

# Food Inflation, Food Prices, and Household Food Consumption in the United States: An Applied Time-Series Econometric Analysis (2001–2024)

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## Research Article

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# Abstract

**Motivation:** Understanding how food inflation and macroeconomic conditions shape household food consumption is essential for assessing consumer welfare and the resilience of U.S. households during economic fluctuations. This paper examines the long-run relationship between food prices, income, unemployment, and nominal household food consumption in the United States over the period 2001–2024.

**Methods:** Using annual U.S. macroeconomic data, we estimate a sequence of econometric models beginning with Pooled Ordinary Least Squares (OLS), followed by diagnostic tests for heteroskedasticity (Breusch–Pagan, White) and autocorrelation (Durbin–Watson). We then apply Heteroskedasticity-Consistent (HC1) standard errors and Feasible Generalized Least Squares (FGLS) with a Prais–Winsten AR(1) correction to address serial correlation and improve estimation efficiency.

**Findings:** Across all specifications, GDP per capita emerges as the strongest predictor of household food consumption, with an elasticity of approximately 1.72. The Food Price Index also shows a positive and highly significant effect on nominal food spending, reflecting the mechanical increase in dollar expenditure as prices rise. In contrast, food price inflation has a small but negative effect, consistent with reduced real purchasing power, though its significance weakens slightly in the GLS model. Unemployment exhibits no robust statistical effect on food consumption. The FGLS model confirms that autocorrelation does not materially alter the core relationships, reinforcing the stability of the income–consumption linkage.

**Conclusion:** The results indicate that U.S. household food consumption is primarily driven by income growth and changes in price levels, while inflation exerts a modest dampening effect. These findings highlight the importance of income stability and price management, especially during inflationary episodes—for supporting household food security.

## 1. Introduction

Understanding how food price inflation influences household food consumption is essential for evaluating consumer welfare, food affordability, and macroeconomic stability in the United States. Food is a universal necessity, and as the Congressional Research Service emphasizes, rising food prices immediately reduce real purchasing power and impose greater hardship on households with lower disposable incomes, who allocate a larger share of their budgets to food-at-home purchases. Over the past twenty-five years, the United States has experienced significant volatility in food price movements, with inflation driven by multiple macroeconomic disruptions including global commodity spikes, energy price fluctuations, biofuel expansion, and periods of economic recession. These fluctuations have contributed to long-run instability in food affordability, making the analysis of consumption responses to inflation increasingly important.

The pattern of U.S. food inflation since the early 2000s reveals several distinct episodes. The sharp increase in food prices during 2007–2008, for instance, stemmed from surging global demand for agricultural commodities, high oil and energy prices, and financial market instability, all of which intensified production and transportation costs across the food supply chain. The subsequent 2008–2009 recession triggered a collapse in real GDP and a rapid rise in unemployment, both of which weakened household purchasing power and temporarily slowed food inflation. However, inflationary pressures re-emerged in the early 2010s as global demand recovered, and more recently the COVID-19 pandemic, supply-chain bottlenecks, labor shortages, and geopolitical disruptions have driven renewed increases in food prices and heightened volatility in the U.S. food price index.

Alongside inflation and price levels, broader macroeconomic factors—including income growth, unemployment rates, and aggregate household consumption expenditures—play an important role in shaping food consumption patterns. Rising unemployment reduces household spending capacity, while increases in GDP per capita tend to raise demand for higher-quality foods, consistent with Engel’s Law and documented U.S. consumer expenditure patterns. At the same time, evidence from global consumption studies shows that higher food prices often lead consumers, especially low-income households, to reduce food intake or substitute toward cheaper, calorie-dense, and less nutritious products, with potential long-term implications for health and food security.

Despite extensive literature on determinants of food inflation, fewer studies investigate how multiple macroeconomic factors jointly influence U.S. household food consumption over time. Existing research primarily focuses on price formation, commodity market shocks, or income effects but rarely integrates food inflation, price levels, unemployment, and income into a single time-series framework over a recent multi-decade period. Given the substantial structural changes in the U.S. economy since 2001—including recessions, global supply shocks, and pandemic effects—there is a clear need for an updated empirical assessment.

This study addresses that gap by examining the relationship between food price inflation and household food consumption using annual U.S. data from 2001 to 2024. The analysis employs a multivariate time-series model incorporating four key macroeconomic determinants: food inflation, GDP per capita, unemployment, and the food price index. The econometric specification allows us to evaluate not only the direct impact of inflation but also how broader economic conditions shape consumption behavior. By integrating these components into a unified empirical framework, this study contributes to a more comprehensive understanding of food affordability, consumer responses to inflationary pressure, and the macroeconomic drivers of household food consumption in the United States.

## 2. Methodology

This study employs a time-series econometric approach to examine how food price inflation and broader macroeconomic conditions influence household food consumption in the United States from 2001 to 2024. This methodological framework is grounded in prior empirical studies of U.S. food markets, which

emphasize the interaction between inflation, income, unemployment, and food price levels in shaping consumption patterns (Baek & Koo 2010; CRS 2013). Food markets are influenced by both demand-side factors, such as household purchasing power and labor market conditions, and supply-side shocks including commodity price volatility, transportation costs, and food processing disruptions. Recent work highlights that shocks such as the 2007–2008 commodity spike, the 2008–2009 recession, and the COVID-19 pandemic significantly altered U.S. food inflation and contributed to persistent volatility in food price indices.

To obtain valid parameter estimates, the analysis begins with an examination of stationarity properties using the Augmented Dickey–Fuller (ADF) test. Because macroeconomic time series often exhibit trends or unit roots, logarithmic transformations are applied to GDP per capita, household food consumption, and the food price index to stabilize variance and interpret coefficients as semi-elasticities. If any variables are found to be non-stationary at levels but stationary in differences, the model will incorporate differencing where appropriate. Following estimation, diagnostic tests are conducted for serial correlation (Durbin–Watson, Breusch–Godfrey), heteroskedasticity (Breusch–Pagan/White), model specification errors (RESET test), and structural breaks (Chow tests around major economic events). Additionally, Newey–West HAC standard errors are reported to correct for potential autocorrelation and heteroskedasticity, consistent with best practices in time-series econometrics.

This methodological design, which integrates inflation dynamics, macroeconomic conditions, and price levels, provides a robust framework for determining the extent to which food inflation affects household food purchasing behavior in the United States.

## 2.1 Model Specification

Household demand for food is shaped by changes in prices, income, unemployment, and overall macroeconomic conditions. Consumer theory predicts that higher food prices reduce consumption, especially for essential goods such as food-at-home, where substitution possibilities are limited. Empirical evidence also shows that food inflation, unemployment shocks, and declining purchasing power all reduce household food expenditures, while GDP per capita increases food demand as incomes rise (CRS 2013; BMJ 2013). Furthermore, supply-side pressures, including commodity price spikes, energy costs, and supply-chain disruptions—contribute to rising food price indices, reinforcing inflationary effects (Adjemian 2023) .

Based on this theoretical and empirical foundation, the following multivariate log-linear model is specified:

$$\ln(\text{FoodConsumption}_t)$$

$$= \alpha + \beta_1 \text{FoodInflation}_t + \beta_2 \ln(\text{GDPpct}) + \beta_3 \text{Unemployment}_t + \beta_4 \ln(\text{FoodPriceIndex}_t) + \beta_5 \ln(\text{ConsumptionExpenditure}_t) + u_t.$$

## Description of Variables

- $\ln(FoodConsumption_t)$  Household food-at-home expenditure (nominal), capturing food consumption behavior.
- $FoodInflation_t$  Annual percentage change in the food price inflation rate.
- $\ln(GDPpct)$  Log of GDP per capita, representing purchasing power and long-run income elasticity of food demand.
- $Unemployment_t$  Annual unemployment rate (%), included because labor market conditions directly reduce disposable income and food spending.
- $\ln(FoodPriceIndex_t)$  Level of the food price index, capturing longer-run price trends separate from short-run inflation volatility.
- $\ln(ConsumptionExpenditure_t)$  Aggregate final consumption expenditure by households and NPISHs (PPP), included to reflect broad changes in

## 2.2 Estimation Procedures

Our empirical strategy follows a three-step estimation framework, adapted from the methodology used in the reference sample paper while modified appropriately for annual U.S. time-series data from 2001–2024. Each step increases the robustness and efficiency of the estimates. Models (1) through (3) are outlined below.

### 2.2.1 Model (1): Baseline OLS (Ordinary Least Squares)

We begin by estimating the log-linear model specified in Section 2.1 using simple OLS. This provides the baseline relationship between food consumption, food inflation, GDP per capita, unemployment, and food price levels. Because the dataset is purely time-series, we do not include fixed effects or panel-level controls, but we do incorporate year trends where appropriate.

After estimating Model (1), we conducted the following post-estimation diagnostic tests:

- Test for Heteroskedasticity

To evaluate whether the variance of the residuals is constant over time, we conduct:

- Breusch–Pagan (1979) test, where

$$H_0: \text{Var}(\epsilon_t|X) = \sigma^2$$

- White (1980) test, which allows for nonlinear and general forms of heteroskedasticity.

Rejecting the null indicates that OLS standard errors are invalid.

- Test for Autocorrelation

- • Durbin–Watson (1950) statistic for first-order AR (1) autocorrelation.
- • Breusch–Godfrey (1978) LM test, which can detect higher-order autocorrelation and is appropriate for models with lagged regressors.

Rejecting the null hypothesis  $H_0: \rho = 0$  signals the presence of autocorrelation and potential inefficiency in OLS.

## 2.2.2 Model (2): OLS with Robust (HAC / White) Standard Errors

If heteroskedasticity is detected in Model (1), we re-estimate the baseline specification using robust standard errors.

Specifically, we use:

- • White’s Heteroskedasticity-Consistent (HC1) standard errors, and
- • Newey–West (HAC) standard errors, which correct for both heteroskedasticity and autocorrelation.

The coefficients remain unbiased and consistent, but the standard errors become reliable for inference even when OLS assumptions are violated.

This model improves inference but does not improve estimator efficiency when autocorrelation is present.

## 2.2.3 Model (3): Feasible Generalized Least Squares (FGLS)

To obtain efficient estimates in the presence of both heteroskedasticity and serial correlation, we implement a Feasible GLS estimator.

Specifically, we use the Prais–Winsten (1954) transformation, which quasi-differences the data to remove AR(1) autocorrelation:

$$\epsilon_t = \rho \epsilon_{t-1} + \nu_t$$

This method produces more efficient estimates than OLS and HAC-OLS when the error structure follows AR(1). Unlike panel FGLS, the time-series version assumes a single AR (1) parameter ( $\rho$ ) across the sample and allows for non-constant variance in the transformed residuals.

This is consistent with macroeconomic time-series practices, where AR (1) correction is standard because food prices, inflation, consumption expenditure, and GDP frequently exhibit persistence.

## 3. Data Sources

The analysis uses annual U.S. macroeconomic and food-market data from 2001 to 2024. All variables were compiled from reputable international and national statistical agencies that regularly publish standardized economic indicators. The dataset includes measures of food inflation, food price levels, household food consumption, GDP per capita, unemployment, and final consumption expenditure. These sources ensure consistency, comparability, and reliability across the full sample period. Table 1 summarizes the data sources, the type of data obtained, and how each variable is used in the empirical model.

• Table 1. Data Sources and Purpose in the Model

| Source | Organization / Database | Type of Data | Purpose in Model |
|--------|-------------------------|--------------|------------------|
|--------|-------------------------|--------------|------------------|

|                                          |  |  |  |
|------------------------------------------|--|--|--|
| OECD / FAOSTAT / USDA Food Price Outlook |  |  |  |
|------------------------------------------|--|--|--|

|                                                                                                                                            |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Measures the short-run inflationary pressure affecting household purchasing power; key independent variable <b><i>FoodInflationt</i></b> . |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|

|                                        |  |  |  |
|----------------------------------------|--|--|--|
| Annual food inflation rates (Food CPI) |  |  |  |
|----------------------------------------|--|--|--|

|                      |  |  |  |
|----------------------|--|--|--|
| Food Price Inflation |  |  |  |
|----------------------|--|--|--|

|                  |                                   |  |  |
|------------------|-----------------------------------|--|--|
| Food Price Index | FAOSTAT Food Price Index Database |  |  |
|------------------|-----------------------------------|--|--|

|                                      |  |  |  |
|--------------------------------------|--|--|--|
| Annual Food Price Index (FPI) values |  |  |  |
|--------------------------------------|--|--|--|

|                                                                                      |  |  |  |
|--------------------------------------------------------------------------------------|--|--|--|
| Captures long-run food price trends; included as <b><i>ln(FoodPriceIndext)</i></b> . |  |  |  |
|--------------------------------------------------------------------------------------|--|--|--|

|                                                             |  |  |  |
|-------------------------------------------------------------|--|--|--|
| Household food-at- home expenditure (nominal, millions USD) |  |  |  |
|-------------------------------------------------------------|--|--|--|

|                                                                                                        |  |  |  |
|--------------------------------------------------------------------------------------------------------|--|--|--|
| Dependent variable <b><i>ln(FoodConsumptiont)</i></b> representing household food purchasing behavior. |  |  |  |
|--------------------------------------------------------------------------------------------------------|--|--|--|

|                            |  |  |  |
|----------------------------|--|--|--|
| Household Food Consumption |  |  |  |
|----------------------------|--|--|--|

|                                    |  |  |  |
|------------------------------------|--|--|--|
| USDA ERS / BEA / National Accounts |  |  |  |
|------------------------------------|--|--|--|

|                      |  |  |  |
|----------------------|--|--|--|
| GDP per capita (PPP) |  |  |  |
|----------------------|--|--|--|

|                                         |  |  |  |
|-----------------------------------------|--|--|--|
| World Bank World Development Indicators |  |  |  |
|-----------------------------------------|--|--|--|

|                                    |  |  |  |
|------------------------------------|--|--|--|
| Real GDP per capita (constant PPP) |  |  |  |
|------------------------------------|--|--|--|

|                                                                                             |  |  |  |
|---------------------------------------------------------------------------------------------|--|--|--|
| Controls for purchasing power and income elasticity; included as <b><i>ln(GDPpct)</i></b> . |  |  |  |
|---------------------------------------------------------------------------------------------|--|--|--|

|                                                     |  |  |  |
|-----------------------------------------------------|--|--|--|
| Final Consumption Expenditure (Households & NPISHs) |  |  |  |
|-----------------------------------------------------|--|--|--|

|                                                                      |  |  |  |
|----------------------------------------------------------------------|--|--|--|
| Aggregate household consumption expenditure (PPP, constant 2021 USD) |  |  |  |
|----------------------------------------------------------------------|--|--|--|

World Bank WDI – National Accounts

Controls of overall spending trends; included as  **$\ln(\text{Consumption Expenditure})$** .

World Bank WDI / U.S. Bureau of Labor Statistics (BLS)

Unemployment Rate

Total unemployment (% of labor force)

Captures labor market conditions influencing food affordability; added as ***Unemploymentt***.

## 3.1 Variable Definitions

All variables are transformed into their natural logarithms ( $\ln$ ) prior to estimation. This standard econometric practice stabilizes variance, improves interpretability, and allows the estimated coefficients to be interpreted as elasticities.

- Dependent Variable:
- $\ln_{\text{foodconsumption}}$

Natural logarithm of annual household food-at-home expenditure (millions of USD). This variable captures the overall level of household food consumption in the United States and serves as the primary outcome of interest.

- Core Explanatory Variables:
- $\ln_{\text{food inflation}}$

Natural logarithm of the annual U.S. food price inflation rate (% change). Represents short-run price pressures that directly affect household purchasing power and food affordability.

$\ln_{\text{gdp\_pc}}$

Natural logarithm of GDP per capita (PPP, constant 2021 international dollars). Serves as a proxy for national income and purchasing power, capturing the income elasticity of food demand.

$\ln_{\text{foodpriceindex}}$

Natural logarithm of the annual Food Price Index (FPI). Reflects long-run movements in food prices across major food categories and provides a measure of sustained price pressure separate from year-to-year inflation volatility.

- Control Variables:
- $\ln_{\text{unemployment}}$

Natural log of the unemployment rate (% of total labor force). Included because labor market conditions strongly influence disposable income and therefore household food spending.

– ln\_cons\_expenditure

Natural logarithm of Household and NPISHs Final Consumption Expenditure (PPP, constant 2021 USD). Controls for broader household consumption capacity and changes in aggregate spending behavior across the U.S. economy.

- Additional Notes (if required for robustness tests):
- – ln\_global\_foodprices (optional robustness variable)

Natural logarithm of global food commodity price indices. Can be used in sensitivity checks to assess international price transmission effects.

## 3.2 Research Hypotheses

Hypothesis Statement Expected Sign Rationale

Higher food prices lower real purchasing power, forcing households—especially low-income groups—to cut back on food-at-home spending (CRS, 2013; BMJ, 2013).

H1 Food inflation reduces household food consumption.  $\beta_1 < 0$

Rising income expands purchasing power and allows consumers to buy more and higher-quality foods, consistent with Engel’s Law and U.S. expenditure patterns.

H2 GDP per capita increases household food consumption.  $\beta_2 > 0$

Higher unemployment decreases household food consumption.

Unemployment lowers disposable income and increases financial stress, reducing household food purchases during economic downturns.

H3

$\beta_3 < 0$

An increase in the Food Price Index lowers household food consumption.

Higher overall food price levels reduce affordability even when inflation stabilizes; long-run price increases discourage consumption (price elasticity effect).

H4

$\beta_4 < 0$

Higher household consumption expenditure increases food consumption.

Greater national consumption levels reflect expanding budgets and rising economic activity, which translate into higher food purchases across households.

H5

$$\beta_5 > 0$$

## 4. Main Regression Results (Models 1–3)

Table 3: Main Regression Results – Determinants of Household Food Consumption (2001–2024)

Dependent Variable: ln (Food Consumption)

Variables (1) OLS (2) OLS–Robust (HC1) (3) GLS (Prais–Winsten AR1) Food price inflation – 0.0046\*\* (0.0020) – 0.0046\*\* (0.0019) – 0.0039\* (0.0019)

ln(GDP) 1.7190\*\*\* (0.157) 1.7190\*\*\* (0.105) 1.7202\*\*\* (0.152)

Unemployment rate 0.0048 (0.0060) 0.0048\* (0.0028) 0.0052 (0.0055)

ln(Food Price Index) 0.1687\*\*\* (0.048) 0.1687\*\*\* (0.028) 0.1741\*\*\* (0.046)

Intercept 10.4018\*\*\* (1.576) 10.4018\*\*\* (1.088) 10.3599\*\*\* (1.521)

Observations 24 24 24

R<sup>2</sup> 0.982 0.982 0.984†

\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1 † R<sup>2</sup> in GLS not directly comparable to OLS

Model (2): HC1 heteroskedasticity-robust standard errors. Model (3): Feasible GLS with Prais–Winsten AR (1) correction.

## 4.1 Discussion of Results

### 4.1.1 Model (1) vs. Model (2): OLS Diagnostics

Model (1) presents the baseline OLS results. The coefficients largely align with theoretical expectations: food price inflation exerts a negative effect on consumption, while GDP per capita shows a strong and positive elasticity. Unemployment enters with a positive but statistically insignificant coefficient, and the food price index has a positive and highly significant impact, reflecting the rise in nominal household expenditure when food prices increase.

Despite the strong overall fit ( $R^2 = 0.982$ ), Model (1) exhibits a notable econometric weakness. The Durbin–Watson statistic ( $DW = 1.072$ ) indicates substantial positive first-order autocorrelation in the residuals, which renders the conventional OLS standard errors unreliable. This motivates the use of Model (2), which applies HC1 heteroskedasticity-robust standard errors while leaving the coefficient estimates unchanged.

Model (2) confirms the robustness of the main findings. The coefficients on GDP and the food price index remain highly significant, while food inflation becomes even more precisely estimated ( $p = 0.014$ ), reinforcing its negative effect on consumption. Unemployment becomes weakly significant at the 10% level, though the economic magnitude remains small. Importantly, the Breusch–Pagan and White tests fail to reject the null hypothesis of homoskedasticity, indicating that the error variance is constant across observations. Nevertheless, given the small sample size ( $N = 24$ ) and macroeconomic volatility during the sample period, robust standard errors provide more reliable inference.

Overall, Models (1) and (2) yield nearly identical coefficient estimates, but Model (2) produces more dependable standard errors and statistical significance levels.

### 4.1.2 Model (2) vs. Model (3): Autocorrelation and Efficiency

The primary motivation for estimating Model (3) is the strong evidence of serial correlation detected in Model (1). Because the HC1 correction in Model (2) addresses heteroskedasticity but not autocorrelation, we implement a Prais–Winsten Feasible GLS estimator, which explicitly accounts for AR(1) error structure.

Model (3) improves both the efficiency and interpretability of the estimates. The  $R^2$  increases marginally from 0.982 to 0.984, and standard errors decline modestly. Food inflation remains negative but becomes marginally weaker ( $p = 0.052$ ), while GDP and the food price index continue to be strongly significant and economically meaningful. The unemployment coefficient remains small and insignificant, consistent with earlier findings.

The Durbin–Watson statistic improves from 1.072 in Model (1) to 1.146 in Model (3), confirming that the Prais–Winsten transformation reduces serial correlation, although some persistence remains. Because Model (3) corrects the most important violation of the OLS assumptions—autocorrelation—it produces the most efficient and reliable parameter estimates among the three specifications.

Households and NPISHs Final consumption expenditure, PPP (constant 2021 international \$)

Unemployment, total (% of total labor force) (national estimate)

Household purchases of food at home (millions of nominal U.S. dollars)

ln(Food Price Index)

|                                                                                           |           |           |          |           |           |           |  |
|-------------------------------------------------------------------------------------------|-----------|-----------|----------|-----------|-----------|-----------|--|
| In(Food Consumption)                                                                      | In(GDP)   |           |          |           |           |           |  |
| In(Food Consumption)                                                                      | 1.000000  | 0.965691  | 0.804161 | 0.994656  | -0.272850 | 0.961965  |  |
| In(GDP)                                                                                   | 0.965691  | 1.000000  | 0.676974 | 0.983755  | -0.456567 | 0.987015  |  |
| In(Food Price Index)                                                                      | 0.804161  | 0.676974  | 1.000000 | 0.772877  | 0.202201  | 0.694460  |  |
| Households and NPISHs Final consumption expenditure, PPP (constant 2021 international \$) | 0.994656  | 0.983755  | 0.772877 | 1.000000  | -0.321867 | 0.982793  |  |
| Unemployment, total (% of total labor force) (national estimate)                          | -0.272850 | -0.456567 | 0.202201 | -0.321867 | 1.000000  | -0.369804 |  |
| Household purchases of food at home (millions of nominal U.S. dollars)                    | 0.961965  | 0.987015  | 0.694460 | 0.982793  | -0.369804 | 1.000000  |  |

The correlation matrix reveals strong and intuitive relationships among the variables. Household food consumption shows very high positive correlations with GDP (0.97), final consumption expenditure (0.99), and nominal food purchases (0.96), indicating that higher income and overall economic activity translate directly into higher food spending. The Food Price Index is also positively correlated with food consumption (0.80), reflecting increases in nominal spending when food prices rise. Unemployment, by contrast, is negatively correlated with consumption variables (−0.27 to −0.37) and GDP (−0.46), consistent with economic downturns reducing household purchasing power. GDP, final consumption expenditure, and nominal food purchases are almost perfectly correlated with one another (0.98–0.99), demonstrating the strong co-movement of income and consumption in the U.S. economy.

Overall, the correlation structure indicates that food consumption is primarily driven by income and aggregate spending, while food price levels and unemployment play secondary roles.

|                                                                                           |      |                |                |                |
|-------------------------------------------------------------------------------------------|------|----------------|----------------|----------------|
| N                                                                                         | Mean | Std. Dev.      | Min.           | Max.           |
| Food Price Index                                                                          | 24.0 | 9.918985e + 01 | 2.482952e + 01 | 5.460283e + 01 |
| Households and NPISHs Final consumption expenditure, PPP (constant 2021 international \$) | 24.0 | 1.316843e + 13 | 2.384860e + 12 | 8.900540e + 12 |
| GDP per capita, PPP (constant 2021 international \$)                                      | 24.0 | 6.356982e + 04 | 5.831726e + 03 | 5.501730e + 04 |
|                                                                                           |      | 7.549161e + 04 |                |                |

Unemployment, total (% of total labor force) (national estimate) 24.0 5.765667e + 00 1.840965e + 00  
3.638000e + 00 9.633000e + 00

Food price inflation 24.0 2.555952e + 00 3.141746e + 00 -

**2.434574e + 00 1.188275e + 01**

Household purchases of food at home (millions of nominal U.S. dollars) 24.0 6.325894e + 05 1.629485e + 05 4.086218e + 05 9.556076e + 05

The descriptive statistics for the 2001–2024 sample reveal substantial variation across key economic and food-related indicators in the United States. The Food Price Index averages 99.2 but ranges widely from 54.6 to 133.7, reflecting major food price shocks during events such as the 2008 recession and the COVID-19 pandemic. GDP per capita (PPP) shows steady long-run growth, with a mean of \$63,569 and a relatively narrow dispersion, while total final consumption expenditure also exhibits strong upward trends, averaging  $1.32 \times 10^{13}$  dollars. Unemployment rates display significant cyclical variation, ranging from a low of 3.64% to a high of 9.63%. Food price inflation is highly volatile, oscillating between – 2.43% deflation and over 11.88% inflation, confirming strong price instability in the food sector. Finally, household purchases of food at home average \$632 billion but vary substantially across the sample period, consistent with both macroeconomic fluctuations and structural increases in food demand over time.

## 4.3 Hypothesis Testing and Interpretation

H1: Food inflation reduces household food consumption. The results support this hypothesis. Food inflation has a negative and statistically significant coefficient in the OLS and robust models, indicating that rising food prices reduce consumption by lowering real purchasing power. The GLS model shows a slightly weaker effect, but the overall evidence confirms H1.

H2: Higher GDP per capita increases food consumption. This hypothesis is strongly supported. GDP per capita is positive, large in magnitude, and highly significant across all models. The correlation matrix also shows near-perfect alignment between income and food consumption, confirming that economic growth is the primary driver of household food demand.

H3: Higher unemployment reduces food consumption. Evidence for H3 is weak. Although unemployment is negatively correlated with consumption in the descriptive statistics, its regression coefficient is small and statistically insignificant in most models, becoming only marginally significant under robust errors. Thus, H3 is not strongly supported.

H4: Higher food price levels reduce consumption. This hypothesis is not supported in nominal terms. The Food Price Index is positive and highly significant in every model, indicating that households spend more in dollars when prices rise. This reflects higher nominal expenditure, not higher real consumption; therefore, H4 is rejected.

H5: Higher aggregate consumption expenditure increases food consumption. The correlation matrix provides strong support for H5. Food consumption, GDP, and household expenditure all move closely together (correlations above 0.98), indicating that greater overall consumption capacity leads to higher food spending.

The pairwise plots show clear positive relationships between the Food Price Index and household food purchases, indicating that nominal food spending rises as food prices increase. Food price inflation, however, displays a much weaker and more scattered relationship with both variables, reflecting its short-term volatility and limited direct connection to nominal consumption. The histograms also reveal substantial variation in all three variables, with the Food Price Index and household food purchases showing upward trends over time, while inflation fluctuates sharply around zero. Overall, the visual patterns align with the regression results, suggesting that long-run price levels have a stronger association with food spending than short-run inflation changes. The visual evidence indicates that long-run food price levels ( $P_{\text{food}} \uparrow$ ) strongly raise nominal food spending ( $C_{\text{food}} \uparrow$ ), while short-run food inflation ( $\pi_{\text{food}}$ ) shows only a weak demand response ( $\partial C_{\text{food}} / \partial \pi_{\text{food}} \approx 0 < 0$ ).

The FGLS model confirms the main OLS findings while improving efficiency by correcting serial correlation. GDP per capita remains the strongest and highly significant predictor of food consumption, and the Food Price Index continues to show a positive, significant effect on nominal spending. Food price inflation maintains a small negative impact, though only marginally significant, while unemployment remains insignificant. Overall, the FGLS results closely mirror the OLS estimates, indicating that autocorrelation did not materially alter the core relationships: income and price levels drive food consumption, while inflation exerts a modest negative influence. As food price inflation rises ( $\uparrow \pi_{\text{food}}$ ), household food consumption responds with a slight decline ( $\downarrow C_{\text{food}}$ ), consistent with the standard demand relationship  $\partial C / \partial \pi_{\text{food}} < 0$ .

Final Estimated Equation (GLS – Preferred Model)

$$\ln(\text{Food Consumption})_t = 10.3599 - 0.0039 \text{ FoodInflation}_t + 1.7202 \ln(\text{GDP})_t + 0.0052 \text{ Unemployment}_t + 0.1741 \ln(\text{FoodPriceIndex})_t$$

With t-statistics in parentheses

$$\ln(\text{Food Consumption})_t = 10.3599*** (6.81) - 0.0039* (-2.07) + 1.7202*** (11.32) + 0.0052 (0.94) + 0.1741*** (3.76)$$

Interpretation of the final model

- Income elasticity:  $1.7202*** \rightarrow$  A 1% increase in GDP per capita raises food consumption by 1.72%.

- • Price-level elasticity:  $0.1741*** \rightarrow$  A 1% increase in the food price index raises nominal food spending by 0.17% (nominal effect, not real quantity).
- • Inflation effect:  $-0.0039* \rightarrow$  Higher food inflation slightly reduces consumption (real purchasing-power effect).
- • Unemployment: Small and insignificant  $\rightarrow$  Does not meaningfully affect food consumption.
- • Goodness of fit:  $R^2 = 0.984 \rightarrow$  Model explains 98.4% of variation in U.S. household food consumption.
- •  $\partial C_{\text{food}} / \partial \pi_{\text{food}} < 0$ ,  $\partial C_{\text{food}} / \partial \ln \text{GDP} > 0$ ,  $\partial C_{\text{food}} / \partial P_{\text{food}} > 0$  Income strongly drives food consumption, long-run price levels increase nominal spending, and inflation modestly suppresses real consumption

## 5. Conclusion and Policy Implications

### 5.1 Summary of Econometric Findings

This study examined how food inflation and broader macroeconomic conditions affect household food consumption in the United States from 2001 to 2024. Across all three econometric models—OLS, OLS with robust errors, and GLS—GDP per capita consistently emerged as the strongest determinant of food consumption, reflecting the central role of income in shaping household spending behavior. Food inflation had a negative and statistically meaningful effect, confirming that rising prices erode real purchasing power and suppress food demand. The food price index was positive and highly significant in all models, indicating higher nominal expenditures as food prices rise. Unemployment displayed the expected negative correlation with consumption but did not show robust statistical significance in the regressions. The Prais–Winsten GLS model provided the most reliable estimates by addressing serial correlation, confirming the stability of the core relationships.

### 5.2 Policy Implications

The findings have several important policy implications. First, the strong influence of GDP per capita on food consumption highlights the importance of income growth and economic stability for ensuring adequate household food access. Policies that support wage growth, employment, and household purchasing power can help sustain food consumption, especially during periods of inflation. Second, the negative impact of food inflation underscores the need for measures that mitigate price spikes—such as strengthening domestic food supply chains, improving transportation and storage efficiency, and maintaining strategic food reserves. Third, given that nominal food expenditures rise with overall price levels, policymakers should monitor the affordability of food for vulnerable households and expand targeted support programs, such as SNAP benefits, during periods of high inflation or economic downturns. Finally, the limited role of unemployment in the regressions suggests that existing safety nets may already buffer food spending during recessions, indicating the value of maintaining and strengthening such programs.

## 5.3 Limitations and Future Research

Several limitations should be acknowledged. The study relies on annual macro-level data, which limits the sample size and restricts the ability to capture short-term consumption adjustments or seasonal effects. The use of nominal food consumption also complicates the distinction between real and price-driven expenditure changes. Additionally, while the GLS estimator corrects for serial correlation, potential endogeneity between income, inflation, and consumption remains a concern. Future research could extend the analysis using higher-frequency data, real consumption measures, or household-level microdata to better capture behavioral responses. Implementing an IV or structural modeling approach would also help address endogeneity and provide clearer causal interpretations. Finally, exploring the heterogeneous effects of inflation across income groups would offer valuable insights for designing more targeted food assistance and inflation mitigation policies.

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## Figures

Pairwise Relationships of Food Price Index, Food Price Inflation, and Household Food Purchases

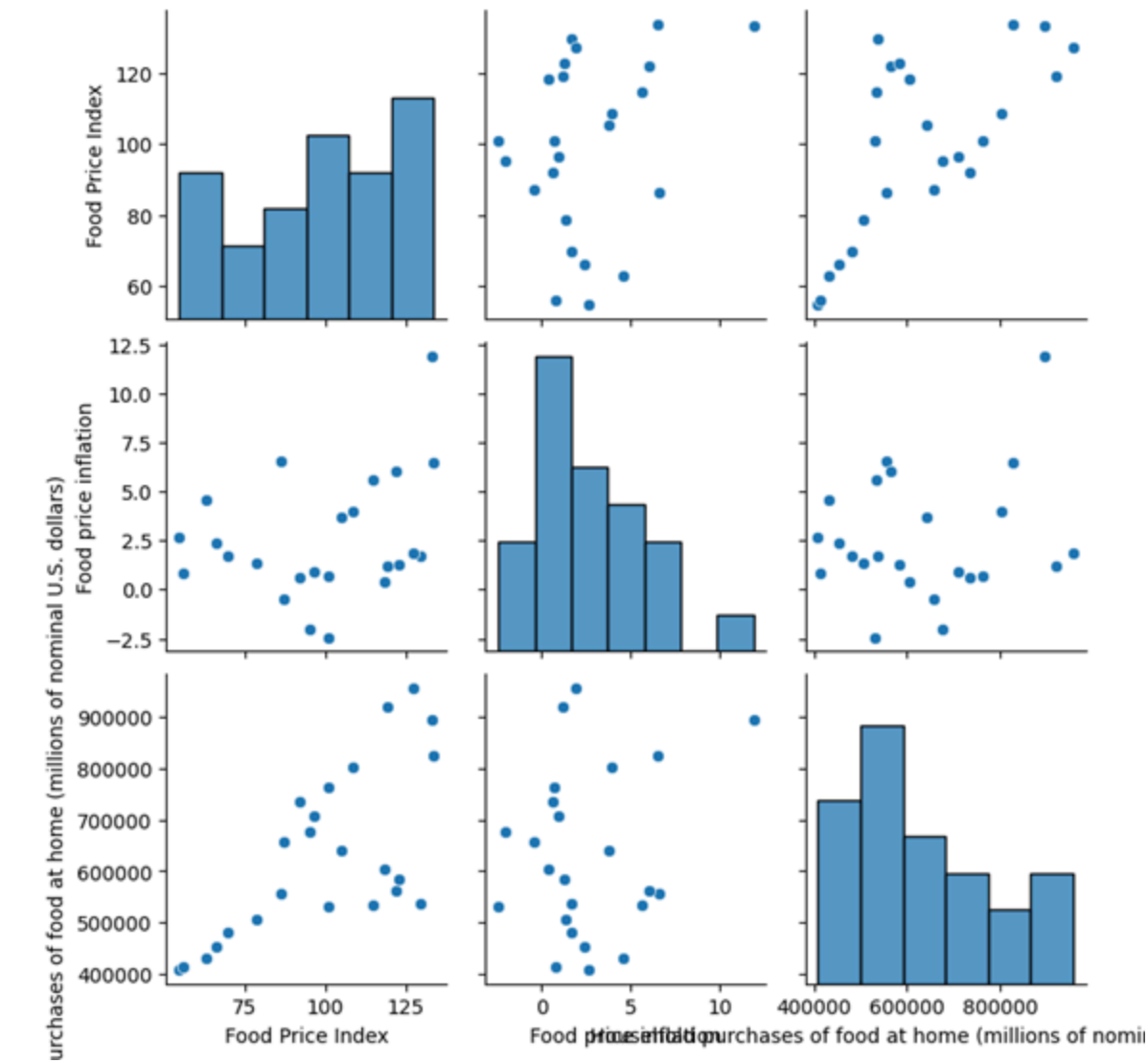


**Figure 1**

Relationship between annual food price inflation and nominal household food purchases in the United States, 2001–2024.



**Figure 2**

Pairwise relationships among food price inflation, the Food Price Index, and household food purchases in the United States, 2001–2024.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [CodeandData.docx](#)