratios and adopting the current lender practices.

Models and data

The analysis is based on data from the ARMS which is conducted annually by the USDA. Data are from US Department of Agriculture, Economic Research Service (2005-2015) with the last year representing the most recent survey results published. While there is no strict definition for an agricultural downturn, Oppedahl (2017) identifies 2013 as the start of the downturn in part because of declines in aggregate net cash farm income. After stagnating aggregate real farm income from 1990 until 2002, there was a period of expansion in farm income until around 2013. The period from 2013 onward is considered as the agricultural downturn in this study, although current data availability preclude use of data after 2015.

ARMS data include detailed information on the financial condition and performance of US farmers. The survey includes questions about the financial indicators included in the farm balance sheets and income statements that proxy the five financial measures used in this study. The five measures of the financial performance of US farms represented by the respective financial ratios are: liquidity (current ratio), solvency (debt-to-asset ratio), profitability (return on assets as well as operating profit margin ratio), efficiency (operating expense ratio), and repayment capacity (term debt coverage ratio). Table I shows the formulas used to calculate these financial ratios, based on recommendations from the Farm Financial Standards Council (Ahrendsen and Katchova, 2012). Each financial ratio is classified as being in the critical zone if it exceeds a critical threshold, indicating that farmers are experiencing financial stress. For example, a current ratio of less than 1 is considered being in the critical zone, and similarly a debt-to-asset ratio that exceeds 55 percent is considered being in the critical zone. While additional financial ratios are available to represent each of the five financial measures, only those financial ratios that have clear guidelines about being in the critical zone are included in this analysis.

The descriptive statistics show that a higher proportion of beginning farmers are in critical zones than the general farm population for each of the six financial ratios with the gap between operating expense ratio as the largest at 10 percent. Beginning farmers are more vulnerable starting their farm businesses as reflected in 6 percent higher proportion of them having liquidity (current ratio) and repayment capacity (term debt coverage ratio) issues. In addition, beginning farmers are typically younger, more educated, operate smaller farms, and have a higher proportion of their income earned off the farm. Beginning farmers also receive a smaller amount of government payments across 2005-2015 as both total dollar amount and as a proportion of gross sales. Government payments are viewed as a proxy for current agricultural policy focus, which suggests that beginning farmers either have fewer available programs or are less likely to take advantage of government programs than the general farming population. This may partially be explained by noting that beginning farmers are more likely to be involved in livestock operations and that a higher share of government payments are allocated to crop farmers. While government payments differ by commodities, ARMS does not allow to identify the types of payments received by farmer and thus specific program effects on the financial stress of farmers cannot be disentangled. The descriptive statistics highlight that beginning farmers have different characteristics than the general farming population. There is still substantial within variation for both groups, although beginning farmers appear slightly more homogeneous (Table II).

Probit models are estimated to determine the factors affecting financial performance for beginning farmers. Classification of financial ratios into critical vs acceptable range is

Financial ratios	Financial measures	Calculations	Critical zones
Current ratio	Liquidity	Current farm assets/current farm liabilities	< 1
Debt-to-asset ratio	Solvency	Total farm debt/total farm assets	> 55%
Return on assets ratio	Profitability	(Net farm income from operations+interest expense – estimated unpaid management costs)/average assets	< 1%
Operating profit margin ratio	Profitability	(Net farm income from operations+interest expense – estimated unpaid management costs)/gross revenue	< 10%
Operating expense ratio	Efficiency	(Operating expenses – depreciation)/gross revenue	> 80%
Term debt coverage ratio	Repayment capacity	(Net farm income from operations + interest expense +depreciations)/(principal and interest)	< 1.1

Table I.
Financial ratio descriptions and critical zone definitions

Variables	Definitions	Means for all farmers	Means for beginning farmers
Critical zone for current ratio	Proportion of farmers falling in the critical zone for this ratio	0.29	0.35
Critical zone for debt-to-asset ratio	Proportion of farmers falling in the critical zone for this ratio	0.03	0.07
Critical zone for return on assets ratio	Proportion of farmers falling in the critical zone for this ratio	0.73	0.78
Critical zone for operating profit margin ratio	Proportion of farmers falling in the critical zone for this ratio	0.67	0.70
Critical zone for operating expense ratio	Proportion of farmers falling in the critical zone for this ratio	0.66	0.76
Critical zone for term debt coverage ratio	Proportion of farmers falling in the critical zone for this ratio	0.14	0.20
Beginning Farmers	Proportion of farmers with 10 or fewer years of experience	0.21	
Age	Age of farmer	58.16	48.82
Bachelors	Proportion of farmers with a bachelor's degree	0.27	0.32
Male	1 if farmer is male	0.89	0.84
Household size	Household size	2.59	2.97
Sole proprietor	1 if the farm's legal status is sole proprietorship	0.84	0.86
Hobby farm	1 if farm is classified as limited resource or residential lifestyle	0.65	0.77
Livestock farm	1 if over 50% of farm revenues are from livestock operations	0.56	0.59
Gross sales	Total value of farm gross sales in thousand dollars	149.83	74.97
Government payments	Total government payments in thousand dollars	4.54	1.94
Total off-farm income	Income from off-farm sources in thousand dollars	81.19	97.20
Farmers-years	Total estimated population of farmers from 2005 to 2015	21,989,122	4,648,124
Number of observations	Total observations in ARMS	228,340	28,193

Table II.
Definitions and
descriptive statistics

consistent with current lender practices of using credit score models to determine the creditworthiness of their applicants. The following specification serves as the primary baseline results for evaluating financial stress:

$$\Pr\left(Y_{i,t} = 1\right) = \Phi\left(\alpha + \alpha_t + \beta BF_{i,t} + \gamma \boldsymbol{X_{i,t}}\right) \tag{1}$$

where the indexes i represent a surveyed farm and t indicates the year of the survey, $Y_{i,t}$ is the financial ratio of interest, α is an overall constant estimated, α_t represents year fixed effects, $BF_{i,t}$ is an indicator for a beginning farmer if a farmer has 10 or fewer years of experience, and $\boldsymbol{X_{i,t}}$ the set of other control variables: age, education, and household size as well as farm characteristics such as farm size, crop/livestock type, and the legal status of the farm. Because of the survey design for ARMS, sample selection is a concern and the appropriate survey weights are applied to each regression to account for selection into the survey with bootstrapped standard errors. The bootstrap method follows Weber and Clay (2013) by clustering observations based upon the strata in ARMS, which accounts for the sampling procedure into the survey. The main variable of interest is the dummy variable for beginning farmers, which coefficient indicates the likelihood for a beginning farmer to experience financial stress as defined through the critical zones. Results are presented as probit coefficients as well as the marginal effects for ease of interpretability[1].

There is a potential for heterogeneous effects for beginning farmers in experiencing financial stress with emphasis on the agricultural downturn. These potential effects are evaluated through introducing an interaction term of beginning farmers with year fixed effects and the other covariates in Equation (1):

$$Pr(Y_{i,t} = 1) = \Phi(\alpha + \alpha_t + \beta BF_{i,t} + \gamma \boldsymbol{X_{i,t}} + \delta BF_{i,t} \times \boldsymbol{X_{i,t}}) \tag{2}$$

where δ represents the additional coefficients from the interaction effects. With the multiplication of two variables as an interaction, the first derivative does not have an associated interpretation with an interaction term. Therefore, marginal effects are not presented for the probit models with interacted variables.

Results

Probit models are estimated for whether or not each of the financial ratios falls in the critical zone with Table III displaying the coefficients and Table IV includes the associated marginal effects for each financial ratio for ease of interpretability. Being in the critical zone is denoted as 1 and seen as elevated risk for that particular ratio, which implies that positive coefficients/marginal effects indicate an elevated financial stress and negative correspond to lower levels of financial stress.

On average, beginning farmers are more likely to experience financial stress across all financial performance indicators – all are statistically significant except for one of the two ratios for profitability. The marginal effects range from a high of being 6.8 percent more likely to be in the critical zone for the efficiency ratio to a low of 1.7 percent for the repayment capacity. The marginal effects associated with beginning farmers for efficiency and liquidity are of similar magnitude and point to declines in cash flows for beginning farmers as a critical and pervasive issue. These effects are in addition to controlling for demographic characteristics as well as farm size, which indicates that beginning farmers on average are more vulnerable to experience financial stress than the rest of the farming population.

In addition to beginning farmer effects, the general trend is for farmers who are younger, operate smaller farm businesses (in terms of sales and household size), and are less educated to be more likely to experience financial stress. These particular results are fairly consistent across all financial indicators and are consistent with previous literature.

The trends of financial performance over time have mixed results. Current ratio, debt-to-asset ratio, and return on assets are more likely to be in critical zones from 2013 onward at statistically significant levels while operating expense ratio prior to 2013 had negative statistically significant effects. Repayment capacity does not have an obvious trend before and after the agricultural downturn, which is an interesting null finding. Repayment capacity is closely tied to debt obligations. One way that repayment capacity can remain unchanged in light of declining farm incomes is if debts are restructured. A restructuring can occur between a farmer and lender cooperatively or through means of a farmer declaring bankruptcy. While data on individual bankruptcies is not readily available, Dinterman *et al.* (2018) evaluate annual farmer bankruptcies since 1996 and find that macroeconomic factors occurring around 2010 led to an increase in farmer bankruptcies at that time. Total farm bankruptcies in 2001 were 383 and this value steadily rose to 723 in 2010 and fell to 407 in 2015, which indicates that some debt restructuring occurred prior to the agricultural downturn and may partially explain the lack of significance in repayment capacity.

Agricultural downturn

	Current	Debt-to-asset	ROA	Operating profit	Operating expense	Term debt coverage
Beginning	0.2061*** (0.0217)	0.3233*** (0.0343)	0.0835*** (0.0226)	0.0261 (0.0217)	0.1894*** (0.020)	0.0793*** (0.0233)
Age	−0.0034*** (0.0007)	−0.0207*** (0.0012)	0.0025*** (0.0007)	−0.0005 (0.0007)	−0.0032*** (0.0007)	−0.0168*** (0.0007)
Bachelors	0.0501** (0.0162)	−0.0155 (0.0286)	−0.0432** (0.0166)	−0.0547*** (0.0161)	0.0208 (0.0156)	0.0563** (0.0185)
Male	−0.1245*** (0.0260)	−0.1263** (0.0484)	−0.0541 (0.0295)	0.0138 (0.0272)	−0.0966*** (0.0256)	−0.0061 (0.0311)
Household size	0.0275*** (0.0058)	0.0431*** (0.0086)	−0.0032 (0.0063)	0.0038 (0.0060)	−0.0085 (0.0057)	0.0204** (0.0065)
Sole proprietor	0.0273 (0.0226)	0.1037*** (0.0297)	0.0446** (0.0211)	0.0883*** (0.0207)	0.1298*** (0.0208)	0.1298*** (0.0258)
Hobby farm	0.3192*** (0.0169)	−0.1788*** (0.0238)	0.2897*** (0.0167)	0.0612*** (0.0156)	0.5429*** (0.0167)	0.0167 (0.0187)
Livestock farm	−0.3357*** (0.0162)	0.0300 (0.0254)	0.3933*** (0.0179)	0.3475*** (0.0161)	0.4137*** (0.0156)	0.1100*** (0.0187)
Gross sales (in $1,000 s)	−0.0016 (0.0033)	0.0467*** (0.0048)	−0.3383*** (0.0181)	−0.1724*** (0.0127)	−0.0842*** (0.0086)	−0.0340*** (0.0063)
Government payments	−0.0005* (0.0002)	0.0018*** (0.0002)	−0.0075*** (0.0004)	−0.0059*** (0.0004)	−0.0054*** (0.0004)	−0.0002 (0.0002)
Total off-farm income (in $10,000 s)	0.6695** (0.2753)	0.1266 (0.3654)	0.0155 (0.2807)	−0.4896 (0.2846)	1.6696*** (0.4365)	0.8827** (0.2734)
Year 2006	−0.1335** (0.0477)	−0.0009 (0.0851)	0.1207 (0.0624)	0.0342 (0.0497)	0.1527 (0.0595)	−0.0226 (0.0521)
Year 2007	−0.1683*** (0.0455)	−0.0788 (0.0847)	0.0984 (0.0656)	−0.0066 (0.0520)	0.1203* (0.0591)	−0.1359* (0.0561)
Year 2008	−0.1887*** (0.0439)	−0.0537 (0.0775)	0.2071*** (0.0616)	0.1080* (0.0493)	0.1952*** (0.0566)	−0.0742 (0.0525)
Year 2009	−0.1049* (0.04901)	0.0683 (0.0803)	0.1861** (0.0629)	0.0542 (0.0492)	0.2054*** (0.0576)	0.0008 (0.0557)
Year 2010	−0.6616*** (0.0470)	−0.0627 (0.0788)	0.1629** (0.0622)	0.0196 (0.0488)	0.12687* (0.0580)	−0.0640 (0.0542)
Year 2011	−0.2080*** (0.0481)	0.0333 (0.0822)	0.1533* (0.0602)	0.0029 (0.0474)	0.1076 (0.0574)	−0.0625 (0.0605)
Year 2012	−0.3385*** (0.0460)	−0.1142 (0.0797)	−0.3089*** (0.0604)	−0.4303*** (0.0474)	0.0668 (0.0551)	−0.3311*** (0.0591)
Year 2013	0.0313 (0.04672)	0.0158 (0.0777)	0.2554*** (0.0620)	0.1094* (0.0494)	−0.0082 (0.0557)	−0.1766*** (0.0565)
Year 2014	0.2130*** (0.0463)	0.1627* (0.0763)	0.1838*** (0.0595)	−0.0353 (0.0476)	0.0168 (0.0578)	−0.0386 (0.0520)
Year 2015	0.1755*** (0.0506)	0.1793* (0.0801)	0.2382*** (0.0618)	0.0427 (0.0476)	0.0125 (0.0587)	−0.0353 (0.0569)
Constant	−0.3575*** (0.0639)	−0.8738*** (0.1153)	0.1132 (0.0780)	0.2646*** (0.0676)	−0.0579 (0.0698)	−0.2957*** (0.0736)
N	224,028	224,028	224,028	224,028	224,028	224,028

Notes: Standard errors are presented below coefficient estimates and in parenthesis. All standard errors are bootstrapped and clustered by strata. *, **, ***Significant at 0.01, 0.05 and 0.1 levels, respectively

Table III.
Probit results for probability of farmers falling into critical zones for these financial ratios: baseline

	Current	Debt-to-asset	ROA	Operating profit	Operating expense	Term debt coverage
Beginning	0.0663*** (0.0069)	0.0171*** (0.0019)	0.0269*** (0.0073)	0.0094 (0.0078)	0.0679*** (0.0072)	0.0168*** (0.0049)
Age	−0.0011*** (0.0002)	−0.0011*** (0.0001)	0.0008*** (0.0002)	−0.0002 (0.0002)	−0.0011*** (0.0002)	−0.0036*** (0.0002)
Bachelors	0.0161** (0.0052)	−0.0008 (0.0015)	−0.0139** (0.0053)	−0.0197*** (0.0058)	0.0075 (0.0056)	0.0119** (0.0038)
Male	−0.0399*** (0.0084)	−0.0067** (0.0026)	−0.0174 (0.0095)	0.0049 (0.0098)	−0.0346*** (0.0092)	−0.0013 (0.0066)
Household size	0.0089*** (0.0019)	0.0023*** (0.0005)	−0.0010 (0.0021)	0.0014 (0.0022)	−0.0031 (0.0021)	0.0043** (0.0014)
Sole proprietor	0.0088 (0.0073)	0.0055*** (0.0016)	0.0143* (0.0068)	0.0318*** (0.0074)	0.0465*** (0.0074)	0.0275*** (0.0055)
Hobby farm	0.1027*** (0.0055)	−0.0095*** (0.0012)	0.0931*** (0.0053)	0.0220*** (0.0056)	0.1946*** (0.0058)	0.0036 (0.0039)
Livestock farm	−0.1081*** (0.0052)	0.0016 (0.0014)	0.1264*** (0.0057)	0.1251*** (0.0058)	0.1483*** (0.0056)	0.0233*** (0.0039)
Gross sales (in $1,000 s)	−0.00052 (0.0011)	0.0025*** (0.0003)	−0.1088*** (0.0058)	−0.0621*** (0.0046)	−0.0302*** (0.0031)	−0.0072*** (0.0013)
Government payments	−0.0002* (0.0001)	0.0001*** (0.00001)	−0.0024*** (0.0001)	−0.0021*** (0.0001)	−0.0019*** (0.0001)	−0.00004 (0.0001)
Total off-farm income (in $10,000 s)	0.2155* (0.0886)	0.0067 (0.0194)	0.0049 (0.0902)	−0.1763 (0.1024)	0.5983*** (0.1566)	0.1869*** (0.0578)
Year 2006	−0.04299** (0.0153)	−0.0001 (0.0045)	0.0388 (0.020)	0.0123 (0.0179)	0.0548* (0.0213)	−0.0048 (0.0110)
Year 2007	−0.0542*** (0.0146)	−0.0042 (0.0045)	0.0316 (0.0211)	−0.0024 (0.0187)	0.0431* (0.0212)	−0.0288* (0.0119)
Year 2008	−0.0608*** (0.0141)	−0.0028 (0.0041)	0.0665*** (0.0198)	0.0389* (0.0178)	0.0699*** (0.0203)	−0.0157 (0.0111)
Year 2009	−0.0337* (0.0158)	0.0036 (0.0043)	0.0598*** (0.0202)	0.0195 (0.0177)	0.0736*** (0.0206)	0.0002 (0.0118)
Year 2010	−0.2129*** (0.0151)	−0.0033 (0.0042)	0.0524*** (0.0199)	0.0071 (0.0176)	0.0454* (0.0208)	−0.0136 (0.0115)
Year 2011	−0.0669*** (0.0155)	0.0018 (0.0044)	0.0493* (0.0194)	0.0011 (0.0171)	0.0386 (0.0206)	−0.0133 (0.0128)
Year 2012	−0.1089*** (0.0147)	−0.0061 (0.0042)	−0.0993*** (0.0195)	−0.1549*** (0.0171)	0.0239 (0.0197)	−0.0701*** (0.0123)
Year 2013	0.0101 (0.0150)	0.0008 (0.0041)	0.0821*** (0.0199)	0.0394* (0.0178)	−0.0029 (0.0199)	−0.0374** (0.0119)
Year 2014	0.0686*** (0.0149)	0.0086* (0.0040)	0.0591** (0.0192)	−0.0127 (0.0172)	0.0060 (0.0207)	−0.0082 (0.0110)
Year 2015	0.0565*** (0.0163)	0.0095* (0.0043)	0.0766*** (0.0199)	0.0154 (0.0172)	0.0045 (0.0211)	−0.0075 (0.0121)
N	224,028	224,028	224,028	224,028	224,028	224,028

Notes: All standard errors are bootstrapped and clustered by strata. *, **, ***Significant at 0.01, 0.05 and 0.1 levels, respectively

Table IV.
Marginal effects for probability of farmers falling into critical zones for these financial ratios: baseline

Agricultural downturn effects

Table V displays the results for probit models with beginning farmer interaction effects, which are coefficients and not marginal effects for reasons explained above. The majority of beginning farmer interaction term effects are null findings, which is a general result that indicates limited evidence for significantly different effects of the control variables on financial stress likelihoods between beginning farmers and the general farming population. However, trends during the agricultural downturn indicate that beginning farmers are less likely to be in the critical zones for repayment capacity and liquidity than established farmers. No other obvious patterns with the interaction effects are evident. Therefore, these effects are only applicable to how beginning farmers' likelihood of experiencing financial stress compared to the general population during the downturn. On average, beginning farmers are still more likely to experience financial stress than the general population.

Beginning farmers are more likely to rent than own land (Ahearn and Newton, 2009), which may shelter beginning farmers from downturns in land value declines. Land owners typically finance their purchase of land and are thus susceptible to declines in land values because the value of the land is typically used as collateral in a loan. Beginning farmers who did not have the resources to purchase land are serendipitously shielded from downturn risks in land values through renting as opposed to owning as debt loads would be smaller for a typical tenant than land owner. Declines in land values will reduce the value of assets for a land owner but not for a tenant – although the other side of the argument suggests that tenants cannot capitalize on increases in land values as land owners would capture. Cash rental rates are typically slow to adjust to changes in farm incomes and exhibit downward stickiness (Lattz, 2017). Stickiness in rental contracts inherently shift costs onto tenants in times of declining incomes, which is an additional downside risk of having a higher share of rented land.

With respect to liquidity, beginning farmers who do not own land are naturally able to stay more liquid in downturns as their rents – hence liabilities – are expected to decline when land values decline. The general farm population would not see as large of a decline because land values are tied to long-term debt. That beginning farmers are less likely to experience liquidity issues would appear to indicate that overall declines in farm incomes has a stronger effect on the general farming population than on beginning farmers.

Conclusions and policy implications

This study examines the financial performance and stress experienced by beginning farms in the US Using USDA's ARMS data, probit models are estimated to examine the personal and farm characteristics that affect whether or not the financial ratios fall into the critical zones. The results show that several characteristics influence the likelihood of experiencing financial stress, with important differences for beginning farms. Across the board, beginning farmers are more likely to experience financial stress across all examined financial measures. However, results indicate that beginning farmers are better positioned in terms of repayment capacity and liquidity when examining heterogeneous effects for beginning farmers in relation to the agricultural downturn. Being in a relatively better position with respect to repayment capacity for beginning farmers during the agricultural downturn suggests there is less financial stress for beginning farmers, yet also suggests that perhaps lenders are being more conservative when giving credit to beginning farmers.

With respect to the agricultural downturn, farmers are more likely to experience financial stress in liquidity, solvency, and profitability but do not experience significantly different likelihoods for repayment capacity stress. These results help characterize the agricultural downturn as that of cash flow and profitability problems, which affects the short-term financial standing of a farm yet has not impacted long-term outlook.

Table V.
Probit results for probability of farmers falling into critical zones for these financial ratios: interactions with beginning farmer dummy variable

	Current	Interaction with BFR	Debt-to-asset	Interaction with BFR	ROA	Interaction with BFR	Operating profit	Interaction with BFR	Operating expense	Interaction with BFR	Term debt coverage	Interaction with BFR
Beginning	-0.1388 (0.1414)		-0.0779 (0.1954)		0.4514** (0.1513)		0.4896*** (0.1343)		-0.3086* (0.1446)		-0.3923*** (0.1429)	
Age	-0.0041*** (0.0007)	0.0031* (0.0015)	-0.0219*** (0.0013)	0.0025 (0.0024)	0.0026*** (0.0007)	0.0005 (0.0017)	0.0002 (0.0007)	-0.0025 (0.0016)	-0.0053*** (0.0007)	0.0093*** (0.0016)	-0.0194*** (0.0008)	0.0077*** (0.0017)
Bachelors	0.0542** (0.0176)	-0.0167 (0.0420)	0.0136 (0.0302)	-0.0637 (0.0618)	-0.0317 (0.0180)	-0.0542 (0.0447)	-0.0494** (0.0176)	-0.0252 (0.0426)	0.0386* (0.0175)	-0.0964* (0.0418)	0.0529** (0.0200)	0.0043 (0.0462)
Male	-0.1880*** (0.0287)	0.2158*** (0.0598)	-0.1461* (0.0601)	0.0428 (0.0953)	-0.0468 (0.0348)	-0.0227 (0.0672)	0.0186 (0.0315)	-0.0156 (0.0597)	-0.1083*** (0.0291)	0.0587 (0.0581)	0.0023 (0.0341)	-0.0206 (0.0659)
Household size	0.0249*** (0.0064)	0.0071 (0.0137)	0.0399*** (0.0104)	0.0065 (0.0179)	0.0094 (0.0068)	-0.0435** (0.0148)	0.0145* (0.0066)	-0.0351* (0.0137)	-0.0159* (0.0064)	0.02117 (0.0129)	0.0124 (0.0073)	0.0175 (0.0142)
Sole proprietor	-0.014747 (0.0247)	0.1975406*** (0.0549)	0.0701024* (0.0318)	0.0965546 (0.0698)	0.0402307 (0.0226)	0.040876 (0.0597)	0.0740486*** (0.0225)	0.0715462 (0.0565)	0.1181674*** (0.0213)	0.07111 (0.0563)	0.0851** (0.0294)	0.1959*** (0.0599)
Hobby farm	0.3373*** (0.0182)	-0.1112** (0.0421)	-0.2048*** (0.0272)	0.0795 (0.0544)	0.3048*** (0.0179)	-0.1057* (0.0442)	0.0751*** (0.0167)	-0.0837* (0.0419)	0.5401*** (0.0176)	-0.0098 (0.0433)	-0.0223 (0.0203)	0.1669*** (0.0493)
Livestock farm	-0.3407*** (0.0179)	0.0157 (0.0401)	-0.0151 (0.0272)	0.1204* (0.0563)	0.4036*** (0.0186)	-0.0528 (0.0410)	0.3629*** (0.0174)	-0.0731 (0.0387)	0.3958*** (0.0166)	0.0854* (0.0378)	0.1193*** (0.0199)	-0.0411 (0.0440)
Gross sales (in $1,000 s)	-0.0046 (0.0038)	0.0231* (0.0091)	0.0378*** (0.0046)	0.0394*** (0.0103)	-0.3222*** (0.0184)	-0.1751*** (0.0408)	-0.1680*** (0.0132)	-0.0461 (0.0251)	-0.0781*** (0.0085)	-0.0824*** (0.0241)	-0.0377*** (0.0070)	-0.0052 (0.0179)
Government payments	-0.0005* (0.0002)	0.0003 (0.0007)	0.0017*** (0.0002)	0.00002 (0.0007)	-0.0073*** (0.0005)	-0.0037* (0.0015)	-0.0056*** (0.0004)	-0.0033** (0.0012)	-0.0051*** (0.0004)	-0.0059*** (0.0017)	-0.0001 (0.0002)	-0.0034** (0.0012)
Total off-farm income (in $10,000 s)	0.7203* (0.3147)	-0.2716 (0.6638)	0.3865 (0.3161)	-1.6949 (1.1982)	-0.0196 (0.3024)	0.1430 (0.8199)	-0.5088 (0.3268)	0.1538 (0.7261)	1.4024** (0.4364)	1.2293 (1.1756)	0.8746** (0.3182)	-0.1863 (0.5994)
Year 2006	-0.1234* (0.0519)	-0.0594 (0.0984)	-0.0071 (0.0955)	0.0226 (0.1315)	0.1685** (0.0573)	-0.2339* (0.1096)	0.0480 (0.0513)	-0.0848 (0.0896)	0.1771** (0.0649)	-0.1171 (0.1048)	0.0009 (0.0547)	-0.1319 (0.1032)
Year 2007	-0.1691*** (0.0488)	-0.0073 (0.1029)	-0.1333 (0.0985)	0.1451 (0.1517)	0.1136 (0.0599)	-0.0938 (0.1137)	0.0075 (0.0525)	-0.0709 (0.0936)	0.1573* (0.0646)	-0.1912 (0.1084)	-0.1032 (0.0586)	-0.1556 (0.1092)
Year 2008	-0.1551** (0.0493)	-0.1466 (0.0933)	-0.1138 (0.0893)	0.1468 (0.1309)	0.2284*** (0.0570)	-0.1271 (0.1115)	0.1520** (0.0505)	-0.2125* (0.0899)	0.2276*** (0.0622)	-0.1645 (0.0987)	-0.0184 (0.0551)	-0.2363* (0.0978)
Year 2009	-0.0829 (0.0553)	-0.1002 (0.0955)	0.0401 (0.0937)	0.0801 (0.1359)	0.2191*** (0.0576)	-0.1775 (0.1103)	0.1079* (0.0488)	-0.2579** (0.0907)	0.2211*** (0.0639)	-0.0704 (0.1058)	0.0457 (0.0585)	-0.1863 (0.0985)
Year 2010	-0.6425*** (0.0542)	-0.0938 (0.1010)	-0.0975 (0.0940)	0.0902 (0.1342)	0.1959*** (0.0572)	-0.1811 (0.1069)	0.06152 (0.0502)	-0.2051* (0.0871)	0.1568* (0.0632)	-0.1548 (0.0980)	-0.0192 (0.0575)	-0.1957* (0.0981)
Year 2011	-0.2092*** (0.0543)	-0.0046 (0.0976)	-0.0019 (0.0991)	0.1025 (0.1452)	0.1537** (0.0546)	-0.0063 (0.1088)	0.0261 (0.0481)	-0.1152 (0.0899)	0.1292** (0.0629)	-0.0976 (0.1051)	-0.0337 (0.0649)	-0.1274 (0.1053)
Year 2012	-0.3186*** (0.0516)	-0.0891 (0.1003)	-0.1336 (0.0912)	0.0587 (0.1421)	-0.2842*** (0.0554)	-0.1427 (0.1077)	-0.4063*** (0.0496)	-0.1201 (0.0931)	0.0938 (0.0602)	-0.1339 (0.1018)	-0.2803*** (0.0629)	-0.2278*** (0.1078)

Agricultural downturn

	Current	Interaction with BFR	Debt-to-asset	Interaction with BFR	ROA	Interaction with BFR	Operating profit	Interaction with BFR	Operating expense	Interaction with BFR	Term debt coverage	Interaction with BFR
Year 2013	0.0764	−0.2101*	0.0230	−0.0155	0.2740***	−0.1093	0.1531**	−0.2205*	0.0241	−0.1603	−0.1059	−0.2931**
	(0.0520)	(0.0972)	(0.0909)	(0.1344)	(0.0575)	(0.1079)	(0.0512)	(0.0966)	(0.0617)	(0.1041)	(0.0580)	(0.1029)
Year 2014	0.2515***	−0.1749	0.2309**	−0.2108	0.2079***	−0.1363	0.0131	−0.2396**	0.0568	−0.1962*	0.0389	−0.3179***
	(0.0499)	(0.0925)	(0.0875)	(0.1268)	(0.0538)	(0.1051)	(0.0476)	(0.0865)	(0.0626)	(0.0995)	(0.0554)	(0.0951)
Year 2015	0.2281***	−0.2416*	0.1984*	−0.0445	0.2723***	−0.1904	0.0762	−0.1696	0.0590	−0.2351*	0.0649	−0.4153***
	(0.0538)	(0.1103)	(0.0913)	(0.1464)	(0.0577)	(0.1104)	(0.0511)	(0.0984)	(0.0632)	(0.1012)	(0.0601)	(0.1108)
Constant	−0.2486***		−0.6998***		0.0287		0.1489*		0.0892		−0.1257	
	(0.0708)		(0.1277)		(0.0796)		(0.0738)		(0.0794)		(0.0773)	
N	224,028	224,028	224,028	224,028	224,028	224,028	224,028	224,028	224,028	224,028	224,028	224,028

Notes: Standard errors are presented below coefficient estimates and in parenthesis. All standard errors are bootstrapped and clustered by strata. *, **, ***Significant at 0.01, 0.05 and 0.1 levels, respectively

Table V.

AFR

These results are not suggestive of beginning farmers being insulated from downturns in the agricultural economy but instead highlight the two sides of the same argument. As beginning farmers are less likely to own land, they are more insulated from downside risk in the farm economy. This would also imply they may not be able to fully capture the benefits of an improving agricultural economy.

These differences in effects among farms are helpful for agricultural lenders to assess the creditworthiness of farmers, especially beginning farmers. Understanding the predictors of financial performance for beginning farmers can help in designing educational programs based on the particular needs of farmers to help them transition into agriculture. With about half of the current farmers planning to retire during this decade, it is of crucial importance to offer financial management training to the next generation of farmers with goals of achieving high profitability, financial efficiency, and adequate repayment capacity.

Note

1. Logit and linear probability regressions produce similar results in both magnitudes and significant effects. However, linear regressions with the continuous financial ratios produce a poor fit and imprecise estimates due to the skewed distribution of financial ratios.

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Corresponding author
Ani L. Katchova can be contacted at: katchova.1@osu.edu