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Forecasting Sectoral Household Monthly Food Consumption Expenditure Trends in Sri Lanka: A Time Series Analysis

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ABSTRACT

The study aims to forecast the trends in monthly food consumption expenditure across urban, rural, and estate sectors in Sri Lanka. Data were obtained from the Household Income and Expenditure Surveys (HIES) conducted in 1990/91, 1995/96, 2002, 2006/07, 2009/10, 2012/13, and 2016 for the districts of Badulla, Kandy, Nuwara-Eliya, and Ratnapura, each representing all three sectors and comprising at least 5% of the population in each sector. The total sample size of the survey was 28,319 households. Monthly household food expenditures were forecasted for the period 2017–2025. To address the irregular frequency of the data, all series were first interpolated using the linear approximation method, after which forecasts were generated using an Auto-Regressive (AR) model. The univariate AR model was selected to predict household food expenditures, as it describes a system in which the current value depends linearly on its past values. The forecasting process employed the AR(1) stochastic difference equation along with a first-order time-dependent Ordinary Differential Equation (ODE) system to enhance the accuracy of the projections. Monthly household food expenditures are projected to increase by an average of 6% between 2017 and 2025 across all three sectors. The forecasted monthly food expenditures for 2025 are LKR 34,906 in the urban sector, LKR 30,405 in the rural sector, and LKR 33,368 in the estate sector. Furthermore, expenditures on meat, fish, and eggs in all sectors, as well as on pulses in the estate sector, are expected to rise significantly. Among the three sectors, the urban sector records the highest level of food expenditure, while the rural sector reports the lowest, with the estate sector positioned in between. It is therefore recommended to enhance food production and marketing facilities to improve food availability and to promote income-generating opportunities that can indirectly support food security.

Keywords: *Auto-Regressive, Food expenditure, Least-square estimation, White noise error term*

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1. Introduction

The study on food consumption expenditure pattern is very important as it is related to measuring the consumer or society or region of a country's behaviour. The consumption pattern is considered one of the most important indicators of economic development in a country. In theory, the change in consumption patterns is determined by price and income changes together with changes in tastes and preferences. As evident in most developing countries, food constitutes the largest share of household expenditure and within the food category, 'staple food' is the most dominant consumption category (Evita et al., 2011).

Consumption expenditure on food commodities serves as a key indicator of household living standards in developing countries such as Sri Lanka. Food expenditure also plays an important role in measuring poverty levels within the country. In addition to food, households incur expenditure on various non-food items such as electricity, clothing, furniture, housing, transport, and education, which together support different dimensions of human well-being. Therefore, analyzing consumption and consumption patterns provides valuable insights into the status and quality of a country's human resources. The analysis of food consumption across rural, urban, and estate sectors further helps to explain regional disparities and offers a sound basis for future investment planning and policy formulation.

In recent years, such studies have gained increased attention due to globalization and rising concerns about food security (Ahamad et al., 2015). Forecasting monthly food consumption expenditure patterns is crucial for ensuring food security, maintaining economic stability, and promoting social welfare. It enables policymakers, economists, and businesses to make informed decisions regarding production, pricing, and resource allocation. However, there remains a noticeable gap in the existing literature on forecasting food consumption patterns in Sri Lanka using robust and appropriate methodologies. This gap highlights the need for further research based on national data and relevant forecasting models. Accordingly, the main objective of this study is to determine the future trends of food consumption expenditure across urban, rural, and estate sectors in Sri Lanka. The central research question that guides this study is: How will monthly food consumption expenditure patterns evolve across urban, rural, and estate sectors in Sri Lanka?

2. Literature Review

The most relevant literature on forecasting future food consumption expenditure patterns using the Autoregressive Integrated Moving Average (ARIMA) model is reviewed. Many time series models can be used to forecast production or consumption patterns. However, more attention to time series models has been drawn for economically forecasting some agricultural productions instead of non-linear functions in recent times (Borkar, 2016). Among various time series models, the ARIMA model was widely employed to forecast domestic consumption and exports as a part of agricultural production (Amin et al., 2014). First, Ozen et al. (2019) studied the consumption of red meat in Turkey from 1993 to 2017 and adapted the ARIMA (0,1,0) model using Brown's exponential smoothing method. Johansen's method addressed the cointegration relationship between the per capita consumption of red meat and other variables. The results revealed that per capita consumption of red meat had an increasing trend. Given the relationship between the consumption of red meat and the level of economic development, the projections concerning red meat consumption were important from the viewpoint of the policies.

Further, Chopin and Darrat (2000) report that there is no consensus about the value of consumer confidence for forecasting consumer spending that was not already captured by economic fundamentals. If the changes in confidence precede changes in consumer behaviour, information on confidence could help explain consumer spending and will be useful for forecasting purposes. But if confidence changes after or simultaneously with other movements in the economy, then measures of consumer confidence add little to models designed to forecast the economy. Empirical work on the usefulness of consumer confidence in forecasting household spending showed mixed results. Carroll et al. (1994) and Bram and Ludvigson (1998) provided empirical evidence showing that lagged values of consumer confidence contain predictive information about United States household spending, while Acemoglu and Scott (1994) found similar results for United Kingdom consumption growth.

Berg and Bergstrom (1996) found that confidence has a significant effect on consumption in Sweden. Loundes and Scutella (2000) also found that consumer confidence is a useful indicator of consumption growth in Australia, particularly discretionary consumption, although it requires a much longer time frame for confidence to impact consumption compared to other studies. Fan and Wong (1998) on the other hand, found no evidence of explanatory power in forecasting consumption growth using consumer confidence indexes in Hong Kong and the United States respectively. Utaka (2003) found that in the case of Japan, consumer confidence has a short-term effect on economic fluctuations, but not in the long term.

Though there is a lack of studies recently identified on forecasting household food consumption expenditure in Sri Lanka using univariate and or multivariate time series models, some kinds of the literature identified for predicting consumable items. For example, Sivapathasundaram & Bogahawatte (2012) studied on forecasting of paddy production in Sri Lanka using the ARIMA (2,1,0) model. The authors utilized secondary annual data from the Department of Census and Statistics from 1952 to 2010. They forecasted paddy production from 2011 to 2013 periods. Furthermore, Kumarasinghe & Peiris (2018) predicted annual tea production in Sri Lanka using yearly data from 1964 to 2015. They used the ARIMA (1,2,0) model to forecast tea production up to 2020. Thattil & Walisinghe (2003) used ARIMA and regression models to predict Sri Lanka's paddy yields.

Recent overseas empirical work on the usefulness of consumer confidence in forecasting household spending showed mixed results. Bram and Ludvigson (1998) and Carroll et al (1994) provided empirical evidence showing that lagged values of consumer confidence contain predictive information about United States household spending, while Acemoglu and Scott (1994) found similar results for United Kingdom consumption growth. Berg and Bergstrom (1996) found that confidence has a significant effect on consumption in Sweden. Loundes and Scutella (2000) also found that consumer confidence is a useful indicator of consumption growth in Australia, particularly discretionary consumption, although it requires a much longer time frame for confidence to impact consumption compared to other studies.

3. Methodology

The design approaches of Household Income and Expenditure Surveys (HIES) were fully adopted in this study. The sample design of the survey was a two-stage stratified random sampling of Neymann allocation from Urban, Rural and Estate sectors. Each district was selected as the main domain used for the stratification. The sampling frame was the list of housing units prepared by the Census of Population and Housing in the prevailing survey years. Data were collected at the field in twelve consecutive monthly rounds to capture seasonal variations in income, expenditure and consumption of household’s weekly records. The data collection of the survey was done through direct interviews using a standard structured questionnaire.

Selection of Sample

A household is used as the sample unit and the district is selected as the study area. The study area is chosen by two conditions. First, it consists of all three sectors in each district; second, each district comprises a minimum of 5% of the population in each sector. According to the latest population of Sri Lanka by district and sector in 2012 given by Economic and Social Statistics of Sri Lanka, only four districts namely Badulla, Kandy, Nuwara-Eliya and Ratnapura districts were selected as the study area in this study with satisfying two conditions.

Sample Size

The sample size was estimated by HIES carried out by the Department of Census and Statistics, Sri Lanka in 1990/91, 1995/96, 2002, 2006/07, 2009/10, 2012/13 and 2016 periods in Badulla, Kandy, Nuwara Eliya and Ratnapura districts. Table 1 illustrates the distribution of the sample by district. It explains that the aggregated number of surveyed sample households selected for this study were Badulla - 6073; Kandy -

9026; Nuwara Eliya - 6045 and Ratnapura - 7175 districts. Totally 28,319 households were selected as samples for this study.

Table 1: Nos of Survey Sampled Households by Districts

HIES Survey Year	Nos of households surveyed				
	Badulla District	Kandy District	Nuwara-Eliya District	Ratnapura District	Total
2016	762	1315	813	1042	3932
2012/13	731	983	791	825	3330
2009/10	743	1010	615	871	3239
2006/07	762	1070	659	889	3380
2002	910	1610	736	1315	4571
1995/96	1119	1588	1488	1216	5411
1990/91	1046	1450	943	1017	4456
Total Households	**6,073**	**9,026**	**6,045**	**7,175**	**28,319**

Source: HIES Reports in 1990/91, 1995/96, 2002, 2006/07, 2009/10, 2012/13 and 2016

Table 2 shows the distribution of the sample by sector. It explains that the given seven HIES comprise 4108, 17667 and 6544 households selected in urban, rural and estate sectors respectively. A sum of 28319 households were selected for this study.

Table 2: Nos of Survey Sampled Households by Sectors

HIES Survey Year	Nos of households surveyed			
	Urban	Rural	Estate	Total
2016	323	2883	726	3932
2012/13	615	1830	885	3330
2009/10	509	1849	881	3239
2006/07	563	1946	871	3380
2002	579	3339	653	4571
1995/96	562	3300	1549	5411
1990/91	957	2520	979	4456
Total Households	**4,108**	**17,667**	**6,544**	**28,319**

Source: HIES Reports in 1990/91, 1995/96, 2002, 2006/07, 2009/10, 2012/13 and 2016

Data and Variables

Microdata were collected from the latest seven HIES mentioned in Table 1. The listed 112 food items in the food category of household expenditure were aggregated to provide ten food groups' monthly food expenditures separately. The main types of food groups were used in this study as (i) Rice (ii) Wheat flour (iii) Bread (iv) Pulses (v) Vegetables (vi) Meat (vii) Fish (viii) Egg (ix) Coconut and (x) Milk & Milk Products. Each food group consists of its food items listed in the HIES given below used in this study;

i. Rice: White Kekulu Normal, White Kekulu Samba, Red Kekulu Normal, Red Kekulu Samba, Samba, Nadu Red, Nadu White, Basmathi and Other Rice
ii. Wheat flour: Wheat Flour
iii. Bread: Normal Bread

iv. Pulses: Gram Dhal, Masoor Dhal, Watana Dhal, Green Gram, Gram, Red Cowpea, White Cowpea, Soya, Soya Meet, Other Pulses
v. Vegetables: Ash Plantain, Brinjal, Ladies Fingers, Bitter Gourd, Thuba Karivila, Long Beans, Snake Gourd, Ridge Gourd, Pumpkin, Beans, Carrot, Beetroot, Cabbage, Cauliflower, Tomatoes, Leeks, Knol Khol, Capsicum, Winged Bean, Radish, Drumstick, Cucumber, Cooking Melon, Ash Pumpkin, Wild Eggplant, Plate Brush, Kohila Yams, Lotus Stem, Plantain Flower, Ambarella, Raw Mango, Raw Cashew Nuts, Mushroom, Immature Jack, Other Vegetables, Mukunuwanna, Gotukola, Kankun, Kathurumurunga, Spinach, Thampala, Sarana, Kohila Leaves, Onion Leaves, Cabbage Leaves, Other Leaves, Jack & Jack Seed, Bread Fruit, Potatoes, Sweet Potato, Mannioc, Kiriala, Innala, Other Yams
vi. Meat: Chicken, Beef, Mutton, Pork
vii. Fish: Balaya, Seer, Shark, Paraw, Thalapath, Tuna (Kelawalla), Mullet, Other Large Fish, Sprats, Hurulla, Karalla / Katuwalla, Kumbala / Angila, Salaya / Sudaya, Other Small Fish, Lula, Theppli / Telapiya / Korali, Catla / Rohu, Other Fresh Water Fish
viii. Egg: Hen Eggs
ix. Coconut: Coconut Nuts
x. Milk & Milk Products: Cow Milk, Goat Milk, Sterilized Milk, Curd, Yoghurt, Condensed Milk, Milk Powder, Infant Milk Powder, Butter, Margarine, Cheese, Milk Packets, Other Liquid Milk

Monthly household data on ten food group expenditures and total food expenditure were utilized in this study. The data analysis was carried out using STATA 15 and EViews 10 statistical software. Monthly household expenditures on the ten food groups were forecasted for the period 2017–2025 using the Auto-Regressive (AR) model. Since the available data lacked regular frequency, all series were first interpolated using the linear approximation method, following the approach of Chow and Lin (1971) and Vinayagathasan (2014), to obtain regularly spaced data. Subsequently, the AR model was employed to generate forecasts for each series.

Auto Regressive Model

This study selected a univariate forecasting model to predict household food expenditures. The AR model was chosen for this study because it effectively captures the persistence and trend of food expenditure patterns over time, especially when limited historical data points are available. After converting the data to a regular frequency using the linear interpolation method, the AR model was applied to forecast future monthly food expenditures for each sector. This approach enables reliable short-term forecasting and provides valuable insights into the expected trajectory of household food spending in Sri Lanka. For that, the Auto-Regressive (AR) model describes a system whose status (dependent variable) depends linearly on its values. AR model with "P" lag i.e., AR(p) can be described as follows.

$$\boldsymbol{Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i Y_{t-i} + \varepsilon_t} \qquad (1)$$

where, β_i describes how much the system's status *i* steps ago will impact current values. Normally, one would expect β_i to decrease as *i* increase, that is, the events that happened further in the past have less impact on current events. Anything that happens earlier than *p* time steps ago will have no impact, and the model is noted as AR (*p*), where ε_t is a white noise error term that describes some random events that affect the status of the system. This error term is often required to be stationary to make lots of statistical estimators valid (least-square estimation, maximum-likelihood estimation etc.). In a very simple scenario, if *p* = 1, we have an AR (1) model where the system's current status is dependent only on the system's status one period step ago which can be defined as below;

$$\boldsymbol{Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t} \quad (2)$$

First Order Time Dependent Ordinary Differential Equation System

The purpose of using the ODE system is to model the time-dependent evolution of food expenditure more smoothly and continuously between discrete time intervals. This helps to capture gradual variations and eliminate abrupt fluctuations that may arise from irregular data frequencies or interpolation. By integrating the ODE framework with the AR model, the study improves the precision, continuity, and interpretability of the forecasts for monthly household food consumption expenditures across urban, rural, and estate sectors. The continuous version of the system can be represented in (2) as a first-order time-dependent ODE with a white noise error term: $\boldsymbol{\frac{dY}{dt} = \beta_0 + (\beta_1 - 1)Y + \varepsilon_t}$ (3)

Without considering the white noise error, the closed formula solution of the ODE is an exponential function:

$\boldsymbol{Y = constant * e^{(\beta_1 - 1)t} + \frac{\beta_0}{1-\beta_1}}$ (4)

It follows immediately that the status of the system will reach an equilibrium point $\frac{\beta_0}{1-\beta_1}$, if $\beta_1 < 1$, as the exponential term vanishes in the long term. Not surprisingly, this is also the expected behaviour of an AR(1) model in equilibrium status when $y_t = y_{t-1}$.

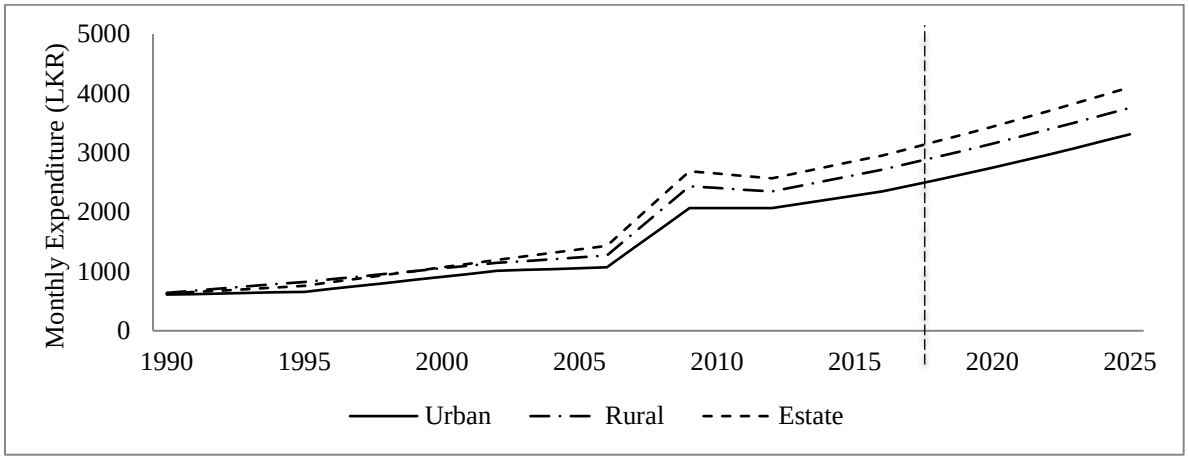
Now it is made the connection between the two systems, it becomes clear that the parameter $(1 - \beta_1)$ could be interpreted as a decay constant that describes how fast the system will reach a steady value as time elapses. When $\beta_1 < 1$, the AR(1) model is nothing more than a system that exponentially decays to a steady state from a certain initial value noted as *constant* in the close formula solution. On the other hand, is when $\beta_1 > 1$, the dependent variable will exponentially increase to a very large value.

4. Results and Discussions

Auto-Regressive (1) model and a first-order time-dependent Ordinary Differential Equation (ODE) system were utilized to forecast monthly household food consumption expenditure. Forecasting is conducted for the monthly food consumption expenditure across ten food groups from 2017 to 2025 in the urban, rural, and estate sectors. The unit of analysis is in nominal prices of food groups per household per month.

Forecasting of Rice

The results from the forecast of monthly household consumption expenditure on rice, as shown in Figure 1, indicate an anticipated annual increase of 4% from 2017 to 2025 across all three sectors. This increase is attributed to both price escalations and changes in the quantity of rice consumption. However, the forecasted monthly expenditure on rice is expected to be higher in the estate sector and lower in the urban sector. By 2025, the projected monthly household rice expenditure difference is LKR 448 between the urban and rural sectors and LKR 772 between the urban and estate sectors, indicating greater variations in rice expenditure in the estate sector. Specifically, the forecasted expenditure is projected to be LKR 2,747 in 2020 and LKR 3,311 in 2025 in the urban sector, LKR 3,153 in 2020 and LKR 3,759 in 2025 in the rural sector, and LKR 3,440 in 2020 and LKR 4,103 in 2025 in the estate sector.

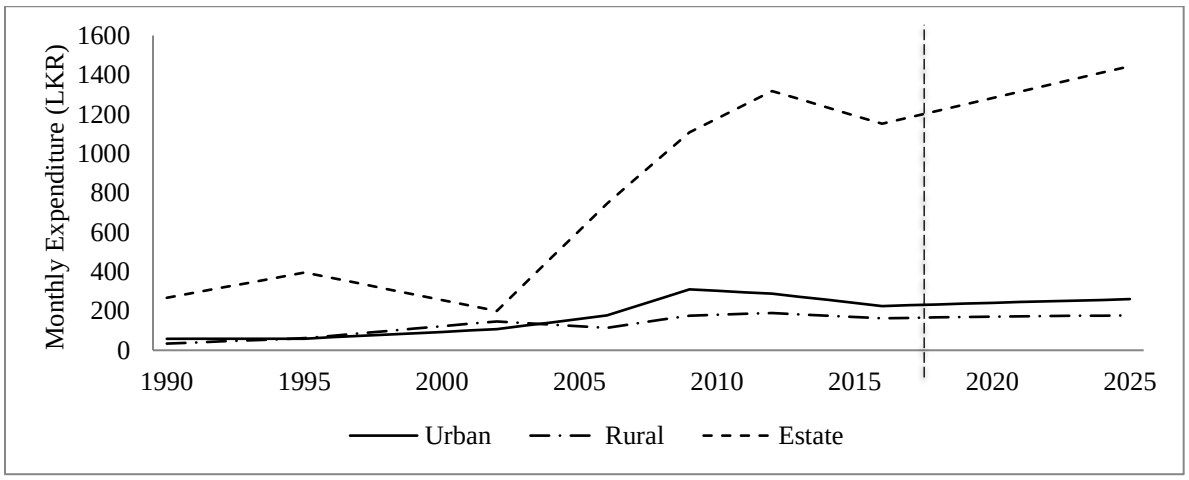


Source: Author's calculations

Figure 1: Forecasting Monthly Household Consumption Expenditure of Rice

Forecasting of Wheat Flour

Figure 2 illustrates that monthly household expenditures on wheat flour are projected to increase annually by 2%, 1%, and 3% in the urban, rural, and estate sectors, respectively, from 2017 to 2025, primarily due to price escalations.

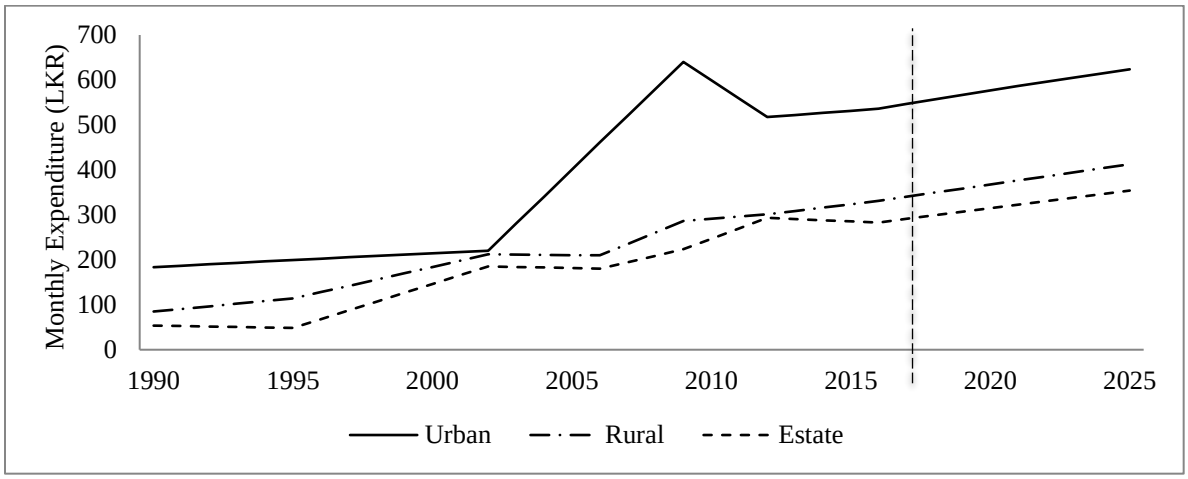


Source: Author's calculations

Figure 2: Forecasting Monthly Household Consumption Expenditure of Wheat Flour

It is forecasted that in the urban sector, wheat flour expenditure will be LKR 241 in 2020 and LKR 260 in 2025; in the rural sector, it will be LKR 171 in 2020 and LKR 178 in 2025; and in the estate sector, it will be LKR 1282 in 2020 and LKR 1444 in 2025. Monthly wheat flour expenditure is projected to be relatively higher in the estate sector and lower in the rural sector. The difference between the urban and rural sectors is LKR 82, and between the urban and estate sectors it will be LKR 1266 in 2025. Therefore, variations in wheat flour expenditure are more pronounced in the estate sector.

Forecasting of Bread



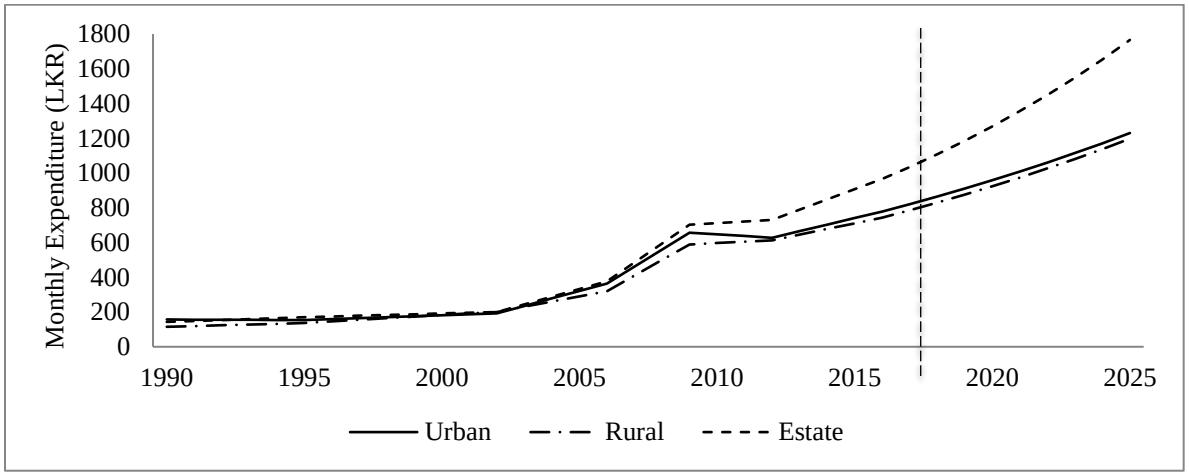
Source: Author's calculations

Figure 3: Forecasting Monthly Household Consumption Expenditure of Bread

Figure 3 illustrates that monthly household bread expenditures are projected to increase annually by 2% in the urban and rural sectors, and by 3% in the estate sector from 2017 to 2025 due to price escalation. It is forecasted to be LKR 577 (2020) and LKR 624 (2025) in the urban sector, LKR 367 (2020) and LKR 412 (2025) in the rural sector, and LKR 315 (2020) and LKR 354 (2025) in the estate sector. The forecast suggests a comparatively higher monthly expenditure on bread within the urban sector, while the estate sector is expected to exhibit a lower level of monthly bread expenditure. The projected differences in monthly household bread expenditure between the estate and rural sectors are LKR 58, and between the urban and estate sectors, it is LKR 270 in 2025. Thus, variations in bread expenditure are more pronounced in the urban sector.

Forecasting of Pulses

Monthly household pulses expenditures are expected to increase by 5% annually in urban and rural sectors but average 7% annually in the estate sector from 2017 to 2025. It is attributed to price escalation and changes in consumption quantity. The forecasted monthly household expenditures on pulses are projected to be LKR 958 in 2020 and LKR 1230 in 2025 in the urban sector, LKR 923 in 2020 and LKR 1198 in 2025 in the rural sector, and LKR 1268 in 2020 and LKR 1766 in 2025 in the estate sector. However, monthly pulse expenditures are forecasted to be relatively higher in the estate sector and lower in the urban sector. The projected difference in monthly household pulse expenditures between the urban and rural sectors is LKR 32, while it is LKR 568 between the rural and estate sectors in 2025. Thus, variations in pulse expenditures are relatively more pronounced in the estate sector.

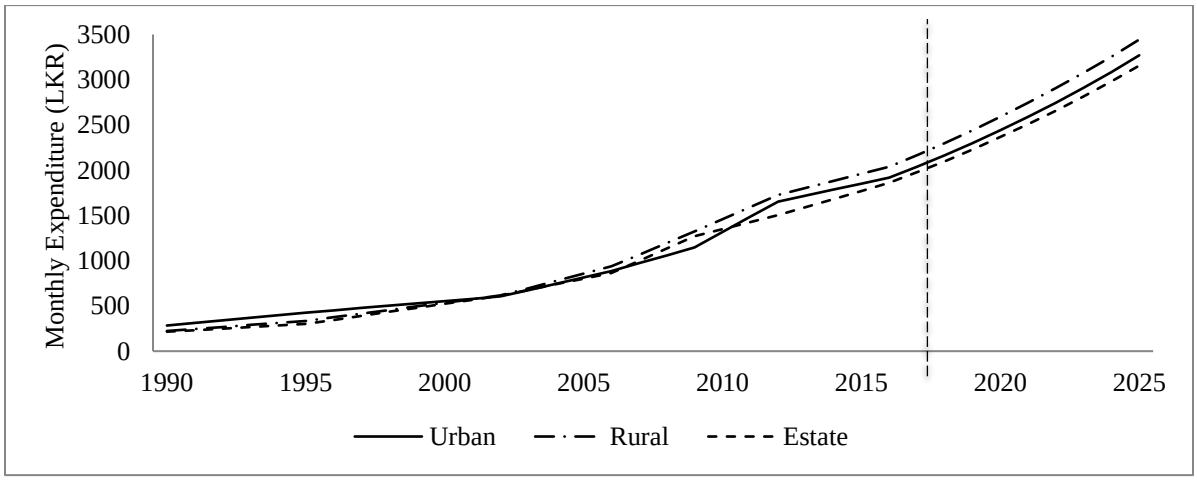


Source: Author's calculations

Figure 4: Forecasting Monthly Household Consumption Expenditure of Pulses

Forecasting of Vegetables

Forecasting the monthly household consumption expenditure on vegetables reveals an expected annual increase of 6% in urban, rural, and estate sectors from 2017 to 2025, attributed to price escalation and changes in consumption quantity. In 2020, the forecasted expenditures are LKR 2440, LKR 2589, and LKR 2365 in the urban, rural, and estate sectors, respectively. By 2025, these figures are projected to rise to LKR 3270, LKR 3444, and LKR 3156 in the urban, rural, and estate sectors, respectively. However, the forecasted monthly vegetable expenditure is relatively higher in the rural sector and lower in the estate sector. The difference in forecasted monthly household vegetable expenditure between the urban and estate sectors is LKR 114, and between the rural and estate sectors, it is LKR 288 in 2025. Thus, greater variations in vegetable expenditure were observed in the estate sector.

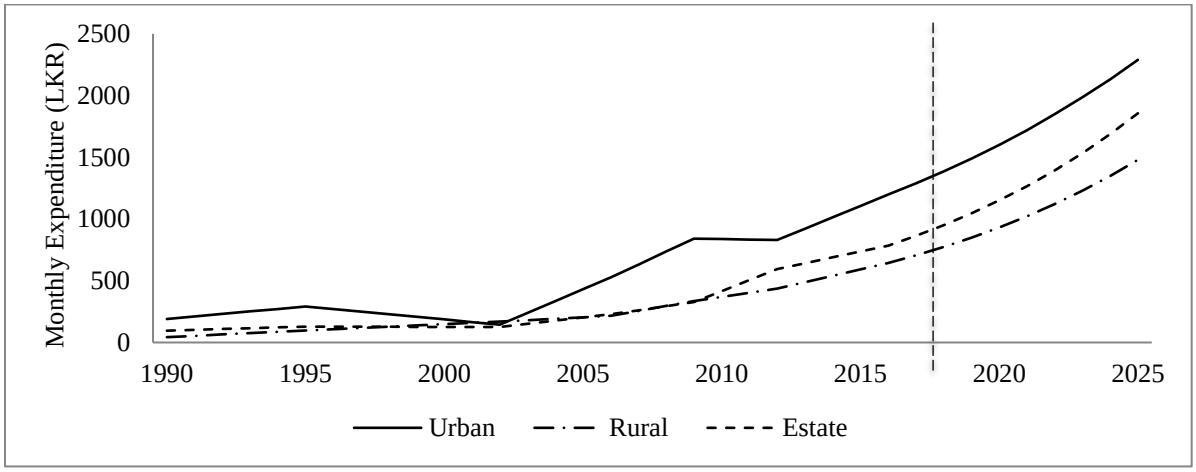


Source: Author's calculations

Figure 5: Forecasting Monthly Household Consumption Expenditure of Vegetable

Forecasting of Meat

It is projected that monthly household meat expenditures will increase by an average of 7% annually in the urban sector and 10% annually in the rural and estate sectors from 2017 to 2025 due to price escalation and changes in consumption quantity. In 2020, it is forecasted to be LKR 1601 and LKR 2289 in 2025 in the urban sector, LKR 932 and LKR 1479 in 2020 and 2025 in the rural sector, and LKR 1151 and LKR 1856 in 2020 and 2025 in the estate sector, respectively. However, monthly meat expenditure is forecasted to be relatively higher in the urban sector and lower in the rural sector. The forecasted monthly household meat expenditure difference between the estate and rural sectors is LKR 377, and between the urban and rural sectors, it is LKR 810 in 2025. Thus, greater variations in meat expenditure were observed in the urban sector.

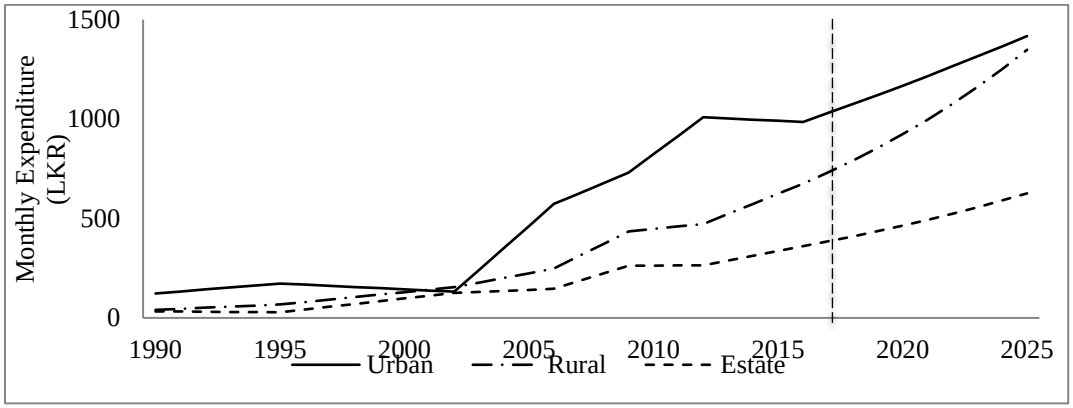


Source: Author's calculations

Figure 6: Forecasting Monthly Household Consumption Expenditure of Meat

Forecasting of Fish

Forecasting monthly household consumption expenditure on fish indicates that expenditures are expected to increase annually by 4% in the urban sector, 8% in the rural sector, and 6% in the estate sector from 2017 to 2025, driven by price escalation and changes in consumption quantity.



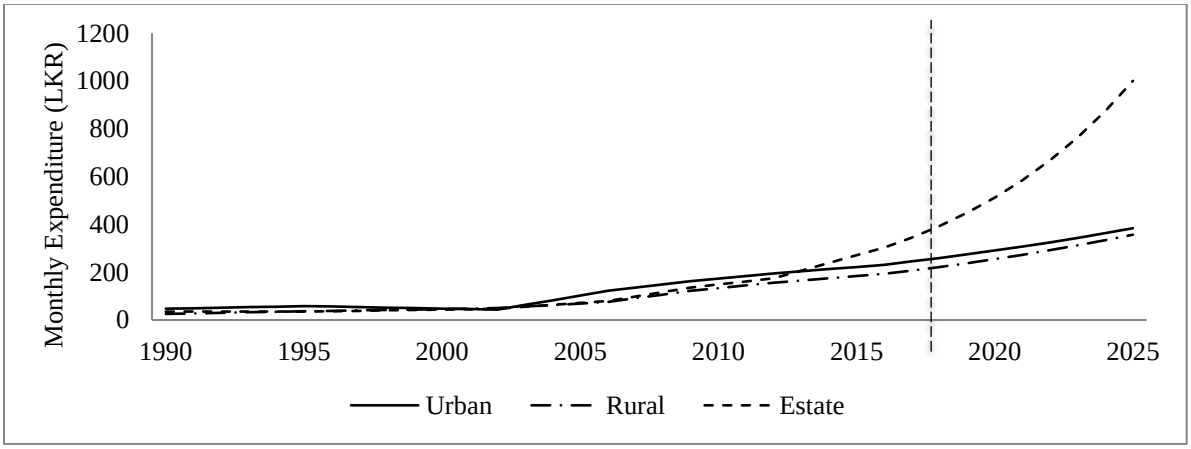
Source: Author's calculations

Figure 7: Forecasting Monthly Household Consumption Expenditure of Fish

In 2020, it is forecasted to be LKR 1168, LKR 923, and LKR 464; in 2025, LKR 1417, LKR 1348, and LKR 626 in the urban, rural, and estate sectors, respectively. However, the urban sector shows relatively higher forecasted monthly fish expenditure, while the estate sector shows lower expenditure. The forecasted monthly household fish expenditure difference between the estate and rural sectors is LKR 722, and between the urban and estate sectors, it is LKR 791 in 2025. Therefore, relatively greater variations in fish expenditure are observed in the urban sector.

Forecasting of Egg

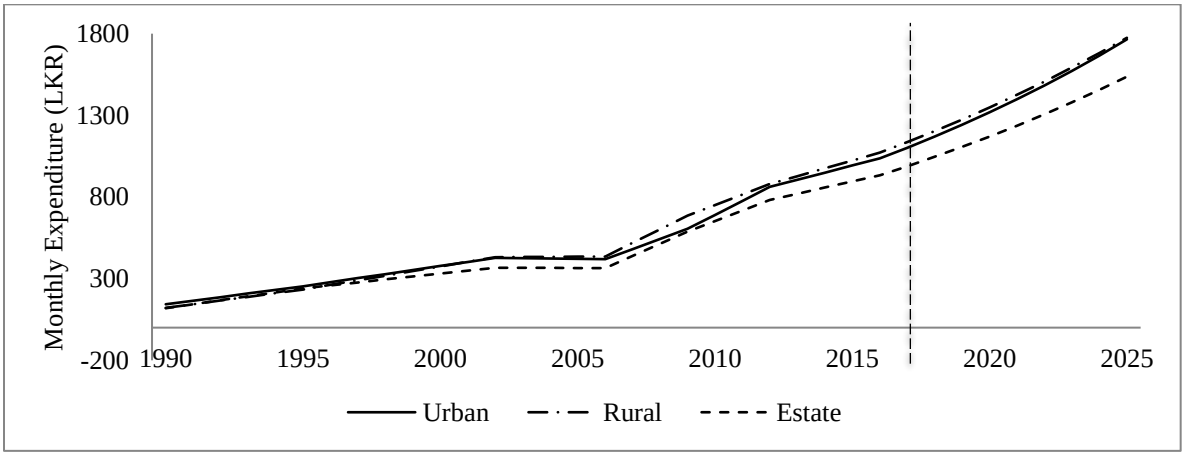
The forecasting of monthly household consumption expenditures indicates that monthly household egg expenditures are expected to increase annually by 6% in the urban sector, 7% in the rural sector, and 14% in the estate sector from 2017 to 2025 due to price escalation. It is forecasted that in 2020, egg expenditures will be LKR 291 in the urban sector and LKR 255 in the rural sector, increasing to LKR 384 and LKR 357, respectively, by 2025. In the estate sector, expenditures are expected to rise from LKR 512 in 2020 to LKR 1001 in 2025. However, relatively higher monthly food expenditures are forecasted in the estate sector compared to the rural sector. The forecasted difference in monthly household egg expenditures between the urban and rural sectors is LKR 27, and between the urban and estate sectors it is LKR 644 in 2025. Thus, relatively greater variations in egg expenditures were observed in the estate sector.



Source: Author's calculations

Figure 8: Forecasting Monthly Household Consumption Expenditure of Egg

Forecasting of Coconut



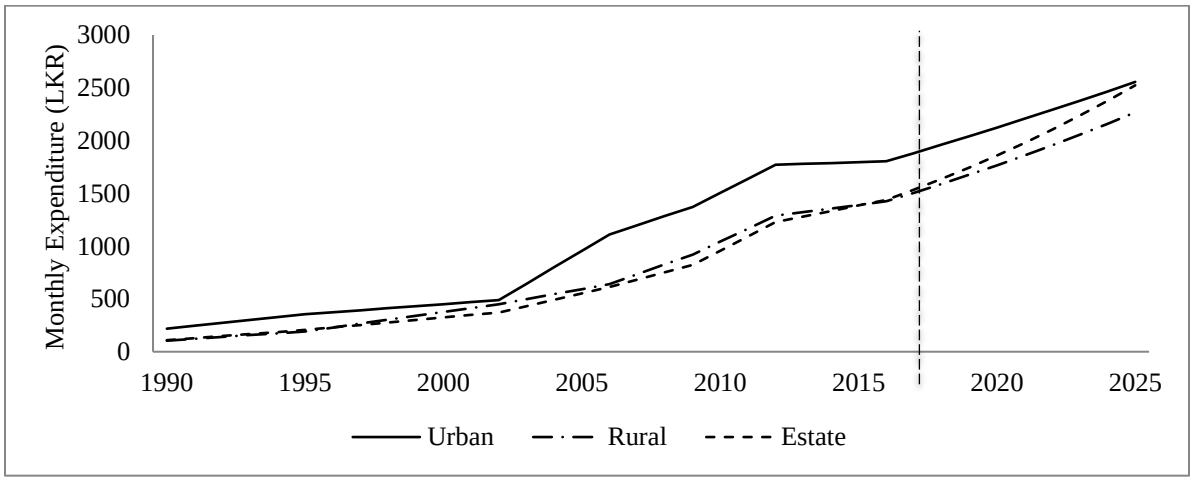
Source: Author's calculations

Figure 9: Forecasting Monthly Household Consumption Expenditure of Coconut

Figure 4.44 depicts that monthly household coconut expenditures are expected to increase by 6% annually in all sectors from 2017 to 2025. It is forecasted that coconut expenditures will be LKR 1318 in 2020 and LKR 1765 in 2025 in the urban sector, LKR 1348 in 2020 and LKR 1775 in 2025 in the rural sector, and LKR 1170 in 2020 and LKR 1537 in 2025 in the estate sector. It is attributed to price escalation and changes in consumption quantity. Relatively higher monthly coconut expenditure is forecasted in the rural sector and lower in the estate sector. The forecasted monthly household coconut expenditure difference between the estate and rural sectors is LKR 238, and between the urban and estate sectors is LKR 228 in 2025. Thus, greater variations in coconut expenditure were observed in the rural sector.

Forecasting of Milk and Milk Products

Monthly household expenditures on milk and milk products are expected to increase by 4%, 5%, and 6% annually in urban, rural, and estate sectors, respectively, from 2017 to 2025. It is forecasted to be LKR 2123 in 2020 and LKR 2556 in 2025 in the urban sector, LKR 1766 in 2020 and LKR 2268 in 2025 in the rural sector, and LKR 1858 in 2020 and LKR 2523 in 2025 in the estate sector. The reasons for this increase are price escalation and changes in consumption quantity. However, monthly expenditure on milk and milk products is forecasted to be relatively higher in the urban sector and lower in the estate sector. The forecasted monthly household expenditure difference between the estate and rural sectors is LKR 255, and between the urban and estate sectors is LKR 288 in 2025. Thus, greater variations in expenditure on milk products were observed in the urban sector.



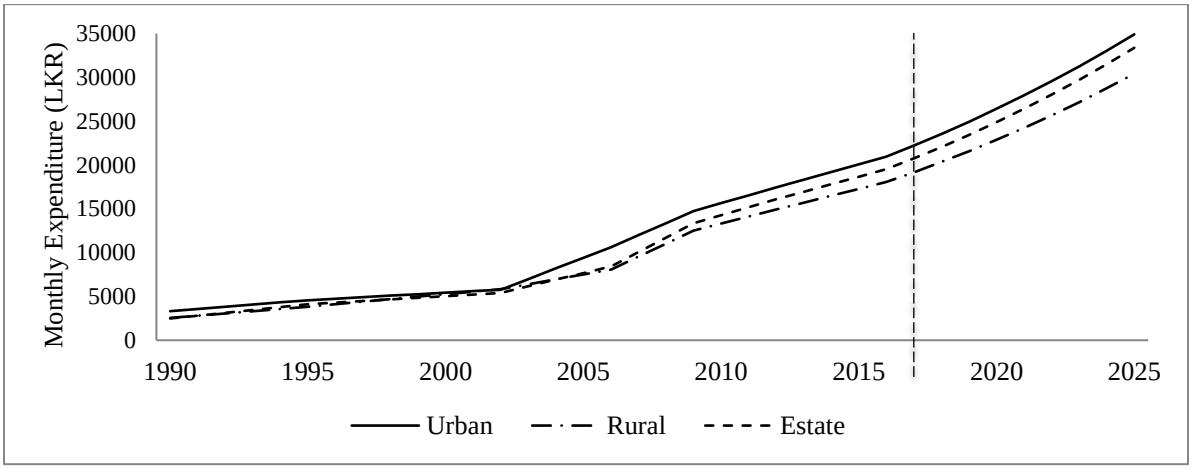
Source: Author's calculations

Figure 10: Forecasting Monthly Household Consumption Expenditure of Milk and Milk Products

Forecasting of Monthly Food Expenditure

The forecasting of monthly household food consumption expenditure obtained by AR (1) and a first-order time-dependent ODE system is presented graphically below. It illustrates that monthly household food expenditures are expected to increase on average by 6% annually from 2017 to 2025 in all three sectors. Price escalation and changes in consumption quantity are the reasons for the expenditure increases. It is forecasted to be LKR 26,406 in 2020 and LKR 34,906 in 2025 in the urban sector, LKR 22,870 in 2020 and LKR 30,405 in 2025 in the rural sector, and LKR 24,884 in 2020 and LKR 33,368 in 2025 in the estate sector. However, monthly food expenditure is forecasted to be relatively higher in the urban sector and lower in the

rural sector. The forecasted monthly household food expenditure difference between the estate and rural sectors is LKR 2,963, and between the urban and rural sectors it will be LKR 4,501 in 2025. Thus, relatively fewer variations in monthly household food expenditure were observed in the rural sector.



Source: Author's calculations

Figure 11: Forecasting Monthly Household Food Consumption Expenditure

5. Summary

The expenditure forecasts for the period 2017-2025 reveal a differentiated pattern across sectors. Urban households are expected to allocate comparatively higher monthly expenditures to bread, meat, fish, and milk. Conversely, estate sector households are projected to have relatively higher monthly spending on rice, wheat flour, pulses, and eggs. Finally, rural households are anticipated to exhibit higher monthly expenditures for vegetables and coconut. The main reasons for these increases are price escalation and changes in consumption quantity. Conversely, monthly food expenditures are expected to be relatively lower for rice in the urban sector; wheat flour, pulses, meat, eggs, and milk in the rural sector; and bread, vegetables, fish, and coconut in the estate sector. These are attributed to the study area's household behaviour, religious traditions, customs, and economic activities. Monthly expenditures on all ten food groups are expected to increase from 2017 to 2025 in all three sectors. Specifically, among the food groups, expenditures on wheat flour, pulses, and eggs in the estate sector; bread, meat, and fish in the urban sector; as well as fish in the rural sector are projected to increase relatively more. Wheat flour in the estate sector and bread in the urban sector are anticipated to dominate the highest increase in monthly expenditures within their respective food categories. Overall, monthly household food consumption expenditure is expected to increase by an average of 6% in all three sectors, contributing to an overall rise in household monthly consumption expenditure over the next six years. Moreover, the applied AR (1) model and First Order Time Dependent ODE system are deemed suitable and provide better results for forecasting monthly food consumption in this study.

Conclusions and Policy Implications

According to the forecasted values for the period 2017 – 2025, monthly household food expenditures are expected to be relatively more for bread, meat, fish and milk in the urban sector; for rice, wheat flour, pulses and egg in the estate sector and vegetable and coconut in the rural sector. The monthly food expenditure is relatively expected to be less, rice for urban, wheat flour, pulses, meat, egg and milk in the rural sector, and bread, vegetables, fish and coconut in the estate sectors.

Monthly expenditures on all ten groups of foods are expected to increase from 2017 to 2025 in all three sectors. However, the monthly expenditures of wheat flour, pulses and egg in the estate sector; bread, meat and fish in the urban sector; and fish in the rural sector are expected to increase. Further, the expenditures on wheat flour in the estate sector and bread in the urban sector will be monthly predominant expenditures in their food basket.

Monthly consumption expenditures on meat, fish and egg are expected to increase more in all three sectors and expenditures on pulses are also expected to increase largely in the estate sector. Further, monthly household food consumption expenditure will be expected to increase by an average of 6% in all three sectors. Since it is expected to increase the overall household monthly consumption expenditure in the next six years, policymakers must find some remedies to overcome this situation. It may be concluded from the findings of this study that to meet the growing demand for food commodities, where there is a need to enhance production, a need to develop processing and marketing facilities for the essential food commodities. Developing production and marketing facilities to improve food availability and providing better income opportunities indirectly are two strategies recommended by this study. Moreover, the applied AR (1) model and First Order Time Dependent ODE system are more suited and appropriate in this study and provide better results in forecasting monthly food consumption.

Competing Interests: The authors declare that they have no competing interests.

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