



Per capita food expenditure in Nay Pyi Taw, Myanmar: Is there household economies of scale?

May Thet Htar, Theingi Myint, Chue Htet Hnin, Htet Marlar Aye, Yin Nyein Aye, Moh Moh, Thi Thi Soe

Department of Agricultural Economics, Yezin Agricultural University,
15013, Yezin, Zayarthiri Township, Nay Pyi Taw, Myanmar
Email: dr.theingimint@yau.edu.mm

Abstract— This paper empirically investigates the existence of economies of scale in food consumption, the share of food expense in total household expenditure, and the determinants of per capita food expenditure in Myanmar. The study was conducted with a total of 400 respondents from Nay Pyi Taw region and the survey took place in October 2021. The results are presented into two sections. In the first section, the descriptive statistics of the variables such as the respondents' age, household size, education and residence are reported. The household monthly income was 227.51 USD, household monthly food expenditure was 112.49 USD, household monthly per capita food expenditure was 36.69 USD, and the share of food expenditure to total household expenditure was 70.20 % on average. In the second section, the inferential statistics of the variables are reported using the Pearson's correlation analysis and regression analysis. Significant negative relationships were found between adult-equivalent household size and per capita food expenditure, and between income and the share of food expense in total household expenditure. The negative effect of household size on per capita food expenditure indicated by the regression analysis suggested that economies of scale in food consumption existed among the study households. Policy makers therefore need to consider economies of scale when designing the poverty alleviation programs.

Keywords—: Food expenditure, Income, Household size, Size economies

Received: 27 Dec 2021

Accepted: 7 March 2022

INTRODUCTION

The Engle laws stated that the share of food expenditure in total household expenditure is an important indicator of the household's welfare (Zimmerman, 1932). It stated that the households having the same share of food expenditure are equally well-off and households with lower share of food expenditure are better off than the other as the poor households have to allocate a large portion of their income on food.

In the Engel method, scale economies can be calculated by comparing the per capita expenditures between two households having the same share of total expenditure to food but with different household sizes (Perali, 2008). Engel's method also predicts that share of food expenditure is negatively related to per capita expenditure (PCE) and household size. Therefore, given that PCE is constant, the share of food expenditure from the larger households will be lower than smaller households. In

the Engel method of scale economies, larger households should have lower food share when the welfare increases along with the increase in household size and resources. However, at the constant PCE, a decline in food share can only be obtained if there is a decline in per capita food expenditure. Deaton and Paxson (1998), therefore, argues that, in poor countries, the statement that absolute per capita food expenditure decreased when the welfare is increased is not acceptable. Several economics also stated that Engel method of household size economies lacks theoretical justification (Logan, 2011).

With the above problems with the Engel method, the study investigates another approach to identify household size economies. In the earliest theory developed by Barten (1964), there are two types of good at the household level: the one that is entirely private such as food and the one that is shared and public such as housing (Gen & Vernon, 2003; Crossley & Lu, 2018). In the larger households, the intrahousehold public goods are shared

among the household members without the need for replication to proportionate to the household size. Given that the incomes of the households are constant, the larger households will benefit from size economies than smaller households in pooling the public goods. In poor economies, these freed resources released from sharing of public goods will be directed towards private goods such as food (Logan, 2011). Larger households, therefore, will have higher per capita consumption of private goods and there will be a positive relationship between household size and per capita consumption of private goods, in this case, per capita food expenditure.

However, Deaton-Paxson (1998) argued that in their empirical research, they found the total opposite of the above public good model across several countries. This opposite evidence, known as Deaton-Paxson puzzle, stated that larger households may benefit from economies of scale and per capita food expenditures may fall even if the number of household members are rising. Deaton (1997) stated that the household economies of scale in food consumption can be obtained from various factors such as increased returns from domestic appliances used for cooking, the contribution of collective goods at the households (for example fire and water used for cooking) and discounts by bulk-purchase of food items and thus paying less per unit.

Therefore, the main objective of this study is to empirically investigate whether the larger households benefit from economies of scale in food consumption in Myanmar. The findings from this study will provide further validations for the relevant theory. The study also aims to identify the per capita food expenditure in the study area. In 2018, the annual per capita expenditure of food in Myanmar was 466.7 US dollars which was increased from 439.8 US dollars in 2014. However, this finding will be varied based on different regions of the country and will be altered through years and CPI Index (Knoema, 2018). Therefore, the study of current per capita food expenditure and its household level determinants will act as valuable reference for researchers, policy makers and development specialists to make informed decisions.

Objectives of the study

1. Identify the per capita food expenditure of the study households
2. Estimate the share of food expense in total household expenditure of the study households
3. Identify the relations and effects of sociodemographic characteristics on per capita food expenditure

MATERIALS AND METHODS

Study areas and sample selection of primary data collection

The study was implemented by conducting surveys with the 400 respondents who are the residents of Zeyarhiri, Ottarathiri and Pobbathiri townships in Nay Pyi Taw, Myanmar. The study was conducted as part of the pilot strategic research for the development of wider food system study countrywide to support and formulate the efficient food security strategy in Myanmar. The potential respondents were based on the fact that they are the main household members managing food at the households in order to collect data on food expense. The research was based on convenience sampling and the potential participants were self-selected with a voluntary way in as much as they choose to participate or not.

Method of data collection, data analysis and ethical considerations

The primary data collection was undertaken in October 2021. The research team visited the households, explained the purpose of the study, and solicited their voluntary participation. After confirming the respondent agreement to involve in the study, the interview was conducted using the structured questionnaire package. In the first section, the questionnaire seeks to collect the socio-demographic information of the respondents which include age, household size, income, residence such as rural or urban and their education levels.

It is followed by the set of questions that pursue to collect the information regarding the household monthly food consumption, monthly food expenditure and total household expenditure. After collecting the data, it was coded first before being loaded into EXCEL and SPSS (v.27). For the first objective of the study, the per capita food expenditure was calculated by dividing total household food expenditure and total adult equivalent household members. For the second objective, the share of food expense in total household expenditure was calculated by dividing household food expense by total household expenditure. For the third objective, Pearson Correlation test was run to find out the relationships between household's sociodemographic characteristics and per capita food expenditure. In addition, Linear Regression was run to measure the strength of these relationships. Analysis of the data, the interpretation and the writing were carried out at the Department of Agricultural Economics of the Yezin Agricultural University. Descriptive analyses (group-level) were used to generate the sample characteristics. A number of ethical issues were considered throughout the research study.

RESULTS AND DISCUSSIONS

Demographic characteristics of respondents

The survey was conducted from 400 sample respondents in Nay Pyi Taw Council. Among the respondents interviewed, the average age was 44.37 years with a standard deviation of 12.25. The family size was ranging from 1 to 13 and the average was 4 persons among the respondent households (Table 1). A high percentage of respondents, 73.00 %, reside in urban areas as their response however the study areas are typically characterized as the pre-urban where the governmental institutions are nearby. The female ratio among the respondents was found to be 94.00 % as the survey was intended to interview the person who mostly manage the food in the households (Table 1).

The respondents were also categorized according to their education levels. The education level was divided into four. These includes primary school level where schooling usually takes 5 years, secondary school level where schooling usually takes up to 9 years, high school level where schooling usually takes up to 11 years and graduate level where the respondents have received education from the university. The secondary school level respondents represent 22.75 % of the total respondent while the high school level respondents were 19.50 % (Table 1). The majority of the respondents, 40 % of them have graduate level education while only 17.75 % have primary school level education.

Table 1 Demographic characteristics of respondents of selected households

Variables		Mean	SD	Range
Age (year.)		44.37	12.25	18 – 91
Family size (no.)		4	1.76	1 – 13
		Frequency		%
Residential place	Urban	292		73.00
	Rural	108		27.00
Gender	Female	376		94.00
	Male	24		6.00
Education	Primary	71		17.75
	Secondary	91		22.75
	High	78		19.50
	Graduate	160		40.00

Adult equivalent

In this study, the food expenditure per capita was calculated by total household food expenditure and total adult equivalent number of the household members. The adult equivalent ratio 0.7 is assigned for an adult who is 60 years old and above, and for a child who is between 9 and 2 years old, 1 is assigned for people who are between 59 and 19 years old, 1.1 is assigned for people who are between 18 and

10 years old and, 0.5 is assigned for a child who is under one year old as shown in Table 2. By calculation, there are a total of 1430 adult equivalent population among 400 surveyed households in this study.

Table-2 Adult equivalent conversion

Age range (years)	Adult equivalent conversion factor	Total observed Number	Converted adult equivalent number
Over 60	0.7	142	99.4
59-19	1	986	986
18-10	1.1	222	244.2
9-2	0.7	134	93.8
Under one	0.5	14	7
Total		1498	1430.4

Source: Ministry of Health and Sports; and CSO, UNDP, WB staff computations. Myanmar Living Condition Survey 2017 Report-3 Poverty Report

Household's monthly income, expenditure, and per capita food expenditure

As shown in Table 3, the average monthly income of the households was 227.51 USD ranging from 28.25 to 2033.90 USD. Regarding with total expenditure, the surveyed households spent the 165.76 on average monthly ranging from 28.25 to 677.97 USD. For food, the surveyed households spent the 112.49 USD on average monthly ranging from 22.60 to 395.48 USD. In terms of the share of food expenditure in total household expenditure, the average share among the households was 70.20 % and ranging from 20 % to 100 %. The food expenditure per capita at the household level was calculated by dividing the total household food expenditure with total adult equivalent number of the household members. As shown in Table 3, the average monthly per capita food expenditure was 36.69 USD ranging from 10.76 to 161.42 USD.

Table-3 Household's monthly income, expenditure, and per capita food expenditure

Variables	Mean	Minimum	Maximum	Sd
Household monthly income (USD)	227.51	2033.90	28.25	175.93
Household monthly total expenditure (USD)	165.76	677.97	28.25	89.28
Household monthly food expenditure (USD)	112.49	395.48	22.60	55.90
Monthly per capita food expenditure (USD)	36.69	161.42	10.76	20.81
Food expenditure/Total expenditure ratio (%)	70.20	100.00	20.00	14.24

USD to Myanmar Kyats- 1,770 (Date-15/1/2022)

The percentage of households according to their monthly per capita food expenditure are shown in Figure 1. The highest percentage of the households, 27%, spent lower than 25 USD for their per capita food expenditure. This is followed by 17% of the households who spent between 25 to 30 USD. Per capita food expenditure between 30-35 USD was spent by 12% of the households, 35-40 USD was spent by 12% of the households, and 40-55 USD was spent by 10% of the households. Only 10% of the households spent the monthly per capita food expenditure higher than 55 USD. Therefore, only a few percentages of the study households are spending the high food expenditure per capita.

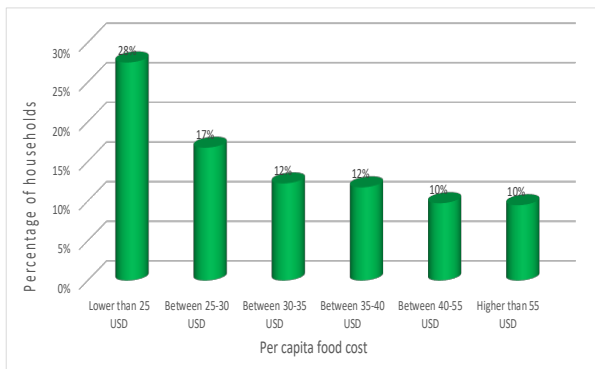


Figure 1 Percentage of households with respect to their monthly per capita food expenditure

The households having the similar share of food expenditure in total expenditure (Food share) were put into groups. Percentage of households with respect to their food share are shown in Figure 2. Food share lower than 60% were found in only 20% of the households. In contrast, households having food share higher than 80% were 34% of the study households. Food share between 60 to 70% was found in 23% of the households while food share between 70-80% was found in 24% of the households.

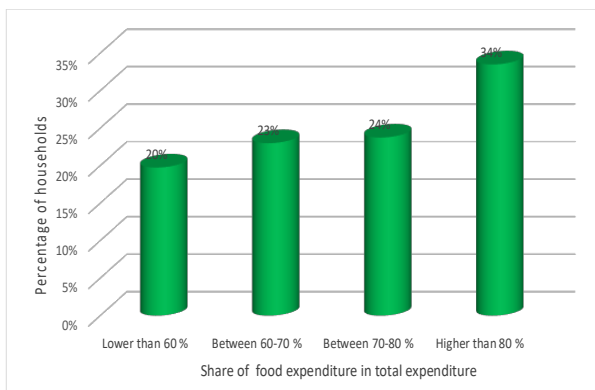


Figure 2 Percentage of households with respect to their share of food expenditure in total expenditure

Relations between sociodemographic characteristics and per capita food expenditure

A Cronbach’s alpha value greater than 0.6 is generally accepted (Flynn et al. 1994). The Cronbach’s alpha value of the data from this study is 0.745 which means that the internal reliability is consistent and acceptable for further analysis. After the reliability test, Pearson’s Correlation analysis was conducted to identify the relationships between household sociodemographic characteristics such as household size (adult equivalent), household income (monthly), respondents’ education level, household’s food share, rural/urban residence, and per capita food expenditure.

According to the results of the correlation test shown in Table 4, there was a significant negative relationship between the household income and household food share ($p < 0.001$). Therefore, if the household income decrease, the food share will increase, and low-income households will have higher food share. This result verified the validity of the Engel’s first law regarding the food share which stated that there is a negative relationship between income and food share as low-income households have to allocate large amount of their income to food. In addition to the household income, respondent’s education level also has significant negative relation with the household food share ($p < 0.001$). It can be interpreted that among the study population, the higher the education level of the household member who manage food, the lower the household food share. The benefits of higher education level on lowering food share may include reducing food waste, effectively managing perishable food products, stocking food products with high price-volatility, and higher ability and incentive to alternate to cheaper but equally nutritious, and delicious food combination etc.,

Regarding with the Deaton’s argument to Engle’s scale economies which states the relationship between income and per capita food expenditure, in this study, the income was not significantly related to the per capita food expenditure. However, the study found out the significant negative relation between per capita food expenditure and residence (Rural = 0, Urban = 1) ($p < 0.001$). Therefore, the rural households among the study population have lower per capita food expenditure. This may be due to the lower farm gate food prices, availability of home garden for vegetables and livestock, lower frequency of eating out in the rural area etc., whereas urban households have to rely on high-value food market.

Importantly, as shown in Table-4, statistically significant negative relation was found between the per capita food expenditure and household size ($p < 0.001$). This result is consistent with the findings of Deaton and Paxton

(1998) where a negative relationship between household size and per capita food expenditure was found in many countries such as Thailand, Pakistan, and African households.

Table-4 Relations between sociodemographic characteristics and per capita food expenditure (Pearson’s correlation test)

	PC-food expenditure	HH size	Income	Food share	Education
HH size	-0.509***				
Income	0.279	0.232			
Food share	-0.076	0.186	-0.278***		
Education	0.428	-0.313	0.242	-0.211***	
Residence	-0.307***	0.272	-0.187***	0.332	-0.445***

The effects of sociodemographic characteristics on per capita food expenditure

In order to measure the influence of the sociodemographic characteristics reported in Pearson’s Correlation test above, the per capita food expenditure was considered as a dependent variable for regression analysis. The household size, household income, respondents’ education, household’s share of food expenditure in total expenditure were utilized as the explanatory variables. The generalized equation for the multiple regression model can be written as

$$PC-FD = \alpha + \beta X_i + \varepsilon \dots\dots\dots(1)$$

Where, PC-FD is the per capita food expenditure as calculated by using equation (1), α is an intercept, β is the matrix of coefficient of independent variables, X_i is the matrix of independent variables and ε is the error terms. Preliminary analyses were performed to ensure there were no violation of the assumption of normality and linearity. The results showed that R square value was 0.69 and the overall regression was statistically significant ($F(5,394) = 72.62$), p value < 0.001 . R square value suggested that 69 percent of the data fit the regression model. The results of the regression analysis are presented in Table 5.

Table- 5 The effects of sociodemographic characteristics on per capita food expenditure (Regression results)

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.693	0.480	0.473	15.110

	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
Constant	22.114	5.202	4.251	0.000
Household size	-6.974	0.511	-13.658	0.000
Food share	0.275	0.057	4.791	0.000
Income	0.050	0.005	9.973	0.000
Education	3.205	0.787	4.072	0.000
Residence	-0.871	1.947	-0.447	0.655

Based on the results in Table 5, the estimated model can be written as

$$PC-FD = 22.114 - 6.974 \text{ household size} + 0.275 \text{ food share} + 0.05 \text{ income} + 3.205 \text{ education level} - 0.871 \text{ residence} \dots\dots\dots (2)$$

where: residence = 0 if rural, 1 for urban

According to the regression results, per capita food expenditure was significantly determined by the education level of household member who manage the food, total food share of the households and household’s income ($p < 0.001$). The magnitudes of the effects of income and education upon per capita food expenditure were significant in this regression model although the relation between them were not significant in Pearson Correlation test. Importantly, the household size has negative contribution on the per capita food expenditure. The significance ($p < 0.001$) indicates that a unit increase in household size will decrease the per capita food expenditure. Therefore, it can be concluded that the larger households in this study have benefitted from the economies of scale in food expenditure.

This result contradicts with the public-private good model of Berton (1964) as it stated that household size will have positive effects on per capita food expenditure. In this case, even under the shared economies of public goods that allow larger households to spend more on private good (food), larger households in this study spend less on food. This empirical evidence, however, agrees with the Deaton-Paxson puzzle which stated that larger households may benefit from economies of scale and per capita food expenditures may fall even if the number of household members are rising. In addition, this result is consistent with the finding from Horowitz (2002).

Table- 6 Regression results of different groups of households having similar food share

Household having food share lower than 60% (N=79)					Household having food share between 60-70% (N=92)				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>		<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	48.133	14.885	3.234	0.002	Intercept	59.094	27.162	2.176	0.033
HH size	-10.409	1.524	-6.831	0.000	HH size	-5.675	0.782	-7.258	0.000
Income	0.038	0.008	4.513	0.000	Income	0.060	0.009	6.327	0.000
Food share	0.026	0.252	0.104	0.918	Food share	-0.412	0.405	-1.016	0.313
Education	3.076	2.019	1.523	0.132	Education	2.243	1.267	1.771	0.081
Residence	1.401	5.898	0.237	0.813	Residence	-1.672	3.459	-0.483	0.630
R square = 0.704 F (5,73) = 0.000***					R square = 0.744 F (5,86) = 0.000***				
Household having food share between 70-80% (N=95)					Household having food share higher than 80% (N=134)				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>		<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-16.214	46.361	-0.350	0.728	Intercept	-16.299	28.625	-0.569	0.571
HH size	-8.792	1.097	-8.013	0.000	HH size	-6.531	0.989	-6.606	0.000
Income	0.080	0.013	6.233	0.000	Income	0.076	0.017	4.565	0.000
Food share	0.746	0.613	1.217	0.227	Food share	0.666	0.322	2.070	0.042
Education	4.337	1.629	2.662	0.010	Education	2.084	1.560	1.336	0.186
Residence	4.017	4.090	0.982	0.329	Residence	5.222	3.677	1.420	0.160
R square = 0.792 F (5,89) = 0.000***					R square = 0.739 F (5,128) = 0.000***				

To further validate the results, the regression analyses were run for different household groups having similar food share as shown in Figure 2. Based on the regression results shown in Table 6, in all groups, household sizes have significant negative effects on the per capita food expense ($p < 0.001$). Therefore, it can be interpreted that even under the constant food share, increasing number of household size reduces the per capita food expenditure. These results, therefore, further validate the presence of scale economies among the study households regardless of their food share.

CONCLUSIONS

The existence and magnitude of household scale economies in food expenditure among the study households has been presented in this paper. Although the study estimates the sociodemographic determinants of per capita food expenditure, it found out the interesting relationships between education level of food prepared person in the household, household income, residence, and the share of food expense in total household expenditure. These findings will be valuable for the policy makers and development specialists in designing the effective and efficient poverty alleviation programs. Rahman (2020) showed that the poverty measurement that do not consider economies of scale at the households level overestimated for large households. Such over-estimation can lead to biased poverty measurement and therefore, allocating resources in the wrong direction and resulting in failure to achieve the objectives of poverty alleviation policies. The study points out the existence of household's scale economies in food consumption and therefore, it is recommended that scale economies need to take into account to obtain the accurate measures of household welfare in designing the development program in Myanmar.

REFERENCES

- Barten, Anton P. (1964). "Family Composition, Prices and Expenditure Patterns." in Peter E. Hart, Gordon Mills, and John Whitaker, eds. *Econometric Analysis for National Planning*. London: Butterworths.
- Crossley, T. F., & Lu, Y. (2018). Returns to scale in food preparation and the Deaton–Paxson puzzle. *Review of Economics of the Household*, 16(1), 5-19.
- Deaton, Angus (1997). *The Analysis of Household Surveys: A Microeconomic Approach to Development Policy*. Baltimore, MD: Johns Hopkins.
- Deaton, Angus and Christina Paxson, "Economies of Scale, Household Size and the Demand for Food," *Journal of Political Economy* 106 (October 1998): 897-930.
- Flynn, B. B., Schroeder, R. G., & Sakakibara, S. (1994). A framework for quality management research and an associated measurement instrument. *Journal of Operations management*, 11(4), 339-366.
- Gan, L., & Vernon, V. (2003). Testing the Barten model of economies of scale in household consumption: Toward resolving a paradox of Deaton and Paxson. *Journal of Political Economy*, 111(6), 1361-1377.
- Horowitz, A. W. (2002). Household size and the demand for food: a puzzle resolved?. V Unpublished Manuscript, University of Arkansas.
- Knoema (2018) Myanmar expenditure on food per capita. Accessed on 10 April 2022. <https://knoema.com/atlas/Myanmar/topics/Food-Security/Expenditures-Spent-on-Food/Expenditure-on-food-per-capita>
- Logan, T. D. (2011). Economies of scale in the household: Puzzles and patterns from the American past. *Economic Inquiry*, 49(4), 1008-1028.
- Perali, F. (2008). The second Engel law: Is it a paradox?. *European Economic Review*, 52(8), 1353-1377.
- Rahman, M., Jeon, S. H., & Yoon, K. S. (2020). Estimation of Equivalence Scale and Assessment of Its Impact on Poverty Measurement in Bangladesh. *Sustainability*, 12(21), 9081.
- Zimmerman, C. C. (1932). Ernst Engel's law of expenditures for food. *The Quarterly Journal of Economics*, 47(1), 78-101.