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Endogenous Classification of Urban Households in Iran

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Abstract: The consequences of the implementation of price adjustment policies (e.g. reduction or redistribution of subsidies, etc.) and the way the households react to it can be far from desirable and may lead to errors on behalf of the policy makers. Obviously, the implementation of these policies has led to changes in the market, and more importantly, it will cause adjustments in food prices; such changes leave the ultimate effects on the consumers' welfare. Therefore, when evaluating and measuring the welfare effects following these policies, it is necessary that the households be classified as the primary recipient of these policies. In this study, using a function of Engel curve and Variance homogeneity test, the Iranian urban households were classified into five independent and distinct classes regarding the similar consumption behavior in expending for food .The results show that the difference in consumption behavior concerning food expenditures is not the same for households who have different income, and this difference is greater in high-income households than in low-income ones. The greatest number of households in 2009 is in the second class, and those in 2010 and 2011 are in the second and forth class. The lowest number of households for each of the three years is in the first and fifth classes.

Key words: classification, households, economic factors, social factors, consumption behavior, food expenses.

INTRODUCTION

One of the most important statistical studies done in different countries is that concerning the relationship between household budget and estimates of household demand for major groups and household budget subgroups. These studies show the importance of detailed and precise data concerning the household budget for evaluating the effects of different economic policies, especially changes in income and costs, on each of the income groups or socio-economic groups. In many countries, the process of laisser-faire economy is underway. Budget issues, macroeconomic imbalances and high cost of support programs, the high cost of laisser-faire programs along with the accession to the World Trade Organization (WTO) are among the main reasons for the change in economic policy. These changes lead to changes in the market and, most importantly, the prices will be adjusted[1]. The execution of improper economic policies in countries has led to economic disorganizations and macro imbalances such as deficit balance of External payments, chronic budget deficits, and increasing inflation in domestic and external arenas of the economy and the

overall economic growth will be negative. After all, these price changes leave the ultimate effect on consumers' welfare. Hence, the authorities and managers attempt to implement a set of economic policies to solve the problems mentioned. The abovementioned arguments indicate that when the welfare effects of adjustment policies ensuing the execution of laisser-faire policies are evaluated and estimated, it is necessary that the households be classified as the major recipient of these policies. The common model for classifying the households in Iran is that based on cost or income deciles.

This model is superior to the models in which the analysis is done through the average or grouped data for all of the households. But the weakness of the model is that the effects of other variables affecting households are not taken into account, and only the income variable is based for classification, which leads to an exogenous determination of the classes. Overall, the purpose of this research is the endogenous classification of the urban households in Iran regarding the consumption behavior. Therefore, in this research, much attempt has been made to classify the Iranian urban households after the method inspired by Jensen and Manrico's[1] studies and to simultaneously use the social and economic characteristics of households in the form of Engel curves for each social variable in the modeling and classification. In the present study, we seek to answer the questions as to whether the frequency function (difference in consumer behavior) of food expenditures is the same for households who have different incomes. And whether the frequency function (difference in consumer behavior) of food expenditures is in households with higher income is greater than that in lower-income households.

1. Theoretical principles of classification and addition of population variables to the demand function.

Theoretical principles of classification are based on microeconomic theory of consumer behavior in which the utility function is extracted with respect to maximum budget and demand as a function of income. In other words, the classification is done based on the logic that the differences between the households' demand for goods and consumption services are explained by the; accordingly, building certain income ranges can lead to the classification of households. Moreover, with respect to goods and services, the fact is that consumer behavior changes in some income levels. In other words, the direction of Engel curve is altered. The method for attracting the abovementioned effect and reflecting it on the coefficients is to fit the demand system in a limited range of income which is possible by classifying households in the different income categories. However, the effect of income variable is not the same for all households, and beside the abovementioned variables, there are also other socio-economic variables whose combination is different in the households and causes distinct consumer behaviors.

2. Classification of Households

In some studies, the sample observations are grouped in the form of subgroups and models are estimated for each of them. Split sample observations can be applied for various purposes. The important thing about the collection of samples and classification in general is that classification leads to estimation of homogeneous and appropriate coefficients within each group. In other words, the main idea behind the classification approach is to be able to classify individuals into groups in a way that the members of the group are given almost equal coefficients for independent variables. In this case, with respect to the observations in each group, an average estimation of the abovementioned coefficients can be obtained. The abovementioned average can appropriately represent the reaction of the individuals in the group due to the homogeneity of the coefficients. But besides utility and classification logic, the households have been studied in different classes and groups. Most of the criteria used for classification are those predetermined by statistics centers and are, in most cases, limited to one variable. Moreover, no mention has been made of the theoretical basis of the selection criteria for household classification. Overall, classification can be questioned from two angles: first, the number of classes is determined exogenously. In other words, this question can be raised as to what is the reason for determining the number of classes. Also, there is the possibility the number of the classes does not fully fit the purpose of the research and does not meet the expectations of research from classification.

3. The concept of endogenous classification of households

Economists divide the population of every society into ten rankings in terms of income and consumption and call each ranking “decile”. The first decile represents ten percent of households that had the lowest annual expenditure. Therefore, we can say that these households are among the poorest classes of the society. In contrast, the tenth decile represents ten percent of the households that expend the maximum amount for their annual costs, so these are the most well-to-do households of the society. Despite their superiority over the manner in which analysis is done through average and grouped data for all the households, the current conventional methods for classification of households in Iran, that is, the classification of households in different deciles (based on income or expenditure) and then measuring the effects of changing prices, consumption, poverty, etc. are defective. The classification based on income or expenditure has two weaknesses: First, since it bases classification on the income variable (or total expenditure), it excludes the effects of other variables such as social variables affecting consumption behavior. Second, the determination of the number of classes is exogenous in which ten classes are usually taken into account; regarding the purpose of the study, this might fail to fit the features of the classes with the original one. Hence, when the sample extracted from the population is classified into distinct subsamples, the number of households in each class (deciles) is reduced and the statistical adequacy of any fitting and conclusion is questioned [2]. In their classification approach in which the number of the classes

is not predetermined and is not confined to one variable, Jarque[3], Jensen-Manrico[1] and Pajuyan-Khosravi Nejad included a set of socio-economic variables and using Engel function, they based their classification on the micro-economic principles. Regarding the fact that the data are used simultaneously in modeling and classification, this type of classification which is done in the estimation of Engel curves based on the consideration of socio-economic characteristics of households, is so-called an endogenous classification. The method relies on the argument that the households in a group have the same consumer behavior. [2].

Review of Literature

In an article titled "The demand for food products in various income groups in Indonesia", Jensen and Manrico [1] addressed the issue of household classification. In this study, the observation unit is the household and includes a total of 3,705 households in urban areas inside and outside of Java. The logic of classification in this study is based on similar consumer behaviors of the households belonging to similar income groups and possessing similar socio-economic characteristics. The study model is based on Engel function. Regression analysis was used to estimate the coefficients and to finally obtain the related residues. After obtaining the residue, Engel function and variance homogeneity test was done in a repetitive manner to classify households in groups with different variance and the households were classified into four categories: low, lower middle, upper middle and high regarding their income.

In his study titled "The application of LDV models in the analysis of spending households in Mexico", Jarque[3] analyzed consumer behavior in terms of classification of Mexican households in the different groups. In this study, using cross-sectional data on income and household spending in 1975 including 494 households, in addition to variable of household cost, variables such as age, household head's occupation, and household size (dimension) or various combinations of these socio-economic variables have been taken into account. Jarque[3] has shown that the criterion for classification of "Overall Relative Explanatory Power" maximization is represented by R^2. The first step is to determine the number of classes. Since the set of classes (L) is to be selected by the researcher, he considers fourteen (L= 14) as the number of classes due to the large size of R^2. The abovementioned method requires a lot of information its classification yields many different classes of households according to the socio-economic characteristics.

In an article titled "grouping urban households and analyzing their demand for education (a function of Engel curves and variance homogeneity test", Ansari and Mohamadi [4] started to group households. In this study, using a function of Engel curves and variance homogeneity test, the urban households in Iran were grouped into five categories regarding the similar consumer behavior for education, and the elongation of total expenses (income) were measured and compared separately for categories. The results show that education is essential

for all classes. The demand of middle-class households (third class) has the maximum sensitivity toward changes in total expenses (income) and the households belonging to the highest income category (fifth class) have the minimum sensitivity.

In an article titled "A method for classification of Iranian urban households based on social and economic factors", Pajuyan and Khosravi Nejad [2] classified urban households based on their socio-economic characteristics regarding their consumer behavior using "Jenson and Manrico" classification method. They used budget data of urban households from 1997 to 2002. In their estimation model, the expenditures for food commodities were considered the dependent variable, and the total expenditure of households and a vector of households' social variables such as age, sex, and occupation of the household head was considered the independent variable. After depicting the Engel function in a linear algebraic shape and fitting it, the homogeneity variance test was conducted and the households were divided into five categories. The results of the proposed method show that the largest number of households is in the fourth class and then in the second one. The lowest number of households is in the first class, and the classes from 1 to 5 are respectively arranged from the low level of income to the high one.

5. Socio-economic variables

Socio-economic variables influencing the behavior of urban households – as applied in this study – are as follows in Table 1. Some of these variables are Qualitative or Polychotomous and must be defined as virtual variables by 0 and 1 codes to enter them in the model.

Table 1. Economic variables of the households and the way they are converted to be entered in the study model

Variable	Attribute	Variable' quantity	Variable	Attribute	Variable' quantity
Gender of the household head			Literacy of household head		
D1	Male	1	D2	Literate	1
	Female	0		Illiterate	0
Employment status of household head			Marital status of household head		
D3	Employed	1	D4	Married	1
	Unemployed (job-seeker)	0		Widowed	0
	Paid without working			Divorced	
	Student			Never married	
	Housekeeper		Recent education degree of the household members		
	Other		G1	Diploma and less	Count
Age composition of the household members			G2	BA	Count
A1	Age group between 0- 10	Count	G3	MA	Count

A2	Age group between 11- 20	Count	G4	PhD and more	Count
A3	Age group older than 20	Count	G5	Religious education	Count
X1	Age of household head	Year	Type of residence possession		
X2	Number of the employed in the household	Count	D5	Site and superstructure	1
X3	Dimension (number of members) in the household	Count		Ownership	
X4	Number of students in the household	Count		Rental	0
EF	Expenses for food, drink, and smoking			Par service	
E	Households total expenditures			Free – other	

Source: Questionnaire of statistics center

6. Models, estimation and classification

The general form of the function is:

$$EF = (TE, Z)$$

Where:

EF: Expenditures for food items as the dependent variable

TE: total household expenditure

Z: the socio-economic variables implies

The general form of the model (based on the Engle function) is as follows:

$$EF = (TE, D1, D2, D3, D4, D5, X1, X2, X3, X4, G1, G2, G3, G4, G5, A1, A2, A3)$$

Whose algebraic form is:

$$EF_i = \alpha_0 + \alpha_1 TE_i + \alpha_2 D1_i + \ldots + \alpha_6 D5_i + \alpha_7 X1_i + \ldots + \alpha_{10} X4_i + \alpha_{11} A1_i + \ldots + \alpha_{16} A6_i + \alpha_{17} G1_i + \ldots + \alpha_{21} G5_i + u_i$$

$$u_i \approx N(0, \sigma_u^2)$$

u_i is the disorder expression that is assumed to have all classic properties, that is, it has mean zero and variance σ_u^2. α s are model parameters. In the first phase, the above equation is estimated for each year; then, removing the variables whose coefficients were not statistically significant, it was shown that demographic variables such as age, sex, education, occupation and marital status of the household head, type of residence possession, number of household members with different ages, number of the employed in the household, household size and number of children in the household have statistically significant effect on food expenditures. Some other variables such as the number of students, the members holding diploma to PhD or religious education degrees are not statistically significant due to their co-linearity with other variables and were thus excluded from the model. Then the model was estimated with the set of observations related to household food expenditure for each year and Gold Field Test was performed. By sorting the observations from small quantities to large ones based on the independent variable of total expenses (E) (according to method Gold Field Test), the observations were divided into classes, the

abovementioned test was performed, the results were evaluated, the existence of the variance anisotropy and repetition was confirmed, and finally, the classification process was pursued as follows:

1. The observations were classified into nine groups.

2. Excluding even classes (2, 4, 6 and 8), the model was estimated for odd classes. The collection of relevant statistical tests were performed for each estimation and the statistic such as R^2 and t were evaluated and variables that were not statistically significant were removed in order to fit the model better.

3. The variance of the regression was calculated for odd classes and Gold Field Test was performed.

4. The even classes were divided into four groups and independently defined, estimated for each model under study, and the variance of the regression equation was calculated.

5. Gold Field Test was performed for each sub-class of even classes with the adjacent odd class and F statistic was calculated.

6. Based on the results of Gold Field Test, the observations of sub-classes related to even classes were merged in the adjacent odd classes in a way that the variance of the observations included in each group be the same.

Finally, following the estimation of Engel curves for calculating residuals and homogeneity of variance test, observations related to each year were grouped into five categories. Since there is a large number of fitted equations, the results of the fit of the models and the range of observations selected classes are presented in Table 2.

Table 2. Selected classes of the observations related to households over the years 2009-2011

2009			2010			2011		
Class	Range of observations	Selected class	Class	Range of observations	Selected class	Class	Range of observations	Selected class
Second	2067-2582	1	Second	2072-2588	3	Second	2077-2595	3
	2583-3098	3		2589-3105	3		2596-3114	3
	3099-3614	3		3106-3622	3		3115-3633	3
	3615-4130	3		3623-4139	3		3634-4152	3
Forth	6199-6714	3	Forth	6214-6730	3	Forth	6229-6741	3

	6715-7230	3		6731-7247	5		6748-7266	5
	7231-7746	3		7248-7764	5		7267-7785	5
	7747-8262	3		7765-8281	5		7786-8304	5
Sixth	10331-10846	3	Sixth	10356-10872	5	Sixth	10381-10899	5
	10847-11362	5		10873-11389	7		10900-11418	7
	11363-11878	5		11390-11906	7		11419-11937	7
	11879-12394	5		11907-12423	7		11938-12456	7
Eighth	14463-14978	7	Eighth	14498-15014	7	Eighth	14533-15051	7
	14979-15494	7		15015-15531	7		15052-15570	7
	15495-16010	7		15532-16048	7		15571-16089	7
	16011-16526	7		16049-16565	7		16608-16090	9

7. Some of the most important socioeconomic features of the five classes

In this section, using certain indices, the most important socio-economic characteristics of the five classes of households are mentioned.

Table 3. Economic characteristics of households in the five classes of urban households in 2009

Class Index	First class	Second class	Third class	Fourth class	Fifth class
Total number of households	2066	5678	3614	5678	2066
Minimum income (Thousand RRs)	2955	31896.4	65341.9	31896.4	2955

Maximum household income (Thousand RRs)	31896.4	65328.3	92266	65328.3	31896.4
Household income range (Thousand RRs)	28941.4	33431.9	26924	33431.9	28941.4
Household's average income	22389.4	48853.2	77959.8	48853.2	22389.4
SD of income (Thousand RRs)	6789.4	9568.1	7710	9568.1	6789.4
Income elongation	0.548	1.19	1.18	1.19	0.548
Income Skewness	0.584	0.011	0.13	0.011	0.584

According to the data in table 3, there is considerable difference between the averages of households' total expenditure which indicates class difference between difference income groups. The averages of households' total expenditure in the fifth class are 14.8, 6.7, 4.2 and 2.5 times as much as the average of total cost of the first to fourth classes, respectively. Based on the average household income, the first class is in the lowest income group and the fifth class is in the highest income group. The second class has the highest frequency and the lowest frequency goes to the first and fifth classes. The range of household income in the fifth class has the maximum value and maintains a significant difference with other classes, and the third class has the lowest value. According to variation coefficients of income (skewness and elongation), the maximum variation is in the fifth class and the minimum variation is in the first class.

Table 4. Economic characteristics of households in the five classes of urban households in 2010

Class Index	First class	Second class	Third class	Fourth class	Fifth class
Total number of households	2588	4656	4139	4656	2588
Minimum income (Thousand RRs)	3379.7	110000	74324	110000	198000
Maximum household income (Thousand RRs)	42989.1	198000	110000	198000	3190000
Household income range (Thousand RRs)	39609.3	88184	35243.9	88184	2990000
Household's average income	30068.2	144960	90911.9	144960	351920
SD of income (Thousand RRs)	9178.9	24454.5	10158.3	24454.5	239674
Income elongation	0.523	0.93	1.16	0.93	25.1
Income Skewness	0.599	0.426	0.13	0.426	4.1

The averages of households' total expenditure in the fifth class are 11.7, 6.0, 3.8 and 2.4 times as much as the average of total cost of the first to fourth

classes, respectively. The income of all the classes has increased compared to the previous year. Based on the average household income, the first class is in the lowest income group and the fifth class is in the highest income group. The second and fourth classes have the highest frequency and the lowest frequency goes to the first and fifth classes. In this year, the range of household income in the fifth class maintains a significant difference with other classes, and it has the maximum value in this class and the least value in the second class. According to variation coefficients of income (skewness and elongation), the maximum variation is in the fifth class and the minimum variation is in the first class.

Table 5. Economic characteristics of households in the five classes of urban households in 2011

Class Index	First class	Second class	Third class	Fourth class	Fifth class
Total number of households	2595	4671	4152	4671	2595
Minimum income (Thousand RRs)	3170.3	53467.5	90275	130000	219000
Maximum household income (Thousand RRs)	53465	90269.5	130000	219000	7450000
Household income range (Thousand RRs)	50294.6	36802	40148.6	89005.6	7230000
Household's average income	38218.2	71940.6	108970	165700	389940
SD of income (Thousand RRs)	11146.8	10527.7	11665.1	24492.3	362613
Income elongation	0.328	1.15	1.2	0.90	119.1
Income Skewness	0.691	0.01	0.15	0.438	8.8

The averages of households' total expenditure in the fifth class are 10.2, 5.4, 3.5 and 2.5 times as much as the average of total cost of the first to fourth classes, respectively. Also, the income of all the classes has increased compared to the years 2009 and 2010. Based on the average household income, the first class is in the lowest income group and the fifth class is in the highest income group. The second and fourth classes have the highest frequency and the lowest frequency goes to the first and fifth classes. In this year, the range of household income in the fifth class maintains a significant difference with other classes, and it has the maximum value in this class and the least value in the second class. According to variation coefficients of income (skewness and elongation), the maximum variation is in the fifth class and the minimum variation is in the first class.

Table 6. Social characteristics of households in the five classes in 2009

Class Index	First class	Second class	Third class	Fourth class	Fifth class	Total
Number of all households	2066	5678	3614	5162	2066	18586

Percentage out of all the households	11.11	30.54	19.44	27.77	11.12	100
Number of individuals in each class	5887	21638	14935	22703	9066	74229
Number of the employed	1255	5365	3734	5933	2497	18784
Percentage of the employed to the total number of the same class	21.32	24.79	25.00	26.13	27.54	25.31
The average age of household head (years)	52.02	46.63	46.69	47.70	47.42	47.62
The number of married individuals (household head)	1437	4998	3303	4810	1974	16522
The percentage of the married (household head) to all the households	69.55	88.02	91.39	93.18	95.55	88.89
The proprietors of each class	1184	3595	2527	3907	1652	12865
Percentage of proprietors of each class to all the household of each class	57.31	63.31	69.92	75.69	79.96	69.22

Regarding frequency, the second class with 30.5 percent has the highest number of households and the first and fifth classes have the lowest frequency. The classes first to fifth have the lowest to highest number of the employed, respectively. In the first class, 21.3 percent of household heads are employed and the ratio is 24.7, 25, 26.13, and 27.5 for the second to fifth classes, respectively. The average age of household head has the greatest value in the first class and the lowest value in the second one. The ratio of married heads of households increases in parallel with the respective ranking of classes. While 69.5% of the household heads in the first class are married, the corresponding ratio for those in the fifth class is 95.5%. The ratio of household heads who own their homes increases in parallel with the respective ranking of classes.

Table 7. Social characteristics of households in the five classes in 2010

Class Index	First class	Second class	Third class	Fourth class	Fifth class	Total
Number of all households	2588	4656	4139	4656	2588	18627
Percentage out of all the households	13.89	25.00	22.22	25.00	13.89	100
Number of individuals in each class	7762	17260	16655	19503	11098	72278
Number of the employed	1691	4258	4087	4969	2976	17981

Percentage of the employed to the total number of the same class	21.79	24.67	24.54	25.48	26.82	24.88
The average age of household head (years)	50.82	47.64	47.81	48.20	49.19	48.48
The number of married individuals (household head)	1917	4061	3764	4366	2456	16564
The percentage of the married (household head) to all the households	74.07	87.22	90.94	93.77	94.90	88.92
The proprietors of each class	1480	2923	2871	3387	2072	12733
Percentage of proprietors of each class to all the household of each class	57.19	62.78	69.36	72.74	80.06	68.36

The second and fourth classes have the greatest number of households and the first and fifth classes, with 13.8 percent, have the lowest number of households. In fact, the middle classes (II, III and IV) have the highest frequency and the initial and final classes have the lowest frequency. The total number of households has increased in 1389 compared to the previous year. The investigation of the ratio of the employed to the total population in the same class shows that the classes first to fifth have the lowest to highest number of the employed, respectively (with the exception of the third floor). In the first class, 21.7% of household heads were employed and the ratio is 24.6, 24.5, 25.4 and 26.8 percent for the second to fifth classes, respectively. The employment of household members has decreased in 2010 compared to that in 2009 in that unemployment has gone up from 12.3 percent to 24.8 percent. The average age of household head has the greatest value in the first class and the lowest value in the second one. The average age of the married heads in all classes has increased from 88.8 to 88.9 percent compared to the year 2009.

Table 8. Social characteristics of households in the five classes in 2011

Class Index	First class	Second class	Third class	Fourth class	Fifth class	Total
Number of all households	2595	4671	4152	4671	2595	18684
Percentage out of all the households	13.89	25.00	22.22	25.00	13.89	100
Number of individuals in each class	7207	17084	16606	19376	11102	71375
Number of the employed	1511	4117	4068	4920	2827	17443
Percentage of the	20.97	24.10	24.50	25.39	25.46	24.44

employed to the total number of the same class						
The average age of household head (years)	53.50	48.33	48.54	49.34	49.77	49.54
The number of married individuals (household head)	1831	4069	3741	4354	2458	16453
The percentage of the married (household head) to all the households	70.56	87.11	90.10	93.21	94.72	88.06
The proprietors of each class	1600	2997	2884	3501	2056	13038
Percentage of proprietors of each class to all the household of each class	61.66	64.16	69.46	74.95	79.23	69.78

The second and fourth classes have the greatest number of households and the first and fifth classes have the lowest number of households. The total number of households has increased in 2011compared to 2009 and 2010. The investigation of the ratio of the employed to the total population in the same class shows that the classes first to fifth have the lowest to highest number of the employed, respectively. The average age of household head has the greatest value in the first class and the lowest value in the second one. The average age of the heads in all classes has increased compared to 2010. The ratio of the married heads has also increased in parallel with respective grade classes. The ratio of the married heads in all classes has decreased in 2011 compared to that in 2010. The ratio of the heads who own their homes ranges from 61.6 percent in the first class to 79.23 in the fifth class.

CONCLUSION

In this study, we tried to classify the households by a set of income-based variables and socio-economic characteristics. Accordingly, 55,897 observations from the households residing in urban areas were grouped into five categories based on the similarity in the consumer behavior regarding food costs. As noted, from the 55897 observations, 18576 are related to 2009, 18627 are related to 2010 and 18684 are related to 2011. According to the data obtained in this research and according to the household economic index in 2009, the greatest variation is in the fifth class and the lowest one is in the first class; in this year, the range of household income in the fifth class maintains a significant difference with that in the other classes. Like in 2009, in 2010 too, the greatest variation is in the fifth class and the lowest one is in the first class; however, the variation of household income has, in general, decreased in 2010 compared to 2009. In 2009, the range of household income in the fifth class maintains a significant difference

with that in the other classes in which the greatest value is related to the fifth group. Like in 2009 and 2010, in 2011, the greatest variation is in the fifth class and the lowest one is in the first class. The income variation in 2011 had been increasing in the third and fifth classes but decreasing the first, second, and fourth classes. Like in 2009 and 2010, in 2011, the range of household income in the fifth class maintains a significant difference with that in the other classes. Therefore, as noted, in each three years, the variation is the greatest in the fifth class which belongs to the high-income households[6,7,8,9,]. Accordingly, investigating the classes separately each year, the first hypothesis is confirmed in that variation (difference in consumer behavior) function of food expenditures is not the same for the households who have different incomes. As it was shown that the income variation is greater in the fifth class for each of the three years, in this respect, the second hypothesis is confirmed too, in that, variation (difference in consumer behavior) function of food expenditures for the households with higher income is greater than that for the households with lower income[10].

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