Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
https://foodsystemsjournal.org

Direct marketing promotes financial resilience for small farms with a tightening credit market

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Submitted March 12, 2026 / Revised June 3 and August 3, 2026 / Accepted August 12, 2026 / Published online November 24, 2026

Citation: Tran, L, Su, Y., & Michael, O. A. (2026). Direct marketing promotes financial resilience for small farms with a tightening credit market. *Journal of Agriculture, Food Systems, and Community Development*, *16*(1), Article 014. https://doi.org/10.5304/jafscd.2026.161.014

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Abstract

Rapid interest rate increases from March 2022 to July 2023 created significant financial pressure on small farms. Using data from 133 Missouri small farmers surveyed in late 2023, we have examined how participation in local food systems, particularly through farmers markets, provides financial buffering capacity during periods of tightening credit markets. Specifically, we employ a series of logistic regressions to estimate associations between direct marketing practices, farm diversification strategies,

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AI Disclosure

Generative AI was used for the literature search and summarization.

Data Availability

The data was obtained through a survey. The datasets generated during and/or analyzed during the current study are available upon reasonable request.

Funding Disclosure

This work is supported by the AFRI Competitive Grant Program, project award no. 2023-67024-39220 and 1890 Capacity Building Grant 2023-38821-39983, from the U.S. Department of Agriculture's National Institute of Food and Agriculture

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

Ethics statement

The project is exempt and approved by the Lincoln University of Missouri IRB board.

and three financial stress indicators: reduced borrowing, deferred investment, and delayed expansion. Results reveal that farmers marketing through farmers markets are 13% less likely to reduce borrowing and expansion, while diversified operations are 18% less likely to curtail expansion. Young farmers and those experiencing declining profitability exhibit elevated financial stress, consistent with credit-constraint mechanisms. These findings underscore the role of direct-to-consumer marketing channels in building community-level agricultural resilience. We argue that investments in farmers market development and support for farm diversification represent not merely marketing alternatives, but strategies that help rural communities withstand economic shocks. We highlight the need for integrated approaches that combine targeted financial support for beginning farmers with technical assistance for direct marketing and diversification, thereby strengthening both individual farms and regional food systems.

Keywords
local food systems, farmers markets, community resilience, farm resilience, direct marketing, agricultural finance, interest rates, small farms, policy, COVID-19, pandemic

Introduction

The COVID-19 pandemic revealed both the fragility and potential resilience of alternative food systems. While conventional supply chains experienced significant disruptions, many local food systems demonstrated remarkable adaptive capacity (Low et al., 2015; Thilmany et al., 2021). During this period, direct-to-consumer channels, particularly farmers markets, helped many operations remain viable, as community members increasingly sought local food sources (Durant et al., 2023). However, this resilience has been tested by the surge in inflation and the rapid increases in interest rates that followed the pandemic.

Between March 2022 and July 2023, the Federal Reserve raised interest rates from near zero to 5.25–5.50% to control inflation, creating significant financial pressures on farm operations through higher input and borrowing costs (Federal Reserve, 2026; Litkowski, 2025). While national data suggests farm businesses remained well positioned financially despite rising debt (Giri & Subedi, 2024), this aggregate picture may mask significant heterogeneity in how different farm types responded to credit market pressures. Yet little research examines how small farm operators respond financially to economic shocks. Existing work has focused primarily on individual farm characteristics rather than on the role of marketing channels in buffering financial stress. The intersection of rising interest rates and input costs has forced small farmers to make tradeoffs among borrowing, investment, and expansion. Small farmers are those with annual sales of less than US$350,000, accounting for more than 80% of U.S. farms (U.S. Department of Agriculture, Economic Research Service [USDA ERS], 2024).

In this study, we address this gap by examining how participation in local food systems, operationalized through farmers market sales and production diversification, is associated with reduced financial stress among small farmers during the period of rising interest rates. We conceptualize farmers markets not merely as alternative market channels, but as resilience-building hubs in local food systems (Hinrichs, 2000). These hubs typically involve three forms of capital: economic (premium prices, direct payment), social (community relationships, customer loyalty), and informational (direct market feedback, networking with other producers). This multidimensional engagement may provide farms with greater financial flexibility and resilience in the face of macroeconomic shocks.

Missouri provides an instructive case for this analysis. Ranking second nationwide in total number of farms and possessing a diverse agricultural economy, Missouri has a well-developed network of over 280 farmers markets, serving communities ranging from metropolitan areas to rural counties (Missouri Department of Agriculture, 2026). Simultaneously, Missouri's farm sector has been significantly affected by inflation and rising interest rates. The projected net farm income would be expected to decline due to elevated operating costs (Kauffman & Kreitman, 2024; Kreitman, 2025; Plastina & Chinn, 2025). While some farms may be resilient financially, others face pressures toward contraction (Giri & Subedi, 2024). This context allows us to examine how farmers market participation and

diversification affect their financial response to rising interest rates across Missouri's farm sector.

Using data collected from 133 Missouri small farm operators, we employ logistic regression models to examine the relationships between farmers market participation and production diversification and three financial stress indicators: reduced borrowing from commercial lenders, deferred investment in fixed assets, and delayed farm expansion. Results show that farmers selling through farmers markets are significantly less likely to reduce borrowing or halt expansion under rising interest rates. Those with diversified operations are also less likely to curtail expansion plans, controlling for farmer demographics, risk preferences, and profitability trends.

These results show farmers markets can serve as community infrastructure and provide benefits beyond individual farm businesses. The function is carried out through two distinct but complementary mechanisms: a direct sales channel and production diversification. Direct marketing through farmers markets provides farmers with three benefits: more stable cash flows through direct payment and premium pricing, reduced dependence on credit via better working capital management, and improved social capital for informal credit and resource sharing. Production diversification offers additional buffering through risk spreading and revenue stream stability (Berti & Mulligan, 2016). This suggests that farmers market development and technical assistance for production diversification represent not only market development initiatives but also strategies for strengthening rural economic stability.

The remainder of the paper is organized as follows. The next section develops the conceptual framework. We then describe our data and methods and then present results. We then discuss findings, policy implications, and limitations, followed by our conclusions.

Conceptual Framework: Local Food Systems as Resilience Infrastructure

How Local Food Systems Affect Financial Resilience

Local food systems are networks that connect food producers and consumers within a defined geographic region through direct and intermediary channels and that provide multiple benefits beyond simple market access (Martinez et al., 2010). Building on Hinrichs (2000), we frame local food systems as providing three forms of capital that contribute to farm financial resilience, which include economic capital, social capital, and informational capital.

Economic capital refers to the direct marketing channels that typically provide farms with higher per-unit returns through price premiums and the elimination of intermediary margins, along with immediate cash payment, reducing working capital requirements (Low & Vogel, 2011). During periods of rising input costs and credit constraints, these characteristics become particularly valuable.

Social capital refers to participation in farmers markets and local food networks that creates relationships with other producers and consumers, generating trust, information exchange, and potential access to informal credit or resource sharing arrangements (Mount, 2012). This engagement may provide buffers during financial stress that are unavailable to farms operating solely through conventional channels.

Finally, informational capital refers to direct interaction with consumers that provides immediate market feedback, which allows rapid production adjustments, while peer-to-peer networking among direct-market farmers facilitates knowledge sharing about adaptive strategies (Hinrichs, 2000). This information flow enables more responsive business decisions during periods of economic uncertainty.

These theoretical mechanisms suggest that farmers market participation and production diversification may reduce financial vulnerability when farmers face macroeconomic shocks like rising interest rates, as these strategies provide access to the economic, social, and informational capital described above. However, few researchers have empirically tested this relationship.

Farm Responses to Rising Interest Rates

When credit costs rise, farmers may respond through various operational adjustments. We conceptualize three categories of adjustment—reduced

borrowing, deferred investment, and delayed expansion—as indicators of financial pressure rather than inherently positive or negative outcomes (consistent with Barry & Robinson, 2001). These behaviors may reflect either involuntary credit constraints (inability to access credit at acceptable rates) or strategic risk management (voluntary reduction of leverage exposure). Our data cannot definitively distinguish these mechanisms, but we can identify which farm characteristics predict these stress manifestations.

Farm household economic theory (Singh et al., 1986) predicts heterogeneous responses based on initial financial position, life-cycle stage, and access to alternative financing. Young farmers with limited equity typically face credit constraints, while established operations with retained earnings have more flexibility. Similarly, farmers with access to stable cash flows (such as those from farmers markets) may have reduced dependence on external credit, making them less sensitive to interest rate fluctuations.

This framework generates several testable predictions:

- Farmers selling through farmers markets should show lower rates of financial stress indicators due to enhanced cash flow stability and reduced credit dependence.
- Diversified farms should demonstrate greater resilience through income stream stability and production flexibility.
- Younger farmers and those experiencing profit declines should show elevated stress indicators consistent with credit constraint mechanisms.
- Risk-averse farmers should show higher rates of adjustment reflecting conservative financial management.

Materials and Empirical Method

Data Collection and Survey Implementation

We conducted a structured survey of Missouri farmers between September and December 2023 to assess operational adaptations to inflation and rising interest rates following the COVID-19 pandemic. We purchased a list of Missouri small farm operators from Dynata,[1] a commercial agricultural contact list provider. The Dynata list included sales volume information for each operation, which we used to identify small farms, defined as those with annual gross sales of US$350,000 or less (USDA ERS, 2024). We stratified this small farm list by crop type into four groups (general farms, grains, livestock, and vegetables/fruits/specialty crops) and by income into four brackets (under US$50,000; US$50,000–$100,000; US$100,000–$150,000; US$150,000–$350,000), resulting in 16 strata. Within each stratum, we applied systematic random sampling by selecting every seventh name to improve sample diversity across farm types and income levels, yielding a pool of 1,200 farm operators for survey administration. The survey instrument included questions on financial decision-making, risk perceptions, marketing channels, production practices, and farm and farmer characteristics.

Surveys were delivered as hard copies via mail, each including a QR code allowing respondents to complete the instrument online through the Qualtrics platform or return the paper copy by mail. The survey instrument required approximately 7–10 minutes to complete. Follow-up reminder mailings were sent to nonrespondents to improve response rates. To encourage participation, respondents completing the survey received a US$20 Amazon gift card. The final sample comprises 133 valid responses, yielding a 15.3% response rate, comparable to recent agricultural surveys conducted during challenging economic periods (Durant et al., 2023; Quaicoe et al., 2024). This study was determined exempt from full review by the Lincoln University Institutional Review Board (October 12, 2021) under exemption categories 2i and 2ii, as it involves anonymous survey procedures posing no risk to participants. Participation was voluntary and all responses were kept confidential.

[1] https://www.dynata.com

Variable Definitions and Measurement

Dependent Variables: Financial Stress Indicators
We constructed three binary indicators of financial adjustment during the March 2022–May 2023 period when the Federal Reserve raised interest rates from near zero to over 5%. Based on farmers' responses to a multiselect survey item asking "How has the increasing interest rate affected your farm?" (see Appendix 1 for full response options), we coded whether farmers reported: (1) reducing borrowing from commercial loan institutions; (2) reducing investment in fixed assets (machinery, equipment, infrastructure); or (3) reducing farm expansion plans. We interpret these behaviors as indicators of financial pressure that may reflect either credit constraints or strategic risk management, although our survey design does not enable us to separate these two responses.

Key Independent Variables: Direct Marketing and Production Diversification
Farmers market sales: Binary indicator coded 1 if farmers market served as a primary or important revenue channel in 2022, 0 otherwise. This captures participation in direct marketing through farmers markets.

Multiproduct diversification: Binary indicator coded 1 if the farm produces multiple categories of products (e.g., livestock, grains, vegetables, fruits, and other specialty crops such as nursery products, berries, and greenhouse-grown items), 0 for single-product operations.

Both variables are operationalized as binary indicators consistent with the survey instrument design and our theoretical framing of farmers market integration and diversification as distinct strategic orientations. Limitations of this measurement approach are discussed in the limitations section below.

Control Variables
We included farmer-level characteristics (gender, age, education, race, risk preferences, inflation expectations) and additional farm-level attributes (profitability trend 2020-2022, annual gross sales, off-farm income proportion, government payments). Profitability was measured as a binary indicator of decreased profitability between 2020 and 2022, serving as a proxy for financial stress. Risk preferences were measured through self-reported likelihood of investing in risky environments (risk-averse vs. non–risk-averse). Annual gross sales were measured on an ordinal scale from 1 (less than US$10,000) to 4 (US$150,000–$350,000). Off-farm income was measured as the proportion of household income from nonfarm sources. Government payments captured whether payments remained unchanged or increased between 2020 and 2022. The details of the survey questions used to measure these variables are available in Appendix 1.

Empirical Models
Given the binary nature of our dependent variables and cross-sectional survey design, we employed logistic regression models to identify farm and farmer characteristics associated with financial stress indicators. The functional form is:

$$Logit\big(Pr(Y_i{=}1)\big){=}\beta_0{+}\ \beta_1 x_{1i}{+}\beta_2 x_{2i}{+}\ \ldots{+}\beta_k x_{ki} \quad (1)$$

where Y_i is the binary dependent variable for farmer *i*, representing farmer *i*'s reported decision to reduce borrowing, investment, or farm expansion due to rising interest rates (Y_i=1 if the farmer "i" reported this reduction, and Y=0 otherwise). The independent variables, $x_{1i} \ldots x_{ki}$, are the farmer and farm characteristics hypothesized to be associated with these decisions. The parameters, $\beta_1 \ldots \beta_k$ are coefficients to be estimated for each corresponding independent variable, and β_0 is the intercept term of the model.

The parameters of the logistic regression models were estimated using Maximum Likelihood Estimation in STATA 18. We report both coefficients and marginal effects to facilitate interpretation of substantive significance.

Results

Descriptive Statistics
Table 1 presents the descriptive statistics for all variables utilized in our analysis, providing a comprehensive overview of our sample characteristics. The categorical or proportion variables are

reported in the range of 0 to 1 for convenience.

Approximately one-third of farmers reported financial stress indicators: 26.8% reduced borrowing, 31.5% reduced investment, and 24.4% reduced expansion. About 38% of farmers reported farmers markets as an important revenue channel, while 73% operated diversified production systems. The sample was predominantly male (63%) and white (94.6%), with most (77.4%) having an education beyond high school. Nearly half (49%) self-identified as risk-averse, and 72.8% expected continued inflation. Regarding financial health, 44% experi-

Table 1. Variable Definition and Summary Statistics (*N* = 133)

Variables	Definition and Measurement	Mean	SD
Reduced borrowing	Binary: 1 if farmer reduced borrowing, 0 otherwise	0.27	0.44
Reduced investment	Binary: 1 if farmer reduced investment, 0 otherwise	0.32	0.47
Reduced farm expansion	Binary: 1 if farmer reduced expansion, 0 otherwise	0.24	0.43
Farmer characteristics			
Gender	Binary: 1 if farmer is female, 0 if male	0.37	0.48
Age	Age of primary farm operator (years)	58.51	15.28
Race	Binary: 1 if farmer is white, 0 otherwise	0.95	0.21
Education (beyond high school)	Binary: 1 if highest education is more than high school, 0 otherwise	0.77	0.42
Expected inflation (increase)	Binary: 1 if farmer expects inflation to rise over the next 12 months, 0 otherwise	0.73	0.45
Risk preferences (risk-averse)	Binary: 1 if farmer will be less likely to invest and do business in risky environment, 0 otherwise	0.49	0.50
Farm characteristics			
Multiproducts	Binary: 1 if farm produces multiple types of products (e.g., livestock, grains, vegetables, fruits, or other specialty crops), 0 if single crop	0.73	0.45
Farming experience (≤ 10 years)	Binary: 1 if farming experience is 10 years or less, 0 otherwise	0.30	0.46
Farming experience (1 –20 years)	Binary: 1 if farming experience is 11–20 years, 0 otherwise	0.17	0.37
Farming experience (> 20 years)	Binary: 1 if farming experience is more than 20 years, 0 otherwise	0.53	0.50
Profitability (decreased)	Binary: 1 if farm's profitability decreased between 2020 and 2022, 0 otherwise (i.e., profitability remained unchanged or increased).	0.44	0.50
Direct sales (Farmers market)	Binary: 1 if farmers markets served as a primary or important channel for annual revenue in 2022, 0 otherwise	0.38	0.49
Annual gross sales	Farm revenue in 2022, originally collected as categories, used numerically in the regression.		
	1 = "less than $10,000"	0.19	0.40
	2 = "$10,000–$50,000"	0.37	0.48
	3 = "$50,000–$150,000"	0.32	0.47
	4 = "$150,000–$350,000"	0.12	0.33
Off-farm income proportion (%)	Proportion of household income from non-farm sources in 2022, originally collected as categories (e.g., 0–10%, 11–20%, . . . 91–100%). For modeling, these categories were assigned their respective midpoints (e.g., 5%, 15%, . . . 95%) and treated as a continuous variable.	52	31
Government payments (unchanged/increased)	Binary: 1 if farmer's government payments remained unchanged or increased between 2020 and 2022, 0 otherwise (i.e., payments decreased)	0.74	0.44

Note: For binary or proportional variables, means are reported as proportions (0–1 range) (e.g., a mean of 0.74 implies 74%) to allow for the calculation of standard deviations (SD).

enced declining profitability between 2020 and 2022. Off-farm income averaged 52% of household income, and 74% of farmers received unchanged or increased government payments during this period.

These descriptive patterns offer preliminary context for the regression analysis that follows. Financial stress indicators were reported by roughly one-quarter to one-third of the sample, indicating meaningful variation in outcomes rather than a floor or ceiling effect. The relatively high rates of farmers market participation (38%) and diversification (73%) alongside these stress indicators suggest that local food system integration does not eliminate financial pressure during credit market tightening, but may condition how farmers respond to it. The share reporting declining profitability (44%) and high off-farm income dependence (52%) further underscore the financial vulnerability present in this sample, providing the variation necessary to identify the associations examined in the models below.

Estimation Results

Table 2 presents the estimation results of the logit regression models (Equation 1), which show that several characteristics explain the likelihood of reduced borrowing, investment, and farm expansion. To aid interpretation, we name the models "Reduced Borrowing Model," "Reduced Investment Model," and "Reduced Farm Expansion Model," respectively. All three models are statistically significant at the 5% level, with pseudo–McFadden R-square values of 15.7% (borrowing),

Table 2. Estimation Results of the Logit Regression Models

Variables	Reduced borrowing model	Reduced investment model	Reduced expansion model
Female	−0.5540 (0.5313)	−1.8371*** (0.8073)	−0.7302 (0.5674)
Age	−0.0264* (0.0156)	−0.0565*** (0.0205)	−0.0270* (0.0165)
White (base: non-White farmers)	−0.5023 (0.9334)	−1.6843 (1.0839)	−0.8686 (0.9853)
Education (base: high school or less)	−0.0241 (0.5241)	0.1398 (0.6508)	−0.2119 (0.5471)
Inflation expectations (base: no increase)	0.6633 (0.5597)	0.2816 (0.6767)	0.5814 (0.5700)
Risk-averse preferences (base: non risk aversion)	1.1484** (0.5085)	1.2446** (0.6827)	1.2036** (0.5223)
Multi-products (base: Single crop)	0.2814 (0.5384)	−0.0139 (0.6925)	−1.1673** (0.5363)
Decreased profitability (base: unchanged/increased profitability)	−0.1275 (0.4782)	1.1512* (0.6305)	0.4337 (0.4857)
Farmers market sales	−0.8333* (0.5283)	−0.5363 (0.6782)	−0.9187* (0.5769)
Annual gross sales	0.3535 (0.2636)	0.3971 (0.3499)	0.1180 (0.2757)
Off-farm income proportion (%)	−0.0076 (0.0080)	0.0017 (0.0101)	−0.0028 (0.0084)
Government Payments: unchanged or increased (base: decreased)	−0.3228 (0.5392)	−0.5508 (0.7059)	0.3869 (0.6088)
Constant	−0.1393 (1.7525)	1.4405 (2.1084)	0.6647 (1.8284)
Goodness of fit			
N	133	133	133
Likelihood-Ratio Chi-Square (χ^2)	24.1	29.7	28.5
Pr(>χ^2)	0.020	0.003	0.005
McFadden's pseudo R^2	15.7%	25.6%	19.4%
Corrected AIC	158.3	115.4	147.4

*, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
- Corrected AIC: corrected Akaike's Information Criterion that accounts for small sample.
- Standard errors are reported in parentheses.

25.6% (investment), and 19.4% (expansion), indicating acceptable model fit. The pairwise correlations and Variance Inflation Factor (VIF) of independent variables in these models were examined. No evidence of multicollinearity was found (see Appendix 2 for details).

Table 3 provides the marginal effects of farmer and farm characteristics on decision-making outcomes. Gender, age, risk preferences, farm diversification, profitability, and direct sales through farmers markets have significant effects. For the results' interpretation, "significant" refers to statistical significance at conventional probability thresholds, indicating that an association is unlikely to be due to chance, rather than necessarily denoting a large or substantively important effect size.

The Role of Farmers Markets and Diversification

Farmers markets play a critical role in direct sales because they are easy to access and flexible. This section focuses on their role in diversification.

Farmers Markets as Financial Buffers

Our central finding concerns the relationship between farmers market participation and financial stress indicators. Farmers reporting farmers markets as an important revenue channel show significantly lower likelihood of reducing both borrowing and expansion. Specifically, farmers market participation is associated with a 13.0% lower probability of reducing borrowing ($p < 0.10$) and a 12.9% lower probability of reducing expansion ($p < 0.10$). These effects are economically meaningful, representing reductions of approximately

Table 3. Marginal Effects of Farmer and Farm Characteristics

Variables	Reduced borrowing model	Reduced investment model	Reduced expansion model
Female	−0.0867 (0.0803)	−0.1610*** (0.0570)	−0.1032 (0.0765)
Age (in years)	−0.0042* (0.0024)	−0.0057*** (0.0019)	−0.0039* (0.0023)
White (base: non-white farmers)	−0.0855 (0.1681)	−0.2172 (0.1588)	−0.1396 (0.1701)
Education (base: high school or less)	−0.0038 (0.0839)	0.0139 (0.0633)	−0.0313 (0.0824)
Inflation expectations (base: no increase)	0.1006 (0.0788)	0.0276 (0.0642)	0.0799 (0.0733)
Risk-averse preferences (base: non risk aversion)	0.1888** (0.0807)	0.1208** (0.0606)	0.1762** (0.0728)
Multiproducts (base: Single crop)	0.0441 (0.0825)	−0.0014 (0.0700)	−0.1840** (0.0868)
Decreased profitability (base: unchanged/increased profitability)	−0.0202 (0.0754)	0.1155* (0.0605)	0.0631 (0.0707)
Farmers market sales	−0.1297* (0.0775)	−0.0522 (0.0632)	−0.1285* (0.0752)
Annual gross sales	0.0563 (0.0409)	0.0400 (0.0347)	0.0170 (0.0397)
Off-farm income proportion (%)	−0.0012 (0.0013)	0.0002 (0.0010)	−0.0004 (0.0012)
Government Payments: unchanged or increased (base: decreased)	−0.0525 (0.0891)	−0.0587 (0.0784)	0.0545 (0.0828)

*, **, and *** indicate conventional significance levels of 10%, 5%, and 1%, respectively.

half relative to baseline rates.

Notably, farmers market participation shows significant associations with borrowing and expansion decisions but not with investment. This differential pattern suggests farmers markets may primarily affect liquidity and growth-oriented financing rather than fixed asset investment, though alternative explanations cannot be ruled out. These findings align with our theoretical framework that farmers markets provide multiple forms of capital enhancing financial resilience.

Production Diversification and Resilience

Multiproduct diversification shows a significant negative association with reducing farm expansion (marginal effect = -18.4%, $p < 0.05$), indicating diversified operations are substantially less likely to curtail expansion plans when facing rising interest rates. This effect is larger than that of farmers market participation, suggesting diversification provides particularly strong buffering for growth-oriented decisions.

Diversification shows no significant association with borrowing or investment decisions, though it does relate to expansion. This differential pattern may indicate that diversification primarily affects confidence in long-term growth planning through income stability from multiple revenue streams, rather than affecting short-term liquidity or capital asset decisions. However, alternative explanations cannot be ruled out.

These findings are consistent with diversification theory. Multiple production enterprises may enhance financial stability through income stream diversification and risk spreading across different products and markets, potentially reducing the perceived risk of expansion even when credit becomes more expensive.

Vulnerable Populations: Young Farmers and Declining Profitability

While farmers markets and diversification show protective associations, several farmer and farm characteristics predict elevated financial stress. Age shows consistent negative associations across all three models: each additional year of age is associated with 0.4% lower probability of reducing borrowing ($p < 0.10$), 0.6% lower probability of reducing investment ($p < 0.01$), and 0.4% lower probability of reducing expansion ($p < 0.10$). Over a 20-year age difference, these translate to 8–12 percentage point differences in stress indicator rates.

These patterns suggest younger farmers face particular vulnerability to interest rate increases, consistent with life-cycle theories of farm finance. Young farmers typically have limited equity accumulation, higher debt-to-asset ratios, and less established customer relationships or market access—all factors increasing sensitivity to credit cost increases (Ahearn & Newton, 2009). The consistency of age effects across all three outcomes suggests young farmers experience broad-based financial pressure rather than selective adjustments in particular areas.

Declining profitability between 2020 and 2022 significantly predicts increased investment reduction (marginal effect = 11.6%, $p < 0.10$), though it shows no significant association with borrowing or expansion decisions. This suggests farmers experiencing profit deterioration specifically curtail capital asset investment, perhaps reflecting constrained cash flow for large purchases even as they attempt to maintain operations through continued borrowing and avoid signaling distress through expansion cuts.

Risk-averse preferences consistently predict higher rates of all three stress indicators (marginal effects of 18.9%, 12.1%, and 17.6% for borrowing, investment, and expansion, respectively, all $p < 0.05$). These substantial effects indicate that risk-averse farmers are approximately 12–19 percentage points more likely to reduce operations across the board, consistent with conservative financial management strategies during periods of macroeconomic uncertainty (Menapace et al., 2013).

Gender Differences in Investment Decisions

Female farmers show 16.1% lower probability of reducing investment in fixed assets compared to male farmers ($p < 0.01$), a substantial and statistically robust effect. However, gender shows no significant association with borrowing or expansion decisions. This pattern represents an unexpected finding warranting careful interpretation.

One plausible explanation involves farm scale and investment baseline differences. Existing literature documents that female-operated farms tend to be smaller in both acreage and revenue (Todd, et al, 2024), a pattern consistent with our data (female-operated farms averaged 202 acres and sales category 2.24 vs. 389 acres and 2.43 for male-operated farms, though these differences were not statistically significant given our sample size). If female-operated farms are already at or near minimal investment levels, they have limited capacity for further reduction, creating a floor effect. In contrast, larger male-operated farms making more substantial debt-financed investments may have greater ability and motivation to cut investment when interest rates rise. This finding highlights important heterogeneity in how different farmer populations experience and respond to economic shocks, and suggests the need for gender-disaggregated analysis in agricultural finance research. However, we are cautious about overinterpreting this result given our limited sample size and lack of detailed investment data by gender.

Several variables showed no significant associations with financial stress indicators, but deserving some discussion. Education, race, and inflation expectations showed no significant relationships with any outcome. Perhaps most surprisingly, neither off-farm income proportion nor government payments predicted financial adjustments. These null results are unexpected given theoretical predictions that alternative income sources should buffer farms from credit market pressures. The lack of off-farm income effects may reflect that while off-farm income provides household consumption support, it does not necessarily translate to farm business cash flow available for investment or operations. Alternatively, farms with high off-farm income may be less growth-oriented, making expansion and investment less relevant regardless of interest rates. The null government payment effect may indicate that pandemic-era payments, while substantial, were largely directed to current operations rather than providing buffers for future investment decisions. These interpretations remain speculative and represent areas for future investigation.

Discussion

Farmers Markets as Financial Infrastructure

Our central finding—that farmers market participation is associated with approximately 13% lower likelihood of reducing borrowing and curtailing expansion during interest rate increases—carries important implications for how we conceptualize local food systems. Rather than viewing farmers markets merely as alternative marketing channels providing premium prices, our results suggest they appear to function as financial infrastructure that enhances farm resilience to macroeconomic shocks.

This resilience likely operates through multiple mechanisms. Economically, the immediate cash payment characteristic of farmers markets improves working capital position and reduces dependence on operating credit. The elimination of payment delays typical in conventional marketing channels means farmers receive revenue when needed for current expenses rather than waiting 30 to 60 days, reducing short-term borrowing needs. Premium pricing may provide some margin cushion to absorb input cost increases, though farmers more likely absorb rising costs through reduced returns to their own labor and management rather than passing all costs to consumers. Direct sales through farmers markets also allow farmers to adjust prices immediately in response to rising input costs, unlike conventional channels with fixed contracts or delayed pricing structures.

Beyond economic mechanisms, farmers market participation may generate social capital through repeated vendor interactions. Whether these relationships extend to resource sharing, equipment borrowing, or informal credit arrangements likely varies considerably by market context and regional culture, and warrants further empirical investigation. Customer relationships built through direct sales may provide demand stability and loyalty that persists even when broader economic uncertainty affects other market channels. The informational capital gained through direct market feedback and networking with other direct marketers may support rapid adaptation to changing conditions, as well as the exchange of ideas for im-

proving production practices and addressing shared production challenges.

These findings align with emerging research on direct marketing and farm resilience during COVID-19, which found that farms with diversified direct marketing channels demonstrated greater adaptive capacity and maintained operations more successfully than those dependent on conventional supply chains (Durant et al., 2023). Our contribution demonstrates that this resilience extends beyond pandemic-specific disruptions to include financial resilience during macroeconomic stress from interest rate increases.

The Complementary Role of Diversification

The strong protective association of production diversification, particularly for expansion decisions, reinforces that resilience emerges from integrated strategies rather than single interventions. Farmers with diversified operations may benefit from multiple income streams that help buffer against price fluctuations or production failures in any single enterprise. This income stability appears to provide confidence to maintain expansion plans even when credit becomes more expensive.

Critically, diversification and farmers market participation operate synergistically. Farmers markets incentivize product diversification, as customers seek a variety of offerings in a single shopping trip. Simultaneously, diversified production may benefit from relatively higher prices and immediate cash flow that direct marketing can provide, though price premiums vary considerably by market location and commodity type. This suggests that policies supporting one strategy implicitly support the other, and that integrated approaches recognizing these connections will be most effective.

The diversification finding also speaks to food systems resilience at the community level. Regions with higher proportions of diversified small farms possess more adaptable agricultural sectors capable of responding to changing consumer demands, climate variability, and economic shocks. Supporting diversification therefore builds not just individual farm resilience but regional food system resilience.

Policy Implications

Our findings suggest that supporting farmers markets and farm diversification represents more than agricultural marketing policy, as these strategies help stabilize rural economies. When small farmers remain financially stable during economic stress, they continue to supply local food systems, employ farm labor, and circulate income within rural communities, strengthening the broader rural economy. Just as investments in roads, broadband, schools, and healthcare support community stability, strategic support for farmers markets may enhance agricultural resilience during economic downturns.

Our results point to several policy considerations. First, the protective association between farmers market participation and financial decisions challenges the view of farmers markets as supplementary or recreational venues. Instead, it suggests they function as economic infrastructure that helps buffer farm businesses during financial stress, likely through immediate cash payment, reduced dependence on credit, and stable customer relationships. This has implications for both infrastructure investment and technical assistance. Infrastructure investments in permanent market facilities, Supplemental Nutrition Assistance Program/Electronic Benefits Transfer access, and professional market management could be incorporated into state and local economic development strategies rather than treated solely as agricultural amenities. Extension services and beginning farmer programs already offer training in business planning, direct marketing, and food safety compliance. However, access to these programs may be limited by distance, cost, or time constraints, particularly for small and beginning farmers. Policy efforts could focus on reducing these access barriers, such as through mobile or virtual training options, subsidized program fees, or flexible scheduling that accommodates farm operation demands. Together, these investments may support both individual farm profitability and broader stability in the farm sector.

Second, the positive association between diversification and farm expansion suggests that farmers with multiple production enterprises in our sample may maintain growth confidence when credit becomes expensive, likely through income stream

stability and risk spreading. However, current agricultural policy often implicitly favors specialization. Crop insurance programs typically cover single commodities rather than diversified systems. Commodity support programs reward scale in specific crops. Agricultural lending often uses commodity-specific risk models that may undervalue diversification's risk-reduction benefits. Policy reforms could address these barriers through whole-farm revenue insurance rather than commodity-specific coverage, lending criteria that recognize diversification as risk reduction, and cost-share programs for diversification infrastructure (processing equipment, storage facilities). Extension programming could prioritize skills in managing multiple enterprises and integrated production systems.

Finally, young farmers were consistently more likely to reduce borrowing, investment, and farm expansion when interest rates rose, indicating particular vulnerability to macroeconomic shocks. Policy responses should integrate financial and technical assistance: low-interest loans or loan guarantees specifically for beginning farmers, combined with technical assistance for developing direct marketing skills and diversified production systems. Programs like USDA's Beginning Farmer and Rancher Development Program should explicitly incorporate direct marketing and farmers market training as core components.

Limitations and Future Research Directions

Despite offering important insights, our study has several limitations. First, the relatively small sample (N = 133) with modest response rate (15.3%) and predominant white composition (94.6%) limits generalizability. This is due to the regional focus and the potential for nonresponse bias. Given the known systemic disparities in financial access, credit availability, and land ownership experienced by non-white farmers, the results regarding financial resilience and sensitivity to interest rates may not be directly applicable to these operators.

Second, while we theorize multiple mechanisms through which farmers markets provide financial buffering (cash flow, premium pricing, social capital), our data cannot distinguish their relative importance. Mixed-methods research combining quantitative analysis with in-depth case studies or interviews would illuminate which mechanisms matter most for different types of farms. Additionally, our measure of farmers market participation (binary indicator of importance to revenue) provides limited information about intensity, duration, or quality of participation. Similarly, the binary measure of production diversification does not capture the degree or complexity of diversification across enterprises. More granular measures of farmers market engagement and diversification would enable more nuanced analysis. Furthermore, our dependent variables measure behavioral adjustments (reduced borrowing, investment, expansion) but not ultimate outcomes. We cannot determine whether farmers that reduced operations experienced better or worse subsequent performance, or whether some reductions represented prudent risk management while others reflected harmful constraints. Longitudinal research tracking farms over time could assess whether direct marketing and diversification strategies actually improve long-term survival, profitability, and growth—the ultimate tests of resilience.

Finally, our findings are specific to small farms, which often prioritize stability over aggressive growth. The financial behavior observed here may differ significantly from that of operators with large commercial farms, who often leverage greater flexibility in cash reserves and deploy more varied investment strategies (Hien et al., 2024; Opler et al., 1999), highlighting the need for context-dependent research across different farm scales.

Conclusions

We provide evidence that integration into local food systems, specifically through farmers markets and production diversification, is associated with greater financial resilience among small farms during periods of credit market tightening. Drawing on a survey of 133 small farmers in Missouri, we analyzed how the operators adapted to the aggressive interest rate hikes of 2022–2023. The analysis yields two primary findings. First, farmers utilizing farmers markets as a primary revenue channel were 13% less likely to reduce their borrowing or halt expansion during this period. Second, diversified operations demonstrated 18% lower likelihood of curtailing expansion plans. These patterns suggest

that farmers markets and diversification are associated with financial benefits beyond premium pricing, consistent with their functioning as economic infrastructure that enhances farm resilience to macroeconomic shocks.

Our findings also highlight vulnerable populations requiring targeted support. Young farmers show elevated financial stress across all three outcomes. Effective support would combine financial assistance (low-interest loans, loan guarantees) with technical training in direct marketing and diversification.

Important limitations qualify these findings. Our relatively small sample from a single state limits generalizability. Our cross-sectional design precludes definitive causal claims. And our outcome measures capture behavioral adjustments but not ultimate impacts on farm viability. These limitations suggest our results are best interpreted as exploratory patterns warranting further investigation rather than definitive conclusions.

Despite these limitations, our findings contribute to emerging literature on local food systems by providing quantitative evidence that infrastructure for direct marketing may provide broad financial benefits to small farmers. For policymakers and practitioners, the results suggest that supporting farmers market development, facilitating farm diversification, and providing technical assistance represent investments with returns extending beyond individual farms to broader rural economic stability. Future research should build on this foundation through larger probability samples, longitudinal designs tracking farms over time to assess actual resilience outcomes, mixed-methods approaches illuminating mechanisms, and comparative studies examining whether local food system integration provides general resilience or shock-specific benefits. Ultimately, investments in farmers market infrastructure and supporting farm diversification represent not just agricultural policy, but a foundation for rural community economic stability in the face of broader macroeconomic pressures.



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Appendices

Appendix A. Survey Questionnaire

Farms' Resilience During High Inflation

Start of Block: Introduction and screening

...

Start of Block: Perception of inflation

...

Please indicate your agreement with the following statement.

2. The U.S. inflation will remain in the next 12 months.

- ○ Disagree
- ○ Neutral
- ○ Agree

3. It is very risky to invest or do business during a high inflation time.

- ○ Disagree
- ○ Neutral
- ○ Agree

4. The growth rate of our farm gross income is greater than the growth rate of our farm input cost in the past two years.

- ○ Disagree
- ○ Neutral
- ○ Agree

5. Farmers could increase prices to cover all increased costs due to inflation in the past two years.

- ○ Disagree
- ○ Neutral
- ○ Agree

...

Start of Block: Inflation Impacts on sales and profitability

E10 Overall, how did your farm profitability change from 2020 to 2022?

- ○ Increase (1)
- ○ Decrease (2)
- ○ No change (3)

Start of Block: Inflation Reduction Act & Interest Rates Policies

I1 Compared to 2020, what happened to your government payments in 2022?

- ○ Increase (1)
- ○ Decrease (2)
- ○ No change (3)

I2 Do you have any existing loans?

- ○ Yes (1)
- ○ No (2)

In order to curb inflation, Fed has increased its interest rate 10 times from almost zero to more than 5% from March 2022 to May 2023. Did the interest rate increase affect your farm?

- ○ Yes (1)
- ○ No (2)

Display this question:

If In order to curb inflation, Fed has increased its interest rate 10 times from almost zero to more... = Yes

I3. How has the increasing interest rate affected your farm?

- ☐ Reducing borrowing from commercial loan institutions (1)
- ☐ Difficult to get loans for farm operation (2)
- ☐ Rent land instead of buying (3)
- ☐ Land value decreased (4)
- ☐ Increased interest payment for existing loans (5)
- ☐ Reduce investment in equipment and other fixed assets (6)
- ☐ Reduce or stop farm expansion (7)
- ☐ Other (please specify) (8) _____

...

Start of Block: Farm and Farmer Characteristics

F1 How many acres of land does your farm have?

- Less than 10 (1)
- 10-49 (2)
- 50-179 (3)
- 180 - 499 (4)
- 500 - 999 (5)
- 1000 and more (11)

F2 Approximately what is your gross farm sales in 2022?

- less than $10,000 (1)
- $10,000 - $50,000 (12)
- $50,000 - $150,000 (2)
- $150,000 - $350,000 (3)
- $350,000 and above (4)

F3 What were the sources of your farm income in the last two years? Choose all that apply.

- Grain and oilseeds (1)
- Livestock (10)
- Fruits (11)
- Vegetables (12)
- Processing (6)
- Packaging (7)
- Agritourism (8)
- Winemaking (14)
- Beekeeping (15)
- Flowers (16)

- [ ] Urban gardening (17)
- [ ] Other specialty crops (honey, nuts, et al) (13)
- [ ] Others (specify) (9) _____

F4 What percentage of your household income from non-farm sources?

- ○ Less than 10% (13)
- ○ 10%-20% (14)
- ○ 20%-30% (15)
- ○ 30%-40% (16)
- ○ 40%-50% (17)
- ○ 50%-60% (18)
- ○ 60%-70% (19)
- ○ 70%-80% (20)
- ○ 80%-90% (21)
- ○ 90%-100% (22)

F5 What is your age?

_____

F6 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to say (3)

F7 What is your highest educational attainment:

- ○ Some high school or less (1)
- ○ High school degree (2)
- ○ 2 year / Associate's degree (3)
- ○ 4 year / Bachelor's degree (4)
- ○ Graduate or professional degree (5)

F8 What is your race?

- ○ White (12)
- ○ Black or African American (13)
- ○ American Indian or Alaska Native (14)
- ○ Asian (15)
- ○ Native Hawaiian or Pacific Islander (16)
- ○ Other (17)

F9 How many years do you substantially participate in a farm operation?

- ○ 0-5 (1)
- ○ 6-10 (2)
- ○ 11-20 (3)
- ○ 21 and above (4)

F10 What is your zip code?

_____

Appendix B. Variance Inflation Factor (VIF) of Benefit Variables

Independent variables	McFadden's R^2	VIF
Gender (Female)	22.5%	1.29
Age	38.0%	1.61
Race (White)	1.4%	1.01
Education	9.4%	1.10
Inflation expectations (Increase)	6.2%	1.07
Risk-averse preferences	24.2%	1.32
Multi-products	18.4%	1.23
Farm experience	45.9%	1.85
Decreased profitability	18.2%	1.22
Farmers markets sales	23.2%	1.30
Annual gross sales	21.5%	1.27
Off-farm income proportion	21.7%	1.28
Government Payments: unchanged or increased	13.8%	1.16