Econometrics Analysis of the Consumer Expenditure Equation Systems using the Bootstrap Method

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Abstract

Bootstrapping technique is a statistical methods used in the field of statistical inference, and the method is based on the idea of generating random samples called bootstrap samples by dragging with the replacement of the original data in order to obtain estimates of the high precision compared to the traditional statistical methods. The research has been used this method in the selection of a optimized model for the consumer expenditure functions, and eight equations representing consumer expenditure was used to achieve the objectives of the research. The study relied on primary data collected for all study variables, and then in Bootstrapping Residuals (BR) could be applied in generate Bootstrapping samples with replacement from the actual distribution, and calculate the Bootstrapping estimate of the value of the expected average forecasting errors, as well as the values of probability for the selection of optimal regression models, in addition to calculate the average sampling of equation models, as well as estimates of the bootstrap to statistical test used to test the significant of the effects of these parameters. The results indicate that both the number of family members and the average price of goods consumed have a significant positive impact on expenditure on food, and the consumers expenditure of the city of Riyadh, Jeddah and Khamis are more than the average spending on food. As can be seen that the Saudi average consumer expenditure is less significantly than non Saudi. Also it can be seen that the consumer expenditure of the family who works in the private sector is significantly less on average to spend on food.

Introduction

The Government of the Kingdom of Saudi Arabia concerned and give attention to the standard of living of its citizens. Many policies were applied to achieve adequate living standards in the context of price changes of global and local. There is no doubt that consumer spending on all goods and services was the first necessities of life to achieve an appropriate level of saturation for different groups of society. Because consumer spending concerns decision makers and economic policy makers, therefore, it is useful to examine the effect of some factors that affect the terms of consumer spending. Although the increase in consumer spending is supposed to give an indication of high income families, but part of the causes of increased consumer spending in the Kingdom come from growth in demand for consumer loans to finance the increase in consumer spending and family, as well as rapid changes in the composition of the population by increasing the formation of new families and their transition to independent housing. The consumer culture among the citizens cause many negative aspects highlighted the continuing high prices, inflation, the emergence of the social problems of families, lack of stability and its ability to reduce spending on key aspects, and the disappearance of the manifestations of savings and investment for the family.

The traditional economic theory of consumer demand included interdependence of social and economic aspects in the Engel Curve, and considered that the income is the main determinant of spending (Davis, 1982). According to some studies, it show the importance of including family size among the explaining variables in the consumption functions, despite the problems it brings, such as Multicollinearity among family members and its income, and then the problems of biased results and inefficient (Abdo, 1982). Some of the studies focused on the impact of the different areas on the food consumption patterns, such as studies by Prais and Houthakker (1971) in the United States of America, Jommah and Meselhi study (1983) in Egypt. In general, the studies that have analyzed the pattern of food consumption in the Kingdom have been addressed is partial and not entirely through the a single equation models, according to the classifications contained on the family budget research, and without divisions into account comparisons of commodities or commodity groups serving specific targets, and ignore the interdependence and interrelatedness between spending on various food commodity groups, so this study aims to highlight the statistical significance of the differences between expenditure items to each other, and to identify the most important economic, social, and demographic factors that must be taken into account as factors explaining the pattern of consumer spending for the family. the study adopted Bootstrapping Residuals (BR) in estimating the parameters of equations system used in the multivariate analysis method, then it is possible to estimate the determine value of an average

errors predict matrix, as a statistical standard can be relied upon in the selection of the regression equations on one hand, and perform all statistical hypotheses tests form of on the other hand.

The statistical bootstrap method is considered the most important methods developed in statistical inference began in 1970. The most important applications are the variance estimation , confidence intervals, and hypotheses tests related to statistical population, especially if the theoretical probability distribution for the statistical population is unknown. Bootstrap means generating random samples by dragging with the replacement of the original data in order to obtain estimates of the high precision compared to the traditional statistical methods.

The (Efron 1979) was the first used this method to study the properties of the distribution of the parameters sample that are calculated using the original sample data, including Ordinary Least Squares (OLS) the parameters of regression models, which used the method of Bootstrapping Residuals (BR) in dragging random samples of the actual distribution of the residuals to be used in the generation of a dependent Bootstrapping samples to be reused for the regression coefficients estimation, and the bootstrap parameters estimate will be the value of the sample average distribution for the parameters used bootstrapping samples.

Shao jun 1996 used this method in the selection of the optimal model, which was based on the criterion of a minimum Bootstrapping to the error average prediction. He presented two methods of generating Bootstrapping samples. The methods are Bootstrapping Residuals (BR), and Bootstrapping Pairs (BP). Shao find out that the Bootstrapping Pairs (BP) in the selection of the optimal model to be consistent if the Bootstrapping dragging random samples size is m instead of n where $\lim_n \infty$ (m/ <n) , while the Bootstrapping Residuals selection is consistent in the case of increasing residuals variance, which pulls out of the Bootstrapping samples, and could be achieved by multiplying this samples by square root of (m/n).

There are many problems facing the researcher using the method of Bootstrapping Residuals Criteria (BRC) in the selection of the system or the optimal model for the spending equations, some is related to economic aspects of the model, and others are to the Bootstrapping Residuals application in the selection of the model. This can be summarized as follows:

1 - There are a large number of variables of various kinds (quantitative and descriptive) have a significant effect on expenditure of all eight commodity types, which recommended its importance many economic studies, and the researcher wants to choose the best combination of these variables to determine the optimal expenditure system equations.

2 - Due to the withdrawal of a very large number of Bootstrapping samples, to calculate the standard (BRC) used in the selection of a large number of expenditure equations models, it is difficult to estimate the standard models using the ready statistical programs, so the researcher needs to use the SAS program, which is the best statistical programs in this direction.

3 – to include an explanatory variables in the expenditure models, it is important to test the significant effect of the including variable in improving the predictive ability of this model, and with the withdrawal of a large number of Bootstrapping samples , it is difficult to calculate the statistical for the Bootstrapping estimate.

The study objectives and data sources

The primarily study aims in this research are to use the method of Bootstrapping Residuals in the selection of the optimal system of consumer spending equations in the Kingdom of Saudi Arabia, the study can achieve its objectives using the following sub-objectives:
estimating bootstrap of the regression coefficients for the optimal model, as well as their standard errors, and then the possibility of testing the significant effect of economic, geographical, and social variables which determinants food expenditure in the model.

The study depend on a preliminary data. The most important cities of the Kingdom have identified (population study). The appropriate sample size was withdrawn at the significant level ($\alpha = 0.05$), and a degree of accuracy (d= 0.04) according to the following equation: (Rifai, 1998.156-157):

$$n = \frac{p(1-p)\left(Z^2_{(1-\alpha/2)}\right)}{d^2} = \frac{(0.5)(0.5)\left(1.96^2\right)}{(0.035)^2} \approx 784$$

Where ($Z_{(1-\alpha/2)}= Z_{(0.095)} =1.96$) is the value of the standard normal variable that an area to the left equal (σ^2 = p(1-p), 0.975) represents the variation in the population, it has been expressed the value (p= 0.5) for having the maximum sample size. Therefore, proportionate partitioning way was used in order to determine the sample size in each region. The total primary data collected was 784 consumers, 657 (84%) was good to the analysis from different cities in Saudi Arabia, namely Riyadh (206), Jeddah (145) , Dammam (119) , Khamis (110) , and Aljouf (77).

Research method

The Bootstrapping is one of the statistical methods used to estimate parameters of the regression systems equations, where the method is based on sampling with replacement from the original sample to estimate the model parameters on one hand, and to conduct all statistical tests and the efficiency of the system on the other. The researchers applied this method due to its higher estimate accuracy compared to other statistical methods to estimate this system, especially if it contained extreme or abnormal values of observations.

To illustrate the steps to implement the Bootstrapping Residuals method (BR), which is one of the Bootstrapping method used to estimate parameters of regression systems equations. first the regression systems equations form will be displayed, , and expressed by the multivariate multiple regression model, which is a special case of simultaneous system equations with random error correlation (Greene, 2003).

Assuming n is a observation sample available, p is the number of explanatory variables, m is the number of linear regression equations consisting of the system, it can be expressed in the following form:

$$\left(Y_1 : Y_2 : \ldots : Y_m\right) = X\left(\mathrm{B}_1 : \mathrm{B}_2 : \ldots : \mathrm{B}_m\right) + \left(\varepsilon_1 : \varepsilon_2 : \ldots : \varepsilon_m\right)$$
$$Y = X\,\mathrm{B} + \mathrm{E} \qquad (1)$$

Where Y= (Y_1: Y_2: ……:Y_m) is the observation matrix for the dependent variables vectors with (n x m), X is the observation matrix of the explanatory variables in each equation, (n x (p +1), B = (B_1 : B_2 : …..B_m) represents the of regression coefficients matrix with ((P+1) x m), E = (ϵ_1 : ϵ_2 : …….ϵ_m) express random errors matrix, (m x n), and assumes that the row i, and is expressed as E_i = (ϵ_{i1} : ϵ_{i2} : …….ϵ_{im}) follows multi-normal distribution with expected zero, and variance matrix (Σ) and assumed to be constant, thus, . E_i = (ϵ_{i1} : ϵ_{i2} : …….ϵ_{im}) ~N_m (0, Σ) i=1,2,….,n.
The steps to apply the bootstrapping residuals method:

1 – using the least squares to estimate the regression coefficients matrix (B) , as follows:

$$\hat{\mathrm{B}} = \left(\hat{\mathrm{B}}_1 : \hat{\mathrm{B}}_2 : \ldots : \hat{\mathrm{B}}_M\right) = \left(X'X\right)^{-1} X'\, Y = \left(X'X\right)^{-1} X'\left(Y_1 : Y_2 : \ldots : Y_M\right) \qquad (2)$$

2 - calculating residuals vectors.

$$\hat{\mathrm{E}} = \left(\hat{\varepsilon}_1 : \hat{\varepsilon}_2 : \ldots : \hat{\varepsilon}_m\right) = Y - X\hat{\mathrm{B}} \qquad (3)$$

Assuming that is the range of models that fall within the selection.

3 - withdraw with replacement a random sample size (n) of the experimental probability distribution (F) of the vectors of the residue class $\hat{\mathrm{E}}_i = \left(\hat{\varepsilon}_{i1} : \hat{\varepsilon}_{i2} : \ldots : \hat{\varepsilon}_{im}\right)$, $i = 1,2,\ldots, n$, which calculated in Equation (3), where:

$$\hat{\mathrm{E}}_i = \left(\hat{\varepsilon}_{i1} : \hat{\varepsilon}_{i2} : \ldots : \hat{\varepsilon}_{iM}\right) \sim_{ind} \hat{F} \ , \ \hat{F} : \ mass \frac{1}{n} \ at \ each \ \hat{\mathrm{E}}_i \Big/ \sqrt{1 - \frac{(p+1)}{n}} \ \ , i = 1,2,\ldots,n \tag{4}$$

Since the vector $\hat{\mathrm{E}}_i = \left(\hat{\varepsilon}_{i1} : \hat{\varepsilon}_{i2} : \ldots : \hat{\varepsilon}_{im}\right)$ has a centers distribution, F is also will be a central distribution.

4 - Assuming that the sample of bootstrapping residuals are:, $\tilde{\mathrm{E}}_i = \left(\tilde{\varepsilon}_{i1} : \tilde{\varepsilon}_{i2} : \ldots : \tilde{\varepsilon}_{im}\right)$ can be used to generate a bootstrapping observations for the model α, by applying the following equation:

$$\tilde{Y}_\alpha = X_\alpha \hat{B}_\alpha + \tilde{\mathrm{E}} \tag{5}$$

And then the vector of least squares regression coefficients estimate (B_α) using a matrix of bootstrapping observations is:

$$\hat{\tilde{\mathrm{B}}}_\alpha = \left(X'_\alpha X_\alpha\right)^{-1} X'_\alpha \tilde{Y}_\alpha \ \ , \ \ \alpha \in \Lambda : \{\alpha_1, \alpha_2, \ldots\} \tag{6}$$

6 – The bootstrap residuals method of estimating the matrix of average prediction errors is calculated on the following form:

$$\hat{\tilde{\Gamma}}_\alpha = \tilde{E} \left(Y - X_\alpha \hat{\tilde{\mathrm{B}}}_\alpha\right)' \left(Y - X_\alpha \hat{\tilde{\mathrm{B}}}_\alpha\right) \Big/ n = \tilde{E} \ (\hat{\tilde{\Sigma}}_\alpha) \tag{7}$$

Where $\tilde{E}$ refers to the expectation for the bootstrap samples, and is calculated by drawing bootstrap samples with replacement R number R, and calculateing the average sample of the matrix $(\hat{\tilde{\Sigma}}_\alpha)$, and thus the bootstrap estimate of the average matrix prediction errors takes the following.

$$\hat{\tilde{\Gamma}}_\alpha = \overline{\tilde{\Gamma}}_\alpha = E_* \ (\hat{\tilde{\Sigma}}_\alpha) = \sum_{r=1}^{R} (\hat{\tilde{\Sigma}}_\alpha)_r \Big/ R \tag{8}$$

Where $(\hat{\tilde{\Sigma}}_\alpha)_r$ is calculated matrix of the average prediction errors in the case of using the bootstrap residuals samples number r, $r = 1,2,\ldots, R$

Then, the optimal model that has the symbol α_0 is the one who achieves a minimum value for a matrix determent to predict the average errors $\overline{\tilde{\Gamma}}_\alpha$, $\alpha \in \Lambda : \{\alpha_1, \alpha_2, \ldots\}$,

$$Optimal \ Model \ \alpha_O = Model \ \alpha \in \Lambda : \{\alpha_1, \alpha_2, \ldots\} \ That \ Minimizes \ \left|\overline{\tilde{\Gamma}}_\alpha\right| \tag{9}$$

This value is positive, thus the logarithm can be calculated to be used for comparison.

Variables identified for expenditure.

First: The dependent variables represent expenditure by Riyals

Collected data on the proportion of spending on monthly family income of each item of consumer spending. And then calculating monthly expenditure of each item as dependent variable, the dependent variables is as follows:

y_1 = Monthly expenditure on food.

y_2 = Monthly expenditure on textiles , clothing, and shoes.

y_3 = Monthly expenditure on renovation, rent, fuel, and water.

y_4 =Monthly expenditure on home furnishings.

y_5 = Monthly expenditure on medical care.

y_6 = Monthly expenditure on transport and communications.

y_7 = Monthly expenditure on education and recreation.

y_8 = Monthly expenditure on other goods and services.

Second: The explanatory variables identified in the following:

Since the total expenditure is equal to household income, therefore, it has been excluded as an explanatory variables to expenditure in order to avoid the multicollinearity between income and total expenditure items, and the following variables define a set of economic, social, and other demographic interpreted the terms of spending.

x_1 =explained variable reflects the number of family members.

x_2 = Geometric mean of prices of goods and services that the consumer consume Riyals.

z_1 = Qualitative variable represents the name of the city (Riyadh, Jeddah, Dammam, Khamis, and Al-Jouf), and is expressed in four dummy variables known as follows:
x_3 = 1 , If the residence Riyadh, x_3 =0, If the residence other city.
x_4 =1 , If the residence Jeddah, x_4 = 0 , If the residence other city.
x_5 =1 , If the residence Dammam, x_5 =0, If the residence other city.
x_6 = 1, If the residence Khamis, x_6 =0, If the residence other city.

z_2 = Qualitative variable represents the type of nationality (Saudi, non-Saudi), expressed as a dummy variable is defined as follows:
x_7 =1 , If the Saudi nationality, x_7 = 0, If the non-Saudi nationality.

z_3 =Variable represents the name of the two types of marital status Married, Single, or divorce), expressed as a dummy variable as follows:
x_8 = 1, If the person is married, x_8 =0, If the situation was otherwise.

z_4 = Qualitative variable represents the name of the type of job (government, private sector, business, and does not work), and is expressed in dummy variables as follows:
x_9 = 1, If a government job, x_9 =0, If the other job.

X_{10} =1, If a private sector job, x_{10} =0, : If the other job.
x_{11} =1 , If business, x_{11} =0, If the other job.

Eight expenditure equations can be formulated in the form of a system of simultaneous equations as follows:

$$y_k = \beta_{k0} + \sum_{j=1}^{11} \beta_{kj} x_j + \varepsilon_k$$

Where the errors (ε_k) are random in the eight equations, and $\beta_{kj}{}' j = 0,1,...,11$, are the regression coefficients of the equation No.k, k=1,2,…8. The bootstrapping residuals method has been applied in multivariate analysis systems for the above expenditure equations. The expectation bootstrapping logarithm of the average square error was calculated as shown in Equation (9), and all statistical analyzes of the parameters tests and the model efficiency were conducted. The statistics used in the test are t- statistical t, and statistical Wilks' Lambda (λ^*), used to calculate the Chi-square statistics (χ^2). SAS statistical software were used to obtain the analysis results required to achieve the objectives of the study.

Results of the regression stepwise:

First: The independent variables was the introduced one by one, then The expectation bootstrapping logarithm of the average square error were used $Log_e|\tilde{\tilde{\Gamma}}_\alpha|$ as a criterion for the independent variable selection, which would cause a less value of $Log_e|\tilde{\tilde{\Gamma}}_\alpha|$ to the model, and then significant test used for adding this variable to improve the predictive potential of the expenditure systems equations depending on the Chi-square statistics (χ^2), the results were summarized in table (1).

Table (1): The bootstrapping expectation logarithm, the percentage of Wilks' Lambda ,and Chi-square statistics (χ^2),

Step	Variables	Bootstraping			
		WL	Chi_sq	Pr (> chi)	$Log_e\|\tilde{\tilde{\Gamma}}_\alpha\|$
Step 1: Nationality	X1	0.7791	162.94		95.594
	X2	0.5428	398.93		95.237
	Z1	0.8490	106.56		95.752
	Z2	0.3780	635.94	0.000	94.883
	Z3	0.9551	29.99		95.795
	Z4	0.7959	148.83		95.665
Step 2: Price average	X1| Z2	0.8054	141.07		94.695
	X2|Z2	0.5650	372.17	0.000	94.346
	Z1|Z2	0.8573	100.09		94.829
	Z3|Z2	0.9636	24.15		94.870

	Z4|Z2	0.9141	58.42		94.867
Step3: location	X1| X2,Z2	0.8898	75.97		94.257
	Z1| X2,Z2	0.8348	117.19	0.000	94.267
	Z3| X2,Z2	0.9732	17.67		94.343
	Z4| X2,Z2	0.9173	56.05		94.334
Step 4: Family size	X1| X2,Z1,Z2	0.8723	88.38	0.000	94.159
	Z3|X2,Z1,Z2	0.9745	16.71		94.266
	Z4|X2,Z1,Z2	0.9174	55.63		94.255
Step 5: occupation	Z3| X1, X2,Z1,Z2	0.9730	17.68		94.157
	Z4| X1, X2,Z1,Z2	0.9222	52.20	0.001	94.153
Step 6: Social status	Z3| X1, X2,Z1,Z2,Z4	0.9649	22.96	0.079	94.142

The results in Table (1) indicates the following:

1 - The nationality was chosen as the best explanatory variable interpreter expenditure systems , as a result of adding it the lowest values of the logarithm of the bootstrapping expectation to the average of squares errors, thus this variable improves the predictive potential of the expenditure systems equations where the value of the chi square = 635.94 which is significant at the level of significance less than 0.05.

2 - The average price was chosen as the best explanatory variable interpreter can be added next to the nationality variable to improve the predictive ability of the expenditure systems equations.

3 - geographical location was selected as the best explanatory variable interpreter can be added next to the nationality variables and the average price to improve the predictive ability of the expenditure systems of equations.

4 - number of family members were selected as the best explanatory variable interpreter can be added next to the previous variables to improve the predictive ability of the expenditure systems equations.

5 – Occupation has been selected as the most important explanatory variable interpreter can be added next to the previous variables to improve the predictive ability of the expenditure systems equations.

6 - Social status has been deleted because adding it to all the other variables does not improve the predictive ability of the expenditure systems of equations.

Second: testing the validity of the model, and the significant of adding each variable to the model in improving the predictive ability, the results as presented in table (2)

Table (2): the proportion of Wilks' Lambda, Chi square (χ^2) statistical, and calculated significant

	WL	Chi_sq	Pr (> chi)
Constant	0.7598	177.05	0.001
x1	0.8760	85.22	0.0001
x2	0.6018	326.97	0.0001

z1	0.8189	128.96	0.0001
z2	0.4371	533.95	0.0001
z4	0.9222	52.20	0.00074
MODEL	0.1684	1151.70	0.0001

The results in Table (2) indicates the following:
1 - The value of chi square = 1151.70, and the level of significance less than 0.001, indicating the validity of the model that represents the expenditure system equations on different items.
2 - Significance level of the variables (the number of family members), (average price), (geographical location), (nationality), occupation) are less than 0.001, indicating that the addition of each explanatory variable next to the other variables are important in improving the predictive potential of the expenditure system equations.
Third: the estimating results of the expenditure system equations:

Table (3): the bootstrap method results of estimating regression coefficients of expenditure system equations

		Const	X1	X2	Z1. X3	Z1. X4	Z1 .X5	Z1 .X6	Z2 .X7	Z3 .X9	Z3 . X10	Z3 . X11
$\hat{y}_1$	BETA	617.436	162.299	50.503	809.779	624.759	-22.952	963.49	-817.48	-227.93	-400.73	-105.84
	(p)	0.027	0.000	0.000	0.000	0.000	0.903	0.000	0.000	0.243	0.07	0.691
$\hat{y}_2$	BETA	-80.917	48.624	15.052	204.511	147.225	-6.433	269.69	30.233	-45.681	-81.66	-39.375
	(p)	0.326	0.000	0.000	0.000	0.005	0.908	0.000	0.520	0.429	0.212	0.618
$\hat{y}_3$	BETA	88.654	116.416	34.83	575.779	394.784	-20.943	621.702	-240.08	-89.321	-200.39	-132.72
	(p)	0.640	0.000	0.000	0.000	0.001	0.870	0.000	0.025	0.499	0.180	0.464
$\hat{y}_4$	BETA	-112.58	49.979	16.135	254.836	157.26	-13.835	288.813	84.927	-63.776	-101.61	-40.735
	(p)	0.192	0.000	0.000	0.000	0.005	0.813	0.000	0.084	0.291	0.137	0.623
$\hat{y}_5$	BETA	-31.665	18.176	5.702	68.318	50.684	-7.14	92.643	41.05	-16.802	-34.624	-21.238
	(p)	0.379	0.000	0.000	0.002	0.029	0.770	0.000	0.047	0.508	0.229	0.541
$\hat{y}_6$	BETA	-278.1	106.217	32.033	489.309	353.738	4.918	543.494	218.012	-99.701	-166.2	-120.16
	(p)	0.109	0.000	0.000	0.000	0.001	0.966	0.000	0.026	0.411	0.224	0.470
$\hat{y}_7$	BETA	-12.107	42.83	12.591	171.554	120.607	-26.888	193.682	-37.869	-25.798	-38.94	-36.783

	(p)	0.865	0.000	0.000	0.000	0.009	0.579	0.000	0.350	0.605	0.492	0.590
$\hat{y}_8$	BETA	-1710.6	179.062	54.061	700.498	467.469	43.701	850.454	1730.78	-72.041	-141.46	-102.84
	(p)	0.000	0.000	0.000	0.000	0.013	0.827	0.000	0.000	0.726	0.538	0.718

The results in Table (3) indicates the following:
1 - the bootstrap estimate for the regression equation on food expenditure take the following form:

$$\hat{y}_1 = 617.4 + 162.3X_1 + 50.5X_2 + 809.8X_3 + 624.8X_4 - 22.95X_5 + 963.5X_6 - 817.5X_7 - 227.9X_9 - 400.7X_{10} - 105.8X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive impact on food expenditure, and the consumers located at the city of Riyadh, Jeddah, and Khamis spend more than the average spend on food. As can be seen that the Saudi average significantly spending less than non Saudi. As well as it can be seen from the table (3) that the family of the consumer, who works in the private sector significantly spend less than average spend on food.

2 - The bootstrap estimate for the regression equation on fabrics, clothing and footwear expenditure take the following form:

$$\hat{y}_2 = -80.917 + 48.62X_1 + 15.05X_2 + 204.5X_3 + 147.2X_4 - 6.43X_5 + 269.7X_6 + 30.23X_7 - 45.68X_9 - 81.66X_{10} - 39.4X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive effect on textiles and clothing, footwear expenditure, and the consumers located at the city of Riyadh, Jeddah, and Khamis spend more than the average spend on fabrics, clothing and footwear expenditure. It can be seen from the table (3) that there was no significant effect of nationality and occupation on fabric and clothing and footwear expenditure.

3 - The bootstrap estimate for the regression equation on spent on repairs, rent, fuel, and water take the following form:

$$\hat{y}_3 = 88.7 + 116.4X_1 + 34.8X_2 + 575.8X_3 + 394.8X_4 - 20.9X_5 + 621.7X_6 - 240.1X_7 - 89.3X_9 - 200.4X_{10} - 132.7X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive effect on renovation, rent, fuel and water spending, and the consumers located at the city of Riyadh, Jeddah, and Khamis spend more than the average spend on repairs, rent, fuel, and water expenditure. As can be seen that the Saudi average significantly spending less than non Saudi. There was no significant effect of the occupation on repairs, rent, fuel, and water expenditure.
4 - The bootstrap estimate for the regression equation on home furnishings take the following form:

$$\hat{y}_4 = -112.6 + 49.98X_1 + 16.1X_2 + 254.8X_3 + 157.3X_4 - 13.8X_5 + 288.8X_6 + 84.9X_7 - 63.8X_9 - 101.6X_{10} - 40.7X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed a significant positive impact on home furnishings spending, and the consumers locate at the city of Riyadh, Jeddah, and Khamis spend more than the average spend on home furnishings expenditure. As can be seen that the Saudi average significantly spending more than non Saudi. As can be seen from the table (3) also shows that there is no significant effect of the occupation on household furnishings expenditure.

5 - The bootstrap estimate for the regression equation on medical care, take the following form:

$$\hat{y}_5 = -31.7 + 18.2X_1 + 5.7X_2 + 68.3X_3 + 50.7X_4 - 7.1X_5 + 92.6X_6 + 41.1X_7 - 16.8X_9 - 34.6X_{10} - 21.2X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive impact on medical care spending, and the consumers of the city of Riyadh, Jeddah, and Khamis spend more than the average on medical care expenditure. As can be seen that the Saudi average significantly spending more than non Saudi. As can be seen from the table (3) also shows that there is no significant effect of the occupation on medical care expenditure.

6 - The bootstrap estimate for the regression equation on transportation take the following form:

$$\hat{y}_6 = 106.2 + 106.2X_1 + 32.03X_2 + 489.3X_3 + 353.7X_4 + 4.9X_5 + 543.5X_6 + 218.01X_7 - 99.7X_9 - 166.2X_{10} - 120.2X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive effect on transport and communications spending, and the consumers of the city of Riyadh, Jeddah, and Khamis spend more than the average on transport and communications expenditure. As can be seen that the Saudi average significantly spending more than non Saudi. As can be seen from the table (3) also shows that there is no significant effect of the occupation on transport and communications expenditure.

7 - The bootstrap estimate for the regression equation on education and recreation take the following form:

$$\hat{y}_7 = -12.1 + 42.8X_1 + 12.59X_2 + 171.55X_3 + 120.6X_4 - 26.9X_5 + 193.7X_6 - 37.9X_7 - 25.8X_9 - 38.9X_{10} - 36.8X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive effect on education and recreation spending, and the consumers of the city of Riyadh, Jeddah, and Khamis more than the average on education and recreation expenditure. it can be clear that on average spending the Saudi has no different from non Saudi. As can be seen that there was no significant effect of the occupation on education and recreation expenditure.

8 - The bootstrap estimate for the regression equation on other goods and services take the following form:

$$\hat{y}_7 = -12.1 + 42.8X_1 + 12.59X_2 + 171.55X_3 + 120.6X_4 - 26.9X_5 + 193.7X_6 - 37.9X_7 - 25.8X_9 - 38.9X_{10} - 36.8X_{11}$$

The results indicate that both the number of family members and the average price of goods consumed have a significant positive effect on other goods and services spending, and consumers of the city of Riyadh, Jeddah, and Khamis more than the average on other goods and services expenditure. As can be seen that the Saudi average significantly spending more than non Saudi. As can be seen that there was no significant effect of the occuoation on other goods and services expenditure.

Conclusion

1- The bootstrap is a statistical methods used in the field of statistical inference, it is based on the idea of sampling with replacement from the original data sample, and it is characterized by high precision estimates compared to some other estimation methods.

2 - The study relied on primary data of size 657 family. The inference bootstrap method has been used to choose the optimal expenditure equations for consumers in Saudi society. Sampling with replacement from the calculated residuals using the expenditure equations systems which has been estimated by the maximum likelihood, and this called the Bootstrapping Residuals method.

3 - The study relied on the standard average prediction errors in the selection of the optimal model, where the bootstrap expectation was calculated to determine an average prediction errors matrix, and used as a criterion for the selection of the optimal model for the expenditure equations among number of models.

4 - The results illustrated that the optimal expenditure system equations includes a set of economic, social, and

demographic explanatory variables. in order of importance: nationality, the average goods price, geographic location, number of family members, and occupation, respectively. Taking these variables into account improves the predictive ability of the system equations of expenditure, however, the social status variable has been excluded because it does not improve the predictive ability of the model.
5- The number of the family members as a demographic variables, has a positive significant impact on all the eight expenditure items.The increase in the number of family members will result in direct household income to increase spending on the foods, repairs, rent, fuel, water , transport and communications, and other goods and services compared to other expenditure items.
6- The average goods prices that consumers demand as an economic variables also has the positive significant effect on all the eight expenditure items. The increase commodity prices, will result in direct household income to increase spending on the foods , repairs, rent, fuel, water, transportation, and other goods and services compared to other expenditure items .
7- Assuming a constant other factors, the household average expenditure on all items in Khamis, Riyadh, and Jeddah cities were more compare to Dammam and Al-Jouf cities.
8- The Saudi family household average expenditure on food, renovation, rent, fuel, water, recreation, education less significantly than non Saudi expenditure on these items. While the Saudi family average spent on all other items compared to non Saudi family.
9- Adding the occupation variable resulted in improving predictive model, but less significant variables in influencing the expenditure system equations compared to other variables already added.The consumer, who works in the private sector spend less on all items of expenditure compared to expenses who works with other sectors (government, business, and other work).

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