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Evaluating the Impact of Off-Farm Decisions on Federal Government Program Utilization and Financial Success for Missouri's Beginning Farmers

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EVALUATING THE IMPACT OF OFF-FARM DECISIONS ON FEDERAL GOVERNMENT PROGRAM UTILIZATION AND FINANCIAL SUCCESS FOR MISSOURI'S BEGINNING FARMERS

A Master's Thesis

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In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Agriculture

By

Lyndsey Ann Parker

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ABSTRACT

Farmers and ranchers will have to increase production by approximately 70% by the year 2050 according to the American Farm Bureau Federation (2017). People in the agriculture industry face several challenges from start-up costs to limited land availability (Ahearn, 2011). There are federal and state government programs available to assist with some of these challenges but bring their own hardships as well. This study measures off-farm decisions that affect financial performance and utilization of government programs for Missouri's farmers and ranchers. Three types of financial performance of Missouri farms are prioritized in this study, liquidity (current ratio), solvency (debt-to-asset ratio), and profitability (rate of return on assets). In addition, government payments received were evaluated as a dependent variable in this study to explore what factors affect the level of payments received by beginning and all Missouri farmers. Using data from the 2019 Agricultural Resource Management Survey (ARMS) for the state of Missouri, several significant results were found. Government payments received and the having an experienced operator displayed better financial performance. Farmers choosing to work off-farm for health benefits, retirement benefits, and income reasons compared to those that did not result in less government payments received. Overall, the results of this study provide valuable information for those involved in the agriculture industry today, tomorrow, and in the future.

K**EYWORDS**: beginning farmers and ranchers, Missouri, financial performance, government programs, marginal effect, farmer challenges, off-farm decisions

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INTRODUCTION

One farmer can feed on average 166 people, according to the American Farm Bureau Federation (2017). It is estimated the 2050 world population will increase by 2.2 billion to approximately 9.7 billion people (American Farm Bureau Federation, 2017). To meet the needs of that increasing population, farmers and ranchers will have to increase production by approximately 70% (American Farm Bureau Federation, 2017).

There are many aspects that go into farmers and ranchers having the ability to increase production. In the agriculture industry, knowledge and experience are important for the success of an operation. There are several challenges farmers and ranchers face every day. Some of those challenges include increasing production, rising input costs, accessing capital, technology upgrades, and continuing education.

Farming and ranching are capital and labor-intensive and often force individuals in the industry to find alternative ways to address financial challenges that arise. These financial challenges can begin as soon as producers enter the industry. Some of these challenges include having access to capital when considering an investment, such as the purchase or improvement of land. Pointedly, the price of non-irrigated Missouri cropland in 2021 averaged $6,326 per acre compared to the 2017 average of $4,877 per acre (Johnson, 2021) and is likely to continue increasing. As land prices increase, having access to capital could become even more challenging and critical.

Although challenges for farmers and ranchers exist, there are government programs designed to assist producers in their day-to-day operations. Many programs aim to help producers particularly in the first 10 years of operation. For example, the Farm Service Agency

(FSA) has programs to aid in start-up costs, improvements, and productivity geared toward beginning farmers. Previous research has shown many beginning farmers have used off-farm income to diversify income streams (Mishra et al., 2009) and address risk in farming (Mishra and Goodwin, 1997) while also securing access to health insurance (Liu et al.,2019). However, it was found in some cases that extra income itself becomes a barrier to government program utilization (Travlos, 2019) while not fully addressing the needs of producers in those challenging first 10 years of production.

This study examines the role farmers' off-farm decisions (such as off-farm income, education, etc.) have on the financial stress and profitability of the farm as well as their utilization of government programs, The results from this study provide insight into additional conditions that could be considered for future federal government programs to provide improved opportunities for Missouri's young and beginning farmers and ranchers for generations to come.

LITERATURE REVIEW

According to the United States Department of Agriculture (USDA), a beginning farmer is defined as someone who has operated a farm or ranch for less than 10 years (Ahearn, 2009). Furthermore, the USDA defines a farm as, "…any place that produced and sold – or normally would have produced and sold – at least $1,000 of agricultural products during a given year" (Ahearn, 2009). Beginning farmers may face many obstacles getting their operation running, including high startup costs, limited land availability (Ahearn, 2011), education (Trede and Whitaker, 2000), insurance costs (Bulut, 2017), and access to credit (Ololade and Olagunju, 2013). Many studies have reported beginning farmers tend to be younger than established farmers and they operate smaller farms or ranches. According to the 2017 Census data, 36.41% of all farmers in Missouri were 65 and above while only 12.17% of beginning Missouri farmers are 65 and above (USDA, 2019). This information supports the important role in agriculture young and beginning farmers will play now and in the future.

Farmers and Ranchers Getting Started

Access to Credit. Agriculture requires a substantial amount of capital as well as land, equipment, and inputs (Susilowati, 2014). Production agriculture also requires non-tangible items such as knowledge, experience, time, labor, and understanding of risk (Kaan, 1998). Beginning farmers face those same agricultural challenges in sometimes more debilitating ways, such as access to credit to even start farming, lack of experience when it comes to methods and production opportunities, and even knowledge of the industry. Finding the right financing is an important step at all stages but can be critical in the first 10 years of an agriculture operation.

However, obtaining those funds can be difficult for young and beginning farmers (Susilowati, 2014).

How to Address Risk in Agriculture. Access to credit for young and beginning farmers is formed by the lender's opinion of the trade-off between risk and return. Many times, beginning and young farmers have a more difficult time accessing credit than established farmers because they are considered a 'risky investment' (Obudzunski, 2016). Having access to credit is essential to developing a strong financial business. Yet, young farmers tend to struggle to get credit especially while carrying educational and other similar debt. In 2021, approximately 42.9 million people in the United States carried student loan debt (Helhoski, 2021). Hansen et al. (2015), reported some people are waiting to start farming because their student loan payments are more than a farming salary would support. It is rare to see farmers have enough funds on hand to purchase equipment, inputs, land, etc. (Grow N.Y.C., 2011). Instead, many times they must access credit to get started (Obudzunski, 2016).

Beginning farmers experience financial risk but also human, legal, marketing, and other production risks daily. As such, these farmers are considered risky investments by both the financial and insurance industries, more so than other farmers with more experience. Farmers must then choose management and operational strategies to make the best use of their operations based on their personal level of risk taking. If farmers are more risk-averse, they are more likely to have an off-farm income (Vergara et al., 2004). A farmer needs to know and understand their attitude towards risk, which will make them more likely to be conscious of the motivations behind the risk decisions they make.

Many things can influence risk, and risk is not always fixed. The same farmer may be risk-averse in some instances, and risk-loving in other situations. Family commitments and

responsibilities can play a large role in risk decisions, as well as the farmer's past experiences.

Farmers also have crop insurance to help mitigate risk and rebound from weather and assist in heavy loss. Crop insurance helps farmers, if needed, repay money to improve or grow the business. Many young and beginning farmers are left underserved because crop insurance premiums can be expensive and the insurance itself is hard to understand. Hansen et al. (2015), noted that:

> For young farmers, especially those who diversify their crops, crop insurance provides limited coverage. Young commodity and row crop farmers have crop insurance policies available, however, they come at a steep cost. Farms without four years of production history must use trend-adjusted yields. This means that young farmers pay more for the same coverage as their more established counterparts. (p.11)

Physical Assets in Agriculture. Starting a farm is not an easy task. Although it is very rewarding, there are a variety of tools and equipment that a farm needs to operate successfully. It can take a while for a beginning or young farmer to accumulate all the essential tools, but there are programs and organizations that can teach skills, handling, operation, as well as even provide funding for tools and equipment (USDA, 2021). Borrowing and leasing equipment is also something beginning and young farmers can take advantage of to save costs. A farmer needs to balance equipment needs while remaining mindful of the overall costs of production.

Some farmers have the time and knowledge needed to run an operation efficiently, but they may not have the support and assistance to ensure the business is effective or efficient. Having outside help such as through a mentor may result in a business that runs more efficiently. "Many farms have two to three operators who specialize in various operations (such as production, marketing, capital management, and human resource management) and are involved

in the day-to-day decision-making process" *(*Mishra et al., 2009). Mishra et al. (2009) examined the financial performance of farmers by using return on assets. The study found management strategies, such as, the number of decision makers on the operation, engaging in value added farming, and having a written business plan could lead to an increase in financial performance as gauged by return on assets. Further results showed younger and more educated new and beginning farm operators had weaker financial positions (Mishra et al., 2009).

Today's farms experience efficiency and productivity thanks to advances in technology. Technology is one factor in agriculture that will continue to grow and be increasingly desirable (Adhikari et al., 2009) . From irrigation tools, to seed, tractors, inputs, and more, farmers and ranchers are challenged to keep up with the constant changes in technology (Adhikari et al., 2009). These technologies help businesses be more profitable, efficient, safer, and even more environmentally friendly (Thatcher et al., 2001). Advanced technologies allow farmers to have safer growing conditions, lower prices with larger production capacity, as well as decrease their use of water, fertilizer, and many other inputs which in turn keeps the price down (Thatcher et al., 2001). Being able to afford this technology may then be increasing important to the farmer overall costs and profitability.

Acquiring Land. Another challenge beginning and young farmers face is getting the opportunity to buy or rent suitable land and having the capital available to acquire land of a large enough scale to be profitable (Ahearn, 2011). When comparing a beginning farmer to an established farmer, beginning farmers are just as likely to own farmland, but they are more likely to have debt associated with that ownership (Ahearn, 2011). Challenges associated with acquiring land adds to a farmer's financial stress.

The average sale price of quality farmland is increasing dramatically compared to previous years (Ahearn, 2011). Online auctions or live one-day auctions are becoming more popular and feasible for many people (Bourron, 2021). Online auctions can reach people from across the United States. Further, one-day auctions add a complication beyond other purchase methods. Unlike established farmers, beginning farmers may not have a relationship built up with their source of credit, which could mean it will be harder for them to be pre-approved for a piece of property or even hear about properties coming up for a quick sale. Farmers may also not be aware of how these auctions run causing them to be unprepared as the bundling of parcels can change once the auction begins. Some credit programs specifically built for beginning farmers and ranchers are not compatible with online or one-day auctions.

Insurance Resources. Insurance coverage in the United States is often viewed as a safety net that is essential for any household. Several Americans receive their health insurance from employer-sponsored program. However, many farmers are self-employed. There is often a concern with the self-employed population having access to affordable insurance (Ahearn et al., 2021). Often a farmer has an off-farm job that not only supplies the household with monetary resources to cover farm and living expenses but health insurance as well (Ahearn et al., 2021).

Education. To overcome industry obstacles, farmers look for educational opportunities, such as continuing education, government programs, certificate programs, and countless others. Technical school, agricultural education programs, certificate programs, or post-secondary education can all be beneficial to anyone but especially to those seeking agricultural work (Yang, 1997). Yang found that higher educated people are more likely to have an improved understanding of decision making, resulting in beneficial outcomes on the farm (Yang, 1997). Many people wish to begin farming but do not know where to begin or even how to correctly

operate the tools and machinery used. There are available programs designed for young and beginning farmers and ranchers, but these farmers are not knowledgeable about the programs and organizations available to them (Travlos, 2019). Travlos (2019) found there was a significant amount of limited program awareness for young and beginning farmers and ranchers. Education is valuable in agriculture because it can allow the farmer to have increased production rates as well as the ability to gather valuable information for their day-to-day operation (Travlos, 2019).

Farmers need ongoing education to stay aware of all the developments in technology, science, business management, and the many other skills that play a role in agriculture operations. Training programs allow farmers to incorporate the latest and greatest advances in technology tools into their operations. On average farmers with a higher level of education managed to operate their farm better than those who were not (Fane, 1975). Continuing education and/or technical education can also benefit farmers. Farm related education taught by extension services, government programs, and other farm-related entities can be a great benefit because it can assist farmers and ranchers with the continuous development of agriculture practices, such as rotational grazing, farm management practices, commodities, and wildlife landscapes, just to name a few.

Off-Farm Work. According to the U.S. Bureau of Labor Statistics (2021), farmers, ranchers, and other agricultural managers work more than 40 hours per week on the farm. Aside from those 40 plus hours worked on the farm, agriculturists usually have an off-farm job they dedicate time to as well. Many farm households dedicate their time to working on- and off-farm. It is believed farmers allocate time for agriculture labor, non-farm labor, and leisure activities to help maintain the family farm's effectiveness. Spending time working on the farm limits the time available for off-farm employment as well as other activities. According to the U.S. Bureau of

Labor Statistics (2021), farmers, ranchers, and other agricultural managers work more than 40 hours per week on the farm. Ultimately, the amount of time spent on farm labor will depend on the type of agriculture enterprise. Additionally, Mishra and Goodwin (1997) found "years of farm experience is a statistically significant determinant of the off-farm labor supply of farmers and their spouses. Confirming expectations, more farming experience corresponds to less work off the farm" (p. 5). When farmers and ranchers understand an operation, it assists them in becoming successful in the industry. Further, having access to government support has been found to decrease the likelihood of off-farm employment (Mirshra et al., 1997).

Government Programs

The following section will discuss government programs created to assist young and beginning farmers with startup costs, insurance benefits, conservation practices, real estate, and even day-to-day operations. There other programs for young and beginning farmers and this should not be considered a complete list of available programs. The programs listed are targeted sources of government funding or support for beginning farmers and ranchers.

Cost-Share Programs. Cost-share programs provide state funding that covers farmers' costs for implementing various improvements. Current programs include the Forestry Incentive Program (FIP), the Agricultural Conservation Program (ACP), the Stewardship Incentives Program (SIP), etc. (Missouri Department of Natural Resources, 2020). Preferential participation programs offer farmers the opportunity to earn payments for actively managing, maintaining, and expanding conservation activities. When farmers and ranchers utilize conservation practices, they are helping keep sustainable agriculture for the future. There are several cost-share programs that offer opportunities that aid in improved water quality, increased production, and

land preservation. One goal of cost-share programs is to conserve soil, which then improves water quality by reducing sedimentation in the rivers and streams (Missouri Department of Natural Resources, 2020).

Conservation Based Programs. Environmental concerns are a priority for agriculture. The Conservation Reserve Program (CRP) pays a yearly rental payment in exchange for removing environmentally sensitive land from agricultural production and planting species to improve environmental quality (Farm Service Agency, 2021-b). This is a voluntary program that rewards the farmers for participation. There are specific provisions for beginning farmers such as specialized programs and requirements. The Farm Service Agency (FSA) offers opportunities for beginning farmers to purchase or rent land enrolled in CRP through the Transition Incentives Program (TIP). TIP provides landowners with two additional annual payments on land enrolled in expiring CRP contracts, but they are required to sell or rent this land to a beginning or socially disadvantaged farmer (Farm Service Agency, 2021-b).

Insurance programs. There are also insurance programs for farmers to participate in such as the Beginning Farmer and Rancher Federal Crop Insurance. Insurance programs aid to address problems with risk, expenses, and overall well-being of an operation. This program allows the farmer and rancher to be exempt from paying a large administrative fee for catastrophic and additional coverage policies (USDA Risk Management Agency, 2020). Beginning farmers and ranchers can utilize this program with special consideration to a more limited amount of information known about the land, they can use the previous producer's production history, and still being able to purchase the insurance.

Operational Loans. Operational loans are one of the more popular loans for farmers and ranchers to utilize. These loans are intended for short-term financing, usually to cover day-to-day

operating expenses. These loans provide farmers and ranchers with access to capital. These types of loans are a great way to start up, maintain, and strengthen a farm or ranch. For beginning farmers, the FSA's Direct Farm Operating Loans provide an essential entry into well-managed agriculture production by financing the costs to operate a farm (Farm Service Agency, 2021-c). These loans can help finance the purchase of equipment, seeds, livestock, fertilizer, and other items to help maintain a smooth farm practice. Operating loans can aid beginning farmers in becoming competitive and financially strong by helping to pay for day-to-day operating expenses or family living expenses; assisting in operation diversification; opening doors for opportunities, and much more (Farm Service Agency, 2021-c). Each year Farm Service Agency sets aside a portion of all loan funds for those in their first 10 years of operation for financing beginning farmer and rancher operations (Farm Service Agency, 2021-c).

Real Estate Loans. Real estate loans are one of the more demanded loan programs in agriculture. Real-estate loans can be used to purchase property, homes, buildings, etc. There are many loan programs to help farmers and ranchers secure farmland, homes, improve/expand current operations, or even create land tenures. Two loans used for land purchases or construction projects are USDA Direct Farm Ownership Loans and USDA Direct Farm Ownership Microloans, some of which have a specialized pool of money for beginning farmers and ranchers. The Direct Farm Ownership Loan was created to help eligible farm enterprises purchase/expand family farms, improve/enlarge current operations, or assist in land tenure, as well as increase agricultural productivity (Farm Service Agency, 2021-a). The Direct Farm Ownership Microloans offer the same benefits, but at a lower maximum borrowing amount with reduced paperwork (such as no appraisal needed, no verification of non-farm income unless

required for repayment, and only three years of management experience) (Farm Service Agency, 2021-d).

Factors for Reduced Participation in Government Programs

Some farmers and ranchers struggle to meet all the requirements of government programs. This results in them having challenges or having to find alternative methods to advance their operation. In some cases, beginning farmers have struggled to decipher what was required of them. Further the strict the program requirements can be a deterrent. A common theme found in previous research identified that farmers and ranchers needed more flexible requirements and eligibility across their state and federal programs (Travlos, 2019).

There are several programs to help young and beginning farmers, but there is question as to if those farmers know about them. In agriculture, knowledge and experience is very important to the success of the farm. For beginning farmers to overcome some obstacles in farming they must first overcome the financial barriers. According to Travlos (2019), many of the participants felt there was not enough effort put towards making farmers and ranchers aware of programs available to beginning producers to overcome financial obstacles. One way to help this issue is to further educate those in the agriculture education sector such as extension programs to provide additional outreach.

Education Factor. Previous research has shown having some type of education; high school, college, certificate programs, or any secondary education can be beneficial to the success of farming. There are 38% of farmers with a bachelor's degree, while 32% have a certificate or associate degree, 30% have a high school diploma, and only 1% do not have an education (Sokanu, 2021). Whitt and Todd (2020), and the USDA Economic Research Services estimates

approximately 45% of farmers have an off-farm job. Mishra et al. (2002), noted young and beginning farmers and ranchers and their spouses have more education and because of that are likely to spend more time finding higher-paying jobs outside of farming. Having a higher level of education and receiving a larger income can cause farmers and ranchers to not qualify for some government programs preventing them from starting up or maintaining their farm.

Working off the farm can lead to less time working on the farm resulting in missed opportunities for government programs. Not only can it take time away from farming but working off the farm can disqualify candidates for some government programs, because their income is too high. The United States off-farm average income in 2019 was $68,750 per the USDA (Todd and Whitt, 2020). "Off-farm income refers to the portion of farm household income obtained off the farm, including nonfarm wages and salaries, pensions, and interest income earned by farm families" (Off-Farm Income, 2017). Most U.S. farm households depend on income from both on-farm and off-farm activities (Giri et al., 2021). Farm operators' off-farm employment and off-farm income vary with the size of the farm. The issue occurs when on-farm and off-farm activities compete for time. How a farm operator allocates their time could lead to less efficient production decisions, increased economic performance on and off the farm, and increase or decrease the economic well-being of the household (Fernandez-Cornejo, 2020).

Previous research has shown there are many ways off-farm decisions and operational challenges can affect utilization of government programs and farmers' financial stress. Those challenges farmers face include gaining access to credit (Susilowati, 2014), acquiring proper equipment and suitable land (Ahearn, 2011), gaining knowledge to be successful (Yang, 1997), etc. There are different government programs designated to help farmers and ranchers with some of these challenges in their day-to-day operations. This research will examine the role off-farm

decisions, government payments and other farm and farmer characteristics have on important farm financial measures while exploring at a cursory glance how those measures and factors relate to the level of farm government payments. This research provides a base for financial farm analysis of Missouri farms while contributing to the literature on how Missouri's beginning and established farmers on- and off- farm decisions impact government payments and financial positions.

METHODS

The purpose of this research was to observe and measure the effects of off-farm decisions on measures of financial stress and the utilization of government programs. This study used a quantitative research design. According to Goertzen (2017) "quantitative research methods are concerned with collecting and analyzing data that is structured and can be represented numerically" (p.1). Quantitative research focuses on data that can be measured, answering the 'what' and 'how' of a given situation. By evaluating the effects of off-farm decisions, recommendations could be found for future government programs and/or program improvement.

Variables

Previous studies recognized several important variables of interest for this study. There are five major types of financial analysis but based off previous research (Katchova et al., 2010; Mishra et al., 2009), three types of financial performance of Missouri farms are prioritized in this study. The financial measures cover: liquidity- how easily assets can be converted into cash; solvency- ability to meet long-term debts and financial obligations; and profitability- ability to generate more revenues compared to expenses. In addition, government programs received were also evaluated in this study. Government payments were chosen as a dependent variable as well to evaluate financial performance as it's an important consideration for farm profitability. The dependent variables used in this study are liquidity (current ratio), solvency (debt-to-asset ratio), profitability (return on assets ratio), as well as government payments received, Table 1 describes the dependent variables and how they were calculated.

In addition to the main variables of interest, it is important to consider the demographic variables hypothesized to influence the financial ratios and government programs, such as operator age (Katchova et al., 2010; Mishra et al., 2009), off-farm income (Katchova et al., 2010; Mishra et al., 2009), operator education (Katchova et al., 2010; Mishra et al., 2009), and having a male operator (Katchova et al., 2010). The research focused on basic farm demographic variables, independent variables from previous literature, and independent variables particular to off-farm decisions and financial stress. Table 2 shows descriptions of the independent variables used in the study.

Conceptual Framework

This study aims to identify what off-farm decisions influence farmers' financial performance. The conceptual framework for this research explores the theory of profit maximization. The profit maximizing equation was based off the framework used in the study of Mishra et al. (2009). The objective of profit maximization is explained by the equation (1).

$$\text{Max } \pi = [\Sigma\, P_i Q_i] - [\Sigma C_i] \quad (1)$$

where, π is net farm income, P_i is the output price received by the farm, and Q_i is the output produced for each i farm. Total revenue varies on the farm operator's level of experience, education, price of output, and management ability. C_i represents the cost of production and is dependent on the quantity produced, labor, and inputs used for each i farm (Mishra et al., 2009).

Equations 2-4 serve as a basis for estimating the farm's financial performance based on the theory of profit maximization. The measures of financial performance of surveyed Missouri farmers are represented by the following ratios respectively: current ratio (liquidity), debt-to-asset ratio (solvency), and rate-of-return on assets ratio (ROA) (profitability). The financial

information provided by the Agricultural Resource Management Survey (ARMS) was used to calculate the ratios used for each Missouri operator in this study.

$$\boldsymbol{Current\ Ratio} = \frac{\text{Current Farm Assets}}{\text{Current Farm Liabilities}} \tag{2}$$

$$\boldsymbol{Debt - to - Asset\ Ratio} = \frac{\text{Total Farm Debt}}{\text{Total Farm Assets}} \tag{3}$$

$$\boldsymbol{Rate\ of\ Return\ on\ Assets} = \frac{(\text{Net Farm Income from Operations} + \text{Interest Expense})}{\text{Average Assets}} \tag{4}$$

Data Analysis

This analysis is based on data from the 2019 Agricultural Resource Management Survey (ARMS), which is conducted annually by the U.S. Department of Agriculture. The ARMS data includes detailed information on the financial performance and condition of Missouri farmers. The 2019 Missouri subset survey data included roughly 14,449 observations. A subset of beginning farmers was created. We theorize the effects of the variables of interest are significantly different for beginning farmers when compared to established operators, however, the low number of observations for beginning farmers were being lost due shear number of established operators in the sample. Creating the subset allowed further analysis of the variables of interest and beginning farmers and ranchers in Missouri. The ARMS survey questions cover both self-reported farm characteristics and financial indicators.

Ordinary Least Squares (OLS) regressions were estimated to determine the factors affecting the financial performance for both beginning and all other farmers (which included beginning and established producers). An OLS regression model (6) can be determined in the following way:

$$Y_i = \beta_0 + \beta_1 X_{i^1} + \beta_2 X_{i^2} + \cdots + \beta_k X_{ip} + \varepsilon_i \quad (6)$$

where Y_i is the case i value on the outcome variable, β_0 is the regression constant, X_{ij} is case i score on the jth of p predictor variables in the model, β_j is predictor $j's$ partial regression weight, and ε_i is the error for case i (Hayes and Cai, 2007). Using a matrix notation, Equation 7 can be represented as (7):

$$y = XB + \varepsilon \quad (7)$$

where y is an n x 1 vector of outcome observations, X is an n x (p+1) matrix of predictor variable values (including a column of ones for the regression constant), and ε is an n x 1 vector of errors, where n is the sample size and p is the number of predictor variables (Hayes and Cai, 2007).

The literature explored for this study identified the importance of government payments to financial performance of farmers. As such, an exploratory analysis was completed on how the on- and off-farm decisions and farm and farmer characteristics impact the level of government payments. This contributes to the study and builds on the theory of profit maximization as government payments represents a potential input in production decision making and contributes to financial performance in the base analysis of the financial measures. Equation (5) explains government payments calculation.

$$\boldsymbol{Government\ Payments} = \sum \mathrm{x}_i \quad (5)$$

where x_i are the various government payments available to farmers for all i farmers.

RESULTS

The objective of this study was to analyze the impacts of off-farm decisions on government program utilization and the financial success of beginning farmers. The purpose was to inform farmers and ranchers, of all experience, with the knowledge it takes to utilize government programs and be financially successful. Three linear regression models were used based on the 2019 ARMS data.

For this study, STATA, 7th version, was used to run regressions, using the OLS multiple regression method. Preliminary analyses were conducted testing the null hypothesis that multicollinearity and heteroskedasticity were present. Heteroskedasticity is commonly referred to when the variance of the residuals is unequal over a range of measured values, this usually results in an unequal error term (Astivia and Zumbo, 2019). When present, analysis and transformations are needed to solve these issues.

A correlation matrix was used to view the correlation coefficients between each of the variables in the model to determine correlation concerns pointing to multicollinearity problems. No signs of multicollinearity were discovered. Next, Breusch-Pagan and Cook-Weisberg tests were used to determine if there were heteroskedasticity issues in the models and determined heteroskedasticity was present. To correct the heteroskedasticity issue, log transformations were performed on the dependent variables. After the necessary log transformations and the use of robust standard errors, heteroskedasticity was corrected and no longer detected.

Interpretation of the coefficients was used to evaluate the percent increase or decrease in the response for every one-unit increase in the independent variable. This helped with the interpretation of regression coefficients as a percent change when the outcome is log-scaled.

When measuring monetary values, common dollar increments of $10,000 were used on each variable besides health and/or dental expenses (*EXP_H*) where measurements of $1,000 were used. Monetary values used were based off practical application The interpretation of the coefficients is based on the use of the transformed variables (Ford, 2018). The formula used in this calculation is equation (8).

$$(\varepsilon\exp(\beta) - 1)\ x\ 100\% \tag{8}$$

where, $\varepsilon\exp(\beta)$ is the exponentiate of the coefficient. The results of this study are found in the following sections.

Rate of Return on Assets Regression Results

All Farm Results. There were 4,352 total observations for the all-farm rate of return on asset regression results (ROA). For ROA, the variable *AgDistrict90* was dropped automatically to avoid dummy variable trap. The final model shows an adjusted R-squared of 0.1403, meaning the variation in the independent variables explained 14.03% of the change in the average ROA among all farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Government payments (*IGOVT*) were found to have a significant positive impact at the 1% level on ROA, therefore farmers that received government payments tend to have a higher ROA. A $10,000 increase in government payments resulted in an increase in the ROA by 2.4%.

Farm sales (*FARMSALES*) and having crops as the main source of income (*FarmCrop*) compared to livestock were also found to have a significant positive impact at the 1% level on ROA. Farmers that have farm sales of $1,000+ and have crops as the main source of income

compared to livestock tend to have a higher ROA. A $10,000 increase in farm sales resulted in an increase in the ROA by 0.135%. Having crops as the main source of income rather than livestock resulted in an increase in the ROA by 41.58%.

Similarly, the debt to asset ratio (*ADARAT2*) and having a male principal operator (*MaleOP*) compared to those with a female principal operator were found to have a significant positive impact at the 1% and 5% level on the ROA. As the debt to asset ratio increased by one unit it resulted in an increase in the ROA by 52.867%, while, having a male principal operator rather than a female resulted in an increase in the ROA by 25.79%.

On the contrary, the principal operators' spouse's off-farm income (*EARNED_SP*) had a significant negative impact at the 1% level on ROA. Consequently, farmers that have a spouse that earned off-farm income tended to have a lower ROA. A $10,000 increase in the spouse's off-farm income resulted in a decrease in the ROA by 16%.

As well as spouses' off-farm income, the operator's age (*OP_AGE*) had a significant negative impact at the 1% level on ROA. Therefore, as the farmer's age increased it resulted in a higher ROA. As the age of the principal operator increased by one year it resulted in a decrease in the ROA by 2.725%. Refer to Table 3 for the complete regression results.

Beginning Farmer Results. There were 624 total observations for the beginning farmer ROA regression results. For ROA, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model showed an adjusted R-squared of 0.1515, meaning the variation in the independent variables explained 15.15% of the change in the average ROA among beginning farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Government payments (*IGOVT*) were found to have a significant positive impact at

the 1% level on ROA, therefore the beginning farmers that received government payments tend to have a higher ROA. A $10,000 increase in government payments resulted in an increase in ROA by 1.77%.

Similarly, the debt to asset ratio (*ADARAT2*) and having access to the internet (*Internet*) compared to those that did not have internet were found to have a significant positive impact at the 1% level on the ROA. As the debt to asset ratio increased by one unit, ROA increased by 75.05%. Having access to internet compared to those that did not resulted in an increase in the ROA by 54.46%.

Having crops as the main source of income (*FarmCrop*) compared to livestock was also found to have a significant positive impact at the 1% level on ROA, meaning farmers that have crops as the main source of income tend to have a higher ROA. Having crops as the main source of farm income rather than having livestock as the main source of income resulted in an increase in the ROA by 49.42%.

Having access to the internet (*Internet*) compared to those that did not was also found to have a significant positive impact at the 10% level on ROA, meaning beginning farmers that have access to internet tend to have a higher ROA. Having access to the internet compared to those that did not resulted in an increase in ROA by 54.46%.

However, producing in federal agricultural district 70 (AgDistrict70) compared to all other Missouri ag districts, had a significant negative impact at a 10% level on ROA, meaning the beginning farmers with operations in agricultural district 70 tend to have a lower ROA. The results displayed that having a farm in Missouri's Agricultural District 70 rather than the other ag districts resulted in a decrease in ROA by 33.27% .

Principal operator's age (*OP_AGE*) also had a significant negative impact at a 1% level on the ROA, so as the age of the operator increased the ROA decreased. As the age of the principal operator increased by one year it resulted in a decrease in the ROA by 2.75%. Refer to Table 3 for the complete regression results.

Debt-To-Asset Ratio Regression Results

All Farm Results. There were 9,796 total observations for the all-farm debt-to-asset regression results. For debt-to-asset, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model shows an R-squared of 0.2018, meaning the variation in the independent variables explained 20.18% of the change in the average debt-to-assets among all farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Government payments (*IGOVT*) were found to have a significant positive impact at the 1% level on debt-to-asset ratio, therefore these farmers that received government payments tend to have a higher debt-to-asset ratio. A $10,000 increase in government payments resulted in an increase in the debt-to-asset ratio by 6%.

Having crops as the main source of income (*FarmCrop*) compared to livestock and interest expense (*INTEREXP*) were also found to have a significant positive impact at the 1% level on debt-to-assets, so these farmers that have crops as the main source of income and increasing interest expense tend to have a higher debt-to-asset ratio. Having crops as the main source of farm income rather than having livestock, resulted in an increase in the debt-to-asset ratio by 31.88%, and a $10,000 increase in interest expenses resulted in an increase in the debt-to-asset ratio by 6%.

Similarly, having access to the internet (*Internet*) compared to those that did not and having a male principal operator (*MaleOP*) rather than having a female operator were found to have a significant positive impact at the 1% level on the debt-to-asset ratio. Having access to the internet compared to those that did not have access, resulted in an increase in the debt-to-asset ratio by 112.79%. Having a male principal operator compared to having a female principal operator resulted in an increase in the debt-to-asset ratio by 1%.

The principal operator's education (*OP_EDUC*) and the principal operator's off-farm income (*EARNED_OP*) had a significant negative impact at a 1% and 10% level on debt-to-asset ratio. Therefore, the farmers that have a higher education and off-farm income tend to have a lower debt-to-asset ratio. The results showed that as the education of the principal operator increased it resulted in a decrease in the debt-to-asset ratio by 16.06%, and a $10,000 increase in the principal operator's off-farm income resulted in a decrease in the debt-to-asset ratio by 0.6%.

Principal operators age (*OP_AGE*) and retirement investments (*NFASST_E*) also have a significant negative impact at a 1% and 10% level on the debt-to-asset ratio, so as the age of the operator and retirement investments increase the debt-to-asset ratio is weaker. The results stated that as the age of the principal operator increased by one year it resulted in a decrease in the debt-to-asset ratio by 5.58%. A $10,000 increase in retirement investments resulted in a decrease in the debt-to-asset ratio by 0.14%. Refer to Table 4 for the complete regression results.

Beginning Farmer Results. There were 1,481 total observations for the beginning farmer debt-to-asset regression results. For debt-to-asset, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model shows an adjusted R-squared of 0.2028, meaning that the variation in the independent variables explained 20.28% of the change in the average debt-to-assets among beginning farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Government payments (*IGOVT*) were found to have a significant positive impact at the 1% level on debt-to-asset ratio, therefore these beginning farmers that received government payments tend to have a stronger debt-to-asset ratio. A $10,000 increase in government payments resulted in an increase in the debt-to-asset by 4.8%.

Interest expense (*INTEREXP*) and having access to internet (*Internet*) compared to those that did not have access to the internet were found to have a significant positive impact at the 1% level on debt-to-asset ratio, therefore those beginning farmers that had increasing interest expenses and access to internet tend to have a stronger debt-to-asset ratio. A $10,000 increase in interest expenses resulted in an increase in the debt-to-asset ratio by 8.08%. Also, having access to internet rather than not having access, resulted in an increase in the debt-to-asset ratio by 128.986%.

Having a male principal operator (*MaleOP*) instead of having a female principal operator was found to have a significant positive impact at the 1% level on debt-to-asset ratio. Therefore, the age of the principal operator increases, they tend to have a higher debt-to-asset ratio. Having a male principal operator compared to having a female operator resulted in an increase in the debt-to-asset ratio by 161.628%.

However, principal operator's education (*OP_EDUC*) and the age of the principal operator (*OP_AGE*) have a significant negative impact at a 1% level on the debt-to-asset ratio, so as the principal operator's education and age increase it tends to result in a lower debt-to-asset ratio. As the education of the principal operator increased it resulted in a decrease in the debt-to-asset ratio by 26.179%, and as the age of the principal operator increased it resulted in a decrease in the debt-to-asset ratio by 4.955%.

The principal operator's off-farm income (*EARNED_OP*) also has a significant negative impact at a 1% level on the debt-to-asset ratio, so when a farmers off-farm income increased it results in a lower debt-to-asset ratio. A $10,000 increase in the principal operator's off-farm income resulted in a decrease in the debt-to-asset ratio by 2.23%. Refer to Table 4 for the complete regression results.

Current Ratio Regression Results

All Farm Results. There were 9,079 total observations for the all-farm current ratio regression results. For current ratio, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model shows a R-squared of 0.0559, meaning that the variation in the independent variables explained 5.59% of the change in the average current ratio among all farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Farm sales (*FARMSALES*) were found to have a significant positive impact at the 1% level on the current ratio, therefore these farmers that had farm sales of $1,000+ tend to have a stronger current ratio. A $10,000 increase in the farm sales resulted in an increase in the debt-to-asset ratio by 6%.

The age of the principal operator (*OP_AGE*) and insurance expense (*EFINS*) were also found to have a significant positive impact at the 1% level on the current ratio, so as the age of the principal operator and insurance expenses increase it results in a higher current ratio. As the age of the principal operator increased by one year it resulted in an increase in the current ratio by 27.79%. Further, a $10,000 increase in insurance expenses resulted in an increase in the current ratio by 5%.

Retirement investments (*NFASST_E*) were found to have a significant positive impact at the 5% level on the current ratio, so those that had higher retirement investments, such as 401k, IRA, and other retirement accounts tend to have a higher current ratio. A $10,000 increase in retirement investments resulted in an increase in the current ratio by 0.149%.

On the contrary, government payments (*IGOVT*) and having crops as the main source of income (*FarmCrop*) compared to having livestock as the main source, were found to have a significant negative impact at the 1% level on the current ratio, so if the farmer has increasing government payments and crops as the main source of income it results in a lower current ratio. A $10,000 increase in government payments resulted in a decrease in the current ratio by 1.57% and having crops as the main source of income rather than having livestock resulted in a decrease in the current ratio by 45.34%.

Interest expense (*INTEREXP*) and having access to the internet (*Internet*) compared to those that did not have access was found to have a significant negative impact at the 1% level on the current ratio, therefore as interest expenses increased and having access to internet resulted in having a lower current ratio. A $10,000 increase in interest expenses resulted in a decrease in the current ratio by 4% and having access to internet rather than not having access resulted in a decrease in the current ratio by 16.87%. Refer to Table 5 for the complete regression results.

Beginning Farmer Results. There were 1,348 total observations for the beginning farmer current ratio regression results. For current ratio, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model shows a R-squared of 0.0594, meaning that the variation in the independent variables explained 5.94% of the change in the average current ratio among beginning farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Principal operator's education (*OP_EDUC*) and age of the principal operator (*OP_AGE*) were found to have a significant positive impact at the 10% level on the current ratio, so as the age and education of the principal operator increased it tends to result in a higher current ratio. As the education of the principal operator increases it resulted in an increase in the current ratio by 13.448%, and as the age of the principal operator increased by one year it resulted in an increase in the current ratio by 1.22%.

Insurance expenses (*EFINS*) were also found to have a significant positive impact at the 1% level on the current ratio, therefore increasing insurance expenses tends to have a stronger impact on the current ratio. A $10,000 increase in insurance expenses resulted in an increase in the current ratio by 4.5%.

However, having crops as the main source of income (*FarmCrop*) compared to those that have livestock and having access to the internet (*Internet*) rather than not having access had significant negative impacts at the 1% and 10% level on the current ratio, so having crops as the main source of income and having access to the internet tend to have a lower current ratio. Having crops as the main source of income rather than having livestock resulted in a decrease in the current ratio by 33.54%. It was also shown that having access to the internet compared to those that did not have access, resulted in a decrease in the current ratio by 32.55%.

Having a male principal operator (*MaleOP*) compared to having a female principal operator and interest expense (*INTEREXP*) were also found to have a significant negative impact at the 5% and 1% level on the current ratio, so having a male principal operator and an increasing interest expense tend to have a lower current ratio. Effects displayed that having a male principal operator rather than a female principal operator resulted in a decrease in the

current ratio by 71.81% and having a $10,000 increase in interest expense resulted in a decrease in the current ratio by 5.9%. Refer to Table 5 for the complete regression results.

Government Payments Regression Results

All Farm Results. There were 1,902 total observations for the all-farm government payment regression results. For government payments, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model shows a R-squared of 0.3284, meaning that the variation in the independent variables explained 32.84% of the change in the average government payment among all farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Debt-To-Asset ratio (*ADARAT2*) and rate of return on assets (*ROA*) were found to have a significant positive impact at the 1% level on government payments, so having a higher debt-to-asset ratio and ROA results in an increase on the government payments received. As the debt-to-asset ratio increased by one unit it resulted in an increase in government payments by 43.40%. It also displayed that as the ROA increased by one unit it resulted in an increase in government payments by 1%.

Principal operator's spouse's education (*SP_EDUC*) and having crops as the main source of income *(FarmCrop*) compared to having livestock, were found to have a significant positive impact at the 5% and 1% level on government payments, so a spouse's education and having crops as the main source of income tend to have a stronger impact on government payments. As a spousal education increased it resulted in an increase in government payments by 8.612%, and when crops were the main source of income rather than livestock it resulted in an increase in government payments by 140.47%.

Interest expenses (*INTEREXP*) and having access to the internet (*Internet*) rather than not having access to the internet, were also found to have a significant positive impact at the 10% and 1% level on government payments, so when interest expenses increase and having access to the internet leads to stronger government payments received. A $10,000 increase in interest expenses resulted in an increase in government payments by 2.15% and having access to the internet compared to having access, resulted in an increase in government payments by 46.08%.

Having a male principal operator (*MaleOP*) instead of a female principal operator, insurance expenses (*EFINS*), and health and/or dental insurance expense (*EXP_H*) have a significant positive impact at the 1% level on government payments. So, when there is a male principal operator, insurance expenses, and increasing health and/or dental expenses it tends to have a stronger impact on government payments received. Effects displayed that having a male principal operator rather than a female principal operator resulted in an increase in government payments by 74.05% and a $10,000 increase in insurance expenses resulted in an increase in government payments by 14%. It was also shown that a $1,000 increase in health and/or dental insurance expenses resulted in an increase in government payments by 1.17%.

However, the current ratio (*CurrentRatio*) was found to have a significant negative impact at the 1% level on government payments, therefore the current ratio decreases government payments increase. An increase in the current ratio by one unit resulted in a decrease in government payments by 0.00287%. The spouse's age (*SP_AGE*) was also found to have a significant negative impact at the 10% level on government payments. Therefore, the spouse's age leads to a decrease in government payments received. As the principal operator's spouse's age increased by one year it resulted in a decrease in government payments by 0.74%.

Choosing to work off the farm for income reasons (*OffFarmBeneIncome*) and choosing to work off the farm for health and retirement benefits (*OffFarmBeneHealthRetire*) compared to those that did not, was found to have a significant negative impact at the 10% and 5% level on government payments. Therefore, working off the farm for income and health and retirement benefits decreased government payments received. Choosing to work off the farm for income reasons compared to those that did not, resulted in a decrease in government payments by 12.74% and choosing to work off the farm for health and retirement benefits compared to those that did not, resulted in a decrease in government payments by 14.78%. Refer to Table 6 for the complete regression results.

Beginning Farmer Results. There were 319 total observations for the beginning farmer government payment regression results. For government payments, the variable *AgDistrict10* was dropped automatically to avoid dummy variable trap. The final model showed an adjusted R-squared of 0.3053, meaning the variation in the independent variables explained 30.53% of the change in the average government payments among beginning farmers across Missouri.

Several variables were found to be significant at the 10%, 5%, and 1% level in the regression. Debt-To-Asset ratio (*ADARAT2*) and the number of established operators (*AnyOpEst*) on the farm were found to have a significant positive impact at the 5% level on government payments, therefore the debt-to-asset ratio and number of established operators increased government payments received. It was found that as the debt-to-asset ratio increased by one unit it resulted in an increase in payments by 30.41% and as the number of established operators on the farm increased it resulted in an increase in payments by 58.74%.

Having crops as the main source of income (*FarmCrop*) compared to those that had livestock and interest expense (*INTEREXP*) were found to have a significant positive impact at

the 1% level, meaning having crops as a main source of income and interest expense increased government payments received. It was found that having crops as the main source of income rather than having livestock resulted in an increase in government payments by 140.197% and a $10,000 increase in interest expenses resulted in an increase in government payments by 6.1%.

Having access to the internet (*Internet*)compared to those that did not, having a male principal operator (*MaleOP*) rather than having a female principal operator and insurance expense (*EFINS*) were all also found to have a significant positive impact. Having access to internet is significant at a 5% level and having a male principal operator and insurance expense are significant at a 1% level. Therefore, having access to the internet, having a male principal operator and insurance expense all individually tend to increase government payments received. It was found that having access to the internet compared to those that did not have access resulted in an increase in government payments by 132.396% and having a male principal operator instead of a female principal operator resulted in an increase in government payments by 297.66%. It was also discovered that a $10,000 increase in insurance expenses resulted in an increase in government payments by 6.79%.

On the contrary, the number of operators (*OP_TOT*) and principal operator's off-farm income (*EARNED_OP*) were found to have a significant negative impact at a 5% and 10% level on government payments, meaning the number of operators and off-farm income decreased the amount of government payments received. Increasing the total number of operators on the farm resulted in a decrease in government payments by 26.271% and a $10,000 increase in the principal operator's off-farm income resulted in a decrease in government payments by 1.68%.

Choosing to work off the farm for access to health and retirement benefits (*OffFarmBeneHealthRetire*) compared to those that did not was found to have a significant

negative impact at the10% level on government payments, meaning when the beginning farmer chose to work off the farm for access to health and retirement benefits it tended to decrease the government payments received. It was found that choosing to work off the farm for health and retirement benefits compared to those that did not, resulted in a decrease in government payments by 30.595%. Refer to Table 6 for the complete regression results.

DISCUSSION

This quantitative study was designed to inform farmers and ranchers, of all experience, with the knowledge it takes to utilize government programs and be financially successful in their operation. The objectives of this research were to analyze the impact of off-farm decisions on financial stress and profitability as well as off-farm decisions and their role on utilization of government programs designed to support beginning producers. For this specific study, research was concentrated on Missouri's beginning farmers and ranchers, all other Missouri farmers and ranchers, and Missourian's utilization of government programs.

Results from this study show the dependent variables had several variables that had a significant positive and/or negative impact. Some of the variables were common in each regression results. This research had three areas of focus to determine financial performance including: *ROA, Current Assets, Debt-To-Asset Ratio,* and *Government Payments*. The following sections will discuss the findings in each section.

ROA

ROA is a measure of financial performance commonly used in literature regarding farm management. It is the ratio of net farm income plus interest payments compared to total assets. Government payments appeared to have a significant positive impact on ROA for both beginning and all farmers alike. In the studies of Mishra et al. (2009) and Katchova et al. (2010) government payments were shown to have a positive significance on ROA and when evaluating. Katchova et al. (2010) concluded government payments are helping farmers improve their financial performance. Our results are consistent with this finding as both beginning and all

farmers receiving government payments results in an increased ROA. Therefore, having a stronger ROA results in farmers and ranchers being more likely to turn their assets into net income. The results indicate farmers and ranchers should be actively pursuing government programs because in return they can purchase assets that aid in the growth of their operation.

For beginning farmers having an operation in agriculture district 70 (see Figure 1) instead of the other Missouri ag districts resulted in a significant negative impact on ROA. From this it is determined that having an operation in agriculture district 70 compared to the other districts in Missouri could result in a weaker ROA and have an impact on the farmer and rancher's financial stress. Agriculture district 70 is in the Southwest part of Missouri where livestock are more common. Having crops as the main source of income was also found to be positively significant on ROA for both beginning farmers and all farmers. This could be because crop farmers have assets that livestock farmers would not, such as equipment and land associated with their operation, so if livestock farmers in agriculture district 70 are less likely to have these assets, they would not have a higher ROA.

The age of the principal operator was shown to have a negative significant impact on both beginning farmer and all farmer results for ROA and the debt-to-asset ratio, but a positive significance on current assets. In Mishra et al. (2009) and Katchova et al. (2010), the variable age was also found to have a negative significance on ROA. Katchova et al. (2010) found older farmers are generally in a better financial condition, having a higher ROA than beginning farmers. Further Mishra et al. (2009) found younger farmers are more likely to have less assets corresponding to a lower financial performance as measured by ROA. Within this study, a potential explanation of this finding is that younger farmers and ranchers have less assets which

results in a weaker ROA whereas older farmers and ranchers are potentially more experienced and knowledgeable in their operation and resources.

The principal operator's spousal off-farm income has a larger role than the operator's off-farm income regarding ROA. The off-farm income earned by the spouse is negatively significant in the regression of all farmers. This means having spousal off-farm income results in a weaker ROA. This could be because the spouse's off-farm income does not play a role in the operation's income and how it is invested into the operation. This could also be related to the finding that when an operator works off the farm, they have less time for the operation in general.

Finally, having access to the internet compared to those that do not, for beginning farmers is shown to have a significantly positive impact on ROA. Internet access plays an important role on financial measures and financial stress, especially for beginning farmers. Internet access is important to farmers because they have access to additional information such as government programs, operational best practices, and educational resources.

Current Ratio

The current ratio is a measure of financial performance used to determine the items an operation uses to produce the products sold. It is the ratio of total current farm assets to the total current farm liabilities. Government payments were found to have a significant negative impact on the current ratio for the all farmers regression results. This is the only regression where government payments are shown to be negatively significant. This could be because as farmers are using government payments to finance additional assets which then lowers the current ratio. Farmers are adding to their total assets but also take on more debt as it is unlikely that

government payments re sufficient to pay outright for capital improvements such as land, buildings, or equipment.

For beginning farmer results and all farmer results, the age of the principal operator is shown to be significantly positive on the current ratio. Therefore, as the age of the operator increases, they are generally in a better financial condition than the younger aged operators. Likely, as a farmer's age increases so does the length of time they have been paying toward any liabilities on their assets. As they pay off their debts compared to the value of their assets, their current ratio will increase. The principal operator's education is also shown to have a significantly positive impact on current ratio for beginning farmers. Having a higher education could lead to a better understanding of how the beginning farmers could run their operation and in return have more assets associated with their operation than liabilities.

Debt-To-Asset Ratio

The debt-to-asset ratio is used to determine the amount of debt an operation has compared to the total assets of the operation. It is the ratio of total farm debt to total farm assets. Having an interest expense, such as on a loan, was found to have a positive significant impact on the debt-to-asset ratio on both beginning and all farmer regression results. This could be because interest payments are a debt when considering debt-to-asset. Government payments were also shown to be positively significant for both beginning and all farmers. This is because government payments allow farmers and ranchers to purchase assets such as equipment, land, etc. Government payments also serve as a source of income for the farmer as well.

Having retirement accounts such as an IRA, Keogh, 401k, and other retirement accounts, was found to be negatively significant on the debt-to-asset ratio regression results.

Retirement accounts are a source of savings for people, but especially for farmers and ranchers. A person puts funds into these accounts to serve as a long-term-asset. Therefore, it is negatively significant because farmers and ranchers are putting funds into these accounts and not getting any current return, although these accounts serve as a long-term investment. Additionally, any investments made into retirement are not being paid toward any outstanding debt.

Government Payments

In considering the importance of government payments as an explanatory variable in the initial analysis, further study was conducted. In an exploratory model, government payments were used as a dependent variable with theorized farm characteristics, operator(s) characteristics, and off-farm choices. The results from this model will help guide future research in this area. The government payments variable was used to determine the amount of government payments received. It is the sum of all government payments received by participants. The number of established operators was found to be positively significant for beginning farmers for government payments received. This could be as a result of beginning farmers having access to established farmers to use as a resource, such as giving them knowledge of government programs, operational resources, and suggestions of production inputs.

Having access to the internet compared to those that did not have access, was found to be positively significant for both beginning farmers and all farmers. Having access to internet gives farmers and ranchers the opportunity to find resources, information, and details on government programs. Having access to the internet is beneficial to all farmers and ranchers because it allows them to have access to many different aspects within the agriculture industry.

CONCLUSION

To meet the future needs of the growing world, farmers and ranchers will have to increase production, remain successful, and operate efficiently. To do that, governmental programs will continue to play a major role in addressing uncertainties in agricultural production and continue to be critical in assisting beginning farmers through the challenges in those first 10 years of operation. This research fills a gap in the literature by exploring the role of on- and off-farm decisions on the utilization of government programs and financial performance of Missouri's beginning and established farmers.

Key Findings

The study chose three measures of financial performance based on the data provided by ARMS. The study identified significant variables affecting liquidity (current ratio), solvency (debt-to-asset ratio), profitability (rate- of- return on assets ratio), as well as government payments received. Having crops as the main source of income compared to livestock as a main source of income, was significant in this study. Farms that had more sales from crops rather than livestock resulted in an operation having a better financial position especially because they have more assets than a livestock operation. In Missouri, soybeans and corn are the state's top agricultural commodities (ERS, 2019). Having crops as the main source of income is important to government payments received because there are more government programs focused on crop production. Yet, it is still important to note that from this and previous research beginning farmers still find it a challenge to have the access to the capital needed for these large purchases.

Government payments are important to profitability and solvency of farms but not liquidity. As many farmers and ranchers receive government payments to aid in operational challenges it often appears to be leading to more current debt for the farm. This result makes sense in the practical needs and uses of many of these programs. However, understanding the payments has a positive overall farm financial health impact which gives integrity to the use of these farms for the benefit of agricultural production. Government payments provide financial stability for farms enhancing the operation's income, food supply, and simply assisting in generating a profit.

The Federal Communications Commission (FCC) found that as of 2021, 18.3 million Americans lack access to broadband internet, although some independent research groups suggest this number is closer to 42 million Americans (Campbell et al., 2021). Expanding rural broadband internet access has been a heavily reviewed and discussed topic currently. This research further supports the importance of having access to internet. This study found that internet is important to solvency and profitability of the farm, while also being significant to increasing the amount of government payments received by a farm. Farmers that have access to the internet can check current commodity prices, purchase/find assets for their operation (equipment, land, inputs), have access to GPS technology, and complete government paperwork electronically. They can adopt the latest technology and strive for improvement to their own management skills through continuing education opportunities.

Lastly, a critical key finding in this research was the importance of having experienced operators on the farm for beginning farmers. As Mishra et al., (2009) reported many farms have two or three operators who specialize in different aspects of the operation. Having an experienced operator on the farm allows for specialized decision making and gives other

operators the ability to expand their knowledge. Networking and mentorship programs are a vital way beginning farmers and ranchers can get an understanding of the agricultural industry. Participating in educational programs, not just book work but hands-on educational programs, are another great way beginning farmers and ranchers can succeed in their operation. An operator on a farm serves as a resource for beginning farmers to ask questions, learn about government program opportunities, and how to essentially become mentally and financially successful with their operation.

Limitations of the Study

This study is one of the first known assessments of the impact off-farm decisions has on the level of federal government program utilization for Missouri's beginning farmers. Because of this, while conducting the study, the research team was able to discover several unexpected findings as well as support for previous results. However, this study only creates a benchmark for the relations between the variables of study, but this benchmark sheds light on critical areas that should be explored further. More critical analysis is warranted, and this research could be replicated in other states.

Further Research

One way this study could serve as a foundation for further research is in terms of breaking down areas into critical zones. Rather than analyzing the results individually, there could be critical zones created to see if there are particular ranges of importance. Another way there is potential to use this study for further research is by analyzing detailed conditions for an operation's success. This research could also be used to break down the agriculture districts of

Missouri into further detail. There was one significant district in the results, but it could be studied further to discover why that specific district was different. Finally, this research could serve as a basis for further research in terms of analyzing risk management strategies and to explore various management strategies an operation must possess to avoid financial and operational stress.

The results from this study provide insight into additional conditions that could be considered for future federal government programs to provide improved opportunities for Missouri's beginning farmers and ranchers for generations to come. Programs created for or targeting young and beginning farmers could reduce the requirements regarding off-farm income limits. Therefore, it could be very beneficial for future studies to evaluate each program individually to understand each programs' requirements for off-farm income and find the reason behind participants having off-farm income in the first place. There could also be implementation of educational coursework for participants to understand the programs and policies in place in order to have a more efficient operation.

This study found some barriers regarding off-farm decisions and the utilization of government programs as well as factors affecting financial success of Missouri's beginning farmers. It is hoped future findings will be used to improve beginning farmer programs and aid in opportunities for Missouri's young and beginning farmers and ranchers for generations to come.

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Table 1. Dependent Variables and Descriptions

VARIABLES	DESCRIPTIONS
ROA	Rate of Return on Assets (ratio) *(Net Farm Income from Operations + Interest Expense)/Average Assets*
ADARAT2	Farm Business Debt-to-Asset Ratio (ratio) *Total Farm Debt/Total Farm Assets*
CurrentRatio	Current Ratio (ratio) *Current Farm Assets/Current Farm Liabilities*
IGOVT	Government Payments Received (dollars $) *Sum of Government Payments Received*
LOG Transformations	
lnROA	Log Transformation of Rate of Return on Assets Variable, to Correct for Heteroskedasticity
lnADARAT2	Log Transformation of Debt-to-Asset Variable, to Correct for Heteroskedasticity
lnCurrentRatio	Log Transformation of Current Ratio Variable, to Correct for Heteroskedasticity
lnIGOVT	Log Transformation of Government Payments Variable, to Correct for Heteroskedasticity

Table 2. Independent Variables and Descriptions

VARIABLES	DESCRIPTIONS
Farm Characteristics	
AgDistrict10	Federal Agricultural District 10 for Northwest Missouri
AgDistrict20	Federal Agricultural District 20 for Northcentral Missouri
AgDistrict30	Federal Agricultural District 30 for Northeast Missouri
AgDistrict40	Federal Agricultural District 40 for West-Central Missouri
AgDistrict50	Federal Agricultural District 50 for Central Missouri
AgDistrict60	Federal Agricultural District 60 for East-Central Missouri
AgDistrict70	Federal Agricultural District 70 for Southwest Missouri
AgDistrict80	Federal Agricultural District 80 for Southcentral Missouri
AgDistrict90	Federal Agricultural District 90 for Southeast Missouri
FarmCrop	Crops as Main Source of Income; Created Binary Variable, Crop Farm=1.
FARMSALES	Farm Sales $1,000
AnyOpBeg	Number of Beginning Operators
AnyOpEst	Number of Established Operators
OP_TOT	Number of Total Operators
Internet	Created Binary Variable, Having Internet=1.
Operator(s) Characteristics	
OP_EDUC	Education Class of Principal Operator
SP_EDUC	Education Class of Principal Operator's Spouse
OP_AGE	Age of Principal Operator
SP_AGE	Age of Principal Operator's Spouse
MaleOP	Created Binary Variable, Male Principal Operator=1
Off-Farm Choices	
OffFarmBeneIncome	Created Binary Variable, Choose to Work Off-Farm for Income Reasons=1
OffFarmBeneHealthRetire	Created Binary Variable, Choose to Work Off-Farm for Access to Health Care or Retirement Reasons=1
EARNED_OP	Off-Farm Income Earned by Operator (dollars $)
EARNED_SP	Off-Farm Income Earned by Principal Operator's Spouse (dollars $)
EFINS	Insurance Expense (dollars $)
EXP_H	Health and/or Dental Insurance Cost (dollars $)
INTEREXP	NASS: Interest Expense (dollars $)
NFASST_E	IRA, Keogh, 401k, and Other Retirement Accounts (dollar $ invested)

**** 14,449 Observations**

Table 3. Rate of Return on Assets Regression Results

Rate of Return on Assets Regression Results

	All Farmers			Beginning Farmers		
lnroa	**Coef.**		**Std. Err.**	**lnroa**	**Coef.**		**Std. Err.**
IGOVT	**0.000002**	***	2.71E-07	IGOVT	**0.000001**	***	0.000000
OP_TOT	0.287664		0.717447	OP_TOT	-0.099272		0.077552
OP_EDUC	-0.017348		0.024878	OP_EDUC	0.002975		0.065887
EARNED_OP	-1.41E-06		1.18E-07	EARNED_OP	-0.000000		0.000000
EARNED_SP	**-0.000001**	***	5.94E-07	EARNED_SP	-0.000001		0.000001
FARMSALES	**0.000000**	***	3.82E-08	FARMSALES	0.000000		0.000000
ADARAT2	**0.424400**	***	0.036230	ADARAT2	**0.559929**	***	0.099605
AnyOpBeg	-0.287253		0.718871	-	-		-
AnyOpEst	-0.266088		0.717583	AnyOpEst	0.100117		0.081804
FarmCrop	**0.347706**	***	0.047799	FarmCrop	**0.401606**	***	0.131457
OP_AGE	**-0.027633**	***	0.001916	OP_AGE	**-0.027855**	***	0.004321
AgDistrict10	-0.008427		0.102447	AgDistrict20	-0.151052		0.247452
AgDistrict20	0.067658		0.111240	AgDistrict30	-0.416010		0.278556
AgDistrict30	-0.005860		0.121790	AgDistrict40	-0.079901		0.232556
AgDistrict40	0.056177		0.111327	AgDistrict50	-0.215747		0.195442
AgDistrict50	-0.090994		0.100602	AgDistrict60	-0.271255		0.217985
AgDistrict60	-0.014728		0.107532	AgDistrict70	**-0.404560**	*	0.221382
AgDistrict70	-0.052576		0.108059	AgDistrict80	0.009491		0.233766
AgDistrict80	0.115867		0.110736	AgDistrict90	-0.215249		0.291453
INTEREXP	0.000000		2.14E-07	INTEREXP	0.000000		6.52E-07
Internet	0.095277		0.067758	Internet	**0.434765**	*	0.205325
MaleOP	**0.229449**	**	0.095360	MaleOP	**0.000656**	*	0.224765

Number of obs.	4,352
F(22,4329)	32.12
Prob > F	0.0000
R-Squared	0.1403
Adj R-Squared	0.1360
Root MSE	1.4321

Number of obs.	624
F(22,4329)	6.3
Prob > F	0.0000
R-Squared	0.1801
Adj R-Squared	0.1515
Root MSE	1.4668

Table 4. Debt-To-Asset Regression Results

Debt To Asset Regression Results

All Farmers				Beginning Farmers			
lnADARAT2	**Coef.**		**Std. Err.**	**lnADARAT2**	**Coef.**		**Std. Err.**
IGOVT	**0.000006**	***	0.000000	IGOVT	**0.000004**	***	0.000000
OP_TOT	-0.737605		0.802466	OP_TOT	-0.128766		0.086437
OP_EDUC	**-0.175020**	***	0.029069	OP_EDUC	**-0.303528**	***	0.073505
EARNED_OP	**-0.000000**	*	0.000000	EARNED_OP	**-0.000002**	***	0.000000
EARNED_SP	0.000000		0.000000	EARNED_SP	0.000000		0.000000
FARMSALES	-0.000000		0.000000	FARMSALES	0.000000		0.000000
AnyOpBeg	0.712836		0.803677	-	-		
AnyOpEst	0.753302		0.801871	AnyOpEst	0.141933		0.091889
FarmCrop	**0.276701**	***	0.055080	FarmCrop	0.140285		0.140191
AgDistrict20	0.024437		0.102605	AgDistrict20	-0.367267		0.273765
AgDistrict30	0.118636		0.116898	AgDistrict30	-0.105509		0.307684
AgDistrict40	0.119017		0.100863	AgDistrict40	-0.159793		0.258503
AgDistrict50	0.106233		0.085302	AgDistrict50	0.149034		0.218769
AgDistrict60	-0.055125		0.098014	AgDistrict60	-0.138276		0.263973
AgDistrict70	-0.046598		0.096417	AgDistrict70	-0.235293		0.250052
AgDistrict80	0.029747		0.099597	AgDistrict80	-0.011970		0.267400
AgDistrict90	0.174265		0.119706	AgDistrict90	0.388948		0.307066
INTEREXP	**0.000006**	***	0.000001	INTEREXP	**0.000008**	***	0.000001
Internet	**0.755126**	***	0.070490	Internet	**0.828491**	***	0.205841
OP_AGE	**-0.057378**	***	0.002162	OP_AGE	**-0.050081**	***	0.004885
MaleOP	**0.741693**	***	0.094974	MaleOP	**0.961752**	***	0.210265
EFINS	-0.000001		0.000002	EFINS	-0.000000		0.000001
NFASST_E	**-0.000000**	**	0.000000	NFASST_E	0.000000		0.000000
EXP_H	**0.000010**	***	0.000003	EXP_H	0.000012		0.000008

Number of obs.	9,796
F(24,9771)	100.66
Prob > F	0.0000
R-Squared	0.2018
Root MSE	2.4635

Number of obs.	1,481
F(23,1457)	17.37
Prob > F	0.0000
R-Squared	0.2152
Root MSE	2.5337

Table 5. Current Ratio Regression Results

Current Ratio Regression Results

All Farmers				Beginning Farmers			
lnCurrentRatio	**Coef.**		**Std. Err.**	**lnCurrentRatio**	**Coef.**		**Std. Err.**
IGOVT	**-0.000001**	***	0.000000	IGOVT	-0.000000		0.000000
OP_TOT	0.248896		0.807063	OP_TOT	0.072552		0.093192
OP_EDUC	0.031847		0.028614	OP_EDUC	**0.126171**	*	0.075621
EARNED_OP	0.000000		0.000000	EARNED_OP	0.000000		0.000000
EARNED_SP	-0.000000		0.000000	EARNED_SP	0.000000		0.000001
FARMSALES	**0.000000**	***	0.000000	FARMSALES	0.000000		0.000000
AnyOpBeg	-0.278736		0.808677	-	-		
AnyOpEst	-0.217995		0.807006	AnyOpEst	0.033909		0.096698
FarmCrop	**-0.603960**	***	0.053268	FarmCrop	**-0.408598**	***	0.143189
OP_AGE	**0.024524**	***	0.002115	OP_AGE	**0.012125**	***	0.004943
EFINS	**0.000005**	***	0.000000	EFINS	**0.000004**	***	0.000000
NFASST_E	**0.000000**	**	0.000000	NFASST_E	-0.000000		0.000000
AgDistrict20	0.094902		0.100719	AgDistrict20	0.316903		0.284356
AgDistrict30	0.015982		0.113612	AgDistrict30	-0.034135		0.304001
AgDistrict40	-0.055185		0.099460	AgDistrict40	-0.349458		0.258707
AgDistrict50	-0.012290		0.084477	AgDistrict50	-0.170475		0.224987
AgDistrict60	0.104752		0.098672	AgDistrict60	-0.056140		0.277041
AgDistrict70	0.071053		0.094412	AgDistrict70	-0.013407		0.263759
AgDistrict80	0.005610		0.099654	AgDistrict80	-0.190221		0.265069
AgDistrict90	0.023431		0.116330	AgDistrict90	-0.178656		0.301736
INTEREXP	**-0.000004**	***	0.000000	INTEREXP	**-0.000005**	***	0.000001
Internet	**-0.184717**	***	0.072899	Internet	**-0.393831**	*	0.209409
MaleOP	-0.016883		0.104774	MaleOP	**-0.549922**	**	0.241132
EXP_H	-0.000000		0.000003	EXP_H	-0.000003		0.000009

Number of obs.	9,079
F(24,9054)	17.37
Prob > F	0.0000
R-Squared	0.0559
Root MSE	2.3404

Number of obs.	1,348
F(23,1348)	4.23
Prob > F	0.0000
R-Squared	0.0594
Root MSE	2.4242

Table 6. Government Payments Regression Results

Government Payment Regression Results

All Farmers				Beginning Farmers			
lnIGOVT	**Coef.**		**Std. Err.**	**lnIGOVT**	**Coef.**		**Std. Err.**
ADARAT2	**0.360452**	***	0.096603	ADARAT2	**0.265502**	**	0.115662
CurrentRatio	**-0.000028**	***	0.000009	CurrentRatio	-0.000032		0.000040
ROA	**0.000996**	***	0.002564	ROA	-0.000249		0.002664
ROE	-0.000052		0.000434	ROE	0.001064		0.000947
OP_TOT	-0.079875		0.774790	OP_TOT	**-0.304774**	**	0.133189
OP_EDUC	0.003397		0.042257	OP_EDUC	-0.123688		0.108994
SP_EDUC	**0.082610**	*	0.043318	SP_EDUC	0.119653		0.115706
EARNED_OP	-0.000000		0.000000	EARNED_OP	**-0.000001**	*	0.000000
EARNED_SP	0.000000		0.000000	EARNED_SP	0.000000		0.000001
AgDistrict20	-0.014982		0.144289	AgDistrict20	0.335387		0.340477
AgDistrict30	-0.125843		0.148969	AgDistrict30	0.276785		0.390439
AgDistrict40	0.022321		0.125547	AgDistrict40	0.161251		0.323017
AgDistrict50	0.056938		0.110741	AgDistrict50	0.150836		0.272196
AgDistrict60	0.081893		0.137000	AgDistrict60	0.172090		0.357243
AgDistrict70	-0.040869		0.120389	AgDistrict70	0.052354		0.315167
AgDistrict80	0.109056		0.126288	AgDistrict80	0.205846		0.330915
AgDistrict90	0.054524		0.142041	AgDistrict90	-0.108953		0.346939
INTEREXP	0.378988		0.123383	INTEREXP	**0.000006**	***	0.000001
FARMSALES	-0.000000		0.000000	FARMSALES	-0.000000		0.000000
AnyOpBeg	-0.088220		0.779302	-	-		
AnyOpEst	0.122906		0.774797	AnyOpEst	**0.462112**	***	0.137349
FarmCrop	**0.877430**	***	0.079423	FarmCrop	**0.876288**	***	0.182138
EFINS	**0.000013**	***	0.000002	EFINS	**0.000006**	***	0.000001
EXP_H	**0.000011**	***	0.000003	EXP_H	-0.000009		0.000013
OffFarmBeneHealthRetire	**-0.159931**	**	0.082657	OffFarmBeneHealthRetire	**0.365205**	*	0.193099
Internet	**0.378988**	***	0.123383	Internet	**0.843272**	**	0.413453
OP_AGE	-0.007174		0.005180	OP_AGE	0.007901		0.013496
SP_AGE	**-0.007441**	*	0.004280	SP_AGE	0.001007		0.012835
MaleOP	**0.554152**	***	0.210953	MaleOP	**1.380428**	***	0.515142
NFASST_E	0.000000		0.000000	NFASST_E	-0.000000		0.000000
OffFarmBeneIncome	**-0.136280**	*	0.077835	OffFarmBeneIncome	0.365205		0.193099

Number of obs.	1,902
F(31,1870)	19.9
Prob > F	0.0000
R-Squared	0.03284
Root MSE	1.4006

Number of obs.	319
F(30,288)	5.66
Prob > F	0.0000
R-Squared	0.3708
Adj R-squared	0.3053
Root MSE	1.4176

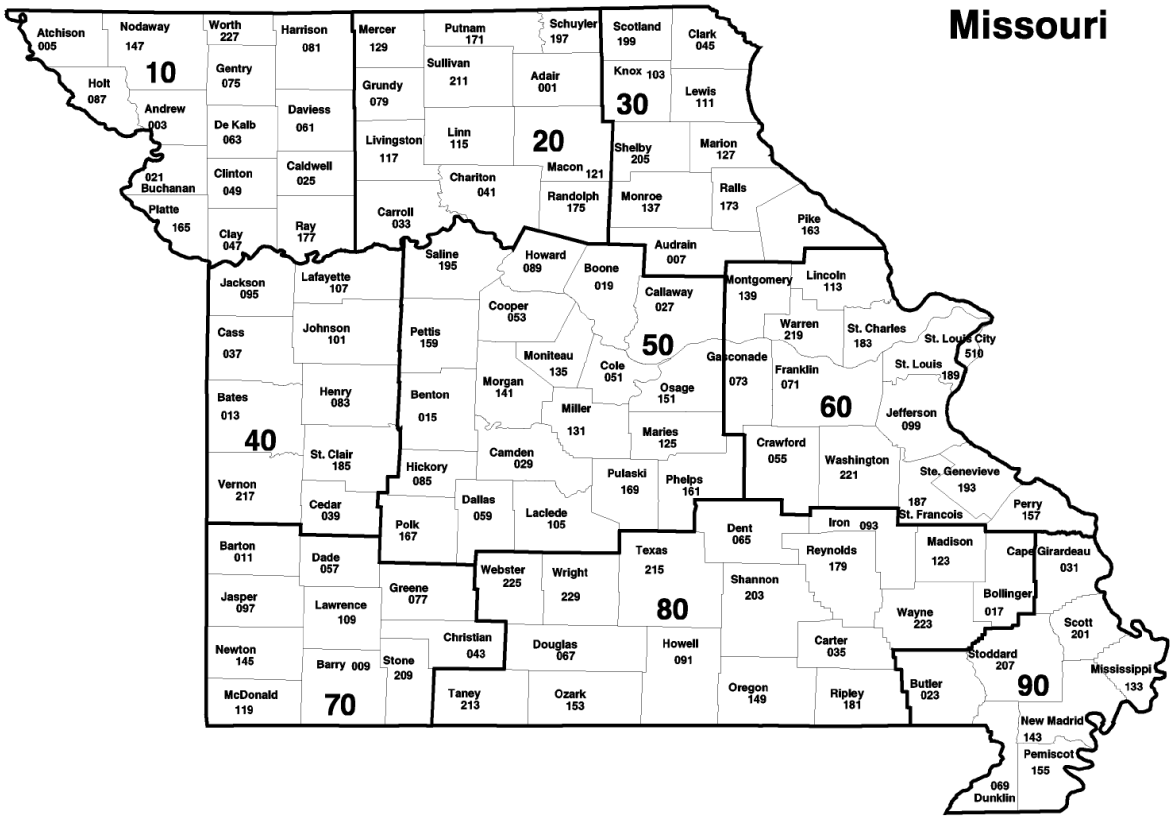

Figure 1: Missouri Agricultural Districts
Source: USDA