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An Exploration of the Role of Farm Business Decisions in Addressing Financial Challenges for Missouri's Beginning Farmers

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AN EXPLORATION OF THE ROLE OF FARM BUSINESS DECISIONS IN

ADDRESSING FINANCIAL CHALLENGES FOR

MISSOURI'S BEGINNING FARMERS

A Master's Thesis

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Master of Science, Agriculture

By

Lucas Paloschi

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AN EXPLORATION OF THE ROLE OF FARM BUSINESS DECISIONS IN

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FARMERS

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ABSTRACT

The next generation of farmers takes an important role in the food production for subsequent years. The American Farm Bureau Federation's (2017) estimation that 70% increase of production will need to be achieved within the next 30 years set awareness across the globe. Researchers have been studying and trying to find means to aid beginning farmers in a variety of ways. This study measures farm decisions that affect financial performance of farmers aiming to facilitate beginning producers' decision making. Three regressions were used to analyze how different variables affect farmers' profitability and repayment capacity. Using a county-level data for the state of Missouri significant results were found. Counties with less diversified farms show a lower financial performance. On the other hand, counties with more operations taking advantage of crop insurance present a better repayment capacity. Altogether, the findings in this study provide significant thoughts for future research and potential ways to help beginning farmers and ranchers to succeed.

KEYWORDS: beginning farmers and ranchers, financial ratios, profitability, repayment capacity, business decisions, county-level data, Missouri

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INTRODUCTION

In an ever-increasing population, agriculture becomes crucial for every nation. The world population is expected to reach almost 10 billion by the year 2050 (FAO, 2009). The United States, as one of the top exporters of agriculture commodities, plays an important role in the fight against hunger. To meet the population's needs, farmers will have to increase production by about 70% in the next 30 years (American Farm Bureau Federation, 2017).

In history, there have been three turning points for humanity related to agriculture. The first occurred about 12,000 years ago when humans started farming. The second was the reorganization of farmland that took place in the 17th century. Lastly, in the 1950s and 1960s the Green Revolution with the advent of fertilizers, pesticides, machinery and high yield crops (Creak and Chivers, 2020). Another revolution is needed to achieve the estimated 70% increase in food production by 2050. Creak and Chivers (2020) believe that this revolution is starting to take place with the introduction of artificial intelligence, smarter planning, autonomous robots, and other farming technologies. These advancements will need to be undertaken by both current and future generations of farmers.

Mishra *et al.* (2007) points out that current farmers will likely be retiring in the next few years. Therefore, the majority of the mission to increase production is carried to the next generation of farmers and ranchers. Unfortunately, studies show the hardships faced by beginning farmers when starting operations such as high start-up costs, lack of financing, lack of knowledge and experience, less availability of land (Ahearn and Newton, 2009; Fernandez-Cornejo *et al.*, 2007; Freedgood and Dempsey, 2014; Kaufmann, 2013; Kuethe *et al.*, 2011;

Mishra *et al.*, 2009). On the other side, beginning farmers might be more comfortable with and early adopters of new practices, facilitating then the new revolution in farming.

The beginning farmer is defined by the USDA as a farmer or rancher who has operated a farm or ranch for 10 years or less (Newton and Ahearn, 2007). According to the 2017 Census of Agriculture, this accounted for about 24% of farmers (National Agricultural Statistics Services, 2021). It is generally thought that a beginning farmer would be a young person and below the age of 35, however, the numbers of the 2017 Census show an increasing percentage of beginning farmers in the age group above 55 years old (National Agricultural Statistics Services, 2021). Studies find an explanation for this as individuals retiring and starting farm operations as a form of income after retirement (Freedgood and Dempsey, 2014).

The objective of the study is to evaluate factors influencing farmer's financial performance with a particular emphasis on number of beginning farmers in Missouri. It uses historical county level data collected from NASS Quick Stats to learn which factors are related with higher returns and favorable interest coverage for producers in the state of Missouri. Findings from this research will provide guidance in decision making for the producers as well as policy makers at the county and state level.

LITERATURE REVIEW

The Role of Beginning Farmers

Previous agricultural studies analyze the importance of beginning farmers to the future. FAO (2009) is concerned with the increasing world's population, which is expected to reach over 9 billion by 2050. In addtion, the 2017 Census of Agriculture shows the average age of primary producers increasing from 58.3 in 2012 to 59.4 in 2017. The 2017 Census also shows that the number of primary producers over 65 years old outnumber the farmers under 35 years old by more than a 6 to 1 ratio (NASS, 2021). These facts raise questions if farmers will be able to produce enough food and if it will be affordable by the population (FAO, 2009). As such, young and beginning farmers will play a very important role in will the near future to meet those demands.

However, as previosly seen, the 2017 Census of Agriculture shows the concerning decreasing numbers of young farmers and ranchers in recent years. According to Mishra *et al.* (2009) rising barriers to entry is the cause of this decreasing number. They also conclude that measures aiming to help beginning farmers stay in the market are necessary. Katchova and Dinterman (2018) also noted the concerns of a rapid increase in the average age of the American farmer as a concern. They explain that policymakers have noted the aging of the current farming population and have increased their interest in the next generation of farmers. The focus for policymakers now is to reduce those barriers and help the next generation of farmers with financial performance and access to land (Katchova and Dinterman, 2018).

Beginning Farmers' Characteristics

To be able to help beginning farmers with policies and programs, it is important to understand how they are characterized. USDA defines beginning farmers and ranchers as "those who have operated a farm or ranch for 10 years or less either as a sole operator or with others who have operated a farm or ranch for 10 years or less" (Ahearn and Newton, 2009). About 24% of U.S. farms can be included in this definition by USDA (NASS, 2021).

When taking a closer look at the age breakdown of beginning farmers it becomes evident that they are in varying age categories. Based on the 2017 United States Census of Agriculture, there were 674,940 beginning producers and 2,065,513 established producers (NASS, 2021). When looking at the age groups we find 7% of established farmers below the age of 35, while 22% of beginning farmers are below the same age. In the category between 35 and 44 years old, 10% of the established farmers and 22% of the beginning farmers are accounted in it. From 45 to 54 years old, we see 18% of the established farmers and 21% of the beginning farmers. Lastly, there are 65% of established farmers above the age of 55 and 35% of beginning farmers in this category. When analyzing the 2017 Census data in the state of Missouri, the percentages in each of the age groups follow the national data pattern with a slight higher percentage of beginning farmers being in the age group below 35 years (NASS, 2017). A summary of these numbers can be found on Table 1.

These numbers are not very different from previous years. Mishra *et al.* (2009) found the number of beginning producers as 412,321 and the number of established producers as 1,632,583, combining those two numbers for a total of 2,044,904 farms in the United States in 2005. The age breakdown found by the authors in that year was 15% of beginning farmers less than 35 years old, while only 1.5% of established farmers in this group. Similarly, a significant

higher percentage of beginning farmers are in the 35 to 44 years old group, 24% versus 9% of

established farmers in that category. In the 45 to 54 years group, beginning farmers still have a

higher percentage, 33% of new farmers and 25% of established farmers. Above 55 years old are

way more likely to be established farmers than beginning farmers, 64% of established farmers

are above the age of 55, while only 27% of beginning farmers are above 55 years old (Mishra *et

al.*, 2009). The data comparison is showed in Table 1.

Beginning Farmers' challenges

       High Start-up Costs and Financing. Farming requires a significant investment to begin

operations and beginning farmers often do not own the required amount of capital to be

profitable (Mishra *et al.*, 2007; Mishra *et al.*, 2009). Fernandez-Cornejo *et al.* (2007) add to this

topic by saying that the high startup costs of farming induce new farmers to run smaller

operations when starting, consequently, off-farm work is the alternative method to compensate

the scale disadvantages. This is the possible explanation to the negative correlation between

operator's off-farm income and size of the farm found in the study by Fernandez-Cornejo *et al.*

(2007).

       These startup costs include the cost of land, equipment, inputs, on-farm infrastructure,

etc. The combination of the cost with current assets held by these beginning farmers leads to

challenges in the area of financing. These farmers face the challenge of being able to acquire

financing or get reasonable interest rates. The reason why lenders are generally more rigorous

when borrowing money to new farmers is explained by Kaufmann (2013), it states beginning

farmers have lower level of equity, which represents higher risks for the lenders. Higher

collateral value is asked by lenders to offset this greater risk, however Pouliot (2011) describes

that beginning farmers do not have the collateral asked for, thereby complicating the process of being awarded with the loan.

   Off-Farm Income. As previously discussed, the difficulties found by new farmers to acquire financing play an important role on seeking off-farm income (Fernandez-Cornejo *et al.*, 2007; Freedgood and Dempsey, 2014). Another factor identified in the literature that support the importance of off-farm income for beginning farmers is that they are generally more educated and more likely to work off the farm (Mishra *et al.*, 2009). Ahearn and Newton (2009) states beginning farmers are more likely than established farmers to have a 4-year college degree. Generally, being more educated means having more job opportunities with higher incomes in the urban area (Ahearn and Newton, 2009).

   Education does not necessarily mean higher returns on the farm level, Mishra *et al.* (2009) argues that if a new farmer overcomes start-up challenges, they need to rapidly gain information about how to farm, how to manage the farm, how to meet regulations and how to be profitable. On the other hand, the literature shows that more educated people tend to be awarded higher wage jobs in the city with multiple benefits like health insurance and life insurance (Jensen and Salant, 1985). Having a job in the city, means that the farmland needs to be located close by. Freedgood and Dempsey (2014) introduces the fact that new farmers search for farmland close to urban areas to satisfy the income needs with job opportunities in the city. However, finding land near cities brings another prevailing issue to the discussion: land availability.

   Availability of Land. Kuethe *et al.* (2011) states that civilizations were built around fertile areas, favorable to agricultural production. However, development pressures end up taking over fertile farmland away from farmers and ranchers (Kuethe *et al.*, 2011). Ahearn

(2011) shares the same thoughts and addresses two main challenges for new farmers. First is having land available to buy or rent, and second is having the capital necessary to acquire enough land to be profitable.

Freedgood and Dempsey (2014) discusses how farmland has been pressured by non-rural areas like roads, business and residential living. This reality not only decreases prime farmland, but also increases the price of it. Kuethe *et al.* (2011) emphasize how the urban development may cause a "bid up" in land values near cities. Further, Freedgood and Dempsey (2014) estimates that from 1982 to 2007 more than 23 million acres of farmland have been turned into non-farm usage, including roads, malls and subdivisions.

Financial Performance

Research supports the idea that established farmers experience less financial stress than beginning farmers (D'Antoni, Mishra and Chintawar, 2009; Katchova, 2010; Katchova and Dinterman, 2018). There could be a variety of factors affecting beginning farmers financial performance. It is found in the literature several studies looking for factors that help beginning farmers to achieve a better financial position including factors such as sources of income, trainings, the number of operators on the operations, etc.

Mishra *et al.* (2009) shows the importance of off-farm income to young and beginning farmers. The average household total income of established farmers is lower than those who have been farming for less than 10 years. On the other hand, established farmers have on average two times the assets that beginning farmers have. The study shows that farm debt is about the same when beginning farmers and established farmers are compared, however due the higher number of assets, older farmers present a higher net worth. These factors are taken in

consideration on loan applications giving an advantage for established farmers to be accepted with lower levels of risk to the borrower (Mishra *et al.*, 2009).

Katchova (2010) states that it is crucial to offer financial management training to beginning farmers with goals of achieving higher profitability, financial efficiency and adequate repayment capacity. Keeping the next generation of farmers in the market is important to offset the retirement of about half of the current farming population. Understanding the financial performance and its stress will help the creation of programs to better address the needs of the young population of farmers (Katchova and Dinterman, 2018).

Mishra *et al.* (2009) identifies factors affecting financial performance of beginning farmers. The study states that increasing the number of decision makers, engaging in value added farming and having a written business plan increase the profitability of the farm. Further, Mishra *et al.* (2009) finds that young and more educated farmers have lower financial performance, which can be compared to the higher likelihood of an operator with these characteristics to work off-farm, which also was negative correlated with financial performance.

Katchova (2010) finds similar results when studying financial performance of beginning farmers. The author states that age is negative correlated with financial performance, as age goes up, farmers are found in better financial positions. Farm size is also statistically significant, the larger the operation, the less likely it is to fall into financial critical zones. Similarly, government payments are found to be helpful for beginning farmers who take advantage of it.

Katchova and Dinterman (2018) evaluates the effects of the agricultural downturn on beginning farmers recreating the 2010 study by Katchova. The downturn experienced by farmers in 2013 and the following couple years is summarized by Harvie (2017) as commodities price crashes that pushed farmers into debt and decreased farmers net farm income by 45% from

2013 to 2016. In the study by Katchova and Dinterman (2018) beginning farmers were found to be more likely to fall into critical zones for all of the major financial ratios. However, they are less likely to be in the critical zones for repayment capacity and liquidity when compared to experienced farmers during the downturn (Katchova and Dinterman, 2018). The authors find the explanation for it on the fact that beginning farmers are tenants rather than proprietors of their land, thus they are not affected by decrease in land values. There are two sides of this finding, first that beginning farmers are more covered during downturns, second, when the agricultural economy is improving, they will not be able to capture the benefits of higher land values (Katchova and Dinterman, 2018).

Mishra, Wilson and Williams (2007) evaluates the impact of technology adoption and certain management practices on beginning farmers' financial performance. The study finds that new farmers who adopt genetically modified seeds have higher financial performance. Another interesting finding is that participation in government programs helps beginning farmers' financial health. It was also emphasized that the use of market-oriented tools such as futures and options are likely to provide higher returns to the operation (Mishra *et al.*, 2007).

Mishra, El-Osta and Johnson (1999) identifies the factors that contribute to financial earnings in grain farms. They found that forward contracting in input markets facilitate inventory planning and farmers who utilize it are more likely to achieve financial success. Diversification of farm products was also found to increase farm earnings, which can be explained by the security of having more than one source of income, if one product is not doing so well, the others can compensate. The findings also support the idea of spreading farm sales throughout the year as another form of security and the use of extension services for learning.

Farmers who adopt these practices are more likely to experience higher earnings (Mishra *et al.*, 1999).

D'Antoni, Mishra and Chintawar (2009) analyzes factors that contribute to the financial stress in young and beginning farmers. The results are similar to other studies involving new farmers and financial positions. Age, farm ownership, off-farm income and type of products grown are significant determinants for falling into vulnerable areas. Aiming to help beginning farmers to overcome difficulties, Mishra, Tegegne and Sandretto (2004) examines the impact of participation in cooperatives on the success of small farms. The study found that participating in marketing and supply cooperatives help farmers to achieve higher returns.

Government programs have been created to aid new farmers. There is evidence in the literature that confirm better financial positions for farmers who take advantage of it. Learning and advertising these programs might be the solution needed to keep the new generation of farmers in business.

Government Programs

USDA has been aiding beginning farmers since the Agricultural Credit Improvement Act of 1992. The Department offers a variety of programs to diminish the risk for farmers. As we can see, previous research support government programs as being helpful to beginning farmers' financial success. The next sections focus on a selected list of programs that impact beginning farmers and their financial health.

Crop Insurance. Farmers in the United States can manage risk by applying to the federal crop insurance program managed by the Risk Management Agency. It provides farmers a guaranteed amount of revenue in case of a disaster. Farm Bureau (2016) explains how the

program works, it is based upon the insured's areas Actual Production History (APH), which takes in consideration four to ten years yield of production in that ground. Often, beginning farmers don't have access to this data, so they are required to show county Transitional Yields (T-Yields) for the missing years of history. Before the 2014 Farm Bill, the number used for T-Yields were 60 percent of the county's average. It changed to 80 percent when the Bill was passed, therefore, increasing the available coverage until enough actual history exists (Farm Bureau, 2016).

In addition, beginning farmers are exempted from paying the administrative fee for catastrophic and additional coverage policies. Another benefit is that young farmers get an additional 10 percentage points of premium subsidy on any crop insurance. Lastly, it is possible to use another person's production history for the specific acreage being insured if the farmer was involved in the decision making or physical activities to produce the crop (Risk Management Agency, 2019).

The Risk Management Agency (RMA) is a branch of USDA that administers the crop insurance programs. RMA defines beginning farmers as those who have not actively operated and managed a farm with an insurable interest for more than 5 years (Risk Management Agency, 2019). This diminishes the number of candidates by a significant amount, but by design of the program to help those who really need the subsidy.

The Environmental Quality Incentives Program. The Environmental Quality Incentives Program (EQIP) focuses on conserving natural resources such as improving water and air quality, increasing soil health and decreasing soil erosion and sedimentation, improving or creating wildlife habitat, etc. by providing financial and technical assistance to farmers (NRCS).

NRCS provides one-on-one help to plan conservation practices, which leads to a better farming operation.

With the 2018 Farm Bill, beginning and socially disadvantaged farmers were provided a separate pool of money for payments in advance to offset costs through EQIP. The payment must be expended within 90 days of the receiving date and it amounts to at least 50% of the conservation practice amount (NRCS, 2021). Another benefit of using EQIP started in 2020, which consists of increased payment rates for high-priority practices. Up to ten practices may be chosen by each state conservationists and increased payments will be given to farmers who address one or more of these practices (NRCS, 2021).

The 2018 Farm Bill also introduced EQIP incentive contracts. These contracts expand the benefits to producers through practices such as cover crops, crop rotations and precision agriculture technologies. Each state will have regions identifying high-priority areas and up to three priority resource concerns. The incentive contract will offer annual payments to address operations and maintenance costs in addition to the payment for practice implementation (NRCS, 2021).

Conservation Stewardship Program. The Conservation Stewardship Program (CSP) helps farmers to build existing conservation efforts while strengthening the operation. NRCS helps farmers through CSP by identifying natural resources problems and providing technical and financial assistance to solve it. Beginning farmers are provided with a special funding pool. Some of the benefits of enrolling in the CSP are enhancing resiliency to weather and market volatility, decreased need for agricultural inputs and improved wildlife habitat conditions (NRCS, 2021).

CSP contracts last 5 years. In case of successfully fulfilling the initial contract and agreement with achieving additional conservation practices, the contract can be renewed. The payments are based on three components: existing activity, additional activity and supplemental activity. For the first component, the farmer is required to maintain the stewardship level already being used in the operation. The second component requires at least one additional resource concern in each land contracted. The payments rate for enhancements vary by state and depends on the conservation practices applied by the farmer. In addition, producers who adopt a resource conserving crop rotation receive a supplemental payment based on the activity chosen (NRCS, 2021).

Conservation Reserve Program. Conservation Reserve Program (CRP) is administered by the Farm Service Agency (FSA) and consists of retiring environmentally sensitive lands from production. Farmers who opt to enroll in this program receive a yearly rental payment and are required to plant species that will improve the land's health and quality. CRP contracts are long term, usually 10-15 years, and aim the reestablishment of a valuable land (FSA, 2021).

FSA provides opportunities for beginning farmers to purchase or rent land through this program. CRP's Transition Incentives Program (TIP) provides landowners with two additional annual payments on land enrolled in expiring CRP contracts with the condition of selling or renting it to a beginning or socially disadvantaged farmer. The new producer must return the land to production using sustainable methods of farming (FSA, 2021).

Agriculture Risk Coverage and Price Loss Coverage. FSA also manages Agriculture Risk Coverage (ARC) and Price Loss Coverage (PLC). ARC provides farmers an income support tied with historical base acres of covered commodities. When the actual county crop revenue is less than the ARC guarantee, payments are issued for those producers enrolled. On

the other side, producers enrolled on PLC receive payments when the effective price of a covered commodity is less than the respective reference price of that commodity. The effective price is defined as the higher between the market year average price (MYA) and the national average loan rate of the covered commodity (FSA, 2021).

ARC is an income support program and PLC is a price support program. There are 22 commodities that can be covered by farmers. Producers that choose ARC can opt between county level yields (ARC-CO) and individual level yields (ARC-IC). The first takes in consideration the 5 years average MYA price multiplied by the 5 years average county yield. On the other hand, ARC-IC takes in consideration the producer's certified yields rather than county data. The benchmark revenue for ARC-IC is calculated in the same way, 5 years average MYA price multiplied by the producer's certified yield in those 5 years. Both programs use the 5 years preceding to the program year to calculate the benchmark revenue (FSA, 2019).

Whole-Farm Revenue Protection. The Whole-Farm Revenue Protection (WFRP) is administered by the Risk Management Agency and provides farmers an opportunity to secure all commodities in the farm under one insurance policy. One of the requirements to be accepted in the WFRP is to provide 5 consecutive years of a schedule F or a tax form that can substitute it, however if you are a beginning farmer you may qualify by providing only 3 consecutive years of the schedule F or tax form that can be converted into it (RMA, 2019). This insurance program can cover any farm with up to $8.5 million in insured revenue. In case of an unavoidable natural cause during the insured period, WFRP will cover the loss of the insured revenue. In addition, if no disasters occur in a year and the farmer extends his insurance to the following year, WFRP provides carryover loss coverage (RMA, 2019).

WFRP provides coverage for a variety of situations. It protects against the loss of farm revenue from commodities produced during the insured period, commodities bought for resale, all commodities on the farm and it also provides replant coverage for annual crops. The coverage levels vary from 50 to 85 percent depending on the diversification of the farm (RMA, 2019).

Risk Management Benefits

Crane *et al.* (2013) define risk as "the chance of loss or an unfavorable outcome associated with an action" (pg 1). Agriculture is considered a risky operation due to the innumerous uncertainties that might occur. Farmers face production, marketing, financial, legal and human risk. There are multiple sources of risk, therefore each farmer is responsible for their own risk management strategy. Vaccinations and irrigation prevent adverse risks like disease outbreak and droughts, use of insurance transfer the risk to someone else, forward pricing locks the price at a desirable rate for the farmer (Crane *et al.*, 2013). As previously discussed, USDA also tries to manage and diminish risks for farmers through national programs.

Any production activity has a production risk, the major sources of this type of risk are weather variability, pests, diseases, technology, genetics, machinery efficiency, etc. Producers can manage this type of risk by adopting better management practices, diversifying, integrating, adopting new technology or they can transfer the risk to someone else through contracting or insurance (Crane *et al.*, 2013). Controlling and minimizing these risks is key to success of the farm. For many years agriculture risk was synonym of production risk, therefore many improvements were made in this area. Genetically modified organisms that are disease and drought resistant, fertilizers that increase yield, herbicides and insecticides that control weeds

and insects are examples of practices that helped reduce agronomic risks and increase production. In addition, income stability, market security and access to capital can be achieved through contracting (Crane *et al.,* 2013).

Marketing risks consist of events that lead to the different prices received by farmers in exchange for their output or what they pay for their production inputs. Managing marketing risks is fundamental since it is the activity that transforms production into financial success. However, it is necessary a coordination with production, financial, legal and human risk strategies. An integrated risk management will be essential to offset possible losses. There are a variety of marketing tools and it is important for the farmer to become familiar with it. Forward contracting, futures and options markets provide a good way for farmers to secure prices. Selecting the right marketing tool at the right time can increase profits and reduce risk (Crane *et al.*, 2013).

There are four components to financial risks, they are the availability of capital, the ability to meet cash flow demands, the ability to maintain and control equity and lastly, the ability to absorb short-term financial impacts. Monitoring and planning financial transactions can lead to a better flow of operations (Crane *et al.,* 2013).

Measuring financial ratios is important to assess and manage financial risks. To capture the key information about farmers balance sheet, income statement, statement of owner's equity and cash flow statement, a set of financial ratios were identified by the Farm Financial Standard Council. The Council also provides critical zones, if the farmer falls into them, it denotes that they may be struggling to keep operations running. High debt levels lead to higher interest rates when applying for loans, therefore it is crucial to maintain the balance sheet balanced.

Increasing equity provides farmers the opportunity to expand the operation, consequently gaining benefits for their family members and employees (Crane *et al.,* 2013).

Legal risks are correlated with many of the day-to-day activities in the farm. It consists of contracts, business organizations, laws and regulations, liabilities and policies. The source of legal risks relies on disagreement between the parties involved. To avoid this type of risk, the service of an attorney is often necessary. An attorney may be familiar with ownership transferring, but not with marketing contracts, so the farmer needs to look for qualified attorneys for each of the situations taking place to avoid worse case scenarios (Crane *et al.*, 2013).

Human risks can be managed by keeping people involved in the farm safe, satisfied and productive. This is the most difficult risk to manage due to the unpredictable human behavior. Open and effective communication among employers and employees is essential to keep operations going (Crane *et al.*, 2013). Respecting each other and establishing a few rules help to keep the work atmosphere healthy. The success of the farm is dependent on the workers, if they are not satisfied, the operation will not grow. Everyone working together is necessary to grow as a team.

As previous research shows, there are varieties of ways to manage risks in agriculture. Mishra *et al.* (2007) argues that government programs are the primary risk-reducing mechanism for many farmers in the US. Other risk management tools, such as marketing and production contracts, are also important for the farm survival. This research will evaluate the impact of these tools on farm financial ratios to determine which decisions bring a higher return financially.

METHODS

Conceptual Framework

The purpose of this research is to identify management practices that have effect on farmers' financial performance. In order to understand financial measures used in this study, it is important to look at how profit maximization is obtained. The objective of a farm business, equation 1, is to maximize the profit, which is expressed in the following way.

$$\text{Max } \pi = \left[\sum P_i Q_i\right] - \left[\sum C_i\right] \tag{1}$$

Where, π is net farm income, P_i is the output price received by the farmer and Q_i is the output produced. The total revenue depends on the operator's level of education, experience, management ability and price of output. The cost of production is represented by C_i, and it is dependent on quantity produced, the inputs used and the labor (Mishra *et al.,* 2009).

The theoretical models 2-4 provide a basis for estimating farm financial performance. Return on Assets (ROA), Operating Profit Margin (OPM) and Interest Coverage Ratio (ICR) were used in this study to represent measures of financial performance.

$$\text{ROA} = \left(\frac{\text{ADJUSTED NET FARM INCOME FROM OPERATIONS}}{\text{TOTAL ASSETS}}\right) \tag{2}$$

$$\text{OPM} = \left(\frac{\text{ADJUSTED NET FARM INCOME FROM OPERATIONS}}{\text{GROSS REVENUE}}\right) \tag{3}$$

$$\text{ICR} = \left(\frac{\text{ADJUSTED NET FARM INCOME FROM OPERATIONS}}{\text{INTEREST EXPENSE}}\right) \tag{4}$$

Empirical Model

The following models are used to estimate the linear relationship between the financial

ratios rate of return on farm assets (5), operating profit margin (6) and interest coverage ratio (7)

and county farm characteristics.

$$ROA = \beta_0 + \sum \beta_{ij} \Delta_{ij} + \varepsilon_1 \tag{5}$$

$$OPM = \beta_0 + \sum \beta_{ij} \Delta_{ij} + \varepsilon_1 \tag{6}$$

$$ICR = \beta_0 + \sum \beta_{ij} \Delta_{ij} + \varepsilon_1 \tag{7}$$

Where, β_0 is the intercept, β_{ij} is a vector of coefficients to be estimated and Δ_{ij} are a set

of independent variables. For detailed information about the independent variables, see Table 2.

Data

The data used for this study was collected from the National Agricultural Statistics

Services (NASS) Quick Stats Database. NASS is a branch of the United States Department of

Agriculture (USDA) that conducts surveys every year and prepares reports about many aspects

of US' agriculture (USDA, 2021). The Quick Stats allows selection of the dataset by

commodity, location, or time period. It is the most comprehensive tool for acessing agricultural

data. (USDA, 2019).

Several variables were studied in the research and narrowed down to be used in the

regressions. All the variables used in this research are from the 2017 Census of Agriculture

available in the Quick Stats Database, meaning a cross-sectional study where the data are looked

at a specific point in time. The 2017 Census of Agriculture was chosen because it was the most recent and comprehensive year available in the database. Farm level data was not available, therefore, for this study county level data was used for the state of Missouri, which has 114 counties.

The calculation of the dependent variables was a combination of separate numbers found in Quick Stats. All three ratios used in this studytook in consideration net farm income from operations in the numerator, as previously stated. However, the denominators used were a set of different variables. For ROA long-term assets had to be calculated by adding agricultural land and building values and a machinery value. Current assets was not available in Quick Stats, therefore it was estimated by using other available information. A ratio was calculated by dividing county average non-current assets per operation by state average non-current assets. Then, the ratio found for each county was multiplied by the state average current assets to find the current assets for each county. The sum of long-term assets and current assets represents the total assets used for the calculation of the ROA. The denominator in OPM was gross revenue, which was represented by total commodity sales measured in dollars per operation. ICR used interest expense, also measured in dollars per operation, in the denominator.

The list of independent variables was exhaustive, but once the study conducted the step-wise linear regressions some of the selected variables were dropped. For the purpose of this research, only the independent variables used in the three regressions will be presented.

The variable *LT11Prod* was representative of beginning farmers in this study, following the USDA definition of 10 or fewer years operating a farm business to be considered a beginning farmer. The age groups were divided in three, with the first one being representative of young

farmers. The groups are *AgeLT34*, *Age35TO54* and *AgeGE55*, respectively, age less than 34 years, age from 35 to 54 years and age greater or equal 55 years.

Representative of education was the variable *EducMoreHS*, meaning education more than High School. This variable is measured in percentage by county, and it takes in consideration the entire population, not only farmers. This was the only variable used in this study that did not come from NASS Quick Stats Database, instead, it was found on the Census Bureau's American Community Survey and it was a 5 year average for the years 2015 to 2019.

FemalePercent was a calculation of the number of female principal producers over the total number of producers, then multiplied by 100. Similarly, *PercentHobby* was calculated by multiplying the ratio of hobby farms by 100. Hobby farms are considered farms where farming is not the primary occupation of the producer. Another variable used as a percentage was *PercentSalesCrop*, which was a representative of diversification of the farm and was calculated by dividing the crop sales over the total commodity sales, then multiplied by 100.

The variable *Size* was represented in this study by the number of cropland acres harvested. The business organizations were represented as *SolProp*, *LLC*, *Partn* and *Corp*, meaning Sole Proprietorship, Limited Liability Company, Partnership and Corporations respectively.

GovtProgFed represented the federal government programs receipts received by the farmers measured in dollars per operation. *PercentCropOpIns* was the percentage of operations that have crop insurance and it was calculated by dividing the number of operations with crop insurance by the number of total operations, then multiplied by 100. Another variable used as a management strategy for land use was cover crops. It was shown as *CoverCrop*, and it was measured in acres per operation. *PercentOpInternet* was the percentage of operations with

access to internet, calculated as the number of farms with internet divided by the number of total operations, multiplied by 100. Lastly, binary variables were created for the Agricultural Districts of Missouri to test regional differences. There are 9 districts in the state and they are represented in this study by the variables *AgDist10* to *AgDist90*. Please refer to Figure 1 to see where each district is located.

The study used the method of Ordinary Least Squares (OLS), which is one of the most powerful and popular methods of regression analysis due to its attractive statistical properties (Gujarati, 2004). OLS chooses the β coefficients in a manner that the sum of residuals is as small as possible. The residuals are the difference between the actual and estimated values of Y (Gujarati, 2004). Another tool used in the study was the stepwise regression method. This method is an automatic procedure that adds or removes variables with concerns of correlation based on their p-values (Akpojaro and Ekerikevwek, 2020). The reference p-value used in this study was 0.33. There are different approaches for stepwise, the regressions in this study used the forward selection, where the model starts with no variables and the software tests the addition of variables one by one. If there is a statistically significant improvement, the variable is added, otherwise it is dropped (Akpojaro and Ekerikevwek, 2020).

Forward stepwise was used because the variables chosen for this research presented collinearity issues. However, there are a few controversial points from using this method that must be noted. Akpojaro and Ekerikevwek (2020) states that possible occurrence of incorrect results, inherent bias in the process and significant computing power to develop complex regression models through iteration are a few of the drawbacks from stepwise.

In the OLS model, a few assumptions need to be taken in consideration. One of them is that the model does not show heteroskedasticity. The term is usually defined as a variation of the

phrase "non-constant error variance" (Astivia and Zumbo, 2019). Heteroskedasticity can be explained as situations where the variance of the residuals is not uniform across the variables used in the regression (Corporate Finance Institute, 2021). When a model is heteroskedastic, it causes the coefficient estimates to be less precise due to biased variance estimators. In short, the conclusions drawn may be misleading if heteroskedasticity is not solved (Gujarati, 2004). To solve it, it is necessary to analyze each variable and make a few transformations, such as variable log transformations, weighted regressions or redefining variables. For the purpose of this study, the long process to resolve heteroskedasticity was not viable.

RESULTS AND DISCUSSION

The objective of this study is to analyze farm business decisions and their effect on financial performance of beginning farmers. The purpose is to aid these farmers with knowledge of management practices that tend to provide a better return financially. Three linear regressions were used based on the data available in NASS Quick Stats for the 2017 Census of Agriculture. The program used in this research to run the regressions was STATA, 7th version, using the forwards stepwise method with a set p-value of 0.33. Variables with higher p-values were dropped automatically. The results obtained are discussed separetely in the next sections. The descriptive statistics can be found on Table 3.

Return on Assets (ROA) Results

Return on Assets representeded the return on capital invested in the business and can be compared to the ROAs of similar farms and past ROAs for the same farm (Kay *et al.,* 2016). This study takes in consideration Interest Expense for ROA calculations, therefore, it measures the profit before the effects of leverage are considered. It can be interpreted by the net margin generated by each dollar of assets before those providing debt capital are paid (Ginder *et al.,* 2001). Farms with higher ROAs are generally in a better financial position.

The descriptive statistics show a mean of 0.0216 Return on Assets for Missouri counties, meaning that 2.16% of the capital invested is turned into profits as an average in the state. For ROA, 6, out of the 26 chosen variables, were dropped. *GovtProgFed*, *PercentOpCropIns*, and *AgDist10*, *AgDist20* and *AgDist50* were among these variables. The variable *AgDist90* was dropped automatically to avoid dummy variable trap.

The final model shows an adjusted R-squared of 0.5218, meaning that the variation in the independent variables explained 52.18% of the change in the average ROA among counties across Missouri. The significance for the overall model is explained by the F-test, which was higher than the critical value of F in this model, meaning that the overall model and its coefficients are significant and different than 0. Unfortunately, STATA noted heteroskedasticity problems with the model when performed the Breusch-Pagan/Cook-Weisberg test. Therefore, it is important to recognize that the results of the regression model may have precision issues. However, it was found consistent results following previous literature, which indicates that this study's results may have not been effected by the presence of heteroskedasticity.

Several variables were found to be significant at the 10%, 5% and even at the 1% level in the regression. Counties with farms operated by farmers that are less than 34 years old, representing young farmers, was found negatively correlated to return on assets, consequently these counties tend to have weaker ROA. That means younger farmers tend to have inadequate experience and resources to operate the farms efficiently compared to their counterparts. Similarly, counties with average age greater than 55 years were negative correlated to the ratio in this study. A plausible reason for this finding is that older operators are entering the farming business after retirement from other occupation and lacking experience in this field to be profitable in the beginning of operations. Which is consistent with the variable representing beginning farmers, *LT11Prod*. It was significant at the 5% level and showed the expected sign. Counties with a higher number of beginning farmers tend to have weaker return on assets. On the other side, the age group representing more experienced farmers, *Age35TO54* is positively correlated to ROA and significant at the 5% level, meaning that middle aged farmers tend to be more profitable due their higher experience accumulated throughout the years.

When analyzing the gender of the principal operator, it was found at the 10% level of significance that the higher the percentage of female operators in the county, the weaker the ROA. That means that female principal operators tend to have weaker return on assets when compared to their counterpart. Another variable that reduces return on assets was the measurement of diversification in this study, *PercentSalesCrop*. It was significant at the 1% level and can be explained as the higher the percentage of crop sales to total commodity sales in a county, the weaker the ROA, which can be explained by the fact that more row crops require more assets, hence reducing the return on assets. On the other hand, the higher the percentage of hobby farms by county, the stronger the return on assets. A possible explanation might be that hooby farms tend to have less total assets, therefore increasing the ROA. These findings are consistent with the study by Mishra *et al.* in 2009.

Out of the 4 types of business organizations, 3 of them were found significant at the 1% level. Counties with higher number of sole proprietors and corporations are likely to have stronger return on assets, while counties with more limited liability companies (LLC) tend to have weaker ROAs. Which can be explained by the fact that sole proprietors have less total assets since they generally operate smaller farms. However LLCs have many different general forms when considering who can be part of an LLC and they are used for both purpose of tax mitigation and limited liability. This structure has the potential for higher asset value with a greater pool of resources as the number of operators/participants increase. The study results show the the weight of the total assets is greater than the returns causing the decrease in return on assets as the number of LLCs increase in a county. Partnerships were not significant in this regression.

For the regionalization variables, southeast region, represented by *AgDist90*, was the reference variable. Hence, the other 8 districts numbers found in the regression are in comparison to District 90. For return on assets, only 4 were statistically significant. *AgDist30* and *AgDist60* were significant at the 10% level and show a positive sign, meaning that in those regions, the ROA is stronger when compared to the southeast district. Similarly, the southwest region, represented by *AgDist70*, showed a positive sign, and it is significant at the 1% level. On the other side, *AgDist80* is significant at the 10% level and shows a negative sign, therefore, representing a weaker ROA when compared to southeast district. The regression results can be found on Table 4.

Operating Profit Margin (OPM) Results

Operating Profit Margin measures the proportion of gross revenue available after all other expenses were paid (Kay *et al.,* 2016). The mean for OPM in this study was 0.2069, in other words, about 20.7% of the gross sales are turned into profits as an average in the state of Missouri. The same stepwise method was used for this regression, and this time there were more variables with p-values higher than 0.33. Therefore, more variables were dropped in the calculation for this ratio.

Among the variables not used in this regression were *AgeLT34*, *Age35TO54*, *EducMoreHS*, *FemalePercent*, *PercentOpInternet*, *CoverCrop* and *Corp*. In addition, the binary variables *AgDist10*, *AgDist20*, *AgDist30*, *AgDist40*, *AgDist50*, *AgDist60*, *AgDist80* and *AgDist90* were also dropped, leaving the final OPM regression with 11 variables and an adjusted R-squared of 0.5654. The 11 variables explain 56.54% of variation in the county operational profit margin of farms in Missouri. The F-test showed again a value above the critical value of

F, meaning that the overall model is significant and its coefficients are different than 0. Once again, the Breush-Pagan/Cook-Weisberg test for heteroskedasticity was performed and the regression for OPM does not show uniform variation in the residuals, meaning that there is heteroskedasticity and the results may be misleading. However, the final results were consistent across the three models in this study and with previous literature, which indicates that the presence of heteroskedasticity may have not effected the precision of the coefficients.

There were 7 statistically significant variables in this model. Counties with higher number of producers in the age group 55 years or older was significant at 1% level and is negatively correlated to OPM, similar to what was seen in the ROA results. That means producers above the age 55 are having profitability issues, similar to what was found in the ROA model. The variable representing beginning farmers, *LT11Prod*, was also significant at the 1% level and showed a negative correlation to operating profit margin, meaning that counties with higher number of beginning farmers show a weaker operating profit margin, similar to what was found in previous literature.

PercentHobby shows a positive sign, meaning that the higher the percentage of hobby farms in the county, the stronger the operating profit. This variable was significant at the 10% level. A plausible explanation for this finding is that farms with few operating expenses, which would be the case for a hobby farm, will generally show a higher OPM ratio (Kay *et al.,* 2016). In the variables representing business organizations, three of them were significant at the 1% level. *SolProp* and *Partn* are positively correlated to operating margin and *LLC* is negatively correlated, which can be explained by the fact that LLCs generally have more people involved in the decision making, thus creating a potential for inconsistency in operating decisions and also increased pool of asset resources. Lastly, the only binary variable used, *AgDist70,* representing

the southwest region, was significant at the 5% level and showed a stronger OPM when compared to the southeast region, which was the reference variable in this study. The regression coefficients can be found on Table 4.

Interest Coverage Ratio (ICR) Results

Interest Coverage Ratio represents the number of times that interest expense can be paid from net farm income from operations. A ratio of 2.5 would be considered a good level and indicates a good repayment capacity (Ginder *et al.,* 2001). The mean for ICR in this study was 2.09, indicating that the state of Missouri as an average is in a good level for this ratio.

Just like the previous two models, this one used a stepwise tool in STATA with a p-value of 0.33 as reference. It dropped 7 variables of the 26 chosen previously. *EducMoreHS* and *Size* plus the binary variables *AgDist10*, *AgDist30*, *AgDist50*, *AgDist80* and *AgDist90* were among the variables not used by the software. The adjusted R-squared was the highest out of the three models in this study with a value of 0.7414, meaning that the final model explains 74.14% of variation in the interest coverage ratio in the state. The F-test indicated that the overall model is significant due the higher F-stat value when compared to the F critical value. In addition, after the Breush-Pagan/Cook-Weisberg test, it was not detected heteroskedasticity in the model. The regression results can be found on Table 4.

Once again, *AgeGE55* was statistically significant at the 1% level and showed a negative correlation with the ratio. The variable for beginning farmers was significant at the 5% level this time and showed the expected sign. Counties with higher numbers of beginning farmers tend to have a weaker ICR when compared to counties with higher number of established farmers. Female percentage was significant at the 1% level and is negatively correlated to interest

coverage, meaning that counties with higher percentage of female producers generally have weaker ICR. That means, female producers might be having additional trouble with repayment capacity when compared to their counterparts.

All 4 variables of business organizations were significant in this model. Sole Proprietorship present a 1% level of significance and a positive correlation to ICR, meaning that sole proprietors have shown a strong financial performance. Partnership, Corporations and LLC were significant at the 5% level, with the first two being positively related to ICR and the latter being negatively related to the ratio once again. The connection between negative correlation and counties with higher number of LLCs follows previous discussion.

The measure of diversification was significant for this ratio at the 1% level and had a negative sign, representing that counties with more variety of products to sell tend to have a stronger ICR. On the other side, counties that show a higher usage of cover crops have stronger interest coverage ratio with a 1% level of significance. In addition, the higher the percentage of operations with crop insurance by county, the stronger the interest coverage ratio. The variable representing crop insurance was also significant at the 1% level. That means, cover crops usage as a risk management strategy to protect the soil also brings a stronger return financially. Enrollment in crop insurance also provides a stronger repayment capacity for farmers who take advantage of it.

In the binary variables results for interest coverage ratio, southwest region was the only significant variable in the study. It showed a positive sign, meaning once again that this region presents a stronger financial position for the ratios used in this research when compared to the southeast region.

CONCLUSION

This study showed the importance of the next generation of farmers due to the increasingly world population. To meet the estimated food needs, producers are needed to enter and stay in business. This research fills a gap in the literature by exploring factors that have statistically significant impact on financial performance of farms using county level data for Missouri.

The study chose three financial ratios based on the data available on NASS' Quick Stats. It identified significant variables affecting profitability (ROA and OPM) and repayment capacity (ICR). Counties with more producers in the age group 55 years and older tend to have weaker financial performance on the ratios measures in this research, this variable was significant across all three ratios calculated. Counties with higher percentage of women producers was significant for the interest coverage ratio and presents a weaker level of repayment capacity.

A very important result found in this study that is consistent with previous literature was the variable representing beginning farmers. Counties with more producers that recently started farming have weaker return on assets, operating profit margin and interest coverage ratio. Another interesting finding was the variable percentage of hobby farms by county, which represents the operations where farming is not the primary occupation . It shows a stronger ROA and OPM in these locations. On the other hand, less diversification reduces return on assets and interest coverage ratio, meaning that producers should think about diversifying their farms sales to achieve a stronger financial position.

Other farm business decisions that were found significant in the research were use of cover crops and crop insurance. Counties with higher percentage of operations with crop

insurance show a stronger repayment capacity and counties with more acreage of cover crops planted by operation also have a stronger interest coverage ratio. The regionalization binary variables showed one district more significant for the regressions than the others. The southwest district was significant across all three ratios and has a better financial performance when compared to the reference district, southeast.

When analyzed the business organizations, sole proprietorships and limited liability companies were significant across the three models, with counties with more sole proprietorships having a stronger performance and LLCs having weaker ratios. Counties with more partnerships have a stronger operating profit margin and interest coverage ratio. Lastly, counties with higher number of corporations show a stronger return on assets and interest coverage ratio.

The study has interesting findings but presents a few limitations that can be studied more in depth in future research. The ICR model was the best among these regressions, showing no heteroskedasticity. Although the models for return on assets and operating profit margin showed heteroskedasticity, it was noted a consistency in the coefficients across the variables for the three models, meaning that even with non-uniform variance in the variables for the first two regression, we can say that the results might not be misleading. In addition, this study had data limitations and used county level numbers. By using county data instead of farm level data, the variability presented across different farms is lost, thus some relationships may not be captured. However, the three models can be used by plugging farm level data in next studies to see similarities between the county average and the actual numbers by farms. Finally, the data available on Quick Stats was limited and some adjustments were made in this research. More variables can be used in the model if the Agricultural Resource Management Survey (ARMS) data could be accessed, such as different government programs and their effect on financial

performance. This study hopes to serve as a tool to future research on this important topic to provide beginning farmers the knowledge about which farm decisions are better to their new operations and facilitate their functioning.

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Table 1: Age breakdown in the United States

	Established farmers	Beginning farmers
Less than 35 years	7%	22%
35 to 44 years	10%	22%
45 to 54 years	18%	21%
More than 55 years	65%	35%

Table 2: Independent Variables

Variables	Explanation
AgeLT34	Number of principal producers who are under the age of 34
Age35TO54	Number of principal producers who are in between 35 and 54 years old
AgeGE55	Number of principal producers with 55 years or more
EducMoreHS	Percentage of the Missouri Counties' population with education higher than High School
FemalePercent	Percentage of female producers
PercentHobby	Percentage of farms where farming is not the main occupation
Size	Cropland acres harvested
PercentSalesCrop	Percentage of crop sales over total commodity sales, representing diversification
PercentOpInternet	Percentage of operations with access to internet
GovtProgFed	Government Programs payments measured in $/operation
PercentOpCropIns	Percentage of operations with Crop Insurance
CoverCrop	Cover Crop planted measured in acres per operation
SolProp	Sole Proprietorship operations
LLC	Limited Liability Companies operations
Partn	Partnership operations
Corp	Corporation operations
LT11Prod	Number of producers with less than 11 years on any operation, representing Beginning Farmers
AgDist10	Missouri's Agricultural District 10
AgDist20	Missouri's Agricultural District 20
AgDist30	Missouri's Agricultural District 30
AgDist40	Missouri's Agricultural District 40
AgDist50	Missouri's Agricultural District 50
AgDist60	Missouri's Agricultural District 60
AgDist70	Missouri's Agricultural District 70
AgDist80	Missouri's Agricultural District 80
AgDist90*	Missouri's Agricultural District 90

Notes: *Reference binary variable

Table 3: Descriptive Statistics

Variables	Mean	Standard Deviation
ROA	0.0216	0.0174
OPM	0.2069	0.1456
ICR	2.094	1.745
AgeLT34	96.66	58.04
Age35TO54	323.2	158.64
AgeGE55	723.6	318.06
EducMoreHS	47.12	8.79
FemalePercent	27.53	4.1
PercentHobby	41.69	45.04
Size	118300.7	86649.98
PercentSalesCrop	46.92	30
PercentOpInternet	72.72	4.87
GovtProgFed	9674.93	8448.11
PercentOpCropIns	19.31	16.7
CoverCrop	126.94	140.77
SolProp	805.49	372.89
LLC	51.45	29.36
Partn	43.89	22.27
Corp	28.54	15.51
LT11Prod	363.3	190.13
AgDist10	0.13	0.34
AgDist20	0.11	0.308
AgDist30	0.09	0.284
AgDist40	0.08	0.271
AgDist50	0.18	0.382
AgDist60	0.11	0.319
AgDist70	0.09	0.284
AgDist80	0.15	0.358
AgDist90	0.07	0.257

Table 4: Regression Results

Variable	Return on Assets (ROA)	Operating Profit Margin (OPM)	Interest Coverage Ratio (ICR)
Constant	0.0177	0.167***	2.107
	(0.0303)	(0.046)	(1.97)
AgeLT34	-0.000107*	-	-0.00538
	(0.00005)	-	(0.0037)
Age35TO54	6.32e-05**	-	0.00219
	(0.00003)	-	(0.00205)
AgeGE55	-6.51e-05***	-0.000247***	-0.00421***
	(0.00002)	(0.00009)	(0.00117)
EducMoreHS	-0.000284	-	-
	(0.00023)	-	-
FemalePercent	-0.000931*	-	-0.111***
	(0.00052)	-	(0.0401)
PercentHobby	0.000140*	0.000787*	0.00766
	(0.00008)	(0.00047)	(0.00556)
Size	3.84E-08	3.95E-07	-
	(0.0000)	(0.0000)	-
PercentSalesCrop	-0.000284***	0.00065	-0.0252***
	(0.00008)	(0.00051)	(0.00621)
PercentOpInternet	0.000607	-	0.0279
	(0.00038)	-	(0.0232)
GovtProgFed	-	-2.11E-06	3.74E-05
	-	(0.0000)	(0.00002)
PercentOpCropIns	-	0.000472	0.0432***
	-	(0.0014)	(0.0143)
CoverCrop	1.71E-05	-	0.00428***
	(0.00002)	-	(0.00134)
SolProp	7.15e-05***	0.000389***	0.00458***
	(0.00002)	(0.00012)	(0.00125)

Table 4 Continued: Regression Results

Variable	Return on Assets (ROA)	Operating Profit Margin (OPM)	Interest Coverage Ratio (ICR)
LLC	-0.000384***	-0.00263***	-0.0216**
	(0.00011)	(0.00065)	(0.00829)
Partn	0.000227	0.00268***	0.0227**
	(0.00014)	(0.0008)	(0.00957)
Corp	0.000340***	-	0.0190**
	(0.00012)	-	(0.00896)
LT11Prod	-6.72e-05**	-0.000487***	-0.00372**
	(0.00003)	(0.00016)	(0.00186)
AgDist10	-	-	-
	-	-	-
AgDist20	-	-	0.446
	-	-	(0.319)
AgDist30	0.00936*	-	-
	(0.00517)	-	-
AgDist40	0.00697	-	0.559
	(0.00563)	-	(0.383)
AgDist50	-	-	-
	-	-	-
AgDist60	0.0100*	-	0.527
	(0.00514)	-	(0.347)
AgDist70	0.0188***	0.0798**	1.480***
	(0.00534)	(0.0324)	(0.354)
AgDist80	-0.00952*	-	-
	(0.00522)	-	-
AgDist90	-	-	-
	-	-	-
Observations	93	93	93
Adjusted R-squared	0.5218	0.5654	0.7414

Notes: *** Significance at the 1% level (p<0.01), ** Significance at the 5% level (p<0.05), * Significance at the 10% level (p<0.1). Standard errors in parentheses.
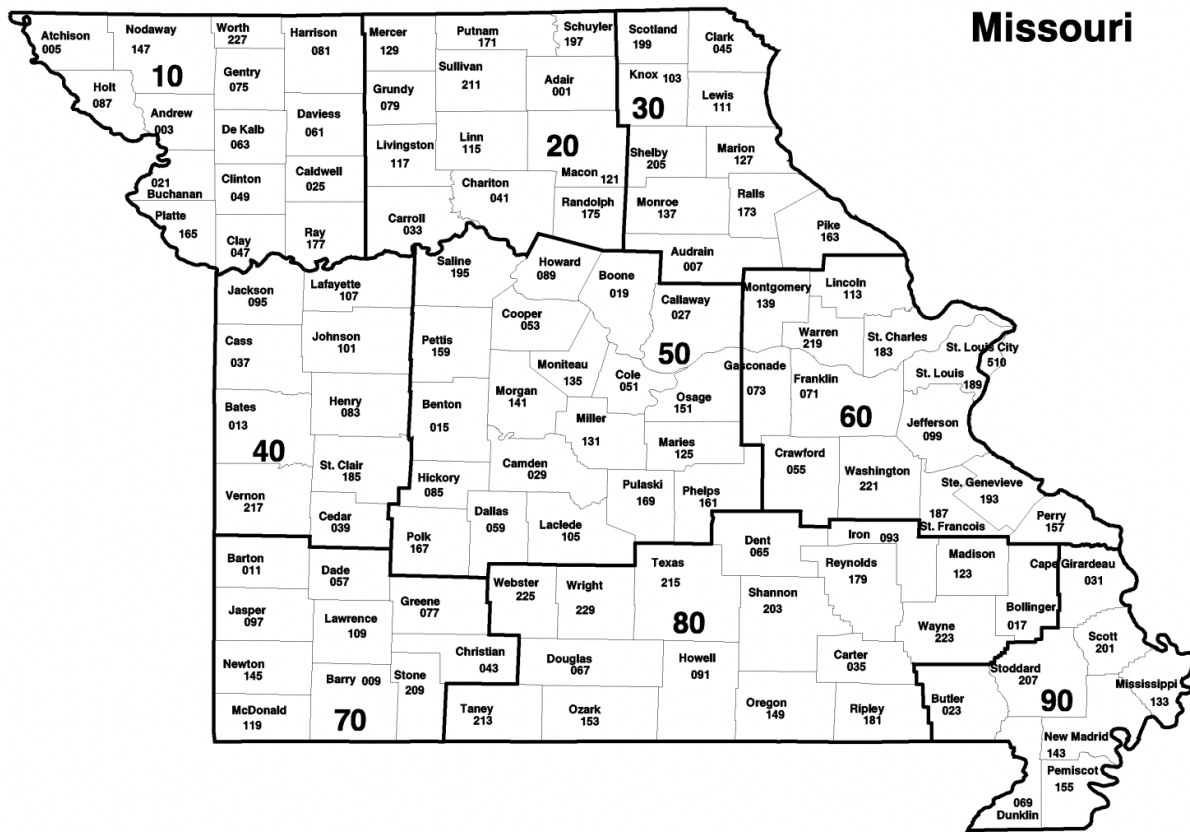
Figure 1: Missouri Agricultural Districts
Source: USDA