

A Probit Model Analysis in Determinants of Household Expenditure on Different Food Items at Household Level in Rural and Urban Areas of Tamil Nadu

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Abstract

The estimated probit functions on the determinants of probability of consumption of different food groups indicated the variables such as per capita household expenditure and household size were positively determining the probability of consumption in all the food groups except milk and pulses, both in urban and rural households. Education was determining the probability of consumption of milk, fish and fruits positively in rural households, while its influence on the probability of consumption of cereals, pulses, meat, vegetables and spices was negative in urban households; Age variable was found to influence the probability of consumption of milk positively in rural households and negatively determining the probability of consumption of edible oil and meat both in rural and urban households. Presence of refrigerator, vehicle and owned dwelling unit were found non-significant in determination of the probability of consumption of most of the food items.

Keywords:probit, determinants, household, consumption, NSSO

I. INTRODUCTION

Food has been a basic part of our existence and food nourishes the body. Food may be viewed as anything eaten or drunk, which meets the needs for energy, building, regulation and protection of the body. In short, food is the raw material from which our bodies are made. Intake of the right kind and amount of food can ensure good nutrition and health, which may be evident in our appearance, efficiency and emotional wellbeing. According to the report of Global Footprint Network (2012), if the current population and consumption trends continue, humanity will need the equivalent of two earths to support it by 2030. The world currently produces enough food for its citizens (FAO, 2011). Kumar et.al., (2011) examined the food demand in India. The result revealed that the productivity of food grains showed a positive growth and it increased from 2.67 percent in 1961-70 to 6.72 percent in 2001-2010. Production

also showed a positive growth and it increased from 4.13 percent to 5.70 percent in the same period. The Tamil Nadu government has fixed a production target of 120 lakh tonnes of food grains in 2013. However, Tamil Nadu achieved a food grain production of 110.65 lakh tonnes (LT) in 2013-14. Taking into consideration the above facts, the present study was undertaken to identify the determinants of consumption of different food items across different groups of households in Tamil Nadu.

II. MATERIALS AND METHODS

The study was based on the secondary data collected from NSSO household consumer expenditure survey (unit level data) 68th round was used to extract the necessary data required for the study. Probit (limited dependent variable analysis) function was employed to identify the determinants of probability of consumption of different food items in rural and urban households of Tamil Nadu. The binary dependent variable 'y' takes on the values of zero and one. The outcomes of y are mutually exclusive and exhaustive. The dependent variable, y, depends on observable variables x_k where $k=1, \dots, K$. While the values of zero and one were observed for the dependent variable in the probit model, there was a latent, unobserved continuous variable, y^* .

$$y^* = \sum_{k=1}^k \beta_k X_k + \varepsilon$$

ε is IN $(0, \sigma^2)$. The dummy variable, y, was observed and was determined by y^* as follows.

$$y = \begin{cases} 1 & \text{if } y^* > 0, \\ 0 & \text{otherwise} \end{cases}$$

Otherwise, The point of interest relates to the probability that y equals one.

From the above equations, we see that:

$$\begin{aligned} \text{Prob}(y=1) &= \text{Prob}\left(\sum_{k=1}^k \beta_k X_k + \varepsilon > 0\right) \\ &= \text{Prob}\left(\varepsilon > -\sum_{k=1}^k \beta_k X_k\right) \\ &= 1 - \Phi\left(-\sum_{k=1}^k \beta_k X_k\right) \end{aligned}$$

where, Φ was the cumulative distribution function of error term ε . The probit model assumed that the data were generated from a random sample of size N with a sample observation denoted by i , $i = 1, \dots, N$. Thus the observations of y must be statistically

independent of each other to rule out serial correlation. Additionally it was assumed that the independent variables were random variables.

Household character variables used in the Probit

Household size (HHS): in numbers. It indicates the inverse relation between household size and per capita expenditure on food items and in turn on the allocation of budget on food items.

Regular Salary Earners (RSE): 1 if there is RSE in household; 0 if there is no RSE in household. It surrogates the improvement in income and possibility of reallocation of resources on food items

Education (Edu): Number of years It surrogates the level of understanding of the nutritional status of food items there by influence the consumption.

Age (Ag): Number of years – It is an indicator representing the stage of household life cycle

Sex (S): 1 for the male headed households; 0 for female headed households.- It represents the rational and speedy decision making on the allocation of expenditure on various food items in the house

Presence of refrigerator: 1 for household having refrigerator; 0 for households not having refrigerator It surrogates the possibility of use high valued food commodities and processed foods in the house hold .

Presence of low weight vehicles (V): 1 for household having vehicle; 0 for household not having vehicles. It surrogates the use of high value products by way of access to it through mobility

Ownership of Dwelling Unit (DU): 1 for the household owning dwelling unit, 0 for household not owning dwelling unit It represent the possibility of producing and processing commodities there by influencing the consumption of food items in the household.

It was the first step in the two step estimation procedure for QUAIDS as given by Shonkwiler and Yen (1999) for estimating the system of equations. The variables used in probit model are presented above.

III. RESULTS AND DISCUSSION

Determinants of Household Expenditure on Different Food Items at Household Level in Rural and Urban Areas of Tamil Nadu

A. Determinants of Cereals Consumption Pattern in Tamil Nadu

Table 1. Estimated coefficients of probit function for cereals in rural and urban Tamil Nadu.

Cereals	Rural		Urban	
	Coefficien t	t - ratio	Coefficien t	t - ratio
Income	0.014*	2.03	0.127**	5.20
HHS	0.002*	2.07	0.015**	4.88

RSE	-0.001 ^{NS}	-0.51	0.002 ^{NS}	0.44
Edu	0.000 ^{NS}	-1.64	-0.004**	-3.51
Sex	-0.002 ^{NS}	-0.89	-0.042*	-2.27
Age	0.000 ^{NS}	0.98	0.000 ^{NS}	1.27
Fridge	0.000 ^{NS}	0.23	-0.015*	-2.11
Vehicles	0.000 ^{NS}	-0.26	0.005 ^{NS}	1.35
DU	0.001 ^{NS}	0.36	0.005 ^{NS}	1.67
Constan t	0.999**	8	0.771**	7

RURAL N = 3291, R² = 0.653, F (21, 3269) = 6.24*, **URBAN** N = 3164, R² = 0.762, F (21, 3142) = 8.35*

** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance

Household characters which determents the cereals consumption in rural and urban Tamil Nadu is given in the Table 1. The comparative analysis on the determinants of consumption of cereals between rural and urban households revealed that the variables such as per capita household expenditure and household size were positively determining the probability of cereal consumption in both households, while the variables such as sex of the head, presence of refrigerators and level of education were negatively determining the probability of cereal consumption in urban households.

B. Determinants of Pulses Consumption Pattern in Tamil Nadu

Table 2. Estimated coefficients of probit function for pulses in rural and urban Tamil Nadu

Pulses	Rural		Urban	
	Coefficien t	t - ratio	Coefficien t	t - ratio
Income	0.014*	2.03	0.127**	5.20
HHS	0.002*	2.07	0.015**	4.88
RSE	-0.001 ^{NS}	-0.51	0.002 ^{NS}	0.44
Edu	0.000 ^{NS}	-1.64	-0.004**	-3.51
Sex	-0.002 ^{NS}	-0.89	-0.042*	-2.27
Age	0.000 ^{NS}	0.98	0.000 ^{NS}	1.27
Fridge	0.000 ^{NS}	0.23	-0.015*	-2.11
Vehicle	0.000 ^{NS}	-0.26	0.005 ^{NS}	1.35
DU	0.001 ^{NS}	0.36	0.005 ^{NS}	1.67
Constan t	0.999**	0	0.771**	7

RURAL N = 3291, R² = 0.584, F (21, 3269) = 8.31*, **URBANN** = 3164, R² = 0.917, F (21, 3142) = 9.72*

** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the pulses consumption in rural and urban Tamil Nadu is given in the Table 2. Comparative analysis on the determinants of consumption of pulses between rural

and urban households revealed that the per capita household expenditure in the case of rural household and the per capita household expenditure and household size in the case of urban households were positively determining the probability of pulses consumption in Tamil Nadu, while the variables such as sex of the head, presence of refrigerators and level of education were negatively determining the probability of pulses consumption in urban households.

C. Determinants of Milk Consumption Pattern in Tamil Nadu

Table 3. Estimated coefficients of probit function for Milk in rural and urban Tamil Nadu

Milk	Rural		Urban	
	Coefficient	t - ratio	Coefficient	t - ratio
Income	0.150**	4.96	0.007 ^{NS}	0.39
HHS	0.013 ^{NS}	1.59	0.008 ^{NS}	1.27
RSE	-0.004 ^{NS}	-	-0.035*	-
Edu	0.009*	2.25	0.006*	2.18
Sex	0.042 ^{NS}	1.03	-0.003 ^{NS}	-
Age	0.002**	2.43	0.001 ^{NS}	0.91
Fridge	-0.088 ^{NS}	-	0.038 ^{NS}	0.64
Vehicles	0.031 ^{NS}	1.31	0.006 ^{NS}	0.36
DU	-0.021 ^{NS}	-	-0.012 ^{NS}	-
Constant	2.757**	5.12	1.866*	3.08

RURAL N = 3291, R² = 0.642, F (21, 3269) = 15.70*, URBAN N = 3164, R² = 0.754, F (21, 3142) = 4.64*
 ** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the fluid milk consumption in rural and urban Tamil Nadu is given in the Table 3. The comparative analysis on the determinants of consumption of milk between rural and urban households revealed that the per capita household expenditure, education in years and refrigerator dummy in the case of rural households and education in years in the case of urban households were positively determining the probability of milk consumption in households, while the variables such as regular salary earners was negatively determining the probability of milk consumption in urban households.

D. Determinants of Fresh Fruits Consumption Pattern in Tamil Nadu

Table 4. Estimated coefficients of probit function for Fresh fruits in rural and urban Tamil Nadu

Fresh	Rural	Urban
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Fruits	Coefficient	t - ratio	Coefficient	t - ratio
Income	0.464**	13.35	0.255**	5.79
HHS	0.046**	5.24	0.026**	3.25
RSE	0.074*	2.14	-0.027 ^{NS}	-
Edu	0.009*	2.18	0.026**	6.47
Sex	0.042 ^{NS}	1.15	0.156**	3.70
Age	-0.002*	-2.24	0.001 ^{NS}	0.86
Fridge	-0.035 ^{NS}	-0.48	0.094 ^{NS}	1.45
Vehicles	0.029 ^{NS}	1.08	0.014 ^{NS}	0.53
DU	0.005 ^{NS}	0.13	-0.024 ^{NS}	-
Constant	0.569 ^{NS}	0.96	-0.859 ^{NS}	-

RURAL N = 3291, R² = 0.701, F (21, 3269) = 47.02*, URBAN N = 3164, R² = 0.843, F (21, 3142) = 33.80*
 ** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the fresh fruits consumption in rural and urban Tamil Nadu is given in the Table 4. The comparative analysis on the determinants of consumption of fresh fruits between rural and urban households revealed that the per capita household expenditure, household size and education in years both in rural and urban households were positively determining the probability of fresh fruits consumption in households, while the presence of regular salary earners in the case of rural households and presence of male as head in the case of urban households were positively determining the probability of fresh fruits consumption. The variable age in years was negatively determining the probability of fresh fruits consumption in rural households.

E. Determinants of Edible oil Consumption Pattern in Tamil Nadu

Table 5. Estimated coefficients of probit function for oil in rural and urban Tamil Nadu

Edible oil	Rural		Urban	
	Coefficient	t - ratio	Coefficient	t - ratio
Income	0.392**	9.54	0.387**	13.17
HHS	0.046**	3.90	0.014**	4.70
RSE	0.010 ^{NS}	0.29	0.004 ^{NS}	0.52
Edu	-0.002 ^{NS}	-0.39	-0.004 ^{NS}	1.08
Sex	0.043 ^{NS}	0.87	-0.005 ^{NS}	-0.11
Age	-0.005**	-4.61	0.069**	5.08
Fridge	-0.144 ^{NS}	-1.21	-0.024 ^{NS}	1.00
Vehicles	0.003 ^{NS}	0.09	0.011 ^{NS}	-0.91
DU	-0.030 ^{NS}	-0.68	0.560 ^{NS}	0.41

Constant	0.638 ^{NS}	0.80	0.040 ^{NS}	0.91
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RURAL N = 3291, R² = 0.690, F (21, 3269) = 10.86*, **URBAN** N = 3164, R² = 0.813, F (21, 3142) = 15.42*
 ** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the edible oil consumption in rural and urban Tamil Nadu is given in the Table 5. The comparative analysis on the determinants of consumption of edible oils between rural and urban households revealed that the per capita household expenditure and household size both in rural and urban households were positively determining the probability of edible oils consumption, while the variable such as age in years was negatively determining the probability of edible oils consumption both in rural and urban households.

F. Determinants of Vegetables Consumption Pattern in Tamil Nadu

Table 6. Estimated coefficients of probit function for vegetables in rural and urban TamilNadu

Vegetabl e	Rural		Urban	
	Coefficient	t - ratio	Coefficien t	t - ratio
Income	0.016*	2.32	0.131**	5.40
HHS	0.002*	2.30	0.016**	5.09
RSE	-0.001 ^{NS}	-0.50	0.003 ^{NS}	0.72
Edu	-0.000 ^{NS}	-1.87	-0.004**	-3.35
Sex	-0.002 ^{NS}	-1.09	-0.041*	-2.23
Age	0.000 ^{NS}	0.73	0.000 ^{NS}	0.91
Fridge	0.000 ^{NS}	0.21	0.016*	2.19
Vehicles	-0.000 ^{NS}	-0.15	0.006 ^{NS}	1.54
DU	0.000 ^{NS}	0.24	0.003 ^{NS}	1.27
Constant	1.002*	88.03	0.771**	10.21

RURAL N = 3291, R² = 0.741, F (21, 3269) = 3.24*, **URBANN** = 3164, R² = 0.834, F (21, 3142) = 2.38*
 ** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the vegetable consumption in rural and urban Tamil Nadu is given in the Table 6. Comparative analysis on the determinants of consumption of vegetables between rural and urban households revealed that the per capita household expenditure and household size in both rural and urban households were positively determining the probability of vegetables consumption, while age in years was positively determining the probability of vegetables consumption in rural households. The variables such as education in years, presence of male head and the presence of reFridgerator were negatively determining the probability of vegetable consumption in urban households.

G. Determinants of Meat Consumption Pattern in Tamil Nadu

Table 7. Estimated coefficients of probit function for meat in rural and urban Tamil Nadu

Meat	Rural		Urban	
	Coefficient	t - ratio	Coefficien t	t - ratio
Income	0.573**	13.15	0.538**	14.13
HHS	0.077**	8.37	0.055**	5.19
RSE	0.004 ^{NS}	0.12	0.008 ^{NS}	0.32
Edu	-0.009*	-1.98	-0.011**	-2.78
Sex	-0.009 ^{NS}	-0.22	-0.051 ^{NS}	-1.41
Age	-0.002*	-2.09	-0.006**	-5.96
Fridge	-0.069 ^{NS}	-0.61	0.154**	2.62
Vehicles	0.021 ^{NS}	0.65	-0.025 ^{NS}	-1.00
DU	0.010 ^{NS}	0.21	-0.032 ^{NS}	-1.29
Constant	2.238 ^{NS}	3.06	1.375*	2.05

RURAL N = 3291, R² = 0.645, F (21, 3269) = 19.98*, **URBAN** N = 3164, R² = 0.912, F (21, 3142) = 17.99*
 ** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the meat consumption in rural and urban Tamil Nadu is given in the Table 7. The comparative analysis on the determinants of consumption of meat between rural and urban households revealed that the per capita household expenditure and household size both in rural and urban households were positively determining the probability of meat consumption, while the variables such as level of education and age in years were negatively determining the probability of meat consumption in rural and urban households as well. The co-efficient of the variable such as the presence of reFridgerator was positively determining the probability of meat consumption in urban households.

H. Determinants of Fish Consumption Pattern in Tamil Nadu

Table 8. Estimated coefficients of probit function for fish in rural and urban Tamil Nadu

Fish	Rural		Urban	
	Coefficient	t - ratio	Coefficient	t - ratio
Income	0.245**	7.38	0.168**	7.95
HHS	0.036**	6.33	0.0247**	6.76
RSE	0.003 ^{NS}	0.15	0.006 ^{NS}	0.39
Edu	0.008*	2.51	0.003 ^{NS}	1.19
Sex	0.038 ^{NS}	1.71	-0.004 ^{NS}	-0.20
Age	-0.000 ^{NS}	-0.40	-0.000 ^{NS}	-1.10
Fridge	0.036 ^{NS}	1.46	-0.009 ^{NS}	-0.76

Vehicles	0.040 ^{NS}	1.91	0.023 ^{NS}	1.68
DU	0.006 ^{NS}	0.19	-0.022 ^{NS}	-1.57
Constant	0.258 ^{NS}	0.49	0.313 ^{NS}	1.37

RURAL N = 3291, R² = 0.723, F (21, 3269) = 6.45*, URBAN N = 3164, R² = 0.732, F (21, 3142) = 5.06*

** Indicates significant at 1% level of significance and * Indicates significant at 5% level of significance.

Household characters which determents the fish consumption in rural and urban Tamil Nadu is given in the Table 8. The comparative analysis on the determinants of consumption of fish between rural and urban households revealed that the per capita household expenditure and household size both in rural and urban households were positively determining the probability of fish consumption in households, while the variable such as level of education was in addition found to determine the probability of fish consumption positively in rural households.

IV. CONCLUSION

The estimated probit functions on the determinants of probability of consumption of different food groups indicated the variables such as per capita household expenditure and household size were positively determining the probability of consumption of all the food groups except milk and pulses, both in urban and rural households. The variable regular salaried employee was found to determine negatively the probability of consumption of milk urban households, while it was positively determining the probability of fruits consumption in rural households. Similarly education was determining the probability of consumption of milk, fish and fruits positively in rural households, while its influence on the probability of consumption of cereals, pulses, meat and vegetables was negative in urban households.

The results of probit function indicated education was a key variable determining the probability of consumption of milk, fish and fruits positively in rural households by way of improving the awareness and knowledge on positive health benefits present in the above said items. Thus special educational programmes with the focus on the importance of the different food items, especially milk, fish and fruits in relation to health and hygiene of the community may be incorporated with in the frame work of general education and in the adult education streams, which would help in improving the consumption of these commodities in rural areas.

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