

Addressing Program Sustainability: A Time Series Analysis of the Supplemental Nutrition Assistance Program in the USA

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Abstract: *Food stamps, or, more formally, the Supplemental Nutrition Assistance Program (SNAP), form a crucial support system for many individuals in the United States. The welfare benefit has been associated with improved nutritional outcomes, making it an effective strategy to address hunger. Additionally, it has been found to enhance labour market outcomes for recipients and contribute to higher birth weights among children born to SNAP recipient mothers. Furthermore, it has been linked to improved height and overall health outcomes. Overall, this benefit is a crucial resource during times of need and helps mitigate the adverse effects of economic fluctuations. Even with the manifold advantages of the program, there exist notable apprehensions about the program's long-term viability. SNAP has experienced significant expansion over more than 50 years. The recipients grew more than 14 times, from approximately 2.9 million individuals in 1969 to over 41 million in 2022. This study utilizes data from the United States Department of Agriculture to investigate the temporal characteristics of this massive expansion. Augmented Dickey-Fuller tests are performed with and without trend and optimally selected lag lengths. In all specifications, the presence of a unit root cannot be rejected. An overwhelming body of evidence suggests that the growth in SNAP beneficiaries may need to be revised. Results of the unit root tests provide credence to the argument that the historical growth rate in the number of SNAP beneficiaries is highly unpredictable and may pose significant challenges to policymakers. This study does not attempt to calculate fraud and abuse in the program. Neither does the study attempt to ascertain the number of beneficiaries that may not be worthy of receiving the benefits.*

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Introduction

A federal assistance program in the US named Supplemental Nutrition Assistance Program (SNAP) offers help to low-income individuals and families buying food. The United States Department of Agriculture (USDA) started a trial experiment in 1939 that would later become the forerunner to the current Food Stamp Program. Through the scheme, producers were allowed to sell surplus food to low-income people at a reduced price to support them. As part of the Agricultural Act of 1961, President John F. Kennedy's administration established a permanent Food Stamp Program. Participants in the voluntary program bought food stamps from the government, which they then used like cash to buy groceries. The program was only offered in a few places. In 1973, the Food Stamp Program was made available in all 50 states on a national scale. Participants received paper coupons that could be used to purchase food and were eligible based on their income and resources.

In 1996, President Bill Clinton's signing of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) resulted in significant modifications to the Food Stamp Program. Its name was officially changed to the Supplemental Nutrition Assistance Program (SNAP) to represent better its broader objective of improving nutrition. Paper coupons were replaced by Electronic Benefit Transfer (EBT) cards, improving efficiency and lowering fraud. The Great Recession in 2008–2009 led to a spike in unemployment and a rise in the need for food assistance. As a result, SNAP enrolment hit historic highs and helped millions of struggling households by offering crucial support. The year 2010 saw the passage of the Hunger-Free Kids Act, which raised the nutritional requirements for school meals and made it easier for SNAP participants to get healthier food options. In 2014, SNAP underwent some modifications due to the Farm Bill, sometimes referred to as the Agricultural Act of 2014. It tightened some qualifying restrictions while funding pilot projects to examine cutting-edge approaches to promoting self-sufficiency.

The COVID–19 epidemic caused a significant rise in unemployment and financial hardship, which sparked a spike in SNAP usage. The government temporarily increased SNAP benefits and eligibility to help those impacted by the pandemic. Millions of low-income people and families receive essential support from SNAP, which remains a key tool in combating hunger and food insecurity in the United States. SNAP issues electronic benefit transfer (EBT) cards to qualified people and families that can be used to buy qualified food items at accredited retail establishments, such as groceries, supermarkets, and farmers' markets. This support ensures that participants have the resources to buy various nourishing foods. By supplementing low-income households' food budgets, SNAP boosts their purchasing power. The quantity of benefits offered depends on several variables, including household size, income, and expenses. These extra funds allow recipients to stretch their limited funds further and purchase more food. SNAP strongly emphasizes promoting nutrition by incentivizing consumers to buy nutritious foods. The program's rules specify what foods are acceptable, focusing on fruits, vegetables, whole grains, dairy products, and proteins. By doing this, it is made possible for participants to have access to a balanced diet and essential nutrients.

SNAP members can select the foods that best suit their tastes and nutritional requirements. It acknowledges that people and families come from various ethnic origins and have various food needs and preferences. Receivers are free to choose their food according to their needs. SNAP helps prevent hunger and lowers the likelihood of food insecurity among disadvantaged individuals by ensuring reliable access to food. It provides that individuals and families do not go without food in times of financial difficulty, unemployment, or other disasters. Nutritionally sound eating habits are crucial for general health and well-being. SNAP promotes users' health outcomes – particularly those of children, expectant mothers, and those with chronic illnesses – by facilitating access to wholesome food. It supports healthy growth and development, brain health, and illness prevention. SNAP also has beneficial economic consequences by pouring federal funds into local economies. When participants utilize their benefits to buy food, it helps farmers and retailers, promoting regional economic growth and job creation.

Annual adjustments are made to SNAP benefits to reflect increases in the cost of living. The changes are based on the Thrifty Food Plan (TFP), a formula that determines how much a balanced diet will cost at a low cost. The TFP considers food costs, nutritional recommendations, and consumption trends. SNAP payment modifications have historically been made to keep up with inflation to guarantee that members can afford an acceptable amount of food. However, the adequacy of SNAP payments in proportion to the cost of living can change over time and between geographical areas. The consequences of increased food costs or other

economic conditions, which can affect SNAP beneficiaries' ability to purchase goods and services, may occasionally be partially countered by benefit adjustments. It is crucial to highlight that there is continuous discussion and disagreement regarding the effectiveness of SNAP payments in reducing food insecurity and meeting participants' nutritional needs. The sufficiency of benefit levels and prospective upgrades to better support low-income individuals and families are frequently at the heart of policy discussions.

The reach and benefits of SNAP can adjust in reaction to the economic cycle to offer more assistance when there is a downturn in the economy or greater need. More people and families may become eligible for SNAP during economic hardship, such as recessions or high unemployment rates. As people face financial problems, they may be able to meet the program's income and asset requirements. Consequently, SNAP membership tends to rise when more people seek assistance during economic downturns. Every year, SNAP benefits are modified to reflect the increased cost of living. Benefit levels may be raised to assist recipients in maintaining their purchasing power and guarantee access to enough food during inflation or rising food prices. Usually, these changes are made in response to inflation rates and economic indices.

The government may put temporary measures in place to offer more significant support through SNAP during national crises or catastrophes, such as natural disasters or economic shocks. For instance, during the COVID-19 pandemic, the government enacted transient measures such as emergency allotments and broadened eligibility to offer more significant support to people and families affected by the pandemic's economic effects. SNAP payments have a stimulating influence on the economy. Families and people who receive SNAP assistance frequently use them to buy groceries, which boosts regional economies. Retailers, farmers, and other businesses involved in the food industry might benefit from increased SNAP funds during economic downturns, promoting employment and economic activity. It is important to note that specific modifications to the Food Stamp Program, such as eligibility standards, benefit amounts, and emergency assistance programs, are subject to legislative policy decisions and may alter over time based on the political and economic environment.

In this paper, the author looks at the time series properties of average benefits received by SNAP recipients. He analyses 54 straight years of data from 1969 to 2022. The period captures several vital milestones of American history: the oil crisis and economic turmoil of the 1970s, economic recovery, inflationary period and savings and loan crisis of the 1980s, post-cold-war economic expansion of the 1990s, dot com bubble crash and 9/11 terrorist attacks towards the beginning of 21st century, the market crash of 2008-09, and more recently, the COVID-19 pandemic.

Literature Review

The reference section lists some of the most influential studies on nutritional assistance, food stamps, and other income-supporting assistance. The results are mostly unequivocally positive. Income-supporting and nutritional status-enhancing welfare programs like SNAP improve health status, reduce malnutrition, deliver superior labour market outcomes, improve newborn children's weight, reduce lifetime healthcare costs, reduce volatility in household access to essential resources, etc. Hoynes, H., Schanzenbach, D. W., & Almond, D. (2016) concluded that having access to food stamps as a child lowers the risk of developing metabolic syndrome and boosts economic independence in women. Bailey, M. J., Hoynes, H. W., Rossin-Slater, M., & Walker, R. (2020) find that before the age of five, children who have access to more financial resources see increases in their adult human capital of 6% standard deviation, adult economic self-sufficiency of 3% standard deviation, adult neighbourhood quality of 8% standard deviation, adult longevity of 0.4 percentage points, and adult likelihood of being incarcerated of 0.5 percentage points.

Bütikofer, A., Løken, K. V., & Salvanes, K. G. (2019) specifically observe favourable impacts of nutritional input (something like a SNAP would offer) on adult height, reduced health risks at age 40 and reduced baby diarrheal mortality. Research by Almond, D., Hoynes, H. W., & Schanzenbach, D. W. (2011) shows that pregnancies exposed to SNAP three months before delivery resulted in higher birth weights, with the most improvements occurring at the lightest birth weights. Additionally, Almond, D., Hoynes, H. W., & Schanzenbach, D. W. (2011) observe slight but statistically insignificant reductions in newborn mortality. They conclude that white and black mothers benefited more from the substantial rise in income from the SNAP, with an even more significant effect on the latter group. In an influential study, Rank, M. R., & Hirschl, T. A. (2009) found that nearly half (49.2%) of all American children would live in a household that receives SNAP benefits at some point between the ages of 1 and 20. Families who required the program used it for just brief periods but were also likely to return to it multiple times throughout the child's childhood. The proportion

of children living in a food stamp family was strongly influenced by race, parental education, and the head of household's marital status.

Gundersen, C., & Ziliak, J. P. (2003) estimated income volatility with and without food stamps and a variance decomposition of consumption using data from the Panel Study of Income Dynamics covering 1980-99. They found that food stamps decreased income volatility by around 12% and food consumption volatility by about 14% among households with a significant ex-ante risk of receiving assistance. Evans, W. N., & Garthwaite, C.L. (2014) find improvements in the self-reported health of impacted women using data from the Behavioral Risk Factors Surveillance Survey. They discover decreases in the likelihood that these same women will have dangerous levels of biomarkers using data from the National Health and Nutrition Examination Survey. Bergmans and Wegryn-Jones (2020) examined the relationship between food insecurity and depression. Harper et al. (2022) conducted an extensive study of the nutritional assistance program during the Covid-19 pandemic and SNAP's critical role in ensuring essential nutrition for a vast fraction of the population.

In another influential study, Peltz and Garg (2019) showed the close relationship between the lack of nutritional sufficiency, emergency medical care usage, and school absenteeism. In this paradigm, investments in expanding healthy supplementation programs like SNAP have solid implications for reduced healthcare costs and improved educational outcomes. Pinard et al. (2017) examined the close relationship between income supplementation via transfers like SNAP, which has strong implications for the uptake of appropriate nutrition and poverty alleviation. Tach and Edin (2017) document the critical impact of transfer programs for the working poor in terms of getting ahead through positive long-term health improvements and better child health.

Food assistance systems have played a crucial role in development and disaster mitigation efforts in other parts of the world. For example, Arora, Nabi, and Sarin (2023) looked at the effect of food assistance in helping India during the Covid-19 pandemic. George and McKay (2019) provide an extensive study regarding India's public food distribution system and its impact on ensuring food security for well over a billion people. Mooji (1998) provides a powerful analysis connecting the public food distribution system with the political economy in India. Mwaniki (2006) discusses the critical role of food distribution systems in ensuring nutritional security in Africa. Del Nino, Dorosh, and Subbarao (2007) provide an excellent international contrast study connecting food distribution and nutritional security between South Asia and Africa. Espinosa-Cristia, Feregrino, and Isla (2019) put pre-existing and emerging concerns regarding food distribution in Latin America. These studies covering vast continents like Asia, Africa, Latin America, etc., provide valuable insight into the critical nature of food distribution and its relationship with nutritional security, political economy, and public policy that affect billions of lives in countless developing nations.

The reference section contains several more influential studies that strengthen and complement the abovementioned general results. The list is by no means exhaustive.

Methodology and Research Methods

The data is collected from the US Department of Agriculture's (USDA) Food and Nutrition Service. The USDA provides easily accessible data related to SNAP at its data website at <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>. This study analyses the data for the national-level annual summary for participation and costs for 1969-2022. The author uses the annual average participation data for this analysis. Please note that the participation numbers can vary monthly as new participants join the recipient rolls while some existing ones leave. The numbers are reported in thousands.

The time series analysis is done using the following methodology. Let t denote time where $t = 1, 2, \dots, T$. Let y_t denote the number of participants in time t . I check the stationarity of the data by using the unit root test. The Augmented Dickey-Fuller (ADF) test is used for this purpose. The standard Dickey-Fuller test involves fitting the model:

$$y_t = \alpha + \delta t + \varphi y_{t-1} + \varepsilon_t \quad (1)$$

The value $\varphi = 1$ represents the null hypothesis. The residual serial correlation may need to be considered while estimating the standard model parameters using OLS. This is addressed by the augmented Dickey-Fuller (ADF) test, which increases the standard model by k delayed differences of the dependent variable. In more detail, it changes standard model into a different form as

$$y_t = \alpha + \delta t + \beta y_{t-1} + \sum_{i=1}^k \gamma_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

The stationarity can be easily checked in the ADF framework by testing the null hypothesis $\beta = 0$. It should be noted that ADF has a universal form and that for regression requirements that result in various distributions of the test statistic, we can restrict either α or δ or both to zero. The test statistic distribution for four potential examples is listed in Hamilton (1994, ch. 17).

The estimation of the ADF model is conducted using a Generalized Least Squares (GLS) method where the optimal lag length is chosen by the Schwert, (1989) method. The lags $k = \{1, 2, \dots, k_{max}\}$ can be optimally chosen to be $k_{max} = \text{floor}[12\{T+1\}/100]^{0.25}$. Because of the choice of the first differenced series, $k_{max} + 1$ observations are lost, and we are left with $T - k_{max}$ observations to work with. Therefore, a longer time series is beneficial as we will be left with a large sample even after losing some observations due to the selection of optimal lag length.

Results

As Figure 1 exhibits, the number of SNAP recipients has dramatically increased from about 2.9 million in 1969 to over 41 million in 2022. It represents over 14 times increase in nearly 53 years, raising serious questions regarding the stationarity of the number of participants. A simple visual examination of the data also uncovers a robust upward trend of growth in the number of beneficiaries between 1969 and 2022.

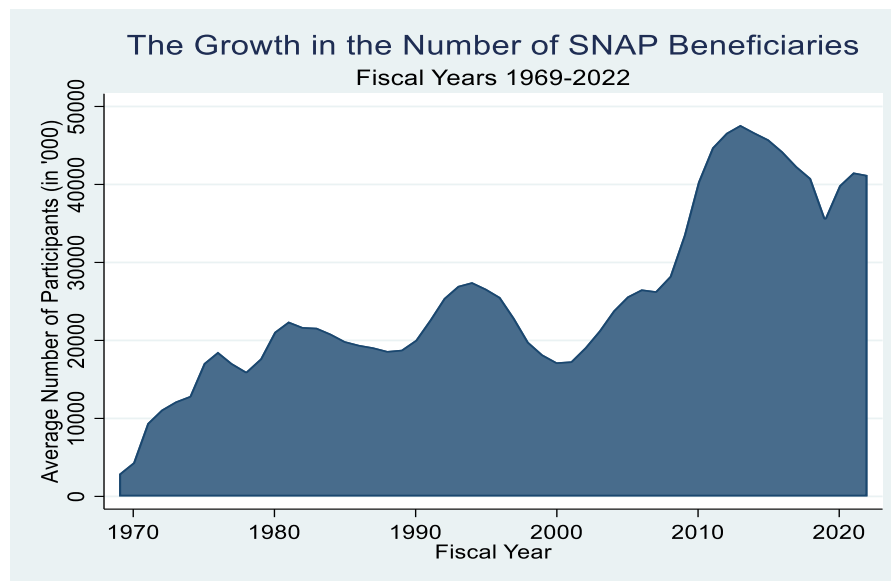


Figure 1. Title The Growth in the Number of SNAP Beneficiaries 1969-2022

Source: Generated using data from Supplemental Nutrition Assistance Program Participation and Costs available from <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

The correlogram and partial auto-correlogram are provided in Figures 2 and 3. A correlogram, alternatively referred to as an autocorrelation plot, is a graphical representation that illustrates the correlation coefficients between a time series and the lagged values of that series. Simply put, it demonstrates the degree of correlation between a specific data point and its preceding values across several time intervals. Every data point on the correlogram is associated with a particular lag, and the vertical position of the point indicates the value of the correlation coefficient at that precise lag. Positive correlation coefficients signify a positive association between the present and past values, while negative coefficients suggest a negative association.

Correlograms are a valuable tool for identifying recurring patterns at particular time lags and uncovering any seasonal patterns in the data. Peaks occurring at consistent intervals suggest the presence of probable seasonal patterns. A stable time series generally displays correlation coefficients that decline quickly as the time lags between observations increase. If the coefficients continue to exhibit significance at higher delays, it indicates the presence of non-stationarity. Correlograms are valuable tools for identifying optimal parameters for autoregressive integrated moving average (ARIMA) models since they provide insights into the order of autoregressive (AR) and moving average (MA) components. The time series data may be highly persistent if the correlogram does not decline quickly as the lag length is increased, pointing to the possible unstableness of the underlying time series.

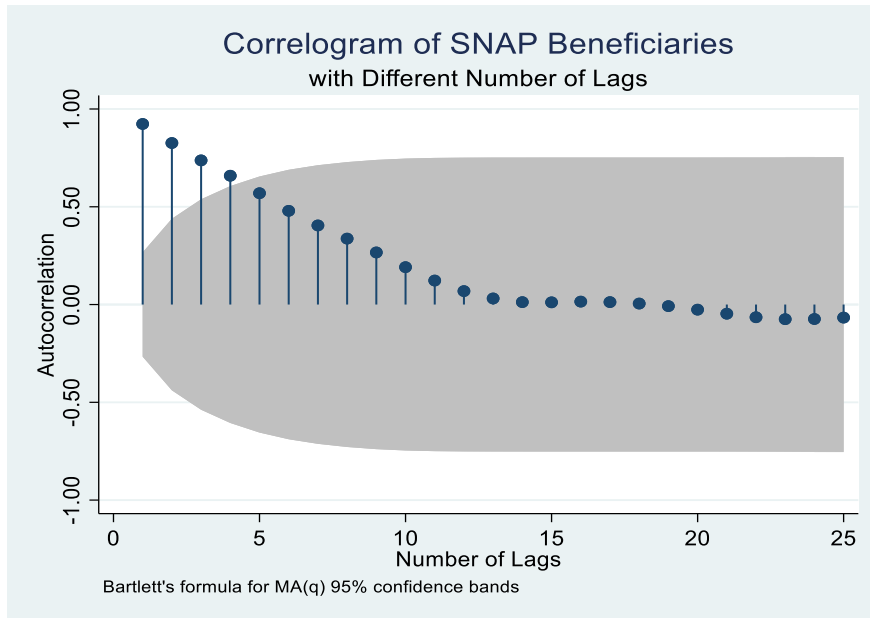


Figure 2. Correlogram of SNAP Beneficiaries with Different Number of Lags

Source: Generated using data from Supplemental Nutrition Assistance Program Participation and Costs available from <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

A partial correlogram, commonly known as a partial autocorrelation plot, is an enhanced version of the correlogram. The analysis illustrates the relationship between a specific data point and its previous values, considering the influence of short-time lags within the time series. In essence, this metric quantifies the direct correlation between two specific points while excluding the impact of any intervening points – the order of autoregressive (AR) models. The partial correlogram is a useful tool for establishing the optimal order of the autoregressive (AR) component within an autoregressive integrated moving average (ARIMA) model. It accomplishes this by identifying large lags directly impacting the model's overall performance.

Differentiating between pure seasonal patterns and mixed seasonal and non-seasonal patterns can be achieved by examining the decay of partial autocorrelation at various lags. Both the correlogram and partial correlogram are essential tools for comprehending the dynamics and stability of a long-term time series dataset. The utilization of these graphical representations' aids in the identification of latent cyclic, trend, and seasonal patterns that may not be readily discernible in unprocessed data. This information holds significant importance in the context of forecasting and decision-making.

Correlograms and partial correlograms provide valuable insights for identifying suitable time series models, facilitating precise predictions and analysis. The presence of rapid decay of correlations in correlograms and partial correlograms serves as an indication of stationarity, a crucial requirement for numerous time series models. The presence of non-stationarity might result in predictions and analyses that need more reliability. Typical spikes or unanticipated patterns observed in the plots may indicate the presence of outliers or anomalies within the dataset, potentially impacting the analysis and forecasting outcomes meaningfully.

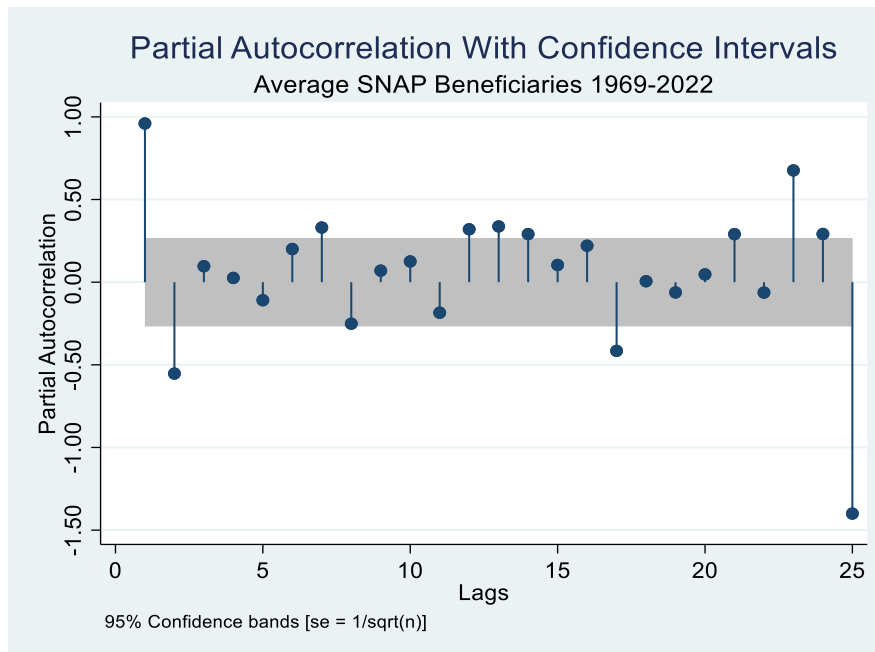


Figure 3. Partial Autocorrelation with Confidence Intervals for Average SNAP Beneficiaries 1969-2022

Source: Generated using data from Supplemental Nutrition Assistance Program Participation and Costs available from <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

Table 1 contains the results from the ADF test using GLS, where the optimal lag is selected by the Schwert (1989) criterion. The Augmented Dickey-Fuller (ADF) test, employing Generalized Least Squares (GLS) estimation, is a statistical technique for assessing the stationarity of time series data. The assumption of stationarity is of utmost importance for several time series models, as it guarantees that the statistical characteristics of the data remain constant during the period under consideration. The ADF-GLS test is precious in identifying stationarity because it can consider potential serial correlation and trend patterns in the data. The ADF-GLS test commences by assuming the null hypothesis that the time series data is characterized by non-stationarity, indicating the presence of a unit root (a root of 1) and displaying a stochastic trend. The alternative hypothesis posits that the observed data exhibits stationarity, indicating the absence of a unit root and the presence of consistent statistical characteristics. The test incorporates lags of the differenced series, which represents the degree of dependence between the present value of the series and its previous values. Incorporating these lagged differences in the ADF-GLS test allows for examining potential serial correlation and autocorrelation within the dataset.

The ADF-GLS test provides flexibility in modelling trends by accommodating many possibilities, such as the absence of a trend, a linear trend, or a quadratic trend. Considering trends is crucial in analysing time series data since such data frequently demonstrate temporal patterns. Therefore, it is imperative to account for these trends while conducting tests for stationarity. GLS estimation incorporates the consideration of heteroscedasticity, which denotes the presence of unequal levels of variation in the data across several periods. The significance of this matter lies in the fact that conventional OLS (Ordinary Least Squares) techniques presume a constant variance. This condition may not apply to time series data.

The Augmented Dickey-Fuller Generalized Least Squares (ADF-GLS) test employs crucial values obtained from statistical tables to ascertain the significance of the derived test statistic. Suppose the value of the test statistic is more negative (or less positive) than the critical values. In that case, it leads to the rejection of the null hypothesis, which suggests non-stationarity, in favour of the alternative hypothesis, which suggests stationarity. If the null hypothesis is rejected, it can be inferred that the time series data exhibits stationarity. It implies the absence of a stochastic trend and the preservation of its statistical characteristics throughout time. Suppose the null hypothesis cannot be rejected. It suggests that the data exhibits non-stationarity and that more analysis or modifications may be necessary before applying time series models.

It may be noted that the presence of unit root cannot be rejected for lags 1-10 for both 1% and 5% levels. This powerful result indicates that the number of participants in the SNAP program may be following an explosive and unpredictable path, supporting the general observations from Figure 1.

Table 1. Results from the ADF GLS Test (Maxlag = 10 chosen by Schwert (1989) criterion)

[lags]	DF-GLS tau Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
10	-2.635	-3.755	-2.689	-2.397
9	-2.109	-3.755	-2.743	-2.454
8	-2.103	-3.755	-2.802	-2.516
7	-2.530	-3.755	-2.864	-2.578
6	-2.031	-3.755	-2.929	-2.641
5	-2.690	-3.755	-2.993	-2.703
4	-2.406	-3.755	-3.054	-2.761
3	-2.504	-3.755	-3.112	-2.815
2	-2.638	-3.755	-3.164	-2.863
1	-2.750	-3.755	-3.209	-2.904
Opt Lag (Ng-Perron seq t) = 10 with RMSE 1432.528 Min SIC = 15.01146 at lag 1 with RMSE 1666.133 Min MAIC = 15.2641 at lag 1 with RMSE 1666.133				

Source: Author's calculations derived using data from Supplemental Nutrition Assistance Program Participation and Costs available from <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

Table 1 does not explicitly adjust for various lags along with trends in a standard ADF model, which has been shown to have a higher power. Therefore, the time series for the number of participants is subjected to more rigorous ADF tests with various lags (3, 5, 10) and trends. The results are presented in separate panels.

Performing ADF-GLS tests with varying lag lengths is crucial to effectively evaluate the stationarity of a given time series dataset. ADF test is a commonly employed statistical technique to assess a time series' stationarity or non-stationarity. This determination holds significant importance as it is a fundamental assumption for numerous time series models. When implemented using the Generalized Least Squares (GLS) approach, the ADF test accommodates heteroscedasticity, enabling the consideration of fluctuating amounts of variance within the data throughout distinct periods. There are several advantages to conducting tests with various lag durations. Time series data can manifest diverse patterns, including varying seasonality, autocorrelation, and trends. We can effectively capture a diverse array of potential patterns in the dataset by conducting experiments with various lag durations. Certain patterns may only become evident at specific time delays, and doing tests with different time lags helps to avoid overlooking these significant qualities. A reduction in lag length has the potential to mitigate bias, but it may also lead to an increase in inefficiency.

Conversely, a longer lag length has the potential to amplify bias, but it may also result in a decrease in inefficiency. By conducting tests using various lag lengths, one can achieve a balance between these trade-offs and gain a complete understanding of the stationarity of the data. Time series data can exhibit different frequencies, encompassing daily, weekly, monthly, or yearly observations. Accurately capturing underlying patterns may require varying lag durations for various frequencies. Conducting tests with different lag lengths is crucial to ascertain the suitability of the test for the particular frequency characteristics of the data.

Sometimes, the association between a variable and its previous values may exhibit a complex pattern. The presence of intricate interrelationships can result in varying time lags becoming significant at different junctures within the time series. Conducting tests using numerous delays facilitates the identification of intricate correlations. Various lag durations offer valuable insights for model selection. Identifying stationarity at one lag length but not another can guide the selecting of suitable models for the data. Considering unique lag dependencies while constructing models is imperative, as the accuracy of analysis and predictions greatly hinges on picking an appropriate model. Statistical tests are susceptible to being influenced by minor alterations in data or underlying assumptions. Including several lag lengths in the testing process enhances the robustness of the analysis, as it ensures that the conclusions on stationarity remain consistent across varied lag specifications. Using numerous lag lengths in tests is a preventive measure against data mining, a phenomenon in which a specific lag length is selectively chosen to align with the desired conclusion. Including diverse delays in the analysis enhances objectivity and reduces susceptibility to prejudice.

Table 2. Augmented Dickey-Fuller Tests with Trend with Different Lags

Panel A: With 3 lags

Augmented Dickey-Fuller test for unit root		Number of obs =		50
		Interpolated Dickey-Fuller		
		1% Critical	5% Critical	10% Critical
		Value	Value	Value
Test Statistic				
Z(t)	-2.586	-4.150	-3.500	-3.180

MacKinnon approximate p-value for Z(t) = **0.2863****Panel B: With 5 Lags**

Augmented Dickey-Fuller test for unit root		Number of obs =		48
		Interpolated Dickey-Fuller		
		1% Critical	5% Critical	10% Critical
		Value	Value	Value
Test Statistic				
Z(t)	-2.520	-4.168	-3.508	-3.185

MacKinnon approximate p-value for Z(t) = **0.3179****Panel C: With 10 Lags**

Augmented Dickey-Fuller test for unit root		Number of obs =		43
		Interpolated Dickey-Fuller		
		1% Critical	5% Critical	10% Critical
		Value	Value	Value
Test Statistic				
Z(t)	-2.591	-4.214	-3.528	-3.197

MacKinnon approximate p-value for Z(t) = **0.2840**

Source: Author's calculations derived using data from Supplemental Nutrition Assistance Program Participation and Costs available from <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

In all panels (A, B, and C), the unit root must be accepted for all values of chosen lags even after including the trend in the estimation. Therefore, the results presented in Tables 1 and 2 are entirely consistent. Both tables establish the strong result that unit root cannot be rejected for any reasonable lag length, both with and without including trend.

Conclusions

The number of participants in the SNAP program has increased dramatically (over 14-fold) between 1969 and 2022. The sustainability of the welfare program has attracted significant attention. Using the Augmented Dickey-Fuller tests both in standard form with trend and various lags and the Generalized Least Square estimation, the existence of a unit root cannot be rejected. In simple terms, the results mean the growth in the number of beneficiaries in the last half a century is explosive and unpredictable. While an essential program like SNAP is a lifeline for millions of deserving beneficiaries, the explosive growth of the program raises serious questions regarding the sustainability of the program.

The significant increase in individuals receiving SNAP benefits underscores the criticality of a solid and comprehensive social safety net. The program is a crucial resource for individuals and families during economic hardship, guaranteeing their ability to obtain nourishing sustenance despite financial constraints. The provision of SNAP benefits not only mitigates food insecurity but also functions as an economic stimulant. Using SNAP benefits by individuals for food purchases stimulates economic activity within grocery shops and food markets, supporting local companies and the overall economy. The increase in SNAP enrollment highlights the magnitude of poverty and financial instability inside the nation. Policymakers focus

on the underlying factors contributing to poverty to mitigate the long-term necessity for aid. Expanding the Supplemental Nutrition Assistance Program (SNAP) necessitates a continuous assessment by policymakers about the program's efficacy, criteria for eligibility, and strategies for reaching potential beneficiaries. The constant evaluation of this program guarantees its adaptability to evolving needs and demographic shifts.

Although the SNAP plays a crucial role, the program's expansion presents significant budgetary problems. Policymakers are required to strike a delicate balance between the expansion of the program and the broader fiscal obligations while ensuring the efficient use of resources. Sufficient nutrition is essential for the holistic maintenance of health and general welfare. Policies aimed at enhancing the availability of nourishing food through initiatives such as the Supplemental Nutrition Assistance Program (SNAP) can provide enduring beneficial effects on public health indicators.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

References

1. Aizer, A., Eli, S., Ferrie, J., & Lleras-Muney, A. (2016). The long-run impact of cash transfers to poor families. *American Economic Review*, 106(4), 935-971. [\[Google Scholar\]](#) [\[CrossRef\]](#)
2. Aizer, A., Hoynes, H., & Lleras-Muney, A. (2022). Children and the US social safety net: Balancing disincentives for adults and benefits for children. *Journal of Economic Perspectives*, 36(2), 149-74. [\[Google Scholar\]](#) [\[CrossRef\]](#)
3. Almond, D., Hoynes, H.W., & Schanzenbach, D.W. (2011). Inside the war on poverty: The impact of food stamps on birth outcomes. *The Review of Economics and Statistics*, 93(2), 387-403. [\[Google Scholar\]](#) [\[CrossRef\]](#)
4. Arora, S., Nabi, T., & Sarin, V. (2023). A Systematic Review on Indian Food Security Systems and Food Assistance Programmes (FAPs) in the Context of the COVID-19 Pandemic. *Changing World Economic Order in the Post-Pandemic Period*, 89-106. [\[Google Scholar\]](#) [\[CrossRef\]](#)
5. Bailey, M.J., Hoynes, H.W., Rossin-Slater, M., & Walker, R. (2020). Is the social safety net a long-term investment? Large-scale evidence from the food stamps program (No. w26942). National Bureau of Economic Research. [\[Google Scholar\]](#) [\[CrossRef\]](#)
6. Bergmans, R.S., & Wegrzyn-Jones, R. (2020). Examining associations of food insecurity with major depression among older adults in the wake of the Great Recession. *Social Science & Medicine*, 258, 113033. [\[Google Scholar\]](#) [\[CrossRef\]](#)
7. Bitler, M., & Hoynes, H.W. (2010). The state of the safety net in the post-welfare reform era (No. w16504). National Bureau of Economic Research. [\[Google Scholar\]](#) [\[CrossRef\]](#)
8. Bitler, M., Hoynes, H., & Kuka, E. (2017). Child poverty, the great recession, and the social safety net in the United States. *Journal of Policy Analysis and Management*, 36(2), 358-389. [\[Google Scholar\]](#) [\[CrossRef\]](#)
9. Blundell, R., & Pistaferri, L. (2003). Income volatility and household consumption: The impact of food assistance programs. *Journal of Human Resources*, 1032-1050. [\[Google Scholar\]](#) [\[CrossRef\]](#)
10. Bütikofer, A., Løken, K.V., & Salvanes, K.G. (2019). Infant health care and long-term outcomes. *Review of Economics and Statistics*, 101(2), 341-354. [\[Google Scholar\]](#) [\[CrossRef\]](#)
11. Case, A., Lubotsky, D., & Paxson, C. (2002). Economic status and health in childhood: The origins of the gradient. *American Economic Review*, 92(5), 1308-1334. [\[Google Scholar\]](#) [\[CrossRef\]](#)
12. Del Ninno, C., Dorosh, P.A., & Subbarao, K. (2007). Food aid, domestic policy and food security: Contrasting experiences from South Asia and sub-Saharan Africa. *Food policy*, 32(4), 413-435. [\[Google Scholar\]](#) [\[CrossRef\]](#)
13. DePolt, R.A., Moffitt, R.A., & Ribar, D.C. (2009). Food stamps, temporary assistance for needy families and food hardships in three American cities. *Pacific Economic Review*, 14(4), 445-473. [\[Google Scholar\]](#) [\[CrossRef\]](#)
14. East, C.N. (2020). The effect of food stamps on children's health evidence from immigrants' changing eligibility. *Journal of Human Resources*, 55(2), 387-427. [\[Google Scholar\]](#)
15. Espinosa-Cristia, J.F., Feregrino, J., & Isla, P. (2019). Emerging, and old, dilemmas for food security in Latin America. *Journal of Public Affairs*, 19(3), e1999. [\[Google Scholar\]](#) [\[CrossRef\]](#)

16. Evans, W.N., & Garthwaite, C.L. (2014). Giving mom a break: The impact of higher EITC payments on maternal health. *American Economic Journal: Economic Policy*, 6(2), 258-290. [\[Google Scholar\]](#) [\[CrossRef\]](#)
17. George, N.A., & McKay, F.H. (2019). The public distribution system and food security in India. *International journal of environmental research and public health*, 16(17), 3221. [\[Google Scholar\]](#) [\[CrossRef\]](#)
18. Gundersen, C., & Ziliak, J.P. (2003). The role of food stamps in consumption stabilization. *Journal of Human Resources*, 1051-1079. [\[Google Scholar\]](#) [\[CrossRef\]](#)
19. Hamilton, J.D. (1994). Time Series Analysis. Princeton: Princeton University Press. Available at: [\[Link\]](#)
20. Hardy, B.L. (2017). Income instability and the response of the safety net. *Contemporary Economic Policy*, 35(2), 312-330. [\[Google Scholar\]](#) [\[CrossRef\]](#)
21. Harper, K., Belarmino, E.H., Acciai, F., Bertmann, F., & Ohri-Vachaspati, P. (2022). Patterns of food assistance program participation, food insecurity, and pantry use among US Households with children during the COVID-19 pandemic. *Nutrients*, 14(5), 988. [\[Google Scholar\]](#) [\[CrossRef\]](#)
22. Hoynes, H., Schanzenbach, D.W., & Almond, D. (2016). Long-run impacts of childhood access to the safety net. *American Economic Review*, 106(4), 903-934. [\[Google Scholar\]](#) [\[CrossRef\]](#)
23. Hoynes, H.W., & Schanzenbach, D.W. (2018). Safety net investments in children (No. w24594). National Bureau of Economic Research. [\[Google Scholar\]](#) [\[CrossRef\]](#)
24. Moffitt, R.A. (2013). The Great Recession and the social safety net. *The Annals of the American Academy of Political and Social Science*, 650(1), 143-166. [\[Google Scholar\]](#) [\[CrossRef\]](#)
25. Mooij, J. (1998). Food policy and politics: The political economy of the public distribution system in India. *The Journal of Peasant Studies*, 25(2), 77-101. [\[Google Scholar\]](#) [\[CrossRef\]](#)
26. Mwaniki, A. (2006). Achieving food security in Africa: Challenges and issues. *UN Office of the Special Advisor on Africa (OSAA)*. Available at: [\[Link\]](#)
27. Peltz, A., & Garg, A. (2019). Food insecurity and health care use. *Pediatrics*, 144(4), e20190347. [\[Google Scholar\]](#) [\[CrossRef\]](#)
28. Pinard, C.A., Bertmann, F.M., Byker Shanks, C., Schober, D.J., Smith, T.M., Carpenter, L.C., & Yaroch, A.L. (2017). What factors influence SNAP participation? Literature reflecting enrollment in food assistance programs from a social and behavioral science perspective. *Journal of Hunger & Environmental Nutrition*, 12(2), 151-168. [\[Google Scholar\]](#) [\[CrossRef\]](#)
29. Rank, M.R., & Hirschl, T.A. (2009). Estimating the risk of food stamp use and impoverishment during childhood. *Archives of Pediatrics & Adolescent Medicine*, 163(11), 994-999. [\[Google Scholar\]](#) [\[CrossRef\]](#)
30. Rosenbaum, D. (2013). SNAP is Effective and Efficient. Center on Budget and Policy Priorities. [\[Google Scholar\]](#)
31. Scholz, J.K., Moffitt, R., & Cowan, B. (2009). Trends in income support. *Changing poverty, Changing Policies*, 203-41. [\[Google Scholar\]](#)
32. Schwert, G.W. (1989). Tests for unit roots: A Monte Carlo investigation. *Journal of Business and Economic Statistics*, 2, 147-159. [\[Google Scholar\]](#) [\[CrossRef\]](#)
33. Smith, J.P. (2009). The impact of childhood health on adult labor market outcomes. *Review of Economics and Statistics*, 91(3), 478-489. [\[Google Scholar\]](#) [\[CrossRef\]](#)
34. Tach, L., & Edin, K. (2017). The social safety net after welfare reform: Recent developments and consequences for household dynamics. *Annual Review of Sociology*, 43, 541-561. [\[Google Scholar\]](#) [\[CrossRef\]](#)