Financial performance of beginning dairy farmers in Minnesota

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I. INTRODUCTION

The U.S. per capita consumption of dairy products increased from 539 to 655 pounds per capita between 1975 and 2020 (USDA-ERS, 2021). Due to increasing consumption of dairy products over the past 45 years, it is necessary to ensure that there is sufficient supply to meet increasing demand. Supply of dairy products can be increased by increasing herd size, increasing productivity per cow, and having new dairy farmers enter the industry. This research focuses on the last supply solution, increasing the number of dairy farmers in the industry. The number of licensed dairy farms in Minnesota has decreased by over 50% from 4,567 farms in January 2010 to 2,171 farms in January 2022 (MDA, 2022). U.S. principal farm operators are on average 58.6 years old (USDA Census, 2017). Thirty-six percent of principal operators are over the age of 65 and, consequently, are expected to retire in the near future (USDA Census, 2017). Surprisingly, dairy producers are some of the youngest farmers with an average age of 50.2 years (USDA Census, 2017). While some farmers transition their farms to the next generation, other farmers exit the industry, which creates a net decrease gap in the number of operating dairy farms. The gap is magnified as only 18.8% of all U.S principal operators categorized as beginning farmers (USDA Census, 2017). Starting any farming operation requires a large capital investment and it may be challenging for beginning farmers to source these funds to enter the industry, especially within the context of dairy farms. Finding the next generation of dairy farmers is a priority for the dairy industry to thrive. Despite the large capital investment in dairy operations, dairy farm transfer is occurring. The farms are being transferred, but it is the farmers determining the success. A farm is defined as any place where at least $1,000 of agricultural products were

produced and sold, or if under normal conditions the products would be produced and sold, while a farmer is the operator of the farm who makes the production decisions (USDA-ERS, 2022). The structure of dairy farms provides an opportunity to study dairy farmers to identify strategies that have allowed beginning dairy farmers to be successful, and potentially use this information as a benchmark for other commodity groups. As dairy consumption increases and farmers leave production, it is essential to financially support beginning dairy farmers and place an emphasis on their financial success. This research aims to determine the factors that impact a beginning dairy farmer's profitability, ensuring the viability of dairy farms moving forward, specifically analyzing dairy farms in Minnesota.

The United States Department of Agriculture (USDA) defines a beginning farmer as an individual or entity who has operated a farm for 10 years or less (USDA-Farm Service Agency, 2022). A beginning farmer is someone experiencing their first endeavor in farming which includes local foods producers, conventional commodity producers as well as first-generation farmers and second-generation-plus farmers. Each beginning farmer has a different starting point, management experience, and financial performance capability.

Farming is a capital-intensive industry and government programs are available at the state and federal level to set farmers up for success while simultaneously encouraging entry into the agriculture industry. Beginning farmers tend to be grouped together in terms of policy consideration regardless of commodity production and generational status. The USDA-FSA provides farm ownership loans, direct and guaranteed loan programs, and operating loans for beginning farmers (USDA-FSA, 2022). These loan

programs offer a lower interest rate than industry banks to assist farmers that are entering the profession. Additionally, the National Institute of Food and Agriculture (NIFA) provides grants through the Beginning Farmer and Rancher Development Program (BFRDP) that provide education, mentoring, and technical assistance to beginning farmers (USDA-NIFA, 2022). The state of Minnesota offers the Minnesota State Farm Business Management (FBM) program. In this program, eight colleges and universities offer one-on-one student-led programs where the student-farmer and farm business management instructor collaborate to help the farmer meet their business goals (AgCentric, 2022). This program offers a scholarship to cover 25-50 percent of the tuition for beginning farmers enrolled in the FBM program. Enrolling in this "course" helps beginning farmers become more efficient to enhance their financial viability. An additional benefit of this program is that the participating farmers contribute farm data to FINBIN (www.finbin.umn.edu), which is the largest nationally representative farm financial database. Beginning in 2014, FINBIN included a "special sort" for farmers that are beginning farmer participants in the Minnesota Farm Business Management program. Within this dataset, second-generation beginning farmers can be identified and compared with first-generation beginning farmers. Additionally, established farmers and farmers transitioning from beginning to established farmers based on the years of experience criteria are identified and analyzed.

The financial performance of farmers differs across farm types and experience levels. Crop, dairy, and specialty crop farms have different cost structures. Additionally, as the farmers gain experience, they are able to leverage their farm financial performance with the knowledge and skills gained in past years.

This research analyzes four groups of Minnesota dairy farmers' financial performance, (first-generation beginning, established, second-generation beginning, and transitioned to established farmers) from 1997-2021 to determine characteristics that drive farm profitability. The research findings will be used to support dairy farms in terms of potential agricultural policy advancement and knowledge for producers to utilize effective practices and characteristics which would directly impact their survival in the industry.

The remainder of the paper is organized as follows. In the following section, existing literature on beginning farmers is discussed. Then research objectives are presented followed by a discussion of the methodology used in the study and a description of the data. Lastly, results and policy implications that arise from the results are discussed.

II. LITERATURE REVIEW

It is well documented that the financial performance of beginning farmers and their decision-making methodology differs from established farmers (Detre et al., 2011; Mishra et al., 2007; Mishra et al., 2009; Katchova, 2010; Kropp & Katchova, 2011; Adhikari et al., 2009; Ahearn & Newton, 2009; Katchova & Dinterman, 2018; Jablonski et al., 2022). The most common characteristics that influence these decisions include the ability to obtain credit, operator's education level, and farm size. Limited research exists studying beginning farmers' financial performance over time due to the difficulty in obtaining multiple years of detailed farm financial data. Additionally, the inconsistency in the definition of a beginning farmer across federal entities (FSA, ERS, NASS) adds to

the data collection challenges. The USDA Farm Service Agency defines beginning farmers as any individual or entity who has not operated a farm for more than 10 years, which is the definition used most commonly in previous research (USDA-FSA, 2022; Detre et al., 2011; Mishra et al., 2009; Mishra et al., 2007; Katchova, 2010; Kropp & Katchova, 2011; Adhikari et al., 2009; D'Antoni et al., 2009; Katchova & Dinterman, 2018). Established farmers are those who have been farming for 10 or more years.

A farmer's age often influences their motivation and decisions on the farm. Not surprisingly, beginning farmers are, on average, younger than established farmers (47.8 years compared to 59.4 for principal operators) (Census of Agriculture, 2017). Previous studies report inconsistent results of the impact of age on financial success. Katchova (2010) and Mishra et al. (2007) find that as a farmer ages, their financial success falls. Katchova (2010) expresses financial success as the probability of the farmers' financial ratios to fall outside critical ranges determined by the Farm Financial Standards Council, while Mishra et al. (2007) uses a modified net farm income measure. Other studies find that age has a positive relationship with farm performance and future farm growth (Katchova, 2010; Katchova & Dinterman, 2018). Williamson (2016) compares age cohorts of beginning farmers. They document that beginning farmers under the age of 45 often intend to farm into the future and will expand production and investment in their farm; meanwhile, beginning farmers over age 45 often farm for enjoyment rather than income purposes and earn lower levels of gross cash income compared to beginning farmers under 45 years old (Williamson, 2016).

Farm Characteristic Organization Structure

Farms entering the industry typically expand over time, as evidenced with 174 acres as the average farm size for beginning farmers compared to 461 acres for established farmers (Ahearn & Newton, 2009). It is documented that farm size is correlated with gross revenue, with Kropp and Katchova (2011) reporting that beginning farmers have lower gross sales than established farmers. Small farms have lower sales and are also vulnerable to price shocks, but carry smaller debt loads (Key & Lyons, 2019; Ahearn & Newton, 2009; Mishra et al., 2009; Mishra et al., 2007; Katchova, 2010). Meanwhile, large farms are more vulnerable to price shocks due to higher debt loads from expanding their farms, (D'Antoni et al., 2009) despite having higher sales and levels of profitability, efficiency, and repayment capacity (Katchova, 2010; Kropp & Katchova, 2011; Katchova & Dinterman, 2018; Key & Lyons, 2019; Ahearn & Newton, 2009; Mishra et al., 2009; Mishra et al., 2007).

Beginning farmers enter farming across all farm types, from fruit and vegetable farms to conventional crop and livestock production farms. Beginning farmers produced 12% of U.S. livestock production, 7% of U.S. crop production, 8% of U.S. fruit and tree nuts production, and 10% of U.S. nursery and vegetable production in 2007 (Ahearn & Newton, 2009). Various studies analyze beginning farmers in different time frames and find an overall trend that beginning farmers primarily specialize in beef cattle production, followed by cash grains and oilseeds production (Ahearn & Newton, 2009; Katchova & Dinterman, 2018; Mishra et al., 2009; Key & Lyons, 2019). Local foods and conventional farms have differing farm structures which impacts their financial strategies and success. A farmer's ability to successfully enter operation is dependent on the enterprise

compilation and diversification of the farm as farm diversification alleviates financial risk for beginning farms (Mishra et al., 2009; Jablonski et al., 2017). An additional consideration when examining local foods and conventional beginning farmers is that data availability differs. Fruit and vegetable production is surveyed more commonly due to increased stakeholder engagement, consumer interest, and demand for local foods (Jablonski et al., 2017; Low et al., 2015; Jablonski & Schmit, 2016). And, the available data for conventional production data differs as this data is gathered through national surveys and USDA statistical services.

Farmers can organize their farm as sole proprietorships, limited liability partnerships (LLP), or limited liability companies (LLC). Approximately 85% of all farms are organized as sole proprietorships, including beginning farmers (Census of Agriculture, 2017). Some studies find that sole proprietorship farms have a higher risk of financial hardship due to their 100% risk structure (Kropp & Katchova, 2011; Katchova & Dinterman, 2018), while Katchova (2010) find that being organized as sole proprietorships had no association with farm performance. Farms not organized as a sole proprietor may be organized as an LLC, but not all states allow farms to be LLCs. In some states, farms must be an LLP, rather than an LLC (Uniform Law Commission, 2021). LLPs and LLCs allow for multiple people to be involved in decision-making on the farm. Increasing the number of decision makers has a positive association with financial performance (Mishra et al., 2009; Adhikari et al., 2009).

Farmland Ownership and Accessibility

Farming is a capital-intensive industry with high start-up costs. Access to land, through either ownership or renting, is a major component of financial success of a farm. Each type of farm ownership structure has a varying impact on debt loads, which affects the financial performance of the farm. Ownership of operated acreage is negatively associatted with farm financial performance relative to renting all operated land, likely due to land values (Mishra et al., 2007).

Beginning farmers are more likely than established farmers to be tenants who rent all their land, (11.2% of beginning farmers are tenants compared to 6.9% of established farmers). Beginning farmers are less likely to be part owners who both rent and purchase land (17% of beginning farmers are part owners compared to 24.1% of established farmers). And, finally, beginning and established farmers are equally likely to be full owners in which they only operate owned land (Census of Agriculture, 2017). Seventy-eight percent of beginning farmers own all the acreage they operate compared to 61% of established farmers (Ahearn & Newton, 2009). Among beginning farmers, 71% did not rent or lease any land (Census of Agriculture, 2017).

A farmer's decision to purchase land depends on their ability to access secured financial loans and their perceptions on future market fluctuations (Ahearn & Newton, 2009). Jablonski et al. (2022) find that credit constraints lower the probability of a beginning farm's survival and growth rates. Access to loans is dependent on collateral. Typically, land is used as collateral, but additional collateral may be required in the event that land values decrease (Katchova & Dinterman, 2018). Given the large principal and interest payments tied to purchasing land, renting may be preferred to decrease liability in

the early years until the farm has revenue generation to make land payments (Ahearn & Newton, 2009). In addition to challenges obtaining loans, land market uncertainty affects the decision to own or rent. In the event of an economic downturn, tenants are likely to experience lower rental prices while an owner experiences financial loss on their balance sheet due to decreased land values (Katchova & Dinterman, 2018). A decline in land value reduces an owner's assets, while an increase in land value allows an owner to capture capital gains or equity generation over time (Katchova & Dinterman, 2018).

Farm Financial Performance

Financial performance is measured by financial ratios that are generated using information from the farm's balance sheet and income statement. The availability of annual financial data allows for benchmark analysis of a farm's financial performance. However, poor record keeping is a limiting factor in analyzing financial performance over time. Due to the lack of historical financial information, it is often a challenge for beginning farmers to have accurate statements at the beginning of their farming endeavors. A farm's financial success is often measured by liquidity, solvency, profitability, operating efficiency, and debt repayment capacity.

Liquidity measures a farm's ability to meet its financial obligations as they come due without disrupting normal business operations. Previous work demonstrates that beginning farms tend to have a lower liquidity levels than established farms, which means they have little readily available cash compared to their short-term debt (Kropp & Katchova, 2011; Katchova, 2010; Katchova & Dinterman, 2018).

Solvency evaluates the farm's ability to cover all of their debt with either assets or equity on their farm. Beginning farms tend to have lower solvency due to a high debt-to-asset ratio with more outstanding liabilities of farmland ownership loans and low asset levels (Ahearn & Newton, 2009; Kropp & Katchova, 2011; Mishra et. al., 2009; Key & Lyons, 2019; Mishra et al., 2007). For example, beginning farmers may lease equipment, which is not reported on the balance sheet. This results in a poor solvency ratio for beginning farmers because they will have low total assets relative to their debt load. Adhikari et al. (2009) shows that as a farm increases its size, the potential for profit increases as well as the potential for debt from farm expansions. This has not been shown specifically with beginning farms, but as established farms grow, they are able to leverage collateral to finance expansion. In turn, it is common to observe high debt-to-asset ratios with large farms (Adhikari et al., 2009).

Profitability measures the farm's ability to generate more revenue than expenses. Previous studies use the rate of return on assets as their profitability measure (Kropp & Katchova, 2011; Katchova, 2010; Katchova & Dinterman, 2018; Detre et al., 2011; Mishra et al., 2009; Adhikari et al., 2009). The rate of return on assets measures the return on all investments on the farm. Beginning farmers often have a lower return on assets due to low profit and high debt on these farms (Kropp & Katchova, 2011; Katchova, 2010; Katchova & Dinterman, 2018). Education (Mishra et al., 2009; Katchova, 2010; Adhikari et al., 2009) and operator off-farm income (Detre et al., 2011; Mishra et al., 2009) are negatively associated with return on assets. These farmers likely maximize total household revenue rather than farm revenue using their human capital off-farm. However, gross farm sales (Detre et al., 2011; Mishra et al., 2009; Adhikari et al.,

2009; Katchova & Dinterman, 2018), livestock operations (Katchova, 2010; Katchova & Dinterman, 2018), and the number of decision makers (Mishra et al., 2009; Adhikari et al., 2009) positively impact profitability.

Operating efficiency measures how effectively a farm uses its resources to generate product. Previous work finds that increased gross farm sales and government payments lower a farm's operating expense ratio, leaving more funds available to cover ownership expenses. (Katchova, 2010; Katchova & Dinterman, 2018). Meanwhile, livestock farms, farms organized as sole proprietorships, and off-farm income have a negative association with farm efficiency as measured by the operating expense ratio (Katchova & Dinterman, 2018).

Debt repayment capacity is important for beginning farmers to obtain credit, demonstrating the farmer's ability to repay their debts on schedule. Farms organized as a sole proprietorship (Katchova & Dinterman, 2018) or a livestock operation (Katchova, 2010; Katchova & Dinterman, 2018) have a greater ability to cover debts. Large farms (Katchova, 2010; Katchova & Dinterman, 2018) and those receiving government payments (Katchova, 2010) have lower repayment capacity. Large farms require more investment and therefore have higher debt levels, which directly ties to having a lower ability to repay their debts.

Limited research exists studying beginning farmers' financial performance over time in a panel data structure. Jablonski et al. (2017) research the impacts of the Building Farmers in the West Program, which is an educational program designed to help small-scale beginning fruit and vegetable farmers. Their study finds that the course has many positive outcomes and courses of similar nature would benefit beginning farmers.

However, Jablonski et al. (2017) focuses on fruit and vegetable beginning farmers while this research analyzes beginning dairy farmers.

Financial characteristics of a farm often have a distributional effect (Detre et al., 2011; Adhikari et al., 2009). That is, high performing farmers and low performing farmers are impacted differently by farm characteristics. For example, the addition of an operator on the farm may have a larger impact for high performing farms as these farms are able to specialize while low performing farms may experience a small impact or even a net loss from the addition where the marginal cost to hire the operator is more than the marginal return. Detre et al. (2011) find that the impact of off-farm work on the farm's rate of return on assets is higher for farms performing at the 90^{th} percentile than at the 70^{th} percentile.

Government Payments

Government payments are an effective resource for low-interest rate loans and grants, however the application process can be timely due to the paperwork requirement. Additionally, there are a variety of criteria limiting who is eligible for payments and payment amounts. And, the criteria differ across programs and entities (USDA-FSA, 2021; MDA, 2022). Cash-rent tenants and foreign people are ineligible unless they meet certain criteria (USDA-FSA, 2021). Additionally, farmers with a net worth above a specified value may be omitted from beginning farmer loan programs (MDA, 2022).

Government payments are an additional revenue source that may increase a beginning farmer's financial performance and lower their risk (Mishra et al., 2009; Katchova, 2010; Mishra et al., 2007; Jablonski et al., 2022). Government payments tend

to be tied to farm production, which is often correlated with farm size (USDA-FSA, 2022; Roberts & Key, 2003; Key & Roberts, 2007). Traditionally beginning farmers have smaller farms so they may receive less government payments than established farmers (Ahearn & Newton, 2009; Key & Lyons, 2019; Key & Roberts, 2007). Two other factors that contribute to lower government payments for beginning farmers are (1) beginning farmers have lower participation rates in government payment programs (25% of beginning farmers are enrolled compared to 42% of established farmers), this difference in participation rates is driven by beginning farmers operating smaller farms and smaller farms are less likely to participate in government programs, (Ahearn & Newton, 2009) and (2) beginning farmers commonly have livestock as their primary enterprise (Ahearn & Newton, 2009; Katchova & Dinterman, 2018; Mishra et al., 2009; Key & Lyons, 2019), and more government payments are available for crop producers than livestock producers. Of the farms that report government payments, beginning farmers under age 45 receive more payments than beginning farmers over age 45, which again suggests that beginning farmers anticipating to farm long-term participate in government programs while those over age 45 may be farming for enjoyment rather than income purposes (Williamson, 2016).

Farm Operator Managerial Characteristics

Farmers' decisions are influenced by their education level. Beginning farmers are slightly more likely to have a college degree than established farmers (Ahearn & Newton, 2009). Education has been researched extensively with results contradicting expectations and findings. Human capital theory hypothesizes that more education positively impacts

financial performance (Katchova, 2010; Mishra et al., 2009; Mishra et al., 2007). Previous research finds that education negatively impacts farm financial performance because individuals with higher education levels have the opportunity to earn higher returns with off-farm work (Detre et al., 2011; Mishra et al., 2009; Mishra et al., 2007; Adhikari et al., 2009).

Due to the higher return expectation for off-farm work, many beginning farmers will work off-farm, suggesting their goal is to maximize total household income rather than farm income (Detre et al., 2011; Mishra et al., 2009; Mishra et al., 2007; Adhikari et al., 2009; Ahearn & Newton, 2009). In 2017, approximately 77% of beginning principal operators worked off-farm in some capacity while only 55% of established principal operators did (Census of Agriculture, 2017). Working off-farm takes valuable time and resources away from the farming operation and may lower farm profitability and performance (Detre et al., 2011; Mishra et al., 2009; Mishra et al., 2007; Adhikari et al., 2009; Key & Lyons, 2019). The decision to work off-farm is also determined by farm size. Larger farms may have higher farm income and less incentive to work off-farm (Ahearn & Newton, 2009).

Previous studies highlight farms' technology adoption, anticipating high adoption rates by beginning farmers. Some studies analyze the farm's adoption of genetically modified seed (Mishra et al., 2007; Detre et al., 2011; Adhikari et al., 2009). Yet other studies use a variety of proxies for the farm's managerial proactive approach including the implementation of production and marketing contracts (Mishra et al., 2007; Mishra et al., 2009), and use of a business plan (Mishra et al., 2007; Detre et al., 2011; Adhikari et al., 2009; Mishra et al., 2009). The technological and management variables considered

have inconsistent results or do not significantly impact financial performance for beginning farmers (Mishra et al., 2007; Mishra et al., 2009; Detre et al., 2011; Adhikari et al., 2009).

III. RESEARCH OBJECTIVES

The objective of this research is to compare differences in the financial performance of Minnesota beginning dairy farmers and identify how their performance changes over time. Farmers are divided into four exclusive groups for the purpose of this research (beginning, established, second-generation beginning, and transitioned to established farmers). A beginning farmer is a farmer with 10 years of experience or less. An established farmer has over 10 years of experience. A second-generation beginning farmer is defined as a beginning farmer that took over an existing operation. A transitioned to established farmer is an established farmer that was also in the dataset as a beginning farmer. Beginning farmers are compared to established, second-generation beginning, and transitioned to established farmers to determine the impact of farm operator characteristics, farm size characteristics, herd indicators, and farm financial metrics on financial performance measured by the operating profit margin, rate of return on assets, and net farm income.

IV. METHODS

Theoretical Framework

According to economic theory, a farmer's goal is to maximize profit, and cost minimization is a necessary condition for profit maximization (Tauer, 1995; Detre et al., 2011; Mishra el al., 2009; Katchova, 2010). Farmers often make decisions using whole farm profit, defined as total revenue less total expenses incurred for the period. Total revenue is the summation of product sold, which in this case is milk yield multiplied by price received, government payments, insurance revenues, and other enterprise revenues. Total cost or expense is the summation of operating and ownership, or variable and fixed expenses. Operating expenses are the expenses incurred to produce a product such as labor, electricity, fuel, and feed. Ownership expenses are those that are incurred regardless of production status such as property taxes, dues and professional fees, and insurance expense. Therefore, a dairy farmer will maximize whole-farm profit subject to a variety of constraints including barn capacity, milk storage, and available labor. The profit function to be optimized is,

$$(1)\ \pi = TR(M, G, I, O) - TC(L, K, N, F),$$

where total revenue is a function of M, milk revenue, G, government payments, I, insurance revenue, and O, other enterprise revenues including cull sales and crop commodity sales. Total cost is a function of L, labor expense, K, capital expense, N, input expense and F, fixed costs. In addition to maximizing annual profits, farmers that anticipate farming in the future will consider investment decisions to expand or maintain production at their current level by, for example, repairing and performing maintenance

on equipment. While farmers maximize profits annually, there are many additional considerations such as tax liabilities and investment decisions.

Empirical Framework

Due to the distributional effect across farmer groups, this research uses the unconditional quantile regression (UQR) approach to determine financial performance of four farmer groups at different quantiles of the performance variable's distribution. Previous literature has used a variety of econometric methods to examine the financial performance of beginning farmers; however, the methods used in these studies have shortcomings in the context of this research. Katchova (2010) and Katchova and Dinterman (2018) used probit models to determine the probability that beginning and established farmers' financial ratios fall within critical ranges as determined by the Farm Financial Standards Council. Jablonski et al. (2017) used ordered probit and logit estimators to identify whether a farm's profitability increased, did not change, or decreased after participation in the Building Farmers in the West program. Weighted least squares was used in multiple studies that used Agricultural Resource Management Study (ARMS) data to examine the determinants of financial performance of beginning and established farmers (Mishra et al., 2009; Mishra et al., 2007; Kropp and Katchova, 2011). The weights used were to reflect the probability of that observation being selected to ensure the sample data is an accurate representation of the U.S. farming industry (Mishra et al., 2009; Mishra et al., 2007; Kropp and Katchova, 2011). These studies do not account for distributional impacts in which the impact of a covariate at low levels of financial performance may differ from the impact at high financial performance. Lastly,

other studies noted differences across financial ratios' distributions and used quantile regression to identify the differences in magnitude and significance of the relationships between covariates and the ratios across quantiles (Detre et al., 2011; Adhikari et al., 2009). Results from these two studies showed that the impact of off-farm work, number of decision makers, education, and adoption of genetically modified corn and cotton on the farm's rate of return on assets differed at various quantiles. For example, the impact of off-farm work was double in magnitude at the 90% quantile compared to the 70% quantile (Detre et al., 2011). Detre et al. (2011) and Adhikari et al. (2009) used the conditional quantile regression framework, which analyzes the conditional distribution rather than the unconditional distribution.

Prior to computing an unconditional quantile regression, distributions of the financial variables are analyzed to determine whether the distributions differ and motivate the use of the unconditional quantile regression approach. Kolmogorov-Smirnov (KS) and first-order stochastic dominance (FOSD) tests analyze the distributions of the financial performance variables. The KS test is a pairwise test, analyzing the equality in distributions with the null hypothesis that the two distributions are equal. Rejecting the null means that the two distributions are not equal. After running the KS tests, stochastic dominance testing determines if one distribution dominates the other across farmer groups. First-order stochastic dominance reveals if one group of farmers consistently outperforms another in a specific financial area of their farm for the full distribution of the financial variable considered, having a higher expected value. FOSD relies on cumulative distribution functions (CDFs) that are defined for each of the four groups of farmers. Each financial ratio is analyzed separately to show if distributions are equal or

different for the four groups of farmers. As an example, beginning farmers first-order stochastically dominate second-generation beginning farmers if,

$$(2)\ F_{2nd}(OPM) \leq F_{BF}(OPM)$$

for all values of the operating profit margin (OPM), with at least once strict inequality where F is the CDF of the operating profit margin. This indicates that for all values of the operating profit margin, the expected value for second-generation beginning famers is higher than beginning farmers.

The UQR approach used in this research has advantages over both ordinary least squares (OLS) and conditional quantile regression (CQR). Quantile regression is preferred to OLS when there are differences in the outcome variable across its distribution and this approach is robust to outliers (Borah & Basu, 2013; Park, 2015; Ma et al., 2019; Khanal et al., 2018). Additionally, UQR is preferred over CQR because CQR estimates cannot be interpreted in terms of a policy context (Park, 2015; Borah & Basu, 2013; Ma et al., 2019; Khanal et al., 2018).

OLS is not preferred because it focuses on average effects and fails to acknowledge the distributional impacts. OLS estimates the impact of an independent variable on a dependent variable by minimizing the sum of squared residuals (Wooldridge, 2017). Linear regression estimates the change in the average dependent variable value as the independent variable changes. A simple OLS model is

$$(3)\ y_i = \beta_0 + \beta_1 x_i + e_i,$$

where y_i is the outcome for person i, β_0 is the intercept, β_1 is the coefficient on the independent variable x, x_i is the independent variable for person i, and e_i is the error

term for person i. The impact of a one-unit change in x is β_1. One limitation of this approach is that a one-unit change in x results in the same impact of a change in y, regardless of the initial point of the independent variable. That is, the impact on y is consistent across the entire distribution of x. The impact of a covariate at the 20th percentile is the same as the effect at the 90th percentile for OLS models.

Quantile regression is used to estimate the relationship between an independent variable and an outcome variable at different quantiles of the dependent variable's distribution (Firpo et al., 2009; Borah & Basu, 2013; Park, 2015; Hansen, 2022; Ma et al., 2019; Khanal et al., 2018). Given $\tau \in [0,1]$, the τ^{th}quantile q_τ of Y is $\mathbb{P}[Y \leq q_\tau] = \tau$ (Hansen, 2022). Conditional and unconditional quantile regression approaches are within the quantile regression framework and previous literature commonly used CQR as derived by Koenker and Bassett (1978).

Conditional quantile regression estimates the impact of the covariates on a specific quantile of the dependent variable, conditional on the covariates (Park, 2015; Borah & Basu, 2013). CQR results cannot be used as interpretation of policy (Park, 2015; Borah & Basu, 2013; Ma et al., 2019; Khanal et al., 2018). The CQR conditions on covariates in the model and therefore, the interpretation of CQR and UQR estimates differ. CQR measures the change in the conditional dependent variable at the τ^{th}quantile, while UQR measures the change in the dependent variable at the τ^{th}quantile (Firpo et al., 2009; Borah & Basu, 2013; Park, 2015; Ma et al., 2019; Khanal et al., 2018). Park (2015) demonstrates the difference in interpretations between CQR and UQR estimates by assessing the relationship between direct marketing practices and farm sales.

The UQR framework proposed by Fipro et al. (2009), allows for estimation of the relationship between covariates and the outcome variable at different quantiles of the unconditional distribution of the dependent variable. This approach is used by Borah and Basu (2013) to derive medication adherence of Alzheimer's patients. Park (2015) follows the same approach to measure the impact of direct marketing on farm sales at various points of the farm sales' distribution. Khanal et al. (2018) identify the effect of participating in certified organic food production on the total value of farm sales and net cash farm income. And lastly, Ma et al. (2019) use the UQR approach to measure the heterogeneous effect of stocking rate on milk solids production. In this research, the impact of government payments is hypothesized to differ across the distribution. Government payment eligibility differs across programs. Within this unique structure of programs, many of the top performing producers are not benefitting as much as the low-to-mid performing producers, or the top producers may become ineligible for payments as they increase production and their net worth. However, these payments can be beneficial for low performing farmers. The differing impacts of government payments on financial performance further motivates the use of the unconditional quantile regression approach.

UQR parameters are estimated by constructing recentered influence functions (RIFs) of the outcome variable, which are then used as the dependent variables and regressed on covariates (Firpo et al., 2009; Borah & Basu, 2013; Park, 2015). The RIFs are derived from influence functions (IFs) as introduced by Hampel (1968, 1974). An IF assesses the effect of adding or dropping an observation on the distributional statistic,

demonstrating the influence of that particular observation on the distributional statistic (Firpo et al., 2009; Borah & Basu, 2013; Park, 2015).

Following the notation from Fipro et al., (2009), the IF for the τth quantile is defined as

$$(4)\ IF(y, F) = \frac{\tau - I[Y \leq q_\tau]}{f_Y(q_\tau)},$$

where τ refers to the τth quantile, Y is the outcome variable, q_τ is the τth quantile of the unconditional distribution of Y, I$[Y \leq q_\tau]$ is an indicator variable taking the value of one if the observation is less than or equal to q_τ, and $f_Y(q_\tau)$ is the value of the probability density function of the distribution of Y evaluated at q_τ. The RIF is defined as

$$(5)\ RIF(y, q_\tau) = IF(y, F) + q_\tau,$$

and it is calculated for each observation in the dataset. The unconditional quantile regression is then

$$(6)\ E[RIF(y, q_\tau)|x],$$

where x is a set of covariates. To implement the UQR, first estimate the RIF of the τth quantile of Y in which q_τ is estimated using the sample estimate of the unconditional τth quantile, and $f_Y(q_\tau)$ at q_τ is estimated with kernel methods (Firpo et al., 2009). Then, regress the RIFs on observed covariates in an OLS regression framework (Firpo et al., 2009). Park (2015) notes the estimates from the regression can be interpreted similarly to the estimates from an OLS model.

In the context of this analysis, UQR shows the distributional impacts of a beginning farmer's status on financial performance. Beginning farmer programs may

have differential impacts on a farm's financial performance, with farms at the lower end of the distribution of the performance metric probably benefiting more than those at the upper end of the distribution.

The formal model to be estimated for this research is

$$(7)\ y_i = \sum_k \delta_k FT_{ki} + X_i\beta + u_i + e_i,$$

where y_i represents the financial performance variable for farmer i, FT_{ki} are three indicator variables capturing farmer type of the i-th farm (Beginning Farmers; Second-Generation Beginning Farmers; Transitioned to Established Farmers, with the baseline being Established Farmers); δ_k are parameters capturing the relationship between a farmer's type and financial performance of farm i; X_i is a vector of farm and operator characteristics, β is a conformable vector of parameters, u_i are unobserved characteristics of farmer i, and e_i is the error term of farmer i.

V. DATA

Data for this research was collected from FINBIN, which is a farm financial data source with participants from 12 states across the nation. FINBIN is housed by the Center for Farm Financial Management at the University of Minnesota (finbin.umn.edu). Rather than issuing surveys, FINBIN data is constructed by farmers working with a Farm Business Management (FBM) instructor to accurately contribute detailed reports of farm information including farm-level financial information as well as farm and operator characteristics. Beginning in 2014, the data includes an indicator for farms receiving a

scholarship through the FBM Beginning Farmer Program, in which funding for this Minnesota program is provided through the Minnesota Department of Agriculture.[1]

FINBIN data used consist of two datasets, whole farm data and enterprise level data, which included a unique FINBIN farm identification number that linked the data from both sources. Using the FINBIN farm ID and the year associated with the data, whole farm data was merged with dairy enterprise data to create a comprehensive dataset. Merging whole farm and dairy enterprise data allowed for a complete analysis of the farm.

Whole farm data consisted of general, non-enterprise specific variables that included operator characteristics, farm characteristics, and financial measures. Operator characteristics included the age of the principal operator and an indicator variable for beginning farmer participants. Farm characteristics consisted of the year the farm began operating and farm type, which indicated whether the farm was a crop, dairy, or crop and dairy farm, among others. Farm type was defined based on the primary income source of the farm. If at least 70% of the farm's income was from the dairy enterprise, the farm was labeled as a dairy farm, meanwhile, if at least 70% of the farm's income was from the summation of the dairy and crop enterprises, the farm was labeled as a crop and dairy farm. Lastly, financial measures included, but are not limited to, net farm income, liabilities incurred on the farm, interest payments, depreciation expenses, and farm financial ratios.

[1] In FINBIN reports, the indicator variable for beginning farmer participants is located in the Special Sort items and is labeled as MN MDA Beg Farm Scholar.

The dairy enterprise data contained dairy specific variables that included herd size measures, dairy expenses, and cow milk production characteristics. Herd size measures included the average number of cows in the herd, number of culled cows, and the number of purchased cows. Dairy expenses consisted of the farm's hired labor expense, quantity and value of feed fed, and veterinary expenses. Cow milk production characteristics included average somatic cell count, milk yield, average milk price received, and milk protein and fat concentration measures.

Variables used in this study included the principal operator's years of experience, the year the farm began operating, herd size, a dummy variable for whether the farm received a beginning farmer scholarship, hired labor expense, operating profit margin, and other variables. Data was collected from 1996 to 2021 from Minnesota dairy farms, but due to creating percent change variables, 1996 was omitted in the analysis.

The whole farm dataset contained 60,447 observations across all farm types from 11,832 farms in Minnesota from 1997-2021. Farms not labeled as "Dairy" or "Crops and Dairy" based on the type of farm by sales were removed resulting in 13,519 observations remaining (46,928 were removed) in the whole farm dataset. The dairy dataset contained 13,080 observations from 2,977 unique dairy farms in Minnesota from 1997-2021. In order to merge the whole farm and dairy enterprise datasets, an additional 48 observations across seven farms were removed from the whole farm dataset and 88 observations across seven farms were removed from the dairy dataset due to farms having multiple observations in a given year. The resulting combined dataset consisted of 3,165 unique farms with 13,963 observations of Minnesota dairy farms from 1997-2021. Finally, farms were required to have a minimum of 3 years of data because moving

averages tend to be based on 3-year periods, and this showed consistency within the data and allowed for market volatility over time. The dataset contained 1,407 observations where the farm had 1 or 2 years of data. The final dataset used in the analysis contained 12,556 observations across 3,157 farms.

FARM EXPERIENCE CLASSIFICATION

Principal operator and farm characteristic data from FINBIN were used to generate four exclusive groups of beginning, established, second-generation beginning, and transitioned to established farmers.

Definitions

Beginning farmers are defined as farmers with 10 years of experience or less, which is consistent with the USDA-FSA beginning farmer definition. A variety of state and federal programs provide subsidized funding, specifically, low interest loans, to beginning farmers (USDA Beginning Farmers and Ranchers Loans, 2022; Minnesota State Northern Agricultural Center of Excellence Discover FBM, 2022). But, after these farmers have 10 years of experience and are no longer considered a beginning farmer, they lose access to these programs.

Beginning farmers differ in the way they enter the industry. Two common options for starting a farming operation are (1) through purchasing or leasing dairy cows and/or a dairy barn and associated facilities and (2) transitioning into a principal operator role on an already existing dairy farm. The former are considered beginning farmers in the context of this research, while the latter are considered to be second-generation beginning

farmers. In some instances, farmers in the second-generation beginning farmer group may be a third or fourth generation farmer, but for the purpose of this research, any farmer taking over an already existing farm has collectively been termed a second-generation beginning farmer.

Farmers with more than 10 years of experience are established farmers. Due to the unique panel structure of this dataset, some farmers are in the dataset as they make the transition from a beginning to an established farmer. Transitioned to established farmers are farmers with more than 10 years of experience that were also in the dataset as a beginning farmer.

Coding Stratification

The primary variable used to create these four groups was the year the farm started operating. For some farms, the operation's start date changed. If the start date changed by less than 20 years, the year that appeared most frequently was used to calculate the experience level for the farmer. If the start date changed by 20 years or more, then the farm was coded as an established farm prior to the change, as each of these farms met the 10 year experience criteria, and after the operation start date change, the farm was coded as a second-generation beginning farm. Nine farms consisting of 42 observations were deleted from the dataset because the year the operation started changed by over 20 years, but the change was to an earlier date.[2] For example, one farm had a start date of 2006 for the years of 2007-2010, but for the years of 2011-2013 the start date

[2] The 42 observations are accounted for and already subtracted from the total observations of 12,556.

was listed as 1980. This farm was one of nine that were removed from the dataset due to inconsistency. Figure 1 illustrates the process used for the year started farming variable.

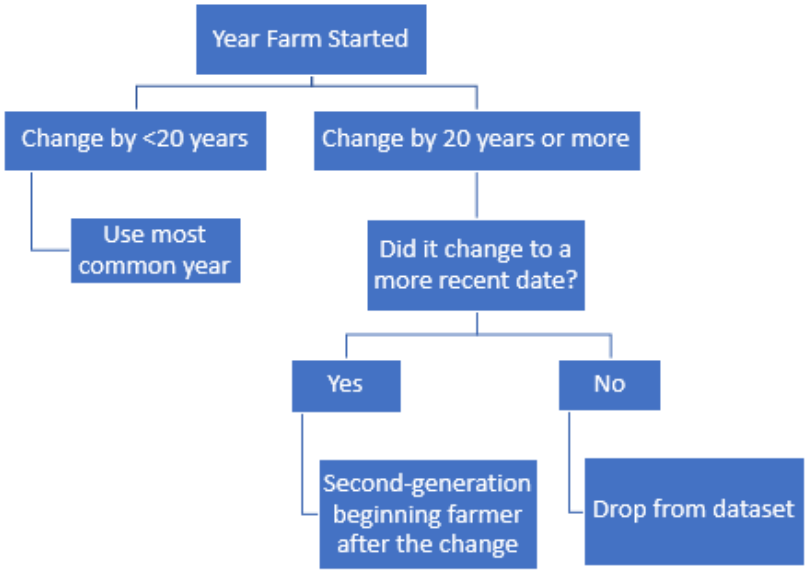

Figure 1: Year Farm Started Changes

In addition to the start date of the operation, a dummy variable for if the farmer was a beginning farmer participant was used to create the exclusive groups. In some instances, the farmer was labeled as a beginning farmer participant, yet the farmer had more than 10 years of experience. If the farmer had 20 years of experience or more and was labeled as a beginning farmer participant using the beginning farmer "special sort", then they were coded as second-generation beginning farmers. One hundred sixty-three observations met these criteria and were labeled as second-generation beginning farmers. There were 57 observations labeled as beginning farmer participants that had an experience level of 11 years to 19 years. Of these 57 observations, 37 were transitioned to

established farmers in which the beginning farmer special sort was not removed from the farm. The remaining 20 observations were labeled as established farmers due to their experience in the industry. This breakdown is illustrated below in Figure 2.

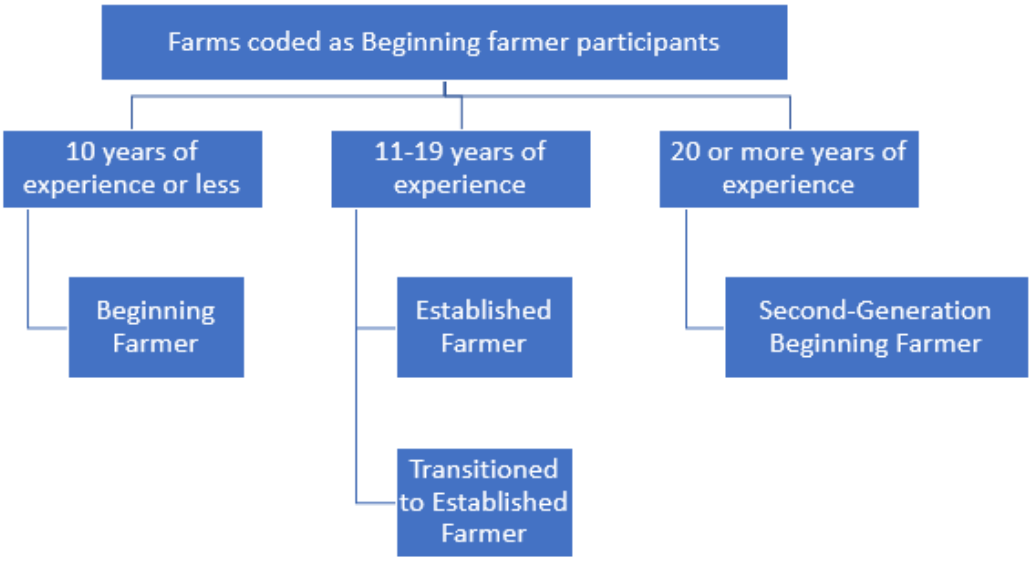

Figure 2: Beginning Farmer Participant Farmer Group Categories

In summary, a beginning farmer was coded as a farmer with 10 years of experience or less. An established farmer was identified as a farmer with more than 10 years of experience that was only in the dataset as an established farmer. Second-generation beginning farmers were coded as those that experienced a change of 20 or more years in the start date of their operation or those labeled as beginning farmer participants with 20 or more years of experience. Lastly, transitioned to established farmers were categorized as established farmers that were also in the dataset as a beginning farmer. The dataset contained 1,748 beginning farmer observations (14%), 9,145 established farmers observations (73%), 350 second-generation beginning farmers observations (3%) and, 1,313 transitioned to established farmers observations (10%).

DEPENDENT VARIABLE: PROFITABILITY

The research objective was to compare differences in financial performance across the four farmer groups and identify characteristics that drive profitability as the farmer's experience grows. In this analysis, three profitability measures were analyzed including the operating profit margin, rate of return on assets, and net farm income. The operating profit margin, rate of return on assets, and net farm income were compared between beginning, established, second-generation beginning, and transitioned to established farmers (Table 1). Continuous financial variables were inflated with 2021 as the base year using the Minneapolis Fed Consumer Price Index (Federal Reserve Bank of Minneapolis, 2022).

Table 1: Financial variables, descriptions, and calculations

Dependent Variable	**Description**	**Calculation**
Rate of Return on Assets	Percent return of all investments on the farm	Return on farm assets / average farm assets
Operating Profit Margin	Percent of revenue that is retained on the farm as profit	Return on farm assets / value of farm production
Net Farm Income*	Represents the farmer's return to labor management and equity	Total Revenue - Total Expenses + Inventory Change - Depreciation

Note: * Indicates the variable was adjusted for inflation using the Minneapolis Fed Consumer Price Index Calculator with 2021 as the base year

The operating profit margin evaluates how much of every dollar of revenue is retained on the farm as profit, considering the opportunity costs of labor and management. It is calculated as the operating profit divided by total revenue. Operating profit is equivalent to the return on assets. An operating profit margin above 25% is good, while a margin below 15% is considered poor and signals that for every dollar of revenue that is generated on the farm, only 15 cents is retained as profit.

The rate of return on assets measures the return on all investments on the farm. It is calculated as the return on farm assets divided by average farm assets, where the return on assets is the sum of net farm income and farm interest less the value of operator labor and management. A ratio below 4% is poor, while a ratio of 8% or higher is considered good which would indicate an 8% return on investments made on the farm.

The net farm income represents the amount of revenue that is left after all expenses are paid. It is calculated as total revenues less total expenses. This metric is not a ratio and therefore cannot be compared across farm sizes. A farmer will maximize net farm income, or profit, and a positive value indicates that the farm retained some revenue as equity. A negative value indicates that the farm lost money, having more expenses than revenues throughout the year.

EXPLANATORY VARIABLES

Explanatory variables included farm operator characteristics, farm size characteristics, herd indicators, and farm financial metrics.

Farm Operator Characteristics

Farm operator characteristics included farmer type (beginning, established, second-generation beginning, and transitioned to established), number of operators, and an off-farm income indicator. Established farmers were the comparison group for farmer type. Each of the farmer groups were included as dummy variables, where a value of 1 indicated the farmer was in that group and it had a value of 0 otherwise. The off-farm

income indicator was a dummy variable with a value of 1 if the farm recorded off-farm income and a value of 0 otherwise. Relative to established farmers, beginning and transitioned to established farmers were expected to have a lower financial performance due to less experience. Given that second-generation beginning farmers often expanded their herd and had the preceding generation assisting with decisions, they were expected to have a higher financial performance than established farmers. As a farm increased its number of operators, the operators may be able to specialize in different areas on the farm, consequently, increasing financial performance. Lastly, many farms reported off-farm revenue sources, which was expected to be negatively associated with farm financial performance.

Farm Characteristics

Farm characteristics consisted of herd size, acreage, and percent of acreage owned. The marginal impact of the addition of a cow to a 50 cow herd was expected to be different than the addition of a cow to a 150 cow herd, and therefore, herd size was comprised of 5 dummy variables (1-50 cows, 51-100 cows, 101-200 cows, 201-500 cows, and over 500 cows). The smallest herd size was used as the reference category. A larger herd size was expected to positively impact farm performance because large farms have the ability to take advantage of efficiencies, lowering per cow expenses. Operating more acreage indicated that the farmer was able to produce more feed on the farm and diversified the operation to include grain commodity sales. Therefore, total acreage and percent of acreage owned were expected to be positively associated with a farm's financial performance.

Herd Characteristics

Herd explanatory variables included milk yield, percent change in milk yield, a herd health indicator, and feed cost per hundredweight of milk. As a cow produced more milk relative to the increase in feed costs incurred to produce the additional milk, revenue was expected to increase, positively contributing to financial performance. Percent change in milk yield measured whether the average production per cow was increasing, decreasing, or consistent. A positive percent change in milk yield indicated that milk production per cow was higher in this year than in the previous year and was expected to be positively associated with financial performance. Health problems within the herd were identified by the proportion of operating expenses dedicated to veterinary expenses. If the farm's veterinary expenses were higher than 5% of the operating expenses, then it was determined that the farm likely had health problems within the herd.[3] A dummy variable was created and a value of 1 was given if the farm has herd health issues and a value of 0 otherwise. The herd health indicator was expected to be negatively associated with farm financial performance. Feed cost per hundredweight of milk was also expected to have a negative association with financial performance. As feed expenses per hundredweight of milk increase, farm expenses increased while milk production also increased simultaneously, however, if the expenses increased more relative to the marginal increase in production, the association between feed cost per hundredweight of milk and financial performance would be negative.

[3] The 5% cutoff value, indicating herd health concerns, represents the value for farms performing at the lowest 10% from 1997-2021 in accordance with the FINBIN benchmark report.

Farm Financial Characteristics

Financial explanatory variables used are interest expense per cow, depreciation expense per cow, a hired labor expense indicator, government payments as a percentage of total revenue, and the current ratio. A high interest expense per cow indicated that the farm has debt and may be expanding with this debt. In the short run, profits were compromised to achieve higher profits long-term. The expected sign on interest expense per cow was negative as this was an expense that would take away from financial performance in the current time-period. Depreciation expense was a noncash expense in which there was an annual loss in an asset's value due to wear and tear. High depreciation expense indicated that capital assets were recently purchased and therefore with the addition of these assets, it was expected that a higher depreciation expense would decrease financial performance. The hired labor expense dummy variable had a value of 1 if the hired labor expense was over 40% of total expenses, which was the median value based on FINBIN benchmark reports, and 0 otherwise.[4] The value of 1 indicated that the farm had high hired labor expenses and was expected to have a negative association with financial performance. The expected sign for government payments as a percentage of total revenue was negative because as government payments comprised a larger share of revenue, this indicated that the farm was reliant on outside sources to provide revenues rather than generating their revenues from producing milk and other commodities on the farm. Lastly, the current ratio measured the farm's liquidity, and a strong current ratio was expected to positively impact profitability.

[4] The 40% cutoff value, indicating high labor expenses, represents the value for farms performing at the 50% level from 1997-2021 in accordance with the FINBIN benchmark report.

VI. RESULTS

Stata Statistical Software, release 17 (StataCorp, 2021) was used to compute t-tests, summary statistics for the financial variables, distribution tests, and unconditional quantile regressions.

T-TESTS

T-tests are performed to determine whether the farmer groups were statistically different from one another using the "ttests" command in Stata (Stata-Corp, 2021). In each pairwise comparison, the farmer groups were statistically different; therefore, conclusions can be made based on farmer groups.

SUMMARY STATISTICS

Table 2 shows the summary statistics for the 3 financial profitability variables. Financial performance metrics fluctuated depending on the market conditions and price volatility for the year. These summary statistics analyzed the long-run average from 1997-2021. Each variable was winsorized at the 1% and 99% levels, meaning that observations below the 1% level were replaced with the 1% value and observations above the 99% value were replaced with the 99% value to eliminate extreme outliers (Hastings et al., 1947; Ludwig-Mayerhofer, 2020). Both the original and winsorized summary statistics were included in the table.

Profitability measures included the operating profit margin, rate of return on assets, and net farm income. When examining the operating profit margin, beginning farmers retained 11.42% of revenue as profit on their farm, however prior to imposing the

3-year data requirement, the operating profit margin for beginning farmers was -0.13% over the 25-year time period. Established, second-generation beginning, and transitioned to established farmers had operating profit margins ranging from 9.58 to 14.77 indicating that these farms retained 9.58 cents to 14.77 cents per dollar of revenue generated on the farm. Due to volatility in prices, an average of 9-14 cents retained over the 25-year time period was substantial. Beginning farmers performed best in terms of rate of return on assets achieving 7.81% return on investments made on the farm, while second-generation beginning farmers performed worst with a 4.77% return. The beginning farmers' rate of return on assets was likely driven by a low level of assets compared to the other farmer groups, which was in the denominator of the calculation. Over the 25-year time-period, each of the farmer groups had a positive net farm income indicating that the farm was generating more revenues than expenses. Beginning farmers had the lowest net farm income at approximately $74,000. However, net farm income and farm size are correlated in which beginning farmers had the smallest herd size on average. Established and second-generation beginning farmers have similar net farm income. Transitioned to established farmers had the highest net farm income at $115,700 on average. For the three measures of profitability, the summary statistics have shown beginning farmers had the highest rate of return on assets, but the lowest net farm income.

Table 2: Operating Profit Margin, Rate of Return on Assets, Net Farm Income by farmer type, 1997-2021

				Non-winsorized		Winsorized	
Dependent Variable	**Farmer Type**	**Unit**	**Obs**	**Mean**	**Std. dev.**	**Mean**	**Std dev.**
OPM	All	%	12,033	12.42	138.08	12.40	22.88
	BF	%	1,701	7.47	112.48	11.42	27.56
	EF	%	8,740	13.22	153.78	12.36	22.00
	SGBF	%	347	9.95	27.24	9.58	22.74
	TEF	%	1,240	14.30	26.90	14.77	21.76
RROA	All	%	12,000	6.41	13.69	6.43	9.19
	BF	%	1,692	8.21	17.43	7.81	12.09
	EF	%	8,717	6.06	13.42	6.16	8.55
	SGBF	%	347	4.83	9.69	4.77	8.74
	TEF	%	1,239	6.87	10.01	6.89	8.87
NFI	All	$	12,033	109.29	222.26	104.84	168.18
	BF	$	1,701	72.98	114.21	73.96	108.18
	EF	$	8,740	114.57	239.40	109.11	177.43
	SGBF	$	347	113.55	212.17	109.67	186.22
	TEF	$	1,240	120.74	207.05	115.70	159.13

KOLMOGOROV-SMIRNOV TESTS

The 18 Kolmogorov-Smirnov tests (3 variables with 6 farmer pairwise groupings) were conducted for each of the financial measures with results in Table 3. Results indicated that distributions for beginning farmers were statistically different than the other three farmer groups at the 1% level in pairwise comparisons across each of the three profitability measures. Established farmers and second-generation beginning farmers had no difference in their distributions for their net farm income. Table 3 also shows that as farmers gain experience, their distributions were different than those

starting their operation, and transitioned to established and beginning farmers had statistically different financial performance across all measures.

Table 3: Kolmogorov-Smirnov Test Results

Pairwise group		**OPM**	**RROA**	**NFI**
BF/EF	D	0.0626	0.1201	0.0999
	P-value	0.000***	0.000***	0.000***
BF/SGBF	D	0.1205	0.1956	0.1471
	P-value	0.000***	0.000***	0.000***
BF/TEF	D	0.0739	0.1067	0.1334
	P-value	0.001***	0.000***	0.000***
EF/SGBF	D	0.0727	0.1020	0.0621
	P-value	0.058*	0.002***	0.152
EF/TEF	D	0.0690	0.0457	0.0508
	P-value	0.000***	0.022**	0.007***
SGBF/TEF	D	0.1292	0.1325	0.0919
	P-value	0.000***	0.000***	0.021**

Note: *=Significant at the 10% level, **=Significant at the 5% level, ***=Significant at the 1% level

FIRST-ORDER STOCHASTIC DOMINANCE

Figures 3-5 present the cumulative density function plots for the first-order stochastic dominance analysis. When the functions crossed, that indicated there was no dominance. Overall, there was no first-order stochastic dominance within these plots. None of the groups had a higher expected value in pairwise group comparisons for the full distribution of the three financial variables considered.

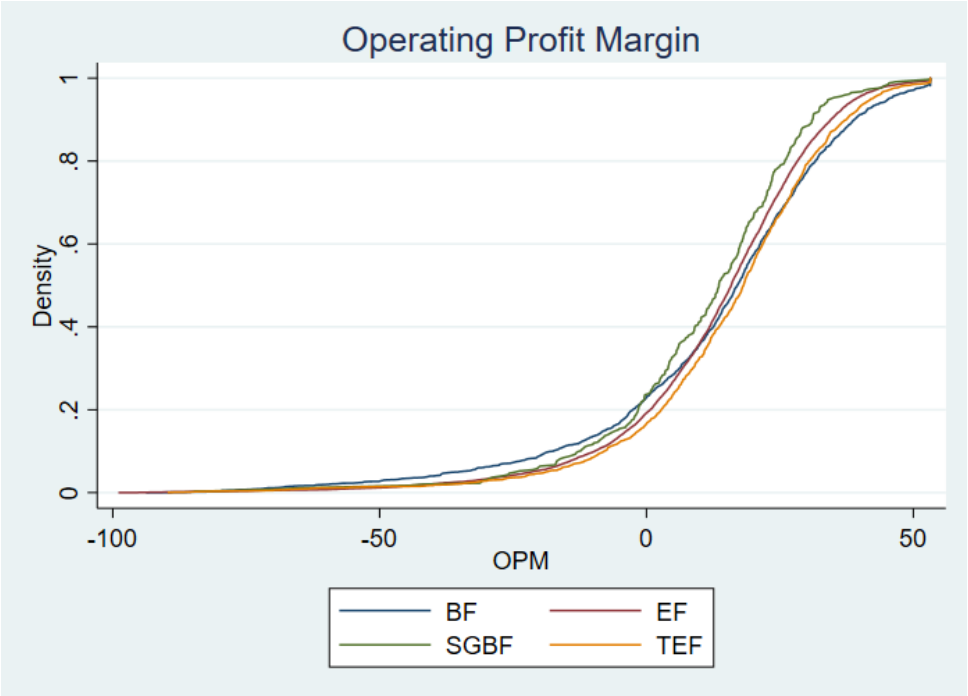

Figure 3: Operating Profit Margin, FOSD Plot by farmer type, 1997-2021

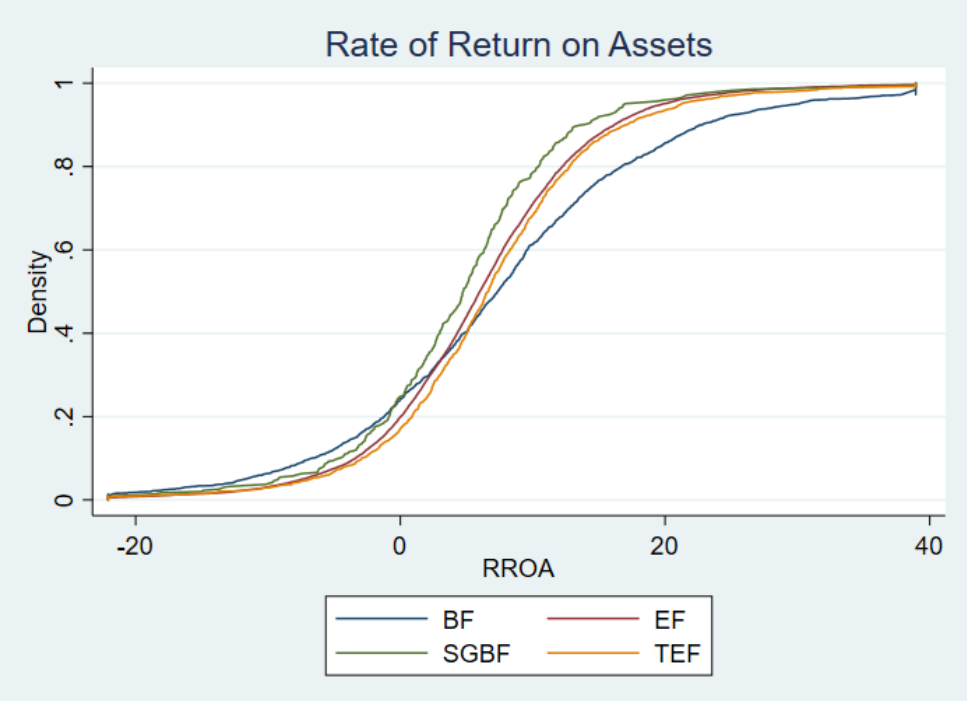

Figure 4: Rate of Return on Assets, FOSD Plot by farmer type, 1997-2021

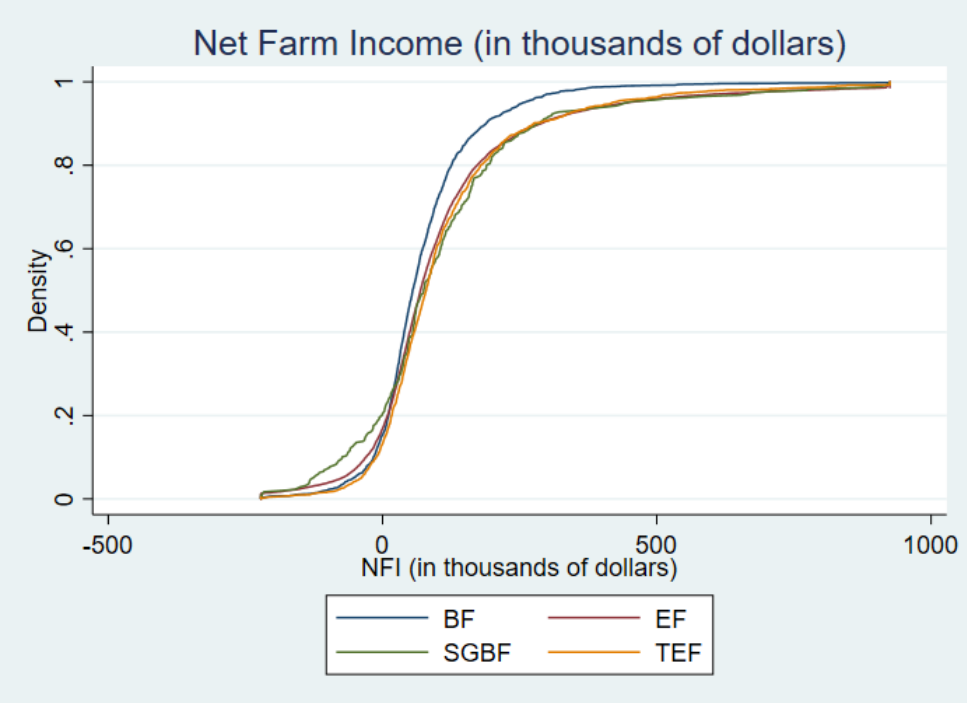

Figure 5: Net Farm Income (in thousands of dollars), FOSD Plot by farmer type, 1997-2021

VIOLIN PLOTS

Figures 6-8 show violin plots of the financial variables for the four groups of farmers (Beginning Farmers; Established Farmers; Second-Generation Beginning Farmers; Transitioned to Established Farmers). These plots combined density and box plots. A density trace showed the distribution of the data where peaks indicated a higher concentration of observations. Box plots showed the median, standard deviation, and outliers in the data. Figures 6-8 show that the distributions, medians, and standard deviations of the financial variables differ across farmer types. Specifically, in Figure 8 the distribution of net farm income resembled normal distributions for each farmer type, however the standard deviation and density differed among groups, and beginning farmers had the smallest spread or volatility in their net farm income.

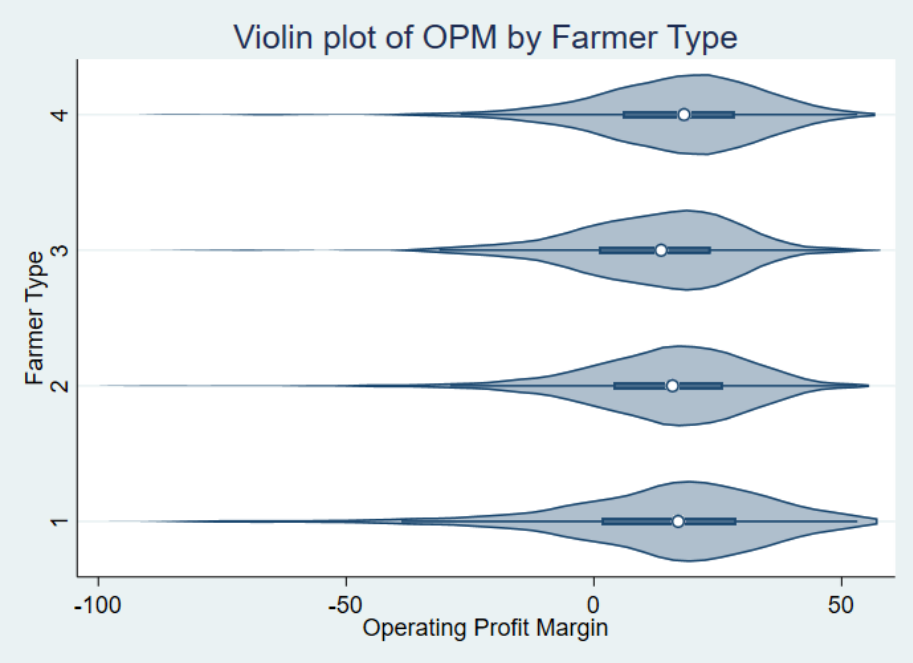

Figure 6: Operating Profit Margin, Violin Plot by farmer type, 1997-2021

Note: Farmer Type 1 = Beginning Farmers, Farmer Type 2 = Established Farmers, Farmer Type 3 = Second-Generation Beginning Farmers, Farmer Type 4 = Transitioned to Established Farmers

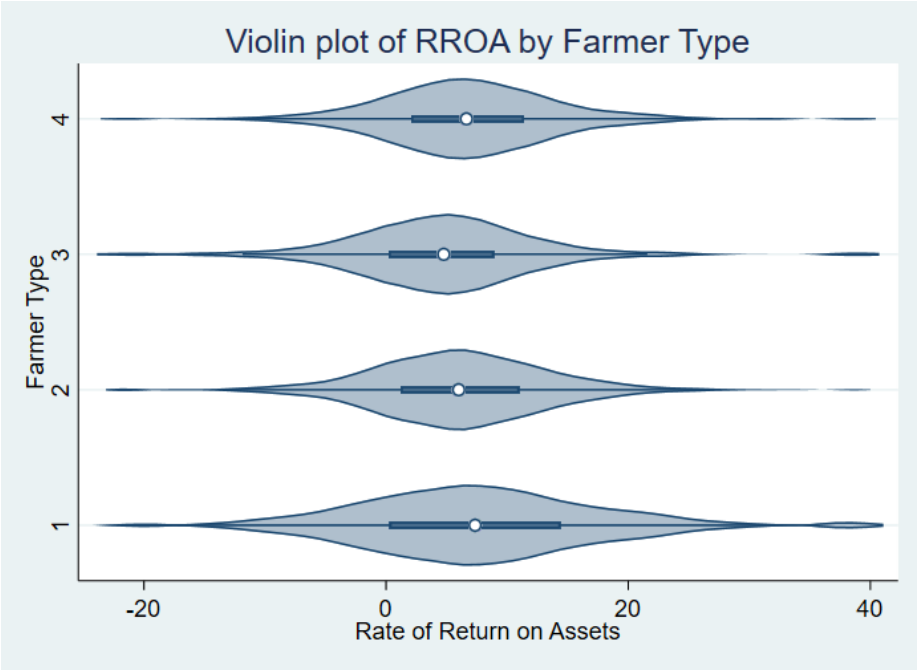

Figure 7: Rate of Return on Assets, Violin Plot by farmer type, 1997-2021

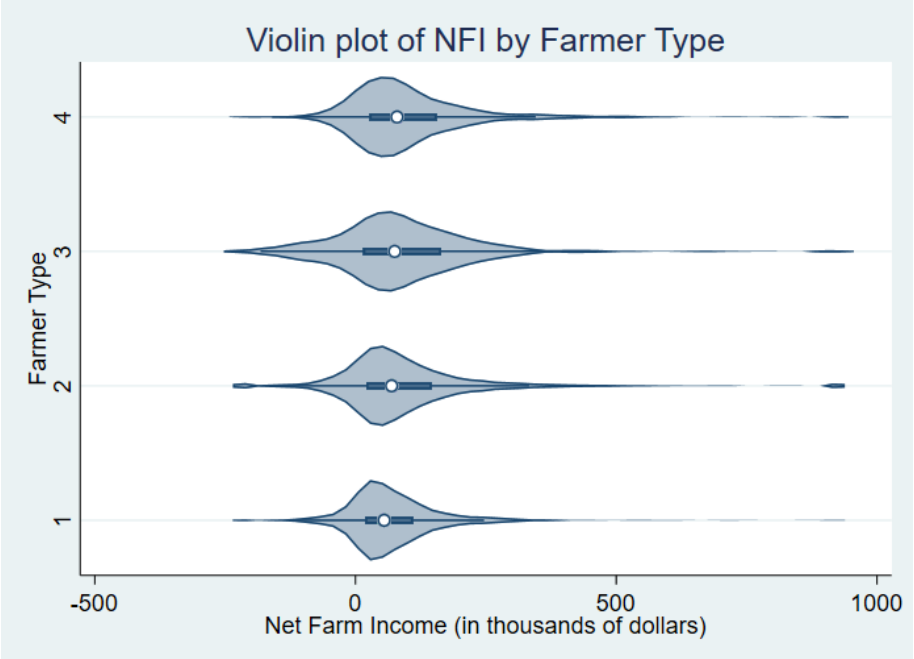

Figure 8: Net Farm Income (in thousands of dollars), Violin Plot by farmer type, 1997-2021

EXPLANATORY VARIABLES

The summary statistics for the explanatory variables for the full dataset, beginning farmers, established farmers, second-generation beginning farmers, and transitioned to established farmers were listed below in Tables 4-8, respectively. Herd size differed by farm type. Beginning farmers had the smallest herd size (94 cows) and second-generation beginning farmers had the largest herd size (175 cows). A similar finding resulted for total acreage. Beginning farmers operated smaller acreage (196 acres) than second-generation beginning farmers (442 acres). These statistics were similar to those found in Ahearn & Newton (2009). Established farmers owned approximately 52% of their land, while beginning farmers owned less than 40% of the total acres operated. About 71% of all farms participated in off-farm employment, while second-generation beginning farmers participated in off-farm employment at the lowest rate (56%). Beginning farmers received a lower proportion of their revenue from government payments, which suggested that they did not participate in government programs at the same level as their counterparts. This was consistent with the fact that government payments are correlated with farm size and beginning farms were smaller on average, participating less in payment programs (USDA-FSA, 2022; Roberts & Key, 2003; Key & Roberts, 2007). Second-generation beginning farmers had 1.66 operators on average which was the highest among the four groups and was consistent with the idea that these farmers were taking over the farm from an older generation that likely was still involved on the farm in some capacity. Beginning farmers had a 1.62% increase in milk yield annually; however, as they gained experience this fell to 0.49% in the transitioned to established farmers group. Lastly, nearly 46% of second-generation beginning farmers had hired labor

expenses comprising over 40% of total expenses as indicated by the hired labor indicator, and beginning farmers fared the best at 27% of farms having high levels of hired labor. Many of the summary statistics supported the hypothesis that second-generation beginning farmers are taking over an established farm and expanding the farm as these farmers had larger herd sizes and acreage operated. Additionally, beginning farmers had the smallest acreage and herd size as they are starting their farming operations.

Table 4: Summary statistics for Explanatory Variables, All Farmers, 1997-2021

Continuous Variables	Unit	Obs	Mean	Std. dev.
Number of operators	Operators	12,025	1.38	0.72
Total acreage	Acres	12,033	388.32	397.29
Percent of acreage owned	%	11,012	49.02	35.99
Milk yield	Lbs.	11,305	19,804.84	4,329.43
Percent change in milk yield	%	9,018	1.02	10.11
Feed cost per cwt of milk	$/cwt	11,023	7.35	2.56
Interest expense per head	$/head	11,021	334.90	282.31
Depreciation expense per head	$/head	11,009	370.43	288.42
Govt payments as a percent of total revenue	%	12,027	4.81	4.75
Current Ratio	$	11,484	3.78	7.77
Discrete Variables	Count	Obs	Proportion	
BF	1,748	12,556	13.9%	
EF	9,145	12,556	72.8%	
SGBF	350	12,556	2.8%	
TEF	1,313	12,556	10.5%	
Off-Farm Income Indicator	8,538	12,033	71.0%	
Herd Size1 (1-50)	2,686	11,659	23.0%	
Herd Size 2 (51-100)	4,520	11,659	38.8%	
Herd Size 3 (101-200)	2,607	11,659	22.4%	
Herd Size 4 (201-500)	1,375	11,659	11.8%	
Herd Size 5 (>500)	471	11,659	4.0%	
Herd Health Indicator	693	10,476	6.6%	
Hired Labor Indicator	4,269	10,532	40.5%	

Table 5: Summary Statistics for Explanatory Variables, Beginning Farmers, 1997-2021

Continuous Variables	Unit	Obs	Mean	Std. dev.
Number of operators	Operators	1,698	1.21	0.62
Total acreage	Acres	1,701	196.24	220.18
Percent of acreage owned	%	1,285	37.52	38.01
Milk yield	Lbs.	1,526	19,063.44	4,040.40
Percent change in milk yield	%	1,075	1.62	10.85
Feed cost per cwt of milk	$/cwt	1,492	7.47	2.59
Interest expense per head	$/head	1,525	278.96	240.16
Depreciation expense per head	$/head	1,523	270.44	226.01
Govt payments as a percent of total revenue	%	1,700	4.03	4.93
Current Ratio	$	1,641	2.88	6.25
Discrete Variables	Count	Obs	Proportion	
Off-Farm Income Indicator	1,201	1,701	70.6%	
Herd Size1 (1-50)	515	1,573	32.7%	
Herd Size 2 (51-100)	640	1,573	40.7%	
Herd Size 3 (101-200)	287	1,573	18.3%	
Herd Size 4 (201-500)	116	1,573	7.4%	
Herd Size 5 (>500)	15	1,573	1.0%	
Herd Health Indicator	117	1,454	8.1%	
Hired Labor Indicator	389	1,464	26.6%	

Table 6: Summary Statistics for Explanatory Variables, Established Farmers, 1997-2021

Continuous Variables	Unit	Obs	Mean	Std. dev.
Number of operators	Operators	8,735	1.42	0.74
Total acreage	Acres	8,740	427.23	422.12
Percent of acreage owned	%	8,240	51.50	35.17
Milk yield	Lbs.	8,157	19,826.63	4,373.04
Percent change in milk yield	%	6,533	1.01	10.03
Feed cost per cwt of milk	$/cwt	7,956	7.22	2.53
Interest expense per head	$/head	8,006	352.50	299.95
Depreciation expense per head	$/head	7,997	389.32	301.06
Govt payments as a percent of total revenue	%	8,735	4.95	4.70
Current Ratio	$	8,317	3.89	7.86
Discrete Variables	Count	Obs	Proportion	
Off-Farm Income Indicator	6,234	8,740	71.3%	
Herd Size1 (1-50)	1,897	8,424	22.5%	
Herd Size 2 (51-100)	3,163	8,424	37.6%	
Herd Size 3 (101-200)	1,882	8,424	22.3%	
Herd Size 4 (201-500)	1,087	8,424	12.9%	
Herd Size 5 (>500)	395	8,424	4.7%	
Herd Health Indicator	518	7,595	6.8%	
Hired Labor Indicator	3,373	7,634	44.2%	

Table 7: Summary Statistics for Explanatory Variables, Second-Generation Beginning Farmers, 1997-2021

Continuous Variables	Unit	Obs	Mean	Std. dev.
Number of operators	Operators	347	1.66	0.79
Total acreage	Acres	347	442.12	339.02
Percent of acreage owned	%	328	43.14	37.29
Milk yield	Lbs.	322	21,284.75	4,676.13
Percent change in milk yield	%	274	1.09	9.33
Feed cost per cwt of milk	$/cwt	309	8.51	2.74
Interest expense per head	$/head	321	272.45	209.43
Depreciation expense per head	$/head	321	378.70	261.15
Govt payments as a percent of total revenue	%	347	5.59	5.04
Current Ratio	$	339	4.51	9.75
Discrete Variables	Count	Obs	Proportion	
Off-Farm Income Indicator	195	347	56.2%	
Herd Size1 (1-50)	31	324	9.6%	
Herd Size 2 (51-100)	111	324	34.3%	
Herd Size 3 (101-200)	109	324	33.6%	
Herd Size 4 (201-500)	46	324	14.2%	
Herd Size 5 (>500)	27	324	8.3%	
Herd Health Indicator	6	304	2.0%	
Hired Labor Indicator	141	307	45.9%	

Table 8: Summary Statistics for Explanatory Variables, Transitioned to Established Farmers, 1997-2021

Continuous Variables	Unit	Obs	Mean	Std. dev.
Number of operators	Operators	1,240	1.25	0.60
Total acreage	Acres	1,240	360.50	335.46
Percent of acreage owned	%	1,154	45.81	36.23
Milk yield	Lbs.	1,217	20,349.90	4,123.91
Percent change in milk yield	%	1,071	0.49	9.89
Feed cost per cwt of milk	$/cwt	1,183	7.88	2.55
Interest expense per head	$/head	1,166	303.07	191.35
Depreciation expense per head	$/head	1,165	368.33	250.37
Govt payments as a percent of total revenue	%	1,240	4.73	4.68
Current Ratio	$	1,192	4.10	8.19
Discrete Variables	Count	Obs	Proportion	
Off-Farm Income Indicator	904	1,240	72.9%	
Herd Size1 (1-50)	179	1,243	14.4%	
Herd Size 2 (51-100)	579	1,243	46.6%	
Herd Size 3 (101-200)	325	1,243	26.1%	
Herd Size 4 (201-500)	126	1,243	10.1%	
Herd Size 5 (>500)	34	1,243	2.7%	
Herd Health Indicator	52	1,120	4.6%	
Hired Labor Indicator	366	1,124	32.6%	

UNCONDITIONAL QUANTILE REGRESSION

Due to the tight distributions across farmer groups, the unconditional quantile regression was estimated only for the operating profit margin. The operating profit was critical to stay in business. The rate of return on assets was fairly stable due to consistent asset bases, and the net farm income was heavily correlated with farm size, and as noted previously, herd size differed across groups which would explain much of the variation in net farm income. This framework provided a comparison across groups while also

capturing the distributional changes across and within a farmer group. The unconditional quantile regression was computed at the 10^{th}, 30^{th}, 50^{th}, 70^{th}, and 90^{th} percentiles for the full dataset as well as for each farmer group individually. Ideally, an unconditional quantile regression would be analyzed for the full dataset, however, there appeared to be unexplained correlation and therefore, the regressions were computed for each farmer group individually as well.

ALL FARMERS

Table 9 presents the results for all farmers in one regression using dummy variables for beginning, established, second-generation beginning, and transitioned to established farmers. Relative to established farmers, being a second-generation beginning farmer decreased the operating profit margin by 6.81% for farms in the 90^{th} percentile. There were no other statistically significant differences between the farmer groups across the distribution of the operating profit margin. Number of operators was not significant, while the off-farm income indicator had a negative association with operating profit margin at the 90% percentile. Each of the farm characteristics were statistically significant and positive at different percentiles which indicated that a larger herd size, acreage, or percent of acreage owned increased the farm's operating profit margin. The strength of these associations differed. For example, relative to a farm with 1-50 cows, a farmer with a herd of 101-200 cows (HerdSize3) at the 10^{th} percentile had an increase of 10.5% in their operating profit margin while at the 30^{th} and 50^{th} percentiles the magnitude was 8.8% and 4.1% respectively. Milk yield had a positive association with operating

profit margin, but the magnitude was similar across percentiles and was not a major driver of the operating profit margin. Feed cost per hundredweight of milk was statistically significant at the 10th and 30th percentiles and held the expected sign. Lastly, for the farm financial characteristics, the hired labor indicator, depreciation per head, the percentage of total revenue that was government payments and current ratio all held expected signs and were significant at different percentiles while interest expense per head was not significant. In addition to the covariates listed above, year dummy variables were included to control for shocks in the system including weather and market shifts. The reference year was 2021 and the results showed no statistical significance for 2002 or 2006. The U.S. economy experienced the Great Recession in 2008 and the dairy industry experienced record high prices in 2014 and these events were the key drivers for the decreased operating profit margins in 2009, 2013, and 2015-2019, relative to 2021. And, these associations impacted low performing farms more than high performing farms.

BEGINNING FARMERS

Table 10 presents the unconditional quantile regression results for beginning farmers. Farm operator characteristics were not statistically significant, except the off-farm income indicator was positive and significant for the lowest 10% of farmers. Herd size was not significant across the different size categories and percentiles except for the herds of 101-200 cows (HerdSize3) at the 90th percentile had a negative association with operating profit margin. Milk yield was significant at the 30th, 50th, and 70th percentiles with similar magnitudes. Interestingly, the herd health indicator was significant, positive,

and decreasing in magnitude across the percentiles. This indicated that beginning farmers had high veterinary expenses relative to their total operating expenses, yet were achieving a higher operating profit margin. These farms may have been proactive in keeping their herd healthy which increased their operating profit margin by eliminating other expenses. Interest expense per head and depreciation expense per head had the expected signs for the percentiles that are significant. Interestingly, beginning farmers at the 10^{th} percentile were unaffected by market conditions and other factors controlled for by the year dummy variables.

ESTABLISHED FARMERS

Table 11 shows that the two farm operator characteristics (number of operators and off-farm income) did not have a statistically significant impact on established farmer's operating profit margin. An increase in herd size was associated with an increase in the operating profit margin for herds of 51-500 cows at the 10^{th} and 30^{th} percentiles with the largest impact for farms performing at the 10^{th} percentile. Similar to the full dataset unconditional quantile regression results, milk yield was positive with a consistent magnitude across quantiles. An increase in feed cost per hundredweight of milk decreased the operating profit margin by 2.7% and 0.8% for farms at the 10^{th} and 30^{th} percentiles respectively. Farms with high hired labor expenses experienced decreases in their operating profit margin at an increasing rate. As the farm generated a larger percentage of their revenue from government payments, it decreased their operating profit margin indicating a reliance on government payments may decrease financial

performance. Similar to the UQR for all farmers, relative to 2021, during the years of 2009, 2013, and 2015-2019 established farmers experienced decreased profitability. In 2020, many farmers received additional government payments as part of the Coronavirus Food Assistance Program (CFAP), and these farmers had an increase in their profitability relative to 2021.

SECOND-GENERATION BEGINNING FARMERS

For second-generation beginning farmers performing at the highest two percentiles, off-farm income had a positive association with operating profit margin (Table 12). For the 30th, 50th, and 70th percentiles, herd size, acreage, and percent of acreage owned had no statistically significant impact. For the lowest 10% of farms, the herd health indicator was significant and negative, which was consistent with expectations. Feed cost per hundredweight of milk and percent change in milk yield were not significant measures of herd characteristics. And, when analyzing the farm financial characteristics, results showed that interest, depreciation, and hired labor expense characteristics had no significant impact on the operating profit margin. Contrary to expectations, the current ratio had a negative effect for the 50th and 70th percentiles indicating that liquid farms have lower profitability. Farmers at the 10th percentile had operating profit margins 60-77% higher during the years of 2002-2005, 2007, and 2008, relative to 2021. The years of 2000, 2006, 2009-2016 and 2019 had no statistically significant difference in profitability relative to 2021 for the second-generation beginning farmers.

TRANSITIONED TO ESTABLISHED FARMERS

Table 13 presents the unconditional quantile regression results for transitioned to established farmers. For these farmers performing at the 30th percentile, increasing the number of operators was found to decrease the operating profit margin. The expectation was that as the number of operators increases, these operators would be able to specialize and become more efficient in their respective area on the farm, however, for these farmers it may be that the additional cost to add operators outweighs the specialization benefits. Herd size positively impacted the operating profit margin, but acreage and percent of acreage owned had a negative association at the 30th percentile. Milk yield was consistently significant and positive across models, however for the transitioned to established farmers milk yield only impacted farmers that were performing at the lowest percentile. Government payments decreased operating profit margin at the 10th and 30th percentiles, while the current ratio increased operating profit margin at the 50th and 70th percentiles. In 2009, transitioned to established farmers at the 10th, 30th, and 50th percentiles experienced declines in their profitability relative to 2021 due to the Great Recession. Other market conditions impacted the agriculture industry as well, such as in 2020, the Coronavirus Food Assistance Program (CFAP) government payments increased profitability relative to 2021. Finally, after the record prices in 2014, farmers experienced losses in profitability (2015-2018).

Table 9: Operating Profit Margin Unconditional Quantile Regression for All Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
BF	2.7981	2.4945	-10.1629	0.4311	10.2679
	(24.0901)	(13.5502)	(8.0007)	(8.2274)	(6.7929)
SGBF	3.6674	3.9329	2.4250	-2.5596	-6.8104**
	(4.8468)	(2.5467)	(2.1256)	(2.0227)	(2.7841)
TEF	4.8514	3.3068	-10.5883	-1.6365	6.4155
	(23.9643)	(13.4647)	(7.9318)	(8.1566)	(6.6080)
NumberOfOperators	-1.2719	1.2906	-1.0147	-0.5797	-1.3120
	(2.0149)	(1.0925)	(0.8376)	(0.8920)	(1.1691)
OffFarmIncomeIndicator	0.7602	0.6641	0.3942	-0.5565	-1.9000**
	(1.6261)	(0.8372)	(0.6404)	(0.6472)	(0.8603)
HerdSize2	5.8647*	4.0067**	1.6069	1.7121	2.3142
	(3.0231)	(1.5586)	(1.2084)	(1.3003)	(1.8075)
HerdSize3	10.5433***	8.8429***	4.0565**	3.0355*	3.3970
	(3.9470)	(2.0102)	(1.5849)	(1.6576)	(2.2791)
HerdSize4	15.9957***	10.1707***	3.7728*	3.0252	1.8696
	(5.1386)	(2.8273)	(2.1793)	(2.2101)	(3.1010)
HerdSize5	7.3352	9.2039**	6.7330**	3.2322	-3.7718
	(6.4775)	(3.8205)	(3.4007)	(3.3518)	(4.4112)
TotalCropAcres	0.0133***	0.0055**	0.0040*	0.0028	0.0038*
	(0.0038)	(0.0023)	(0.0023)	(0.0020)	(0.0022)
PercentAcresOwned	0.0386	0.0395**	0.0327**	0.0295*	0.0646***
	(0.0359)	(0.0200)	(0.0149)	(0.0153)	(0.0207)
MilkYield	0.0019***	0.0009***	0.0009***	0.0006***	0.0007***
	(0.0004)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
PercentChangeMilkYield	0.0500	0.0448	0.0182	0.0338	0.0154
	(0.0665)	(0.0337)	(0.0249)	(0.0250)	(0.0322)
HerdHealthIndicator	-1.0398	0.2785	0.7475	1.0507	-0.1583
	(2.3585)	(1.2976)	(1.0100)	(1.0082)	(1.3089)
FeedCostPerCwtMilk	-2.7003***	-0.8435***	-0.2232	0.0213	0.1507
	(0.5719)	(0.2705)	(0.1942)	(0.1938)	(0.2529)
InterestExpensePerHead	-0.0020	0.0017	0.0023	0.0011	-0.0022
	(0.0041)	(0.0021)	(0.0017)	(0.0017)	(0.0024)
DepreciationPerHead	-0.0138***	-0.0090***	-0.0106***	-0.0113***	-0.0109***
	(0.0034)	(0.0016)	(0.0012)	(0.0013)	(0.0018)
HiredLaborIndicator	-2.1008	-0.6284	-1.5095**	-2.6054***	-3.8223***
	(1.7530)	(0.9264)	(0.7431)	(0.7731)	(1.0298)
GovtPaymentsPercent	-0.6754***	-0.3643***	-0.1245	-0.0028	0.1677
	(0.2137)	(0.1211)	(0.0909)	(0.0888)	(0.1372)
CurrentRatio	0.2812***	0.1561***	0.0437	0.0721*	0.1000
	(0.0791)	(0.0433)	(0.0363)	(0.0380)	(0.0631)
1997	9.2315	7.1590**	6.6539***	3.8430	4.8628
	(6.2547)	(3.3400)	(2.5495)	(2.4438)	(3.1458)
1998	16.7527***	15.4997***	15.6908***	13.3514***	18.2980***
	(6.0424)	(3.1644)	(2.4661)	(2.4573)	(3.3155)

Table 9 Continued: Operating Profit Margin Unconditional Quantile Regression for All Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
1999	15.7421***	17.0158***	15.1649***	13.7268***	13.7928***
	(5.9297)	(3.0578)	(2.3729)	(2.3940)	(3.1110)
2000	11.4781**	9.4828***	7.6196***	4.2993*	2.3330
	(5.8241)	(3.0919)	(2.3759)	(2.3317)	(2.9312)
2001	12.0128**	11.5545***	8.0743***	6.9712***	7.0877**
	(5.7478)	(3.0827)	(2.4071)	(2.3623)	(2.9791)
2002	4.0194	2.9450	2.2884	1.7525	1.1002
	(5.7510)	(3.0581)	(2.3309)	(2.2166)	(2.7452)
2003	7.3503	6.4386**	6.1586***	2.1212	2.5551
	(5.6192)	(2.9692)	(2.2664)	(2.1643)	(2.7271)
2004	8.7340	12.0118***	13.0050***	11.5098***	8.8550***
	(5.3355)	(2.8434)	(2.2093)	(2.1862)	(2.8743)
2005	7.1333	12.3774***	9.6830***	9.6351***	6.9094**
	(5.3350)	(2.7746)	(2.1734)	(2.1552)	(2.7401)
2006	-4.7011	1.3375	1.1629	1.6000	4.3465
	(5.3672)	(2.8690)	(2.1976)	(2.1064)	(2.6770)
2007	10.5351**	15.2726***	15.7455***	16.5963***	21.5863***
	(4.9913)	(2.6507)	(2.1172)	(2.0956)	(2.9084)
2008	6.4478	6.7795***	5.9540***	4.2780**	5.7140**
	(4.8735)	(2.6089)	(2.0741)	(1.9686)	(2.4421)
2009	-34.1137***	-14.4967***	-8.0385***	-6.0226***	-0.9722
	(5.7231)	(2.6152)	(1.8964)	(1.7678)	(2.1418)
2010	2.9004	5.1364*	5.9040***	3.7013*	5.4071**
	(4.8880)	(2.6660)	(2.0967)	(1.9951)	(2.4952)
2011	12.9298***	10.5828***	9.4361***	5.6609***	8.3380***
	(4.6268)	(2.4985)	(2.0160)	(1.9502)	(2.5425)
2012	17.4019***	13.7395***	10.3426***	8.4094***	9.3581***
	(4.3640)	(2.3968)	(1.9491)	(1.9059)	(2.4400)
2013	-13.8364**	-8.4835***	-6.3891***	-3.5716**	0.0166
	(5.4469)	(2.7178)	(2.0331)	(1.8069)	(2.0867)
2014	11.4741**	10.8421***	8.9559***	8.7470***	7.6150***
	(4.4687)	(2.5057)	(2.0880)	(2.0469)	(2.5799)
2015	-21.0372***	-14.6392***	-7.6411***	-4.3451**	0.2791
	(5.0905)	(2.6239)	(1.9199)	(1.7116)	(2.0405)
2016	-31.1716***	-20.1610***	-11.3528***	-6.0149***	-0.0519
	(5.2770)	(2.5889)	(1.8880)	(1.7245)	(2.0393)
2017	-26.6039***	-14.4173***	-9.5715***	-4.9887***	0.1230
	(4.8573)	(2.5727)	(1.9188)	(1.7198)	(2.0015)
2018	-45.1783***	-26.0690***	-13.7667***	-7.3476***	-1.1953
	(5.0779)	(2.3485)	(1.7496)	(1.6028)	(1.8897)
2019	-12.3445***	-9.3811***	-6.8848***	-5.0318***	-0.0538
	(4.2735)	(2.4515)	(1.8443)	(1.6444)	(1.9053)
2020	8.0430**	12.5904***	11.3297***	12.9649***	10.2941***
	(3.3905)	(2.0809)	(1.7497)	(1.7723)	(2.4009)

Table 9 Continued: Operating Profit Margin Unconditional Quantile Regression for All Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
constant	-33.5558**	-16.1240**	-1.7950	8.4859	14.0103**
	(14.4539)	(7.3735)	(5.3921)	(5.4531)	(7.0160)
N	7283	7283	7283	7283	7283
R^2	0.384	0.463	0.462	0.436	0.370

* p<0.10, ** p<0.05, *** p<0.01

Table 10: Operating Profit Margin Unconditional Quantile Regression for Beginning Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
NumberOfOperators	-0.6704	0.3532	-0.7198	0.5335	0.4201
	(2.5895)	(1.2346)	(1.2255)	(0.8296)	(1.0902)
OffFarmIncomeIndicator	12.8602*	-0.2945	0.7020	-1.1150	-2.6335
	(7.5968)	(3.9221)	(2.5252)	(2.4151)	(3.6860)
HerdSize2	-19.5664	-3.3530	-2.8558	-2.4878	0.5623
	(14.8049)	(7.2088)	(4.4380)	(4.0247)	(5.3078)
HerdSize3	-17.5781	-9.3266	-4.9752	-0.3278	-14.3377*
	(23.7344)	(10.1516)	(6.2213)	(6.1798)	(8.1744)
HerdSize4	-4.4142	-8.5260	4.7407	-8.4377	-5.1635
	(30.4263)	(12.4331)	(10.3376)	(9.3891)	(9.5841)
HerdSize5	8.4812	-7.3391	19.7579	-6.8335	4.1137
	(40.9815)	(23.7990)	(19.6008)	(12.2155)	(14.2794)
TotalCropAcres	0.0153	0.0059	0.0247*	0.0239**	0.0233
	(0.0390)	(0.0174)	(0.0136)	(0.0112)	(0.0144)
PercentAcresOwned	0.2948*	0.0738	0.0924*	0.0617	0.1406**
	(0.1566)	(0.0787)	(0.0511)	(0.0496)	(0.0676)
MilkYield	0.0032	0.0023**	0.0024***	0.0017***	0.0014
	(0.0027)	(0.0011)	(0.0007)	(0.0006)	(0.0009)
PercentChangeMilkYield	-0.2442	0.0990	0.0213	0.0202	0.0187
	(0.2862)	(0.1513)	(0.0900)	(0.0745)	(0.1089)
HerdHealthIndicator	23.0878*	13.1780**	12.1908***	8.9249**	8.8974
	(13.8330)	(6.2923)	(4.0783)	(4.1026)	(6.5184)
FeedCostPerCwtMilk	0.8003	-0.6176	0.3684	0.0895	0.6484
	(2.5369)	(1.4486)	(0.8706)	(0.8129)	(1.2848)
InterestExpensePerHead	-0.0584**	-0.0057	-0.0072	-0.0291***	-0.0079
	(0.0293)	(0.0132)	(0.0103)	(0.0078)	(0.0136)
DepreciationPerHead	0.0032	-0.0168**	-0.0147***	-0.0137***	-0.0082
	(0.0172)	(0.0072)	(0.0057)	(0.0048)	(0.0066)
HiredLaborIndicator	-7.5567	0.0235	2.3822	2.5844	1.2725
	(7.2761)	(3.6430)	(3.1247)	(3.1487)	(3.4431)
GovtPaymentsPercent	-1.4154	0.1811	0.3738	0.5964**	0.8426*
	(1.0331)	(0.4340)	(0.2891)	(0.2698)	(0.5003)
CurrentRatio	-0.1911	0.0863	-0.1337	-0.2018	0.3250**
	(0.8128)	(0.1957)	(0.1604)	(0.1587)	(0.1627)
1997	44.3603	12.3002	5.2048	-5.1286	31.2229
	(47.2705)	(22.5814)	(16.1277)	(13.9917)	(20.0920)
1998	56.9743	22.3627	16.8293	0.0603	39.1871*
	(47.2102)	(22.4495)	(16.1610)	(14.0272)	(20.2487)
1999	57.5279	19.0277	8.4844	-2.6682	34.8146*
	(45.2888)	(22.2844)	(15.8927)	(13.6474)	(19.4350)
2000	47.1531	9.3966	-5.4322	-16.3581	14.7742
	(46.4226)	(22.3665)	(15.9005)	(13.9001)	(18.9615)
2001	55.4341	11.3100	-8.8022	-10.4402	30.8632
	(45.4963)	(22.2259)	(16.1037)	(13.8661)	(19.0807)

Table 10 Continued: Operating Profit Margin Unconditional Quantile Regression for Beginning Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
2002	40.1749	-22.0786	-20.1412	-17.4743	15.4223
	(43.9176)	(21.5225)	(15.4910)	(13.4188)	(18.2635)
2003	40.4465	-10.3728	-15.7777	-19.7208	12.6315
	(43.4165)	(21.3064)	(15.1732)	(12.9334)	(18.2072)
2004	40.6723	10.3447	0.4121	-6.5944	17.7448
	(42.3663)	(20.5336)	(14.9711)	(12.9181)	(18.4524)
2005	39.8250	10.5355	-3.1050	1.5199	28.1520
	(41.5498)	(19.7963)	(14.1595)	(12.5719)	(18.0883)
2006	22.2751	-7.4884	-11.0215	-7.9519	33.9458*
	(41.3793)	(19.7669)	(13.9123)	(12.3833)	(17.6089)
2007	50.3372	28.5620	10.2627	13.5919	58.0823***
	(39.2432)	(17.6773)	(12.7615)	(11.6386)	(16.8401)
2008	42.6631	21.0099	2.9697	3.6669	38.7776***
	(37.6657)	(17.0863)	(12.2674)	(11.1074)	(14.8276)
2009	3.8644	-19.2056	-24.0679**	-18.5558*	16.7329
	(39.1810)	(17.0517)	(11.6831)	(10.2106)	(13.2255)
2010	27.5392	14.1925	-2.2756	-3.1485	28.7242*
	(35.8574)	(17.2652)	(11.8592)	(10.5617)	(15.0602)
2011	38.8897	29.8860*	12.7306	2.7809	27.9847**
	(34.1925)	(16.1747)	(11.2607)	(10.2804)	(12.9911)
2012	39.9819	31.6547**	4.1829	-4.9813	27.7821**
	(32.7570)	(15.6718)	(11.0668)	(9.6351)	(13.1302)
2013	-23.0748	5.5092	-9.5857	-14.7979	15.7082
	(36.6428)	(16.3739)	(10.5008)	(9.5631)	(12.1635)
2014	11.3416	21.0755	-5.2624	-13.9301	20.6526*
	(35.3298)	(16.3893)	(11.3624)	(9.3712)	(12.4131)
2015	-3.2992	-7.3016	-12.8528	-14.7397*	3.7472
	(32.4820)	(14.6670)	(9.6981)	(8.2706)	(10.2186)
2016	-17.2183	-4.4499	-13.7493	-12.2973	10.7744
	(32.1720)	(13.5652)	(9.5786)	(8.7014)	(10.5068)
2017	-13.1460	-0.8115	-10.2900	-12.1901	11.8242
	(29.4421)	(13.2532)	(9.4029)	(8.6533)	(10.5313)
2018	-18.3162	-11.3812	-13.6853	-13.1096	7.2333
	(30.8892)	(12.5424)	(9.4328)	(8.6462)	(11.1082)
2019	2.0415	0.3824	-3.0098	-0.7392	1.6664
	(22.4277)	(12.4033)	(8.9336)	(7.4019)	(7.3700)
2020	21.8491	19.2682**	8.1908	13.0262*	19.7619**
	(18.5051)	(8.3221)	(7.4508)	(7.0233)	(10.0509)
constant	-97.0738	-39.6922	-33.4746	-0.6386	-28.1383
	(77.2571)	(36.8775)	(25.2397)	(22.4824)	(32.2527)
N	715	715	715	715	715
R^2	0.496	0.585	0.573	0.532	0.472

* p<0.10, ** p<0.05, *** p<0.01

Table 11: Operating Profit Margin Unconditional Quantile Regression for Established Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
NumberOfOperators	-3.4298	0.5272	-0.7120	0.3070	0.4270
	(2.5011)	(1.2178)	(1.0812)	(1.1913)	(1.6222)
OffFarmIncomeIndicator	-1.0880	0.0720	0.1143	-0.7195	-1.3411
	(1.9241)	(0.9383)	(0.7468)	(0.7594)	(0.8989)
HerdSize2	7.1571**	3.1888*	1.0627	1.0520	-0.7426
	(3.5807)	(1.7660)	(1.3899)	(1.4834)	(2.0878)
HerdSize3	13.1969***	7.1476***	3.0262	2.1307	-0.6763
	(4.6471)	(2.2882)	(1.8598)	(1.9267)	(2.5824)
HerdSize4	17.0782***	8.1239**	0.4740	1.2582	0.0144
	(6.0198)	(3.2326)	(2.5375)	(2.5642)	(3.5463)
HerdSize5	10.4252	5.0229	1.4769	2.0622	-7.4515
	(7.4087)	(4.1117)	(3.6595)	(3.8441)	(5.0020)
TotalCropAcres	0.0149***	0.0080***	0.0050*	0.0026	0.0033
	(0.0044)	(0.0026)	(0.0026)	(0.0024)	(0.0024)
PercentAcresOwned	0.0311	0.0472*	0.0397**	0.0298	0.0816***
	(0.0442)	(0.0245)	(0.0182)	(0.0188)	(0.0239)
MilkYield	0.0017***	0.0007***	0.0006***	0.0006***	0.0006**
	(0.0005)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
PercentChangeMilkYield	0.0464	0.0133	0.0009	0.0180	0.0099
	(0.0784)	(0.0377)	(0.0290)	(0.0288)	(0.0356)
HerdHealthIndicator	-0.2845	-0.4816	-0.1478	-0.5086	-1.8003
	(2.5304)	(1.4049)	(1.1527)	(1.1475)	(1.4623)
FeedCostPerCwtMilk	-2.6826***	-0.8356***	-0.2877	-0.0594	0.0280
	(0.6633)	(0.3146)	(0.2258)	(0.2217)	(0.2754)
InterestExpensePerHead	0.0014	0.0016	0.0018	0.0015	-0.0036
	(0.0043)	(0.0022)	(0.0019)	(0.0019)	(0.0026)
DepreciationPerHead	-0.0159***	-0.0094***	-0.0105***	-0.0114***	-0.0097***
	(0.0039)	(0.0018)	(0.0013)	(0.0014)	(0.0020)
HiredLaborIndicator	-1.0930	-1.2356	-2.1001**	-3.4300***	-3.7245***
	(2.0384)	(1.0225)	(0.8480)	(0.8875)	(1.1431)
GovtPaymentsPercent	-0.5643**	-0.3039**	-0.1128	-0.0630	0.0611
	(0.2534)	(0.1382)	(0.1088)	(0.1035)	(0.1447)
CurrentRatio	0.3113***	0.1594***	0.0374	0.0707*	0.0562
	(0.0849)	(0.0462)	(0.0396)	(0.0421)	(0.0692)
1997	9.0079	7.6734**	6.2042**	2.6978	1.2877
	(7.1422)	(3.8617)	(3.0013)	(2.7965)	(3.4545)
1998	16.2669**	15.0551***	14.4511***	13.7118***	15.0277***
	(6.9308)	(3.6809)	(2.9142)	(2.8293)	(3.6193)
1999	14.9998**	17.5325***	15.0063***	13.7911***	11.5566***
	(6.8321)	(3.5744)	(2.8021)	(2.7668)	(3.4200)
2000	12.1693*	10.0470***	8.6460***	4.9761*	0.6896
	(6.7424)	(3.6129)	(2.7906)	(2.7220)	(3.2730)
2001	10.9307	11.7918***	8.8078***	7.2945***	4.5636
	(6.6799)	(3.6133)	(2.8483)	(2.7480)	(3.3054)

Table 11 Continued: Operating Profit Margin Unconditional Quantile Regression for Established Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
2002	4.3667	5.6982	3.6992	2.6384	-1.2369
	(6.7069)	(3.5607)	(2.7762)	(2.5971)	(3.0636)
2003	8.1690	6.9454**	6.7437**	2.2341	0.8702
	(6.5390)	(3.5276)	(2.7153)	(2.5377)	(3.0746)
2004	8.3173	11.9104***	12.6896***	11.5110***	7.2012**
	(6.2571)	(3.3755)	(2.6675)	(2.5729)	(3.1674)
2005	8.4026	13.7119***	10.1930***	10.3016***	5.4450*
	(6.2552)	(3.2933)	(2.6118)	(2.5551)	(3.0548)
2006	-5.5526	2.0619	1.9590	2.6629	1.2159
	(6.3442)	(3.4124)	(2.6437)	(2.4885)	(2.9109)
2007	10.9097*	16.2546***	16.6607***	16.8544***	18.1594***
	(5.8888)	(3.1695)	(2.5679)	(2.4686)	(3.2165)
2008	5.8048	7.4391**	6.3990**	4.0889*	3.6633
	(5.8397)	(3.1312)	(2.5035)	(2.3263)	(2.6750)
2009	-35.3297***	-13.5409***	-7.1619***	-5.2627**	-1.9964
	(6.8143)	(3.1537)	(2.3228)	(2.1143)	(2.4397)
2010	6.3435	6.8762**	7.3118***	4.8010**	4.3764
	(5.7477)	(3.1757)	(2.5342)	(2.3822)	(2.7766)
2011	13.6008**	10.6379***	9.4509***	6.0600***	5.8402**
	(5.6596)	(3.0236)	(2.4775)	(2.3497)	(2.8549)
2012	17.4100***	14.5397***	11.2692***	8.6919***	7.5994***
	(5.4471)	(2.9341)	(2.4306)	(2.2919)	(2.7970)
2013	-14.3740**	-9.3301***	-6.5184***	-3.5762	-1.5118
	(6.6788)	(3.2930)	(2.4836)	(2.1781)	(2.2921)
2014	12.6168**	11.6224***	9.5550***	9.8314***	4.6438*
	(5.5873)	(3.0748)	(2.5760)	(2.4577)	(2.7693)
2015	-21.6860***	-12.3251***	-6.9614***	-2.5433	0.6816
	(6.2535)	(3.1450)	(2.3379)	(2.1049)	(2.3590)
2016	-27.8823***	-20.7126***	-10.9052***	-6.0284***	-1.3288
	(6.3674)	(3.1510)	(2.3380)	(2.0478)	(2.2303)
2017	-28.6219***	-14.5907***	-9.5452***	-4.6025**	-1.1764
	(6.1024)	(3.2469)	(2.3986)	(2.1026)	(2.2368)
2018	-48.1056***	-25.8990***	-13.6033***	-6.3542***	-2.2664
	(6.4362)	(2.9239)	(2.1757)	(1.9907)	(2.1274)
2019	-10.9744**	-11.9140***	-7.9683***	-5.5042***	-1.4777
	(5.5104)	(3.1567)	(2.3009)	(2.0180)	(2.2320)
2020	8.3163*	10.9122***	11.5918***	13.4314***	7.9563***
	(4.5484)	(2.7841)	(2.3300)	(2.2595)	(2.9862)
constant	-27.5348*	-11.2783	0.5807	9.2748	20.1447***
	(15.6728)	(7.8317)	(5.9837)	(6.0175)	(7.8023)
N	5387	5387	5387	5387	5387
R^2	0.382	0.473	0.460	0.446	0.388

* p<0.10, ** p<0.05, *** p<0.01

Table 12: Operating Profit Margin Unconditional Quantile Regression for Second-Generation Beginning Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
NumberOfOperators	14.9389	8.8673	1.8672	-0.7692	-0.4740
	(10.4365)	(7.9310)	(5.3102)	(5.1726)	(4.7638)
OffFarmIncomeIndicator	7.9519	-0.1666	3.4865	9.8556***	9.1215*
	(8.8875)	(5.6325)	(4.6330)	(3.5232)	(5.1750)
HerdSize2	16.6132	-5.4523	-1.4606	-17.5781	19.1478
	(18.4389)	(10.7744)	(13.6867)	(13.3896)	(12.7616)
HerdSize3	53.4751*	-17.2280	-12.1022	-23.3772	27.5115*
	(27.4769)	(19.2224)	(17.1521)	(14.8501)	(14.0441)
HerdSize4	90.5268***	-17.2088	-11.7218	-21.8763	30.6723*
	(32.9107)	(22.6829)	(18.7683)	(16.1068)	(15.5192)
HerdSize5	68.2234*	-17.8064	20.0806	-13.1106	31.3587*
	(35.4294)	(24.9841)	(20.4465)	(21.1501)	(16.7393)
TotalCropAcres	0.0280	0.0492	-0.0024	0.0297	0.0167
	(0.0625)	(0.0330)	(0.0245)	(0.0209)	(0.0265)
PercentAcresOwned	-0.0369	0.1230	0.0675	0.1234	0.1773**
	(0.1412)	(0.1111)	(0.0873)	(0.1119)	(0.0872)
MilkYield	0.0084***	0.0030*	0.0025**	0.0022**	0.0002
	(0.0031)	(0.0015)	(0.0011)	(0.0011)	(0.0014)
PercentChangeMilkYield	0.0213	0.1448	0.0214	-0.1266	0.1292
	(0.4754)	(0.2377)	(0.1667)	(0.1788)	(0.2500)
HerdHealthIndicator	-41.1382**	-4.5551	-3.3430	-14.9919	9.7769
	(18.2764)	(10.8645)	(9.7809)	(10.5454)	(13.5675)
FeedCostPerCwtMilk	0.7994	-0.9422	0.5679	1.0179	-0.8111
	(2.5729)	(1.1511)	(0.9248)	(0.9507)	(1.0435)
InterestExpensePerHead	-0.0246	-0.0157	-0.0074	-0.0070	0.0091
	(0.0247)	(0.0150)	(0.0126)	(0.0131)	(0.0110)
DepreciationPerHead	0.0090	-0.0018	-0.0106	-0.0077	0.0094
	(0.0214)	(0.0113)	(0.0093)	(0.0100)	(0.0107)
HiredLaborIndicator	-5.8110	3.9122	5.2954	6.1453	4.6487
	(12.2870)	(6.6148)	(4.3994)	(5.5983)	(6.5694)
GovtPaymentsPercent	0.6250	0.3340	-0.7473	-0.8454*	-1.1176*
	(1.4516)	(0.6834)	(0.5308)	(0.4934)	(0.6680)
CurrentRatio	0.5674	0.1736	-0.5099**	-0.4726*	-0.4160
	(0.4793)	(0.2808)	(0.2325)	(0.2631)	(0.4631)
1997	24.9573	-6.6029	-7.0639	33.9841**	24.7462
	(49.0521)	(23.7422)	(16.2583)	(16.3166)	(21.6460)
1998	60.8204	9.3836	8.5381	34.2441*	31.6325
	(41.4281)	(24.4438)	(16.2267)	(18.2388)	(21.3098)
1999	70.0971	-6.1975	7.8616	33.5400**	26.7391
	(43.7786)	(19.5056)	(15.6344)	(14.2252)	(18.4390)
2000	65.6490	-3.2962	-6.8193	17.4421	28.4313
	(44.3585)	(17.8482)	(15.7166)	(12.8182)	(19.7337)
2001	72.8159	22.3182	26.8017*	23.8364*	5.3769
	(44.6355)	(21.5829)	(15.9417)	(14.0147)	(13.5882)

Table 12 Continued: Operating Profit Margin Unconditional Quantile Regression for Second-Generation Beginning Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
2002	77.1373*	11.6779	-0.4118	15.8079	21.3668
	(42.7557)	(19.4484)	(14.5871)	(12.6197)	(15.2509)
2003	70.3534*	-3.3785	12.2605	24.9630*	22.9571
	(42.3768)	(18.1592)	(15.4378)	(14.0596)	(14.5239)
2004	70.5722*	13.2785	14.9710	23.3575	14.8090
	(39.6491)	(17.6063)	(13.5598)	(14.1792)	(14.8664)
2005	71.1057*	5.1861	3.9717	8.2294	1.9904
	(40.6931)	(20.2405)	(14.1428)	(12.7419)	(13.6080)
2006	62.4506	12.3433	6.6901	6.6142	6.2113
	(39.9346)	(17.3797)	(13.6080)	(11.7844)	(14.7137)
2007	61.4503*	20.1522	20.3178	42.0210***	35.2106*
	(36.6636)	(17.2857)	(14.5919)	(13.2511)	(18.4036)
2008	60.0326*	11.8856	5.7185	19.3949	10.3616
	(31.7753)	(16.0139)	(13.0802)	(13.2097)	(13.7641)
2009	18.5865	-23.0724	-7.6636	7.9693	8.1410
	(43.9265)	(18.0524)	(12.4629)	(11.7821)	(13.1250)
2010	51.1645	17.5649	-6.9802	7.7278	10.9569
	(35.8047)	(16.2876)	(13.8677)	(13.6168)	(13.6251)
2011	52.8388	3.6561	-9.7410	2.0327	0.8471
	(33.4846)	(17.5419)	(12.3077)	(12.2460)	(13.2181)
2012	24.8739	10.8225	5.6821	13.8017	17.0971
	(27.4809)	(14.7889)	(11.3188)	(13.0096)	(15.4271)
2013	10.8284	-2.5927	-1.8384	7.3612	14.5998
	(30.6115)	(19.5230)	(12.8555)	(13.1954)	(13.0434)
2014	30.3047	16.5841	0.8736	14.8409	9.3385
	(25.1169)	(13.2379)	(9.4404)	(11.2919)	(12.6700)
2015	18.7759	-2.7972	1.2462	-5.2713	-5.4377
	(25.4189)	(12.1032)	(8.4423)	(9.1243)	(10.3531)
2016	-20.7737	-1.2597	-4.0071	-0.4763	-0.6848
	(23.4003)	(11.3811)	(7.3853)	(8.6392)	(7.9452)
2017	-31.0099	-7.6014	-8.5739	-9.8289	-14.0028*
	(22.3237)	(10.7307)	(7.0586)	(6.9329)	(7.7641)
2018	-28.6209	-20.0567**	-10.1773*	-10.7277*	-7.9239
	(23.9077)	(9.8251)	(6.0069)	(6.0765)	(7.0147)
2019	-22.0470	-2.2496	-5.0936	-6.2724	0.1825
	(16.2532)	(8.0323)	(6.4193)	(5.4175)	(6.4819)
2020	5.9867	12.5243	24.4284***	20.9792***	13.9652**
	(12.5121)	(7.7701)	(5.8427)	(5.9688)	(6.2785)
constant	-297.1655***	-82.5900*	-38.0910	-36.6985	-15.7669
	(95.8255)	(43.8880)	(35.8556)	(33.2100)	(40.3013)
N	230	230	230	230	230
R^2	0.587	0.655	0.675	0.634	0.498

* p<0.10, ** p<0.05, *** p<0.01

Table 13: Operating Profit Margin Unconditional Quantile Regression for Transitioned to Established Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
NumberOfOperators	-21.1993	-6.6375*	-5.0539	-2.6733	-13.0288
	(16.1121)	(3.9210)	(3.8757)	(3.7634)	(8.7867)
OffFarmIncomeIndicator	-2.6986	-0.3046	-0.1453	2.2485	-5.6699*
	(4.5686)	(2.5043)	(1.9982)	(1.9643)	(3.1816)
HerdSize2	0.9917	4.0946	9.2491**	11.8349***	11.5827**
	(9.6866)	(5.1921)	(4.3006)	(4.3936)	(5.6618)
HerdSize3	-9.6324	6.5811	5.7731	17.5792***	17.2251**
	(11.6507)	(6.2949)	(5.2782)	(5.6461)	(7.0968)
HerdSize4	-6.7311	9.3476	10.5661	20.8951***	6.6556
	(15.8245)	(8.5588)	(6.4322)	(7.1304)	(10.5966)
HerdSize5	-23.1070	32.1316**	17.6535	23.1150**	10.6707
	(18.6665)	(13.3030)	(11.6951)	(9.5602)	(12.7258)
TotalCropAcres	-0.0129	-0.0153***	-0.0060	-0.0067	0.0004
	(0.0116)	(0.0057)	(0.0059)	(0.0048)	(0.0085)
PercentAcresOwned	-0.0948	-0.1275*	-0.0488	-0.0140	0.0158
	(0.1393)	(0.0695)	(0.0605)	(0.0562)	(0.0797)
MilkYield	0.0041***	0.0007	0.0008	0.0001	0.0011
	(0.0013)	(0.0007)	(0.0006)	(0.0005)	(0.0008)
PercentChangeMilkYield	-0.0811	0.1646*	0.0661	0.1265	0.0130
	(0.1807)	(0.0903)	(0.0775)	(0.0785)	(0.1094)
HerdHealthIndicator	2.1762	5.5879	3.6877	5.5757	4.3320
	(6.2394)	(4.2275)	(3.5071)	(3.3974)	(3.9341)
FeedCostPerCwtMilk	-2.9023*	-1.0549	-0.8300	-0.1864	1.0131
	(1.5168)	(0.6567)	(0.5706)	(0.6042)	(0.8395)
InterestExpensePerHead	0.0071	0.0038	0.0072	0.0039	0.0122
	(0.0205)	(0.0085)	(0.0065)	(0.0067)	(0.0097)
DepreciationPerHead	-0.0136	-0.0055	-0.0068	-0.0029	-0.0188***
	(0.0097)	(0.0058)	(0.0049)	(0.0046)	(0.0064)
HiredLaborIndicator	-0.0496	4.1079	-2.8935	1.0827	-0.2557
	(4.8908)	(3.0903)	(2.7162)	(2.6019)	(4.7478)
GovtPaymentsPercent	-1.1809**	-1.0175***	-0.3787	-0.1705	0.1812
	(0.5163)	(0.3608)	(0.2617)	(0.3088)	(0.5296)
CurrentRatio	0.4416	0.2358	0.4596***	0.4361***	0.3404
	(0.2704)	(0.1788)	(0.1483)	(0.1459)	(0.2786)
1997	-11.3004	-22.4282	-16.8122**	-7.8286	14.5567
	(16.2084)	(20.5999)	(8.0301)	(9.7619)	(11.0309)
1998	8.2378	2.1510	11.5828	20.8049**	56.0632***
	(19.2480)	(9.7796)	(8.8747)	(8.8618)	(16.4523)
1999	-2.0791	0.0825	6.8953	11.7869	24.3771**
	(16.3521)	(8.0688)	(7.4696)	(7.7360)	(11.8995)
2000	0.3235	-4.8872	-3.3865	2.9823	11.1418
	(16.0751)	(8.6543)	(7.2603)	(6.9126)	(8.9357)
2001	4.2761	-5.0821	-2.3495	4.4576	11.5346
	(15.6258)	(8.1360)	(6.9657)	(6.9753)	(9.3107)

Table 13 Continued: Operating Profit Margin Unconditional Quantile Regression for Transitioned to Established Farmers, 1997-2021

	Percentile				
	10%	30%	50%	70%	90%
2002	-12.4509	-14.5746*	-9.2602	-1.4054	9.3190
	(16.6366)	(7.8251)	(6.5601)	(6.2837)	(8.0816)
2003	-0.3577	-1.5250	0.7291	6.6887	10.9333
	(14.1442)	(7.0416)	(6.2091)	(6.2817)	(7.7812)
2004	-2.1089	0.4094	4.4698	11.0956*	16.2524*
	(13.7059)	(6.7735)	(6.1231)	(6.3826)	(8.8656)
2005	-9.2689	-2.2364	0.7869	7.5517	11.5311
	(14.1061)	(6.7359)	(6.1808)	(6.1518)	(8.4680)
2006	-3.6177	-9.6179	-8.3111	0.2343	16.5146*
	(13.7160)	(6.9522)	(6.1299)	(6.0176)	(8.6422)
2007	-3.5772	-4.9126	3.9050	13.2176**	30.4759***
	(13.2903)	(6.8428)	(5.8542)	(6.1518)	(9.4349)
2008	-6.5850	-9.3558	0.7235	5.0436	13.1255
	(12.3898)	(6.6102)	(5.8675)	(5.8239)	(9.4014)
2009	-43.7897***	-22.3903***	-13.6831***	-7.7288	3.8057
	(14.8835)	(6.3674)	(5.2745)	(5.0168)	(6.5523)
2010	-11.8016	-7.8820	-1.2711	2.3772	7.7663
	(14.5912)	(6.8901)	(5.8089)	(6.0120)	(8.0190)
2011	1.9335	-4.5020	2.0076	5.4081	17.3499**
	(10.6085)	(6.2879)	(5.3121)	(5.5767)	(8.6332)
2012	17.4193*	-0.7492	6.4946	10.1246*	18.2105**
	(9.2943)	(5.9879)	(4.9819)	(5.4372)	(8.1985)
2013	-3.6638	-14.9165**	-10.4839**	-6.2943	2.5016
	(11.9206)	(6.7369)	(5.1573)	(5.1578)	(7.3355)
2014	12.2499	5.3918	10.8569**	10.4907	21.5193**
	(9.8177)	(5.9041)	(5.0864)	(6.4099)	(9.5191)
2015	-22.1284*	-23.5874***	-15.5406***	-12.2929***	2.7096
	(11.3508)	(6.5765)	(5.0393)	(4.6569)	(6.1698)
2016	-40.3194***	-24.0672***	-15.0972***	-9.9050**	1.3169
	(13.6621)	(6.5361)	(5.0628)	(4.9693)	(6.6946)
2017	-24.2929**	-16.0708***	-13.0123***	-11.0921**	0.9129
	(10.2164)	(6.0903)	(4.9610)	(4.5858)	(6.3128)
2018	-32.3906***	-26.9725***	-15.8966***	-12.0182***	-0.1171
	(9.7478)	(5.4326)	(4.6244)	(4.1462)	(5.6694)
2019	-4.5211	-4.1869	-6.3681	-7.9514*	2.5623
	(7.4050)	(4.6581)	(4.4899)	(4.1615)	(5.3083)
2020	12.1655*	15.6105***	13.8811***	8.4341**	16.5492***
	(6.2791)	(3.9700)	(3.6057)	(3.8518)	(5.7322)
constant	-13.7861	26.6117	14.3936	11.7978	1.7416
	(43.1360)	(20.1167)	(16.6436)	(16.6972)	(26.4209)
N	866	866	866	866	866
R^2	0.439	0.483	0.525	0.511	0.388

* p<0.10, ** p<0.05, *** p<0.01

VII. DISCUSSION

This study analyzed differences in profitability across the four farmer groups using FINBIN data from dairy farms in Minnesota from 1997-2021. Results indicated that there were different factors driving the operating profit margin for each farmer group and across the distribution within each farmer group.

Operator characteristics had no statistically significant impact on the operating profit margin for established farmers. After gaining experience, it does not matter if the farmer worked off-farm or added additional operators. However, for transitioned to established farmers, the addition of an operator decreased the farm's operating profit margin as the marginal cost to hire the operator was higher than the marginal return in specialization. And, while off-farm work had no impact on established farmers, beginning and second-generation beginning farmers had a positive association with off-farm work. The positive association found in this study contradicted the results reported in Detre et al. (2011) and Mishra et al. (2009). The second-generation beginning farmers likely utilized knowledge and experience from the first-generation farmer who may have assisted with decision making on the farm. This allowed the second-generation beginning farmer to split their time working on and off the farm to maximize household income. For first-generation beginning farmers, working off-farm may have allowed them to add expertise by gaining skills in another environment that would be translated to their farm, helping the beginning farmer to be successful farming on his/her own.

Farm characteristics, including herd size, acreage, and percent of acres owned, were important factors that drove a farm's operating profit margin for all the groups.

These factors, however, differentially impacted operating profit margin across the distribution. A larger herd was commonly associated with an increase in financial performance (Katchova, 2010; Kropp & Katchova, 2011; Katchova & Dinterman, 2018; Key & Lyons, 2019; Ahearn & Newton, 2009; Mishra et al., 2009; Mishra et al., 2007). The marginal cost, or cost of purchasing the cow, was less than the marginal return, or milk revenues generated from the additional cow. However, the impact was not significant across the full distribution and the percentiles that are significant differ across farmer types. High performing established farms, moderate performing second-generation beginning farms, and low performing transitioned to established farms were not impacted by herd size. Meanwhile, beginning farmers at the 90th percentile had a decrease in their operating profit margin as their herds increased. These farms were just starting their operations and it was possible that the increase in herd size was negative due to available feedstuffs. Acres operated was positively associated with a farm's operating profit margin. Dairy farms typically have lower feed costs when producing homegrown feed compared to purchasing. Therefore, an increase in acres may have indicated that the farm was able to feed more of its livestock or potentially add a revenue stream from the sale of a commodity. Interestingly, for beginning farmers herd size decreased operating profit margin, while acreage increased it. As these farmers gained experience, the sign of these impacts switched. Transitioned to established farmers were negatively impacted by an increase in acreage and positively impacted by an increase in herd size. Therefore, initially, farmers starting operations may want to focus on adding land, which could minimize feed costs, and as they gain experience, increase their herd size.

Herd characteristics included in this study are milk yield, percent change in milk yield, a herd health indicator, and feed cost per hundredweight of milk. These characteristics had no impact on high performing transitioned to established farmers. Milk yield was consistently statistically significant and positive across each farmer group, except it had no statistically significant impact on the mid-to-high performing transitioned to established farmers. Beginning farmers had the highest proportion of farms with herd health concerns at 8.1% of the sample. Interestingly, beginning farmers with herd health concerns had an increased operating profit margin that decreased in magnitude across the distribution, that is the impact was larger for farms at the 10^{th} percentile than the 70^{th} percentile. It is possible that these farms may have been proactive in keeping their herd healthy which increased their veterinary expenses as a proportion of total operating expenses, or they had low feed expenses relative to total operating expenses. Additionally, if the beginning farmers had new facilities and equipment, repairs and supply expenses may be limited.

A number of financial variables were considered in this study. Low performing second-generation beginning farmers' operating profit margin was not associated with any of the financial variables considered. The hired labor indicator was not statistically significant for beginning, second-generation beginning, and transitioned to established farmers. Interest expense per head was only significant for beginning farmers at the 10^{th} and 70^{th} percentiles, decreasing their operating profit margin. The sign of the impact of government payments varied across farmer types. Previous studies indicated that government payments either had no association or a positive association with financial

performance (Mishra et al., 2009; Katchova, 2010; Mishra et al., 2007; Jablonski et al., 2022). Beginning farmers' operating profit margin was positively impacted while the other three groups were negatively impacted by government payments. An increase in the proportion of revenue that was derived from government payments may indicate that a farm was reliant on government payments or that the farm had an additional revenue stream to increase their profit. A variety of state and federal programs exist to assist beginning farmers entering the industry, and partaking in these programs positively impacted beginning farmers in their earlier years. Second-generation beginning farmers also had access to these programs, but the funding did not appear to be impacting them in the way it was intended. For established and transitioned to established farmers, an increase in government payments decreased their operating profit margin which may be due to reliance on outside revenue streams to be profitable. These farmers have been in the industry and have gained the skills and knowledge to be successful and partaking in government payments did not impact them positively.

Finally, market shifts and economic shocks impacted the farmer groups differently. Beginning farmers and second-generation beginning farmers were largely not impacted by these conditions. Established and transitioned to established farmers commonly had associations with profitability and these shocks. Lower performing farms experienced larger losses during years where the association was negative (2009, 2013, 2015-2019).

VIII. CONCLUSIONS AND POLICY IMPLICATIONS

This research analyzed beginning, established, second-generation beginning, and transitioned to established dairy farmers in Minnesota from 1997-2021. Results showed that on average these groups differ. Often, a beginning farmer's financial performance was not as strong as the other groups. Transitioned to established farmers had similar performance as established farmers on average. However, while these groups differed on average and did not have equal distributions, their financial performance across the full distribution did not differ statistically.

Policies have been created to assist beginning farmers enter the industry, and these policies are available to all beginning farmers regardless of generation or production status. However, this research showed that beginning farmers' and second-generation beginning farmers' financial performance differed on average. But, from a distributional standpoint, none of the farmer groups were statistically different. Additionally, these farmers had different factors impacting their performance.

The unconditional quantile regression was used to analyze farmers across the full distribution of the dependent variable. Results showed that across distribution and farmer types, the impact of a variable changed in magnitudes and sign. Specifically, government payments impacted beginning farmers positively and the other three groups negatively. This was likely due to the size of the established, second-generation beginning, and transitioned to established farms with some becoming ineligible for program payments. For those that are eligible, government payments were negatively impacting their profitability. Each of these groups of farmers had unique challenges that impacted their

financial performance. Participating in off-farm work, increasing acreage, and participating in government payment programs disproportionately increased profitability for beginning farmers. As these farmers gain experience, they should increase their herd size.

Farmers have the opportunity to invest in cattle and acreage. This investment decision distinguishes between high and low performers. Dairy farmers tend to emphasize investing in more cows to increase total milk production on the farm, but there are additional costs to consider when increasing herd size. This study shows that increasing herd size decreases profitability. Meanwhile, increased acreage was shown to increase profitability. Land is a non-depreciable asset that farmers can use to alleviate feed costs by producing homegrown feedstuffs.

This research illustrated that beginning farmer programs can provide positive impacts in a farmer's early years, but participation in these programs is limited. Therefore, it is beneficial to use these results to increase participation rates among beginning farmers.

Finally, there are policy modifications that can be derived from this study. Results show that for beginning farmers, increasing herd size decreases profitability while increasing acreage improves profitability. A potential policy modification is to emphasize increased acreage by incorporating a threshold of acres per cow. If a farm falls below the threshold, then the farm would have limited investment opportunities. However, if the farm meets the acres per cow threshold, then they may be allowed to invest in livestock. Using funds in a more targeted approach may decrease total government expense while

simultaneously increasing a beginning dairy farmer's success in the industry. The policy change is not based on a single unit, but rather on a standardized ratio. This research did not calculate the optimal acres per cow threshold, but that could be done in future work with state agencies.

REFERENCES

Adhikari, A., Mishra, A. K., & Chintawar, S. (2009). Adoption of technology and its impact on profitability of young and beginning farmers: a quantile regression approach. *Southern Agricultural Economics Association Annual Meeting, January 31-February 3, 2009, Atlanta, Georgia.* https://doi.org/10.22004/ag.econ.46830

AgCentric. (2022). *Farm business management & beginning farmer resources.* https://www.agcentric.org/farm-business-management/

Ahearn, M. C., & Newton, D. J. (2009). Beginning Farmers and Ranchers. *U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin, 53.* https://doi.org/10.22004/ag.econ.58618

Borah, B. J., & Basu, A. (2013). Highlighting differences between conditional and unconditional quantiles regression approaches through an application to assess medication adherence. *Health Economics, 22*(9), 1052-1070. https://doi.org/10.1002/hec.2927

Borgen, N. T. (2016). Fixed Effects in Unconditional Quantile Regression. *The Stata Journal*, *16*(2), 403–415. https://doi.org/10.1177/1536867X1601600208

Detre, J. D., Uematsu, H., & Mishra, A. K. (2011). The influence of GM crop adoption on the profitability of farms operated by young and beginning farmers. *Agricultural Finance Review, 71*(1), 41-61. https://doi.org/10.1108/00021461111128156

D'Antoni, J., Mishra, A. K., & Chintawar, S. (2009). Predicting financial stress in young and beginning farmers in the United States. *Southern Agricultural Economics Association Annual Meeting, January 31-February 3, 2009, Atlanta, Georgia.* https://doi.org/10.22004/ag.econ.46861

Federal Reserve Bank of Minneapolis. (2022). *Consumer price index, 1913-*. Retrieved from https://www.minneapolisfed.org/about-us/monetary-policy/inflation-calculator/consumer-price-index-1913-

FINBIN (2022). *Livestock Enterprise Analysis*. Center for Farm Financial Management: University of Minnesota. Retrieved from http://finbin.umn.edu

FINBIN (2022). *Whole Farm Enterprise Analysis*. Center for Farm Financial Management: University of Minnesota. Retrieved from http://finbin.umn.edu

Firpo, S., Fortin, N. M., & Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica, 77*(3), 953-973. https://doi.org/10.3982/ECTA6822

Hansen, B. (2022). *Econometrics.* Department of Economics, University of Wisconsin-Madison.

Hampel, F. R. (1968). *Contribution to the theory of robust estimation.* Ph.D. Thesis, University of California at Berkeley.

Hampel, F. R. (1974). The influence curve and its role in robust estimation. *Journal of the American Statistical Association. 69*(346). 383-393. https://doi.org/10.1080/01621459.1974.10482962

Hastings, C., Jr., Mosteller, F., Tukey, J. W., & Winsor, C. P. (1947). Low moments for small samples: A comparative study of order statistics. *The Annals of Mathematical Statistics. 18*(3). 413-426. https://doi.org/10.1214/aoms/1177730388

Jablonski, B. B. R., Key, N., Hadrich, J., Bauman, A., Campbell, S., Thilmany, D., & Sullins, M. (2022). Opportunities to support beginning farmers and ranchers in the 2023 Farm Bill. *Applied Economic Perspectives and Policy.* 1-18. https://doi.org/10.1002/aepp.13256

Jablonski, B. B. R., & Schmit, T. M. (2016). Differential expenditure patters of local food system participants. *Renewable Agriculture and Food Systems, 31*(2), 139-147. https://doi.org/10.1017/S1742170515000083

Jablonski, B. R., Thilmany McFadden, D., Sullins, M., & Curtis, K. R. (2017). Determinants of effective beginning farmer programming and implications for future programs. *Journal of Agriculture and Resource Economics, 42*(3), 427-438. https://doi.org/10.22004/ag.econ.264071

Katchova, A. L. (2010). An analysis of the financial performance of beginning farmers. *Agricultural & Applied Economics Association Annual Meeting, July 25-27, 2010, Denver, Colorado.* https://doi.org/10.22004/ag.econ.61513

Katchova, A. L., & Dinterman, R. (2018). Evaluating financial stress and performance of beginning farmers during the agricultural downturn. *Agricultural Finance Review, 78*(4), 457-469. https://doi.org/10.1108/AFR-08-2017-0074

Key, N., & Lyons, G. (2019). An overview of beginning farms and farmers. *U.S. Department of Agriculture, Economic Research Service, Economic Brief, 29.* https://doi.org/10.22004/ag.econ.301074

Key, N. D., & Roberts, M. J. (2007). Do government payments influence farm size and survival?. *Journal of Agricultural and Resource Economics, 32*(2), 330-348. https://doi.org/10.22004/ag.econ.8645

Khanal, A. R., Mishra, S. K., & Honey, U. (2018). Certified organic food production, financial performance, and farm size: An unconditional quantile regression approach. *Land Use Policy, 78,* 367-376. https://doi.org/10.1016/j.landusepol.2018.07.012

Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica,* 46(1), 33-50. https://doi.org/10.2307/1913643

Kropp, J. D., & Katchova, A. L. (2011). The effects of direct payments on liquidity and repayment capacity of beginning farmers. *Agricultural Finance Review, 71*(3), 347-365. https://doi.org/10.1108/00021461111177611

Low, S., Adalja, A., Beaulier, E., Key, N., Martinez, S., Melton, A., Perez, A., Ralston, K., Stewart, H., Suttles, S., Vogel, S., & Jablonski, B. (2015). Trends in U.S. local and regional food systems. *U.S. Department of Agriculture, Economic Research Service, Administrative Publication, 068.* Retrieved from https://www.ers.usda.gov/publications/pub-details/?pubid=42807

Ludwig-Mayerhofer, Wolfgang. (2020). Winsorizing and Trimming. *Stata Guide: Winsorizing/Trimming*, Retrieved from https://wlm.userweb.mwn.de/Stata/wstatwin.htm.

Ma, W., Renwick, A., & Greig, B. (2019). Modelling the heterogeneous effects of stocking rate on dairy production: an application of unconditional quantile regression with fixed effects. *Applied Economics, 51*(43), 4769-4780. https://doi.org/10.1080/00036846.2019.1602710

Minnesota Department of Agriculture. (2022). *Aggie bond beginning farmer loan program.* Retrieved from https://www.mda.state.mn.us/business-dev-loans-grants/aggie-bond-beginning-farmer-loan-program

Minnesota Department of Agriculture. (2022). *Beginning farmer loan program.* Retrieved from https://www.mda.state.mn.us/business-dev-loans-grants/beginning-farmer-loan-program

Minnesota Department of Agriculture. (2022). *Dairy farm activity report January 1, 2022.* Retrieved from https://www.mda.state.mn.us/sites/default/files/docs/2022-01/1.2022-MN-Dairy-Farm-Activity-Report.pdf

Mishra, A. K., Wilson, C. A., & Williams, R. P. (2007). Technology adoption, management practices, and financial performance of new and beginning farmers: evidence from a national survey. *Agricultural and Applied Economics Association Annual Meeting, July 29-August 1, 2007, Portland, Oregon.* https://doi.org/10.22004/ag.econ.9982

Mishra, A., Wilson, C., & Williams, R. (2009). Factors affecting financial performance of new and beginning farmers. *Agricultural Finance Review, 69*(2), 160-179. https://doi.org/10.1108/00021460910978661

Park, T. (2015). Direct marketing and the structure of farm sales: An unconditional quantile regression approach. *Journal of Agricultural and Resource Economics, 40*(2), 266-284. http://www.jstor.org/stable/44131861

Rios-Avila, F. (2020). Recentered influence functions (RIFs) in Stata: RIF regression and RIF decomposition. *The Stata Journal*, *20*(1), 51-94. https://doi.org/10.1177/1536867X20909690

Roberts, M. J., & Key, N. (2003). Who benefits from government farm payments?. *Choices, 18*(3), 7-14. https://doi.org/10.22004/ag.econ.93712

StataCorp. 2021. Stata Statistical Software: Release 17. StataCorp LLC.

Tauer, L. W. (1995). Do New York dairy farmers maximize profit or minimize costs?. *American Journal of Agricultural Economics,* 77(2), 421-429. https://doi.org/10.2307/1243551

Uniform Law Commission. (2021). Limited Liability Company Act, Revised. *Uniform Laws.* Retrieved from https://my.uniformlaws.org/committees/community-home?CommunityKey=bbea059c-6853-4f45-b69b-7ca2e49cf740

USDA Economic Research Service. (2021). *Dairy Products: Per capita consumption, United States (pounds per person).* Retrieved from https://www.ers.usda.gov/data-products/dairy-data.aspx

USDA Economic Research Service. (2022). *Farm household well-being: Glossary.* Retrieved from https://www.ers.usda.gov/topics/farm-economy/farm-household-well-being/glossary/

USDA Farm Service Agency. (2021). *Payment eligibility and payment limitations.* Retrieved from https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/payment-elligibility-limitations-factsheet.pdf

USDA Farm Service Agency. (2022). *Beginning farmers and ranchers loans.* Retrieved from https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/beginning-farmers-and-ranchers-loans/index

USDA Farm Service Agency. (2022). *Programs and Services.* Retrieved from https://www.fsa.usda.gov/programs-and-services/index

USDA National Agricultural Statistics Service. *2017 Census of Agriculture*. Complete data available at www.nass.usda.gov/AgCensus

USDA National Institute of Food and Agriculture. (2022). *Beginning farmer and rancher development program (BFRDP).* Retrieved from

https://www.nifa.usda.gov/grants/funding-opportunities/beginning-farmer-rancher-development-program-bfrdp

Williamson, J. M. (2016). Following beginning farm income and wealth over time. *Agricultural Finance Review, 77*(1), 22-36. https://doi.org/10.1108/AFR-07-2016-0069

Wooldridge, J. M. (2015). *Introductory econometrics: A modern approach.* Cengage Learning.