

FoodShare Participation and Household Economic Vulnerability in Wisconsin Counties, 2019–2023

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Abstract

This study examines annual FoodShare recipient rates in 71 Wisconsin counties in 2019, 2021, 2022, and 2023, with particular attention to households below the poverty line and households classified as ALICE (Asset Limited, Income Constrained, Employed). FoodShare participation is used as a county-level proxy for food-assistance use and food-insecurity risk rather than as a direct measure of food insecurity. Combining data from the Wisconsin Department of Health Services, the U.S. Census Bureau/American Community Survey, and the United for ALICE Research Center, the analysis shows that the mean county FoodShare recipient rate was higher in 2021, the first observed pandemic-era year in the dataset, than in 2019, and it remained above the 2019 baseline in 2023. Regression results indicate that both poverty-household rates and ALICE-household rates are positively associated with FoodShare participation in cross-county models. Robustness checks show that these relationships remain present in population-weighted models and when Milwaukee County is excluded, while county fixed-effects models suggest that much of the relationship reflects persistent differences across counties rather than short-run within-county changes. The findings support a broader interpretation of household economic vulnerability: poverty measures identify severe hardship, while ALICE measures capture additional households above the federal poverty line but below the basic cost of living in their county.

Keywords

FoodShare, food insecurity, ALICE households, poverty, Wisconsin, COVID-19, county-level analysis

1. Introduction

Food insecurity is a persistent public-policy problem in Wisconsin, but it is not always visible through poverty statistics alone. Official poverty measures identify households with the most severe income deprivation, yet many households above the federal poverty line still struggle to meet basic expenses. The ALICE framework—Asset Limited, Income Constrained, Employed—captures this second category of vulnerability: households above the Federal Poverty Level but below the ALICE Threshold, meaning that their income is insufficient to afford basic expenses in their county. Although many ALICE households include workers, the county-level ALICE household rate should not be interpreted as a direct employment-status variable.

The COVID-19 pandemic made this distinction more important. Pandemic-era disruptions affected employment, household income, childcare, transportation, and food prices. At the same time, food-assistance participation was shaped by program rules, administrative access, emergency benefit policies, and household willingness or ability to apply. Because extra COVID-19 FoodShare benefits in Wisconsin ended after February 2023, 2023 should be interpreted as a later post-2019 year affected by policy transition rather than as a clean post-pandemic counterfactual (Wisconsin Department of Health Services, 2023). For that reason, this paper does not treat FoodShare participation as identical to food insecurity. Instead, it uses FoodShare participation as a measurable proxy for food-assistance dependence and food-insecurity risk.

This paper asks three related questions. First, how did county-level FoodShare participation in the Wisconsin analytic sample change from the pre-pandemic baseline to the first observed pandemic-era year and later post-2019 years? Second, are poverty-household rates and ALICE-household rates associated with FoodShare participation? Third, do the results survive basic robustness checks, including population-weighted estimates, exclusion of Milwaukee County, and county fixed effects?

The central finding is that both poverty and ALICE measures matter in cross-county models. Counties with higher poverty-household rates tend to have higher FoodShare participation, and ALICE-household rates add explanatory power beyond official poverty. However, the relationship weakens in county fixed-effects models, suggesting that the main association is largely between counties rather than within counties over the short 2019–2023 panel.

2. Literature Review

Prior research shows that food insecurity varies across geography, household characteristics, and broader economic conditions. Bartfeld and David (2003) documented Wisconsin food-insecurity patterns by income, household composition, employment status, race, disability, tenure, and location, showing that food insecurity is closely related to poverty but not limited to households outside the labor force. Their findings support the use of a broader vulnerability frame rather than a poverty-only approach.

Guerrero et al. (2014) provided a statewide statistical analysis of food insecurity among Wisconsin adults using the Survey of the Health of Wisconsin. Their study examined demographic and geographic correlates such as age, education, poverty-income ratio, race, and urbanicity. The finding that food insecurity does not reduce neatly to urban-rural differences supports the need for county-level analysis rather than a simple urban-versus-rural frame.

Research on the pandemic period further shows that food insecurity is shaped by overlapping economic pressures. Using Canadian evidence, Men and Tarasuk (2021) analyzed food insecurity during COVID-19 in relation to employment, household composition, government assistance, and charitable food access. Their work underscores that food insecurity is not explained by income alone; it also depends on the institutional and household context through which economic shocks are absorbed.

More recent research also highlights the importance of vulnerability beyond conventional poverty measures. Liu et al. (2024), for example, examined food-insecurity disparities across immigration status and showed that disadvantaged groups can remain exposed even when aggregate trends improve. For Wisconsin specifically, the ALICE framework offers a way to measure households that are not officially poor but remain economically constrained.

This paper contributes to that literature by linking FoodShare participation in the 71 Wisconsin counties included in the analytic sample to both official poverty and ALICE household vulnerability across the pre-pandemic, first observed pandemic-era, and later post-2019 period. The empirical contribution is modest but specific: it tests whether ALICE rates contain information about food-assistance dependence beyond poverty rates alone.

3. Data and Measures

The analysis combines county-level observations for 71 Wisconsin counties in 2019, 2021, 2022, and 2023. The year 2020 is not included because the ALICE source used for this project does not provide a comparable county-level file for that year, so the study cannot observe the first pandemic year directly. The final corrected dataset contains 284 county-year observations. Menominee County is not included because it is absent from

the Wisconsin Department of Health Services FoodShare data used in the project; therefore, the results refer to the analyzed counties rather than to every Wisconsin county.

The dependent variable is the annual FoodShare recipient rate, calculated as annual cumulative FoodShare recipients divided by total county population. The Wisconsin Department of Health Services reports yearly recipients as unduplicated within a county or tribe, while noting that duplication can occur between counties or tribes; therefore, the rate is interpreted as a county-level annual program-use proxy rather than a point-in-time FoodShare prevalence rate or a precise statewide unduplicated resident measure. The key independent variables are the poverty-household rate and the ALICE-household rate, each calculated as a share of total county households. County population values are taken from the Census/ACS-linked population field in the analytic file and are aligned to the county-year structure used for the ALICE and DHS merge. Total population enters the preferred regression as a log control because county size may affect FoodShare participation, administrative access, and the composition of recipients.

The original data required several cleaning decisions. Blank rows and a stray bracket row were removed from the spreadsheet. A duplicated 2023 year-dummy column was removed. One entered value—Marquette County poverty households in 2019—was internally inconsistent because it showed 66,241 poverty households despite only 6,648 total households. The value was corrected to 652 using the United for ALICE Wisconsin Data Sheet, producing a poverty-household rate of 9.81 percent for that county-year.

Table 1: Variables and Data Sources

Variable	Operational definition	Primary source	Use in analysis
Annual FoodShare recipient rate	Annual cumulative FoodShare recipients / county population	Wisconsin DHS	Dependent variable / annual program-use proxy
Poverty-household rate	Poverty households / total households	United for ALICE (ACS-based)	Key predictor
ALICE-household rate	ALICE households / total households	United for ALICE	Key predictor
Log population	ln(county population used as denominator)	U.S. Census / ACS-linked population field in analytic file	Scale control
Year indicators	2021, 2022, and 2023 dummies; 2019 omitted	Constructed from dataset	Timing controls

4. Empirical Strategy

The main specification estimates the association between FoodShare participation and household economic vulnerability at the county-year level:

$$\text{FoodShareRate}_{ct} = \beta_0 + \beta_1 \text{PovertyRate}_{ct} + \beta_2 \text{ALICERate}_{ct} + \beta_3 \ln(\text{Population}_{ct}) + \gamma_t + \epsilon_{ct}$$

where c indexes counties and t indexes years. The coefficients on the poverty-household and ALICE-household rates measure the relationship between household vulnerability and FoodShare participation. Year fixed effects capture common statewide changes relative to 2019, including 2021 as the first observed pandemic-era year and 2022–2023 as later post-2019 years. Standard errors are clustered by county to account for repeated observations within counties.

The estimates should be interpreted as associational, not causal. Counties with high poverty or ALICE rates may also differ in industrial structure, age distribution, housing costs, program administration, or local food access. To test whether the main results depend on modeling choices, the paper reports three robustness checks: a population-weighted model, a model excluding Milwaukee County, and a county fixed-effects model.

5. Results

5.1 Descriptive Trends

Table 2 shows that the mean county annual FoodShare recipient rate increased from 13.5 percent in 2019 to 15.2 percent in 2021. Participation declined slightly in 2022 and 2023, but the 2023 mean remained above

the 2019 baseline. This pattern is consistent with a pandemic-era increase followed by partial, rather than complete, normalization in the later post-2019 years.

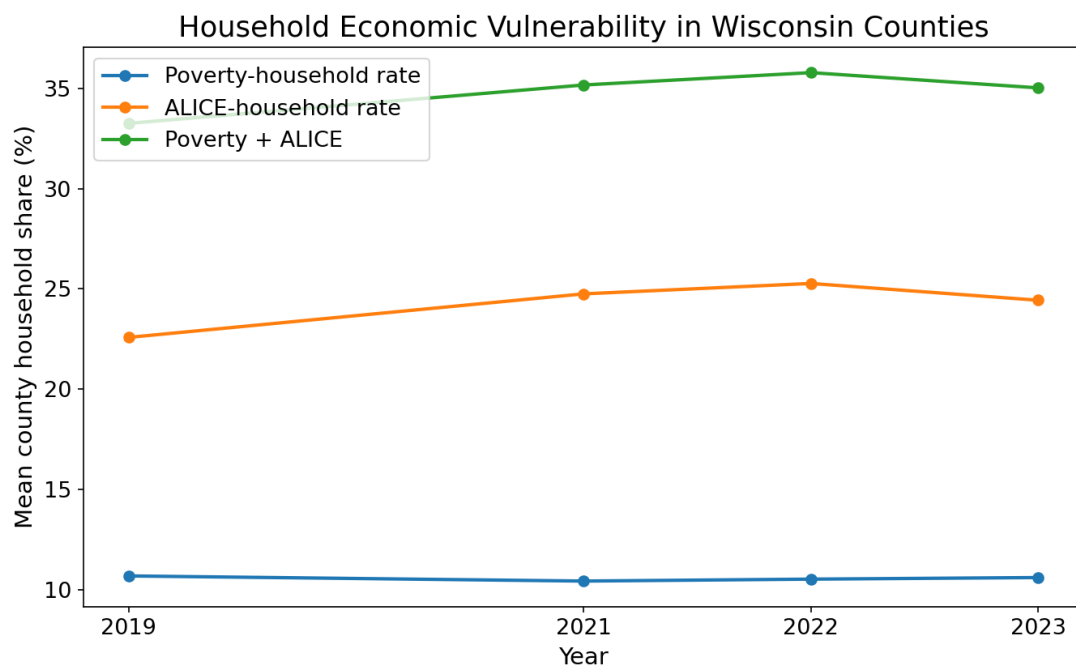
The household-vulnerability measures show a related but not identical pattern. Mean county ALICE-household rates increased from 22.6 percent in 2019 to 25.3 percent in 2022, then declined to 24.4 percent in 2023. Poverty-household rates remained comparatively stable. The combined poverty-plus-ALICE share rose from 33.3 percent in 2019 to 35.8 percent in 2022 and remained around 35.0 percent in 2023.

Table 2: County-Level Descriptive Trends, 2019–2023

Year	County-year observations	Mean FoodShare recipients	FoodShare rate (%)	Poverty households (%)	ALICE households (%)	Poverty + ALICE (%)
2019	71	12,281	13.5	10.7	22.6	33.3
2021	71	13,905	15.2	10.4	24.8	35.2
2022	71	13,681	15.0	10.5	25.3	35.8
2023	71	13,558	14.9	10.6	24.4	35.0

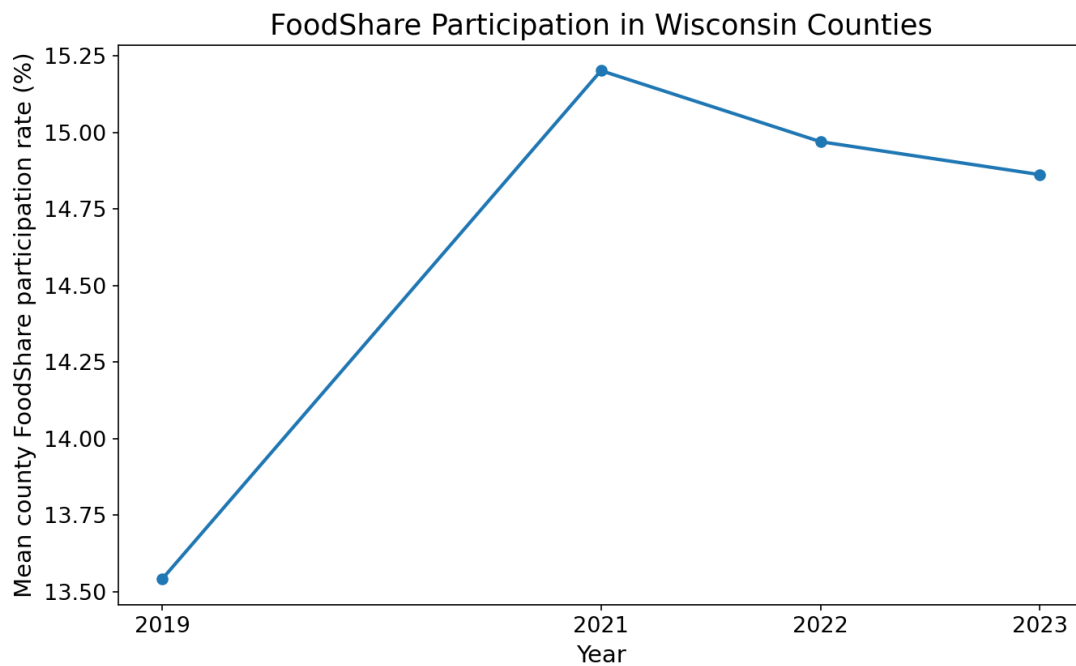
Note. Values are unweighted county means for the 71-county analytic sample and should not be interpreted as statewide population-weighted rates. FoodShare rate is annual cumulative recipients divided by population. Marquette County 2019 poverty households were corrected from 66,241 to 652 using the United for ALICE Wisconsin Data Sheet.

Figure 1: Household Economic Vulnerability in Wisconsin Counties



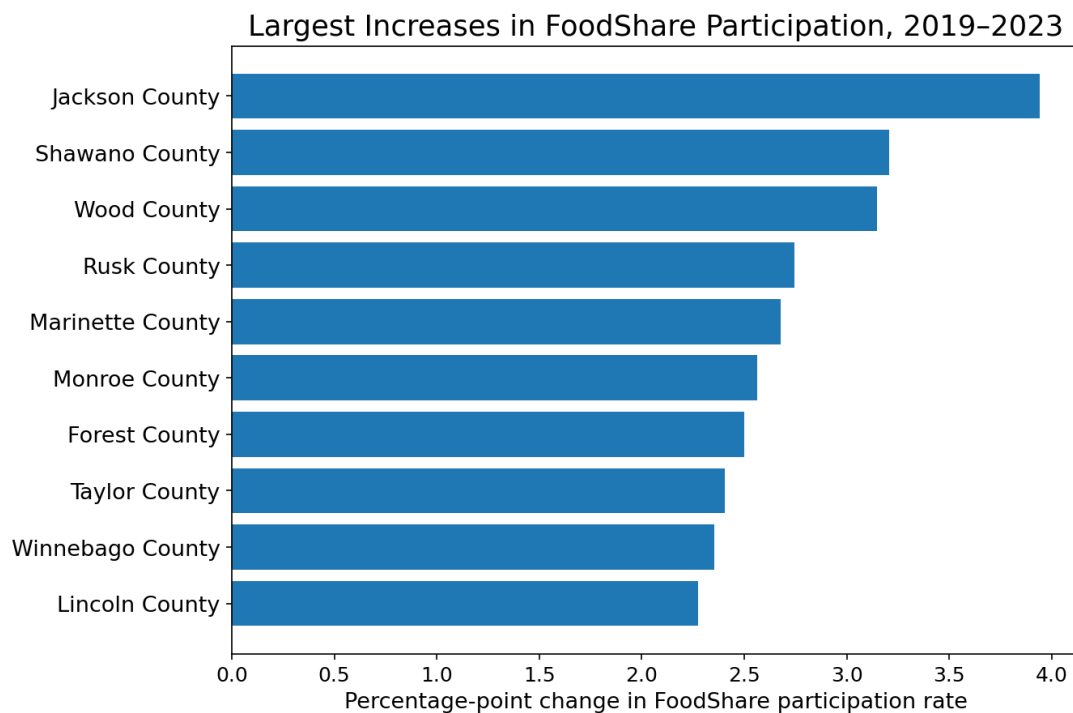
Note. Values are mean county percentages. The combined line equals the poverty-household share plus the ALICE-household share.

Figure 2: FoodShare Participation in Wisconsin Counties



Note. FoodShare participation equals annual cumulative FoodShare recipients divided by county population.

Figure 3: Largest County-Level Increases in FoodShare Participation, 2019–2023



Note. Figure reports the ten counties with the largest percentage-point increase in FoodShare participation between 2019 and 2023.

5.2 Correlations and Main Regression Results

The correlation matrix confirms the basic descriptive relationship. FoodShare participation is strongly correlated with the poverty-household rate and moderately correlated with the ALICE-household rate.

Population size is negatively correlated with both vulnerability rates, which supports the decision to include log population as a control rather than relying on raw recipient counts.

Table 3: Correlation Matrix for Key Variables

	FoodShare rate	Poverty rate	ALICE rate	Log population
FoodShare rate	1.000	0.705	0.422	-0.117
Poverty rate	0.705	1.000	0.301	-0.246
ALICE rate	0.422	0.301	1.000	-0.349
Log population	-0.117	-0.246	-0.349	1.000

Note. Correlations are calculated using the corrected cleaned regression sample ($N = 284$).

Table 4: OLS Estimates of County FoodShare Participation

Variable	Model 1	Model 2	Model 3
Poverty-household rate	1.313*** (0.193)	1.184*** (0.193)	1.243*** (0.196)
ALICE-household rate		0.326*** (0.093)	0.344*** (0.121)
Log population			0.006 (0.006)
Year 2021			0.012*** (0.004)
Year 2022			0.007 (0.004)
Year 2023			0.008** (0.004)
Constant	0.008 (0.019)	-0.058** (0.024)	-0.137 (0.091)
Year fixed effects	No	No	Yes
County fixed effects	No	No	No
Population weights	No	No	No
Observations	284	284	284
R-squared	0.497	0.545	0.570

Note. Dependent variable is annual FoodShare recipients divided by county population. County-clustered standard errors are in parentheses. The omitted year in Model 3 is 2019. * $p < .10$; ** $p < .05$; *** $p < .01$.

The main regression results support the central claim that poverty and ALICE vulnerability both matter in cross-county models. In Model 1, the poverty-household rate is positive and statistically significant. Model 2 adds the ALICE-household rate, which is also positive and statistically significant. This indicates that ALICE captures household vulnerability not fully explained by poverty alone.

Model 3 adds log population and year fixed effects. The poverty-household rate remains positive and significant, and the ALICE-household rate also remains positive and significant. A ten-percentage-point increase in the poverty-household rate is associated with approximately a 12.4-percentage-point increase in the FoodShare participation rate, holding the other controls constant. A ten-percentage-point increase in the ALICE-household rate is associated with approximately a 3.4-percentage-point increase.

The year effects show elevated FoodShare participation after 2019. Relative to the pre-pandemic baseline, the 2021 coefficient is positive and statistically significant, the 2022 coefficient is positive but not statistically significant at conventional levels after the data correction, and the 2023 coefficient remains positive and statistically significant. These results suggest that participation did not fully return to its pre-pandemic level by 2023.

5.3 Robustness Checks

The robustness checks sharpen the interpretation of the results. The population-weighted model produces larger poverty and ALICE coefficients, suggesting that the association is not driven only by small counties. Excluding Milwaukee County also leaves both poverty and ALICE rates positive and statistically significant, which reduces the concern that the main result is simply a Milwaukee effect.

Table 5: Robustness Checks

Variable	Preferred OLS	Population weighted	Excluding Milwaukee	County fixed effects
Poverty-household rate	1.243*** (0.196)	1.772*** (0.207)	1.033*** (0.134)	0.070 (0.051)
ALICE-household rate	0.344*** (0.121)	0.609*** (0.118)	0.273** (0.113)	0.015 (0.024)
Log population	0.006 (0.006)	0.014** (0.007)	-0.001 (0.004)	
Year fixed effects	Yes	Yes	Yes	Yes
County fixed effects	No	No	No	Yes
Population weights	No	Yes	No	No
Observations	284	284	280	284
R-squared	0.570	0.819	0.532	0.992

*Note. All specifications use county-clustered standard errors. The population-weighted model gives larger counties greater influence. The county fixed-effects model uses within-county variation over four observed years and omits log population because county indicators absorb persistent county size differences and short-panel population variation is limited. * $p < .10$; ** $p < .05$; *** $p < .01$.*

The county fixed-effects model changes the interpretation. Once persistent county-level differences are absorbed, the poverty and ALICE coefficients become small and statistically insignificant. This does not necessarily contradict the main results. Rather, it indicates that poverty and ALICE explain differences between counties more clearly than short-run changes within the same county over the four observed years. The year coefficients remain positive and significant in the fixed-effects model, reinforcing the evidence of a statewide increase in FoodShare participation after 2019.

6. Discussion

The findings have two main implications. First, poverty alone understates the geography of economic vulnerability associated with FoodShare participation. Counties with larger shares of ALICE households also show higher FoodShare participation in cross-county models, even after accounting for poverty. This matters because ALICE households are outside the narrowest definition of poverty but still face unstable budgets and limited ability to absorb shocks.

Second, the pandemic should be understood as both a temporary shock and a stress test of household resilience. FoodShare participation rose sharply in the first observed pandemic-era year, 2021, and remained above its 2019 level in 2023, even though 2023 was also a policy-transition year after the end of extra COVID-19 FoodShare benefits (Wisconsin Department of Health Services, 2023). The evidence does not prove that every increase was caused by greater food insecurity; program rules and take-up behavior also matter. But the persistence of elevated participation suggests that the pre-pandemic baseline was not fully restored.

The county-level evidence also cautions against treating food insecurity risk as exclusively urban. Large counties contain more recipients in absolute numbers, but rates and changes reveal vulnerability across smaller and more rural counties as well. The county-change results show that several counties outside Wisconsin's largest urban centers experienced notable increases in FoodShare participation between 2019 and 2023.

7. Limitations

This study has several limitations. First, FoodShare participation is not a direct measure of food insecurity. It measures annual program participation, not every household that lacks reliable food access and not a point-in-time prevalence rate. Some eligible households do not participate, while participation can also rise because of policy changes, administrative outreach, temporary eligibility expansions, or movement between counties or tribes in the DHS yearly data structure. DHS recipient subcategories such as adults and children should also not be treated as mutually exclusive annual counts.

Second, the analysis does not include 2020 because comparable ALICE county-level data were not available from the source used for this project. This makes the pandemic shock less precisely measured because the first observed pandemic-period year is 2021. Third, the dataset excludes Menominee County because it is

missing from the DHS FoodShare data used here. Fourth, Marquette County's 2019 poverty-household entry was corrected after source verification; the final corrected regression sample contains 284 county-year observations. Earlier specifications that treated this entry as missing used 283 observations, but the correction does not alter the substantive conclusions.

Finally, the regression estimates are associational rather than causal. The county fixed-effects model shows that the main poverty and ALICE relationships are weaker when the analysis relies only on within-county changes. Future research could improve the design by adding direct household food-insecurity survey measures, additional years, county fixed effects with a longer panel, demographic controls, and spatial analysis.

8. Conclusion

Annual FoodShare participation in the analyzed Wisconsin counties from 2019 to 2023 is better understood when poverty and ALICE household vulnerability are examined together. Poverty identifies the most severe economic hardship, but ALICE identifies households above the poverty line that still lack enough income to cover basic costs. In cross-county models, both measures are positively associated with FoodShare participation.

The broader conclusion is not that FoodShare participation and food insecurity are identical. The stronger claim is more careful: annual FoodShare participation provides evidence of food-assistance dependence and food-insecurity risk, and that risk is associated with a wider footprint of economic vulnerability than poverty statistics alone capture. For policy analysis, this means that poverty-based indicators should be supplemented with ALICE-style measures when evaluating household hardship in Wisconsin.

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Conflicts of Interest

The authors declare no conflict of interest.

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