Farm Ownership, Leverage, and Government Programs Impact on Net Farm Income

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ABSTRACT
As agriculture faces increasing sustainability challenges, understanding the financial aspects of farm firms is critical for preparing future agricultural professionals. This research presents a simulation model to analyze multi-year farm profitability under different tenure structures, multiple leverage scenarios, and the presence or absence of government programs. The model considers crop prices, yields, government payments, and market fluctuations to assess the financial viability of the farm. By generating income statements, balance sheets, cash flow reports, and financial ratios, it evaluates farm stability across operations of 400, 800, and 1,200 acres. Preliminary findings suggest that government programs have a significant impact on financial resilience, risk management, and long-term profitability, with effects varying by farm size and market conditions. This study offers a valuable decision-making tool, enabling professionals to strike a balance between profitability and sustainability in an evolving agricultural landscape.

KEYWORDS
Farm Financial Analysis; Farm Profitability; Farm Tenure Structures; Government Farm Programs; Agricultural Risk Management; Financial Resilience; Farm Size & Economic Stability; Farm Firm Financial Simulation Model; Agricultural Leverage; West Central Iowa Agriculture

INTRODUCTION

The purpose of this research is to develop and validate a comprehensive farm financial simulation model. This model aims to provide agricultural professionals with insights into navigating the complexities of financial management, risk assessment, and profitability projections within the dynamic agricultural industry landscape. In agriculture, a distinct convergence of factors, including unpredictable markets, substantial capital investments, and a heavy reliance on uncontrollable variables, has created a strong demand for a comprehensive resource that empowers industry professionals to manage the complexities of their financial landscape. With such a resource, a farm financial simulation model is poised to improve capital budgeting, debt management, and profitability projections. By harnessing advanced forecasting data, comprehensive financial statements, and a deep understanding of market volatility, this simulation promises to give agricultural professionals in the West Central District of Iowa valuable insights into the future of their enterprises and the broader agricultural sector.

LITERATURE REVIEW

Bankruptcies

Several key factors emerge as critical metrics for assessing the agricultural industry's financial health and stability. These factors include net cash farm income, farm debt expense, farm real estate values, and the debt-to-asset ratio, collectively serving as indicators of profitability, asset and debt management, liquidity, solvency, and overall financial health within farm firms. The fluctuations in farm bankruptcies offer additional insight. In 2004, bankruptcies in the farm sector reached an all-time low of 0.5 per 10,000 farm firms, which marked a notable contrast to the situation in 2003, which saw an all-time high of 3.3 bankruptcies per 10,000 farm firms.[1] More recently according to a 2024 report by the American Farm Bureau Federation (2024), there were 216 Chapter 12 farm bankruptcies within 38 states, a 14% increase from the previous year, 2023, but still down 64% from 2019.[2] This uptick in Chapter 12 filings, which are specifically designed for family farmers, signals renewed financial stress in the agricultural sector, driven by factors such as high interest rates, tightening margins, and decreased commodity prices. High interest rates directly impact farmers by increasing the cost of borrowing for operating capital and long-term investments, thereby squeezing already tight profit margins. Specifically, the Midwest region has seen 71 filings, a 69% increase from 2023, while Iowa saw seven filings within the state during the same period.[2] This recent increase suggests a potential weakening of financial resilience in specific segments of the agricultural sector, underscoring the importance of analyzing factors that contribute to farm profitability and stability.

Farm Classification
Understanding the distribution and production capacity of different farm classifications is crucial for contextualizing the financial performance and resilience that will be analyzed across 400-, 800-, and 1,200-acre farm operations, which may align with certain aspects of these broader classifications. According to the United States Department of Agriculture's (USDA) Economic Research Service, as shown in Figure 1, in 2024, small family farms accounted for 86% of all farm firms, down from 89 percent in 2021. Small family farms are typically defined as those with gross cash farm income (GCFI) of less than $350,000. Medium-sized farms comprised 6 percent, while large family and nonfamily farms constituted a 4 percent share of the total.[3] However, a mere glance at the distribution of farm firms only tells part of the story. The production values associated with these categories reveals intriguing disparities. Although small family farms dominate in numbers, they account for only 17 percent of the overall production value. Conversely, nonfamily farms, relatively scarce in number, play a significant role in the industry, accounting for 17 percent of the total production value.[3] This significant difference in production value suggests that the financial impacts of factors such as government programs and leverage may vary considerably depending on the scale of the farm operation. This disparity in production value may be attributed to factors such as economies of scale, where larger farms can achieve greater efficiency, or specialization in value-added commodities. Furthermore, different tenure structures may be more common within specific farm classifications, which could potentially influence financial outcomes. This stark contrast highlights the effectiveness of different-sized firms in utilizing available resources and emphasizes the complexity of the agricultural landscape.

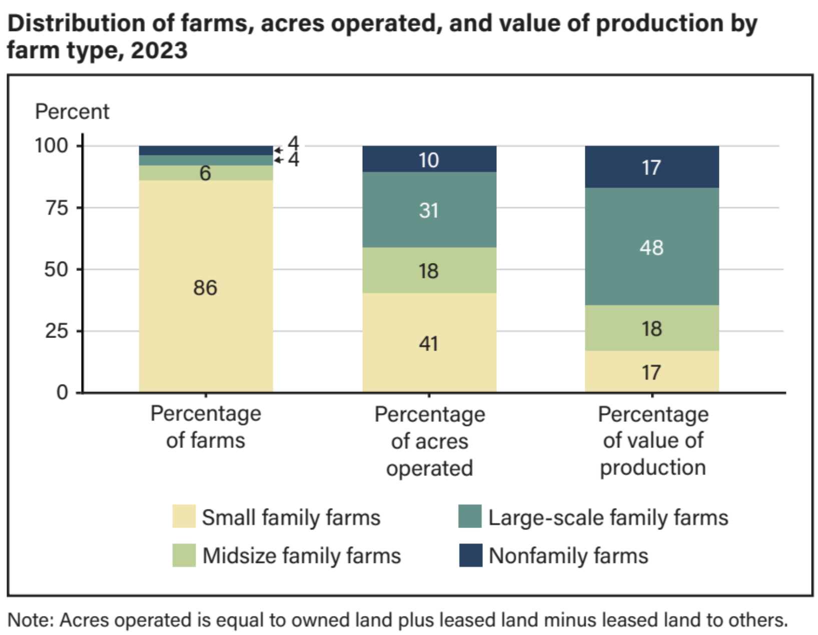

Figure 1. Farm and Ranch at a Glance 2024 Distribution of Farms. Source: United States Department of Agriculture, Economic Research Service, Farm and Ranch at a Glance 2024

Farm Ownership
Iowa's farmland has undergone significant changes over the past 40 years. The Iowa Farmland Ownership and Tenure Survey is conducted every five years, as mandated by the Iowa Code. Commentary and data are written by Tong and Zhang (2023). The survey focuses on state-level farm ownership, tenure, and transition for farmland. Changes in Iowa farmland ownership and operational structures have direct implications for farm tenure, a central aspect of this research examining farm profitability and financial stability. A few major trends have affected and will continue to affect the farming landscape in Iowa, the first being the type of ownership in which farmland is held. According to Tong and Zhang (2023) in the Iowa Farmland Ownership and Tenure Survey, the largest declines in farmland ownership are seen in the sole ownership and joint tenancy categories, which have decreased by 18% and 10%, respectively, from 1982.[4] Combined, these ownership types represented 80% of farmland in 1982 but only 52% in 2022.[4] Conversely, trusts over the same period have increased significantly, from representing only 1% of farmland in 1982 to 23% in 2022, a 2200% increase from the initial value.[4] The increasing prevalence of trusts may have implications for land transfer, potentially impacting access for new and beginning farmers, and could also influence long-term investment decisions on the land.

While the ownership structure has undergone significant changes, so have landowner demographics. The Iowa Farmland Ownership and Tenure Survey shows that Iowa farmland owners are aging at an increasing rate, particularly among those in the late stages, who are older than 74 years. In 1982, this age category owned 12% of the land, but by 2022, they now represent 37% of the total farmland, a 208% increase from the 1982 value.[4] On the other hand, early-stage owners aged 25-34 in 1982 owned 10% of the land, but by 2022, they represented only 1%, a 90% reduction from the 1982 value.[4] When combined, the age group of 65 and older has seen a 279% increase in land ownership, holding 66% of the total farmland in 2022. In contrast, the age groups 64 and younger have seen a combined decrease of 51.4% (a change from 70% in 1982 to 34% in 2022). In terms of gender distribution, males accounted for 54% of Iowa farmland owners in 2022, while females represented 46%. This proportion remains nearly unchanged from 1982, when males owned 53% and females 47%, reflecting only a 1% shift over four decades.[4] When examining the amount of time owners have owned their land, the largest share (44%) has been owned for 20 years or less, while 50 years or more represents 10% of the total land.[4] The increasing age of Iowa farmland owners raises questions about land succession, potential land availability for sale or rent, and the transfer of agricultural knowledge and practices to younger generations.

The next major trend observed in the Iowa Farmland Ownership and Tenure Survey is the operational structure of farmland, specifically whether it is owned or leased. Owned-and-operated land declined over the past 40 years, specifically going from 55% of operations to 35%, a 36.4% decrease from the initial value.[4] On the leasing side of agriculture, it is common to witness two major styles: cash rent and crop share. A cash rent agreement is one in which the farmer or tenant pays the landowner a fixed payment rate to farm the owner's land. This payment can vary depending on the type of soil and the quality of production. Under this type of agreement, the tenant assumes 100% of the risk of production and decision-making. The other major type of leasing structure is a crop share. In this type of farming agreement, the farmer and the owner share the production risk, decisions, and outcome based on their share agreement. For example, in a two-third tenant, one-third owner share agreement, the owner pays for one-third of the production costs, the tenant pays for the other two-thirds, and the production is split accordingly. The dominance of cash rent agreements, where tenants bear the full production risk, may influence their financial vulnerability and decisions regarding borrowing and investment compared to crop-share arrangements. Cash rents have become increasingly prominent over the past 40 years(1982-2022), rising from 21% to 56%, while crop shares have declined from 21% in the same year to 8% in 2022.[4] Understanding these evolving ownership and operational landscapes in Iowa is crucial for analyzing the financial performance of farm firms under different tenure structures and for evaluating the impact of government programs and leverage in this dynamic environment.

Farm size

Beyond ownership structures, the size and scale of farm operations are another crucial aspect of the agricultural sector, influencing financial performance and resilience. In Iowa, the average farm size was 355 acres in 2017, then by 2022, this figure had dropped to 345 acres, marking only the second time that average farmland had decreased over the last 82 years year over year (1940-2022), with the only other drop being reported in 2002.[5] It is important to note that the 2002 drop is credited to the USDA changing reporting requirements, which included smaller farms by decreasing the production minimum. The farm sizes modeled in this research (400, 800, and 1,200 acres) generally represent operations larger than the current average in Iowa, allowing for an analysis of financial dynamics in more substantial farming enterprises. The slight decrease in average farm size in Iowa, contrasting with the national trend, may be attributed to factors such as higher land values making expansion more difficult, an increase in smaller specialty farms, or land being divided for generational transfer. This contrasted with the national average for the United States, which in 2017 was 441 acres.[5] However, by 2022, it had grown by 22 acres to reach 463 acres, and the number of farms had decreased by 141,733.[5] The scale of a farm operation can significantly influence the choice of tenure structure, the amount of leverage a farm can manage, and the applicability or benefits derived from various government programs.

The rising value of farm assets, mainly farmland, is a notable factor. For the four years from 2018 to 2021, the value of one acre of farmland in Iowa appreciated by 57.09%, surging from $7,264 to $11,411.[6] Notably, in 2023, land values in Iowa continued to appreciate , reaching $11,835 before falling in 2024 to $11,467, a 3.1% year-over-year decline, marking the first drop in value since 2018.[6] The rapid appreciation and subsequent slight decline in Iowa farmland values create a dynamic financial environment, impacting farmers' asset wealth, borrowing capacity, and the overall risk associated with agricultural investments.

Government programs

Government programs represent another critical layer that influences the financial stability and profitability of agricultural operations. Government payments have long played a role in supporting financial stability within U.S. agriculture, particularly for farmers in Iowa. However, these payments have never been static in their structure, calculation methods, and policy objectives evolving considerably over time.

A recent major shift occurred with the passage of the Agriculture Act of 2014, which eliminated the direct payment system that had been in place since 1996, as stated by the United States Senate Committee on Agriculture.[7] During that period, according to Purdue University Center for Commercial Agriculture, direct payments were designed to help farmers transition to a market-oriented system by providing predictable income support as agriculture moved away from government intervention and toward supply-and-demand pricing. When this direct payment system was discontinued, it was replaced by a variety of new farm subsidy programs, each with different eligibility and calculation criteria.[8] Over the years, these programs have continued to change, resulting in significant variability in payment levels.

Data from the USDA Economic Research Service (ERS) Farm Income and Wealth Statistics (2025), expressed in 2025 real dollars, illustrates historical fluctuations in government payments. The graph below focuses exclusively on payments related to crop production, ad hoc programs, and disaster assistance, as these categories most accurately reflect conditions for West-Central Iowa farmers modeled in this research. Using 2025 real dollars ensures that all values are adjusted for inflation, allowing for consistent comparison of payment levels across different years. Iowa crop producers received their highest payments in 2020, totaling approximately $3.84 million, driven mainly by supplemental and ad hoc disaster assistance. Historical trends reveal dramatic swings as seen between 1977 and 1978, payments surged by 10,705.61%, rising from $1,728 to $186,721. Conversely, in 1995, payments fell by 96.48% compared to the previous year, dropping from $578,339 in 1994 to just $20,335. The graph below illustrates total government program payments and crop-specific payments in Iowa from 1949 to 2024, adjusted to 2025 real dollars.[9]

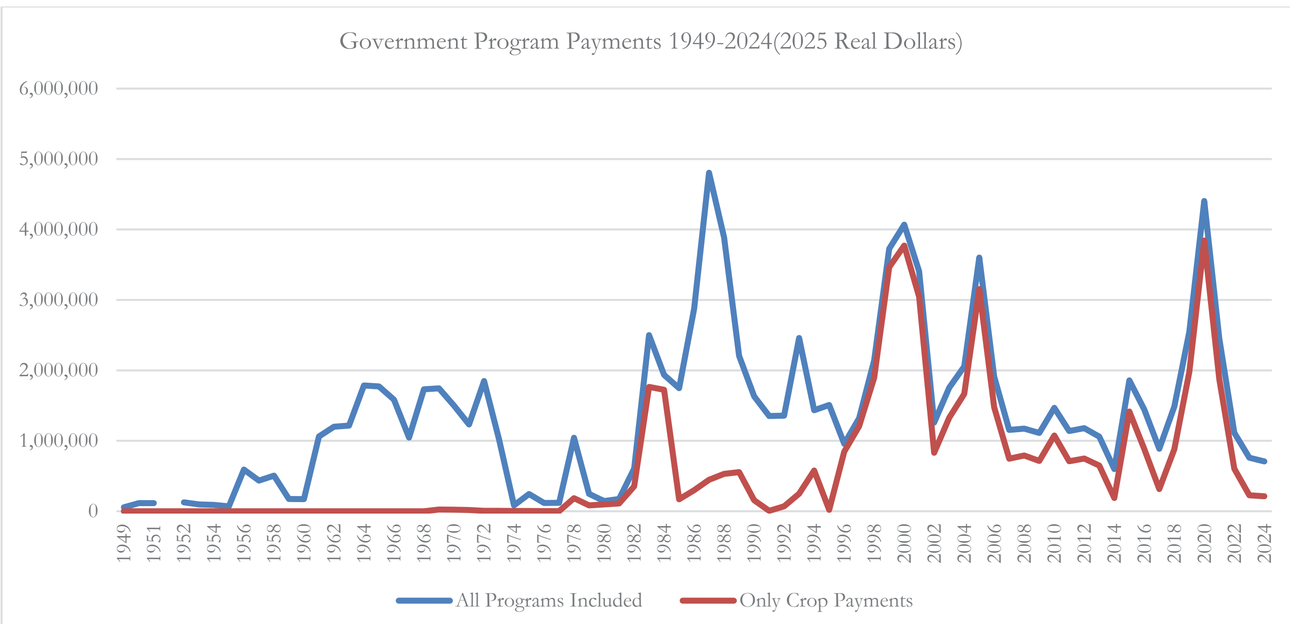

Figure 2. Iowa Government Program Payments 1949-2024 Source: Authors.

When looking at the USDA's net farm income forecast for the 2025 growing year, it could be assumed that the agricultural industry is healthy and making a surge from the 2024 growing year, rising by $180.1 billion or 29.5%, as seen in Figure 2.[10] This forecasted increase highlights the impact of government programs despite declining crop receipts on net farm income. Crop receipts, specifically corn, are projected to decline by 4.3%, and soybeans are expected to fall by 6.6% from 2024 to 2025.[10] With crop receipts expected to fall in 2025, the USDA's projection is out of context until government programs are factored in. In 2025, government programs are estimated to account for $42 billion or 23.6% of the total net farm income.[10] When comparing the 2025 estimates, in 2024, government programs accounted for 6.5%; in 2023, they were 8.2%; in 2022, they were 8.8%; and in 2021, they were 17.8%.

The major driver of this increase in 2025 is the American Relief Act of 2025, an ad hoc program passed in December of 2024 in response to ongoing economic challenges in the agricultural sector, providing significant disaster and financial assistance to producers. This program includes $31 billion to be distributed between two central pillars. The first $21 billion is for disaster relief, and the second $10 billion is for economic relief to producers. Given the significant and variable contribution of government programs to net farm income, as highlighted by the 2025 forecast, this research incorporates the presence or absence of such programs as a key variable in the simulation model to assess their impact on farm profitability and financial resilience.[10]

Along with this bill, Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC) are expected to triple from 2024 to 2025 due to the decline in commodity prices. The simulation model will specifically analyze the impact of programs such as Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC), which are projected to see increased payouts in 2025. It is plausible that the benefits and accessibility of these government programs may vary depending on a farm's tenure structure (owned vs. leased) or its level of financial leverage, aspects that will be explored in this research. The American Farm Bureau (2024) notes that while both the ARC and PLC payments provide a safety net for financial stability, the programs lack mitigation tactics for trade risk.[2]

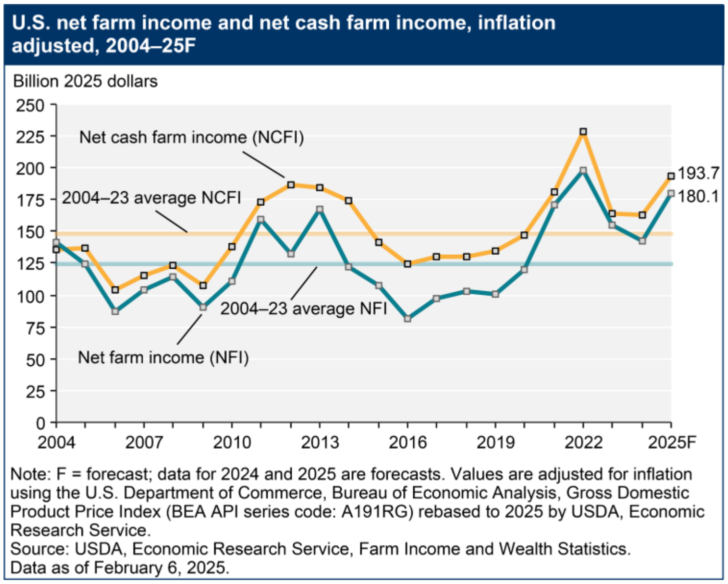

Figure 3. USDA Net Farm Income Projection 2025

Farm Debt

Another critical aspect of the agricultural financial landscape is the level and management of farm debt, which can significantly influence a farm's vulnerability to economic downturns. Debt trends can be first identified by tracking banking information and trends in agricultural lending. When analyzing the Federal Reserve Bank of Kansas City's (2025) 2024 fourth-quarter commercial bank report, it is seen that in 2024, farm debt outstanding rose at agricultural banks by 10% on non-real estate loans and 4% on real estate loans, contrary to non-agricultural banks that saw no increase from the previous year in real estate loans but saw a 2% increase in non-real estate loans.[11] These trends in rising farm debt at agricultural banks highlight the critical importance of analyzing the impact of different leverage scenarios on farm financial stability, a key component of this research.

Agricultural banks are well above historical 20-year averages in both real estate and non-real estate loans. Delinquency rates increased from historic lows in both real estate and non-real estate loans, climbing above 1% for the first time since 2020. Specifically, the duration of delinquency over 90 days more than tripled year-over-year.[12] The increase in delinquency rates and the reduced likelihood of some farmers qualifying for operating credit suggest potential financial headwinds in the agricultural sector, possibly influenced by factors such as declining commodity prices and increasing input costs.

Complementing these trends is the Federal Reserve Bank of Chicago's February 2025 AgLetter, which found that 44% of survey respondents reported an increase in non-real estate farm loans from the previous year, with only 15% reporting a decrease. Along with this, 1.7% of farm customers who had operating credit last year were not likely to qualify for new operating credit in 2026. This may disproportionately affect new and beginning farmers who lack a long credit history or substantial asset base. Notably, 40% of banks reported tightening credit standards for farm loans, and 19% noted an increase in the amount of loan collateral.[13] These financial trends reported by the Federal Reserve Banks are particularly relevant to the Iowa agricultural sector, which is the focus of the simulation model. Access to and utilization of farm debt may also vary depending on the farm's tenure structure, as landowners may have different collateral options compared to tenant farmers.

Importance

The forthcoming financial simulation model from this research is poised to have a significant impact on the agricultural community it serves. By comprehensively understanding the industry's historical context and prevailing trends, this model is engineered to empower and elevate the financial decision-making processes of agricultural professionals.

The model relies heavily on both historical and current forecasting data. The paramount consideration in data collection is prioritizing localized information, as it is most relevant to the end-users within the community. Furthermore, the model draws its data from a roster of trusted and respected sources, including but not limited to the USDA (United States Department of Agriculture), NASS (National Agriculture Statistic Services), Iowa State University, University of Missouri, and other reputable entities.

METHODS AND PROCEDURES

Scenarios

In this research, the variables of acres, leverage, tenure, and government programs were analyzed to determine the maximized operation based on net farm income per acre. The farm size levels (400, 800, and 1,200 acres) were selected to represent a range of small to large farm sizes common in West Central Iowa, while the leverage levels (10%, 25%, 50%, and 75%) span from low to high debt-to-asset ratios observed in agricultural operations. Government programs were either included in the simulation or excluded from the simulation to show the effects of these overall payments. When government programs were factored in, the model included payments from programs such as Price Loss Coverage (PLC), Agricultural Risk Coverage (ARC), and ad hoc disaster relief payments as outlined in the 2025 forecasts.

The primary metric for determining the maximized operation was net farm income per acre. However, the simulation also generated income statements, balance sheets, cash flow reports, and key financial ratios for a comprehensive assessment of economic viability and stability under each scenario.

Simulation Scenarios			
Scenario #	Ownership(Tenure) %	Cash Rent %	Crop Share %
1	100	0	0
2	75	100	0
3	75	75	25
4	75	50	50
5	75	25	75
6	75	0	100
7	50	100	0
8	50	75	25
9	50	50	50
10	50	25	75
11	50	0	100
12	25	100	0
13	25	75	25
14	25	50	50
15	25	25	75
16	25	0	100
17	0	100	0
18	0	75	25
19	0	50	50
20	0	25	75
21	0	0	100

Table 1. Simulation tenure scenarios. Source: Authors.

Simulation

This type of analysis allows representative farms in the West Central District of Iowa to: (1) assess the riskiness of their decisions, (2) plan appropriately for each possible outcome, (3) gain a better understanding of the farming operation process, (4) acknowledge the uncertainty of the results, and (5) present a more credible and justifiable set of decisions.[14]

Like most simulation models, this one is solved over a range of deterministic input values. This study assumes that crop prices and yields are deterministic over a 5-year period. Crop prices and yields were modeled using historical distributions fitted to recent market data obtained from USDA-NASS for Iowa (2014-2023).[15] The parameters of these distributions (mean and standard deviation) were derived from this data. For the first year, family consumption was modeled using a normal distribution based on the average family living expenses for farm households in Iowa as reported by the USDA ERS (2023).[14] Key deterministic variables in the model include interest rates based on the defined leverage levels, government program payment rates as per the 2023 Farm Bill, and projections for ad hoc payments and baseline operating costs derived from Iowa State University Extension data (2024).[6] For each of the 504 distinct scenarios (3 acre sizes, 4 leverage levels, 2 government program conditions, 21 tenure structures), the simulation was executed.

Farm Simulation Assumptions
The research objective of developing a farm profitability forecasting model was successfully achieved by establishing key assumptions to delineate the profile of the farm firm and its operating environment. These assumptions create the foundation for the simulation, enabling a comprehensive understanding of the farm firm's dynamics before external factors are introduced.

Financially, the farm firm possesses $64,843 in cash reserves, a figure based on the average liquid asset holdings of farms in the Midwest with similar acreage.[16] A minimum cash reserve requirement of $30,000 was set to ensure the farm firm maintains sufficient liquidity to cover short-term obligations and unexpected expenses within the simulation. Additionally, the firm allocated $60,000 to marketable securities, distributed as 12.5% in the S&P 500, 12.5% in bonds, and 75% in Certificates of Deposit (CDs), representing a diversified investment strategy common among farm operations to manage retained earnings. Another $60,000 was allocated to longer-term, less liquid investments held outside of daily trading, with a distribution of 50% in the S&P 500 index funds, 25% in bond funds, and 25% in Certificates of Deposit. These will be referred to as "non-marketable securities" within the model. The initial levels of cash reserves and marketable securities can affect a farm's capacity and willingness to utilize debt financing under the different leverage scenarios.

The simulation also incorporates detailed crop input costs on a per-acre basis. These costs include fertilizer, herbicides, insecticides, seed, drying and storage, machinery hire and repairs, labor, and other crop-related expenses. On average, corn production costs in Year 0 total $338.27 per acre, while soybean production costs average $206.63 per acre. In addition, the analysis accounts for property taxes, with an assumed average of $27.81 per cropland acre also in Year 0.

Furthermore, the simulation incorporated growth rates to project changes in costs and asset values over the 5-year forecasting period. Notably, crop costs were projected to increase at an annual rate of 2.17%, based on the average of USDA projections for input costs.[17] The Consumer Price Index (CPI) was expected to grow by 4.5% annually, reflecting the average of the USDA Chief Economist's 2032 (2023) economic projections. Real estate values were forecasted to appreciate at a rate of 3.75% annually, based on the historical trends in Iowa farmland values reported by the Iowa State University Land Value Survey.[6] Marketable securities were anticipated to grow at 6.17% annually, representing the long-term historical average return of a balanced portfolio of S&P 500 and bonds.[18] Non-marketable securities were projected to grow at a 9.3% annual rate, reflecting a potentially more aggressive long-term investment strategy. The underlying trend for crop costs is assumed to follow this deterministic growth rate. In scenarios involving crop share agreements, a 67% split was assumed for the tenant and a 33% split for the landowner.

These assumptions collectively formed the basis of the farm profitability forecasting model, facilitating the generation of realistic and insightful financial projections over the specified timeframe. Unless otherwise stated, all financial results are expressed from the viewpoint of the tenant farmer.

RESULTS

Crop Share vs Cash Rent
One of the major findings in this research is the significant difference in net farm income returned to the farm tenant observed between 100% crop share and 100% cash rent tenure structures across varying leverage levels and farm sizes. By comparing all scenarios with 100% crop share (scenarios 6, 11, 16, 21) to scenarios with 100% cash rent (scenarios 2, 7, 12, 17), it was found that, on average, crop share resulted in a higher net farm income per acre at lower leverage levels. Specifically, at a 10% leverage, the average net farm income per acre was $89.81 higher under 100% crop share compared to 100% cash rent. This difference increased to $123.18 per acre at 25% leverage and $146.27 per acre at 50% leverage. At the highest leverage level of 75%, the average difference in net farm income per acre between crop share and cash rent was $155.16, still favoring crop share on average.

These average differences were calculated by taking the mean net farm income per acre across all 100% crop share scenarios and comparing it to the mean across all 100% cash rent scenarios within each specified leverage level, with government programs factored into the simulation.

Interestingly, the farm size at which the largest change in net farm income occurred varied depending on the leverage. At the 10%, 25%, and 50% leverage scenarios, the largest positive impact of crop share over cash rent was observed on the 400-acre farm, with an average difference of $96.48 per acre. However, at the 75% leverage level, the most considerable difference shifted to the 800-acre farm. Conversely, the smallest difference in net farm income per acre between the two tenure structures across all leverage scenarios was consistently found in the 1,200-acre farm.

This suggests that at lower leverage, the returns under a crop share agreement outweigh the shared risk and lower operating costs associated with crop share, particularly on smaller farms. However, as leverage increases, the financial implications of fixed cash rent versus crop share have a more pronounced impact, potentially interacting differently with farm size and debt obligations. These differences are further illustrated in Figure 3, which provides a detailed breakdown of net farm income per acre by leverage level, which is averaged across all farm sizes.

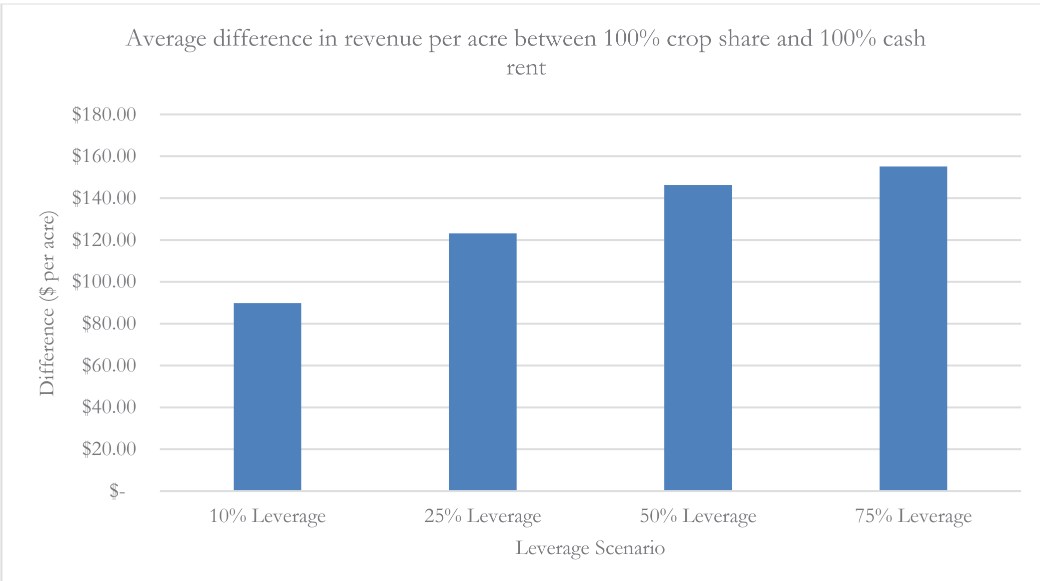

Figure 4. Revenue Difference Between 100% Crop Share and 100% Cash Rent. Source: Authors.

When comparing the 50% crop share and 50% cash rent scenarios (Scenarios 4, 9, 14, and 19), profitability varies across leverage and ownership levels. At 10% leverage, the highest net income per acre occurs on a 400-acre farm with 75% ownership, while the lowest is on a 1,200-acre farm with 0% ownership. At 25% leverage, the most profitable scenario shifts to a 400-acre farm with 0% ownership, whereas the least profitable is a 1,200-acre farm with 75% ownership. At 50% leverage, the highest income remains with a 400-acre farm at 0% ownership, and the lowest again is a 1,200-acre farm at 75% ownership. Finally, at 75% leverage, the pattern persists where the highest income is achieved by a 400-acre farm with 0% ownership, and the lowest by a 1,200-acre farm owning 75% of its land.

This trend reflects the interaction between leverage and ownership costs. At higher leverage levels, farms with 0% ownership perform better by avoiding interest expenses and other fixed costs associated with land ownership. Conversely, at lower leverage levels, farms with higher ownership tend to show greater returns due to reduced ongoing rental costs.

Government programs

The simulation results clearly demonstrate that government programs significantly increase net farm income across all farm sizes and leverage levels. It was found that the difference between having government programs on a farm, with 10% leverage and farming 400 acres is $155.17 higher with programs. The difference is $145.53 higher for 800 acres and $141.19 higher for 1,200 acres. This positive impact of government programs grows as leverage increases. A 400-acre farm sees a $199.53 increase, an 800-acre farm a $199.72 increase, and a 1,200-acre farm a $199.60 increase.

On average across all leverage levels and farm sizes, 27 scenarios witnessed a negative net farm income per acre with government programs in place. In contrast, the average increased to 56 scenarios without government programs, particularly at the 50% and 75% leverage rates, especially with high land ownership. This suggests that at higher debt burdens and when a larger proportion of land is owned (resulting in higher fixed costs such as mortgage payments and property taxes), the absence of government support significantly increases the vulnerability to negative profitability. Interestingly, the positive impact of government programs on net farm income also varied across different tenure structures, with leased land sometimes showing a slightly higher dependence on programs at high leverage, as the operator bears the full production risk under cash rent agreements. The significant impact of government programs is visually represented in Figure 4, which compares the distribution of net farm income per acre with and without program payments across different leverage levels and farm sizes.

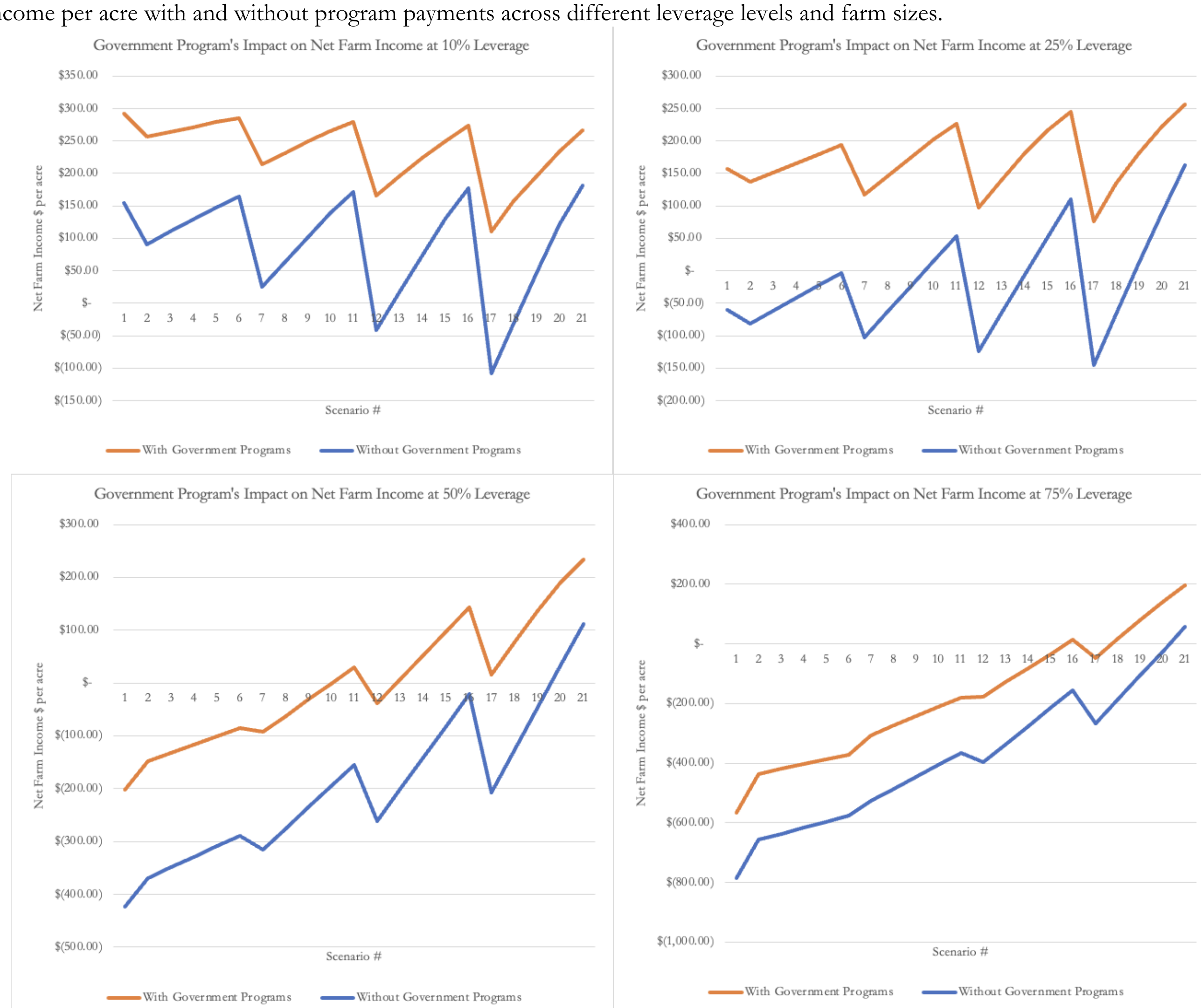

Figure 5. Impact of Government Programs on Net Farm Income Across Different Leverage Levels. Source: Authors.

Scenario Analysis

When government programs were included, notable effects on net farm income were observed. The 800-acre farm was able to maximize net farm income with 100% land ownership at 10% leverage, leading to a $278.42 per acre income. The lowest net farm income conversely was on a 100% land ownership farm at a 75% leverage level with government programs, leading to a -$566.53 per acre loss as seen below in Table 2. A 400-acre operation follows the same key scenarios, where maximizing net farm income per acre with 100% land ownership at 10% leverage led to a $343.53 per acre income. This is a difference of $904.05 from the lowest net farm income of -$560.52 as seen in Table 3. At the 1,200-acre operation, the highest net income was $253.05 per acre, and the lowest was -$568.53 per acre.

800 Acre- Revenue Per Acre Including Government Programs				
	10%	25%	50%	75%
1	$ 278.42	$ 149.06	$ (206.88)	$ (566.53)
2	$ 243.00	$ 129.02	$ (152.70)	$ (436.83)
3	$ 250.37	$ 143.36	$ (137.33)	$ (421.11)
4	$ 257.88	$ 157.54	$ (121.96)	$ (405.39)
5	$ 265.33	$ 171.55	$ (106.58)	$ (389.67)
6	$ 272.46	$ 185.48	$ (91.21)	$ (373.96)
7	$ 200.94	$ 108.77	$ (98.52)	$ (307.13)
8	$ 218.87	$ 137.65	$ (67.78)	$ (275.69)
9	$ 235.80	$ 165.90	$ (37.03)	$ (244.26)
10	$ 251.23	$ 193.76	$ (6.29)	$ (212.82)
11	$ 266.14	$ 218.51	$ 24.46	$ (181.38)
12	$ 153.50	$ 88.19	$ (44.35)	$ (177.43)
13	$ 182.71	$ 131.86	$ 1.77	$ (130.27)
14	$ 210.72	$ 173.45	$ 47.89	$ (83.12)
15	$ 236.61	$ 206.64	$ 93.28	$ (35.96)
16	$ 259.50	$ 232.45	$ 137.74	$ 11.19
17	$ 99.36	$ 67.39	$ 9.83	$ (47.73)
18	$ 144.48	$ 125.73	$ 71.28	$ 15.14
19	$ 183.52	$ 171.54	$ 131.06	$ 77.84
20	$ 220.61	$ 210.14	$ 187.52	$ 138.67
21	$ 252.76	$ 243.05	$ 227.34	$ 197.23

Table 2. 800 Acre- Revenue Per Acre Including Government Programs. Source: Authors.

400 Acre- Revenue Per Acre Including Government Programs				
	10%	25%	50%	75%
1	$ 343.53	$ 187.49	$ (182.91)	$ (560.52)
2	$ 305.29	$ 167.75	$ (128.74)	$ (430.82)
3	$ 314.28	$ 181.84	$ (113.36)	$ (415.10)
4	$ 321.98	$ 195.78	$ (97.99)	$ (399.38)
5	$ 330.17	$ 209.70	$ (82.61)	$ (383.66)
6	$ 336.99	$ 223.63	$ (67.25)	$ (367.95)
7	$ 258.64	$ 147.87	$ (74.56)	$ (301.12)
8	$ 278.09	$ 176.20	$ (43.81)	$ (269.68)
9	$ 297.15	$ 204.05	$ (13.07)	$ (238.25)
10	$ 315.13	$ 231.91	$ 17.35	$ (206.81)
11	$ 330.92	$ 259.77	$ 47.65	$ (175.37)
12	$ 208.54	$ 127.73	$ (20.38)	$ (171.42)
13	$ 240.07	$ 170.54	$ 25.41	$ (124.26)
14	$ 269.23	$ 212.33	$ 70.68	$ (77.11)
15	$ 297.99	$ 253.88	$ 115.39	$ (29.95)
16	$ 324.21	$ 289.61	$ 159.32	$ 16.92
17	$ 150.25	$ 107.45	$ 33.46	$ (41.72)
18	$ 200.92	$ 164.83	$ 93.69	$ 20.89
19	$ 240.92	$ 220.12	$ 152.74	$ 82.65
20	$ 279.72	$ 264.38	$ 210.03	$ 143.26
21	$ 316.52	$ 302.77	$ 267.03	$ 202.02

Table 3. 400 Acre- Revenue Per Acre Including Government Programs. Source: Authors.

1,200 Acre- Revenue Per Acre Including Government Programs	10%	25%	50%	75%
1	$ 253.05	$ 136.19	$ (214.87)	$ (568.53)
2	$ 220.17	$ 115.98	$ (160.69)	$ (438.83)
3	$ 227.30	$ 130.40	$ (145.32)	$ (423.11)
4	$ 234.13	$ 144.68	$ (129.94)	$ (407.39)
5	$ 240.70	$ 158.71	$ (114.57)	$ (391.68)
6	$ 247.24	$ 171.78	$ (99.20)	$ (375.96)
7	$ 180.77	$ 95.49	$ (106.51)	$ (309.13)
8	$ 198.48	$ 124.61	$ (75.77)	$ (277.69)
9	$ 213.90	$ 153.17	$ (45.02)	$ (246.26)
10	$ 228.11	$ 179.60	$ (14.28)	$ (214.82)
11	$ 241.47	$ 200.61	$ 16.47	$ (183.39)
12	$ 133.98	$ 74.76	$ (52.34)	$ (179.43)
13	$ 163.43	$ 118.82	$ (6.21)	$ (132.28)
14	$ 190.70	$ 158.49	$ 39.90	$ (85.12)
15	$ 214.59	$ 187.68	$ 85.84	$ (37.96)
16	$ 235.63	$ 212.01	$ 130.50	$ 9.19
17	$ 81.30	$ 53.42	$ 1.84	$ (49.73)
18	$ 124.83	$ 110.90	$ 63.33	$ 13.14
19	$ 164.28	$ 153.58	$ 123.78	$ 76.01
20	$ 200.23	$ 190.85	$ 173.81	$ 137.14
21	$ 229.61	$ 222.30	$ 208.71	$ 192.06

Table 4. 1,200 Acre- Revenue Per Acre Including Government Programs. Source: Authors.

This analysis leads to the conclusion that at a 10% leverage rate, net farm income is maximized when land ownership is 100% across all acreage scenarios. At a 25% leverage rate income maximization varies based on acres, where a 1,200-acre farm's income will be maximized at 50% land ownership, an 800-acre farm will maximize income at 25% land ownership, and finally a 400-acre farm will have 0% land ownership to maximize income. Finally, at a 50% and 75% leverage rate across all acre farms, 0% land ownership will maximize net income.

DISCUSSION

This research analyzed the impact of farm size, leverage, tenure, and government programs on farm profitability, revealing key insights. Firstly, despite representing only 8% of farmland, 100% crop share arrangements in our simulation yielded a significant 31%-58% higher net farm income per acre than 100% cash rent across all leverage and acre scenarios. This suggests that the benefits of shared risk and flexible costs in crop share may be undervalued, warranting further investigation into the drivers behind the dominance of cash rent and the characteristics of land under crop share. In addition to understanding the factors driving shifts in leasing structures from both tenant and landowner perspectives, it is essential to model these arrangements using both deterministic and stochastic approaches. This will allow for a comprehensive evaluation of the financial impact of various lease types and differing levels of shared risk.

Secondly, the simulation underscores the crucial role of government programs in upholding farm income, particularly under high leverage and land ownership where fixed costs are substantial. This aligns with projections showing increased reliance on government payments. However, the long-term sustainability and market implications of this dependence require further consideration. Future research could focus on optimizing program design to achieve a balance between support and market efficiency.

Finally, an inverse relationship emerged between leverage and optimal land ownership. Higher leverage often favors lower ownership levels, likely due to the increased burden of fixed ownership costs, including interest and taxes, compared to the more flexible cost structures of leasing, especially crop share. This highlights the need to carefully align tenure decisions with debt levels. Future research could build on these findings by incorporating the data into a stochastic modeling framework to evaluate the degree of correlation between simulated outcomes and actual historical results. This approach would provide insight into the reliability and predictive accuracy of the model under varying risk and uncertainty conditions.

CONCLUSIONS

The farm financial simulation model developed in this study was used to evaluate how farm size, leverage, tenure structure, and government programs influence profitability in the West-Central district of Iowa, yielding several key insights. First, crop share arrangements consistently outperformed the more common cash rent model. This finding suggests the need for future research to explore the motivations behind leasing preferences and to develop models that identify the most equitable distribution of risk and return between landowners and tenants. Second, government programs were shown to have a critical impact on farm income, particularly for highly leveraged operations. Finally, the analysis revealed an inverse relationship between leverage and optimal land ownership, indicating that higher debt levels favor lower ownership percentages.

While these findings provide a valuable framework for decision-making, they also raise important questions for future research. Further studies could incorporate stochastic modeling to assess the reliability of these results under uncertainty and compare simulated outcomes with historical performance. Additionally, exploring the long-term sustainability of government support and its interaction with market efficiency, as well as analyzing more nuanced tenure structures and risk-sharing arrangements, would deepen understanding of farm financial resilience. By advancing these areas, future research can refine strategies that balance profitability, risk, and sustainability in an evolving agricultural economy.

These findings provide a strong foundation for future research, but there are several areas that warrant deeper exploration. Future studies could incorporate stochastic modeling to capture variability and uncertainty, producing more robust and predictive results. Additionally, recreating this model for historical periods would allow for validation and verification of its accuracy over time. Beyond model refinement, examining the long-term effects of government programs and payments on market dynamics could inform policy decisions aimed at creating a sustainable and competitive agricultural marketplace. By advancing these research directions and maintaining a focus on risk management, profitability, and economic sustainability, farm firms in West-Central Iowa will be better equipped with tools to achieve both financial resilience and environmental stewardship.

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PRESS SUMMARY

Agriculture faces increasing pressure to remain both profitable and sustainable. This study introduces a farm financial simulation model designed to evaluate how factors such as land tenure, leverage, government programs, and market fluctuations influence farm financial stability over time. By modeling operations of 400, 800, and 1,200 acres, the research generates income statements, balance sheets, cash flow reports, and financial ratios to assess resilience under real-world conditions. This work provides agricultural professionals, policymakers, and stakeholders with a decision-making tool to balance long-term profitability with sustainability in today's evolving agricultural economy. The research is relevant to anyone interested in agricultural risk management, profitability, ownership strategies, or related financial considerations.