ESTIMATING THE ENGEL CURVES FOR HOUSEHOLD EXPENDITURES IN JORDAN FROM 2010 TO 2011

Dr. Fedel Al-Habashneh
Dr. Khalid Al-Majali
Department of Finance Business Economics, Mutah University

Abstract

This present study aims at estimating the Engel curves for household expenditures using data of household expenditures and income survey of Jordan for the year 2010. In order to achieve the above objective, six functional forms have been formulated and estimated. The data was grouped into nine commodity groups from the raw data which covers 13866 households from urban and rural areas.

The main findings of the study are

1. The family size does not affect the demand for the Vice, Housing, Transportation and Health Commodity groups. On the other hand, the family size for the other groups is significantly different from zero which suggests that family size affect the demand for these commodity groups.
2. The family size does not affect per-capita consumption of these commodity groups. The t-test indicates that there are economies of scale only for food.
3. The consumption pattern for clothing, housing, personal care and miscellaneous commodity group, are not the same in urban and in rural areas.

Keywords: Demand , consumption , engel curve, commodity groups, household , Jordan

Introduction

Demand studies could be classified into two broad groups.

The first group of studies concentrates on the demand for a particular commodity or commodity group, while the second group is concerned with the problem of allocating total expenditure among on exhaustive set of different commodity group.

The latter studies usually assume that the problem of how much in total to be consumed at any given point in time has been solved and

therefore, it concentrates on the problem of allocation among the commodity groups. Such studies involve the simultaneous estimation of complete demand systems containing demand equations for every commodity groups; therefore, this present study is concerned with the estimation of Engel curves for Jordanian household.

The estimation of Engel curves and Engel elasticities has occupied the central position in all family budget studies since the work of Engel (1857). The Engel curve describes the relationship between a household expenditure on a particular good and total household expenditure on income, these relationships have attracted a considerable amount of attention, because they play an important role in various models of income distribution (Bewley 1982 and 1986).

The Engel curve has been applied to different countries and has been used by many researchers. For instance, Abdulai (1999) used the India household survey to estimate a complete demand system. The researcher found that Working – Leser specification is not a suitable representation of food consumption behavior in Switzerland. Furthermore, he found that all food groups were necessities which confirms with previous knowledge.

Also Crawford F.laisney and I.Preston (2002) commeron.V.Jos and Graafode

Eijl.Marts (2013) have estimated household demand for housing, whereas Garabats and

M.Ramada-Sarasola (2011) determined housing demand for Uruguay.

M.lloy.Randsham,H(2011) has shown the effect of gasoline prices on household location.

In addition, Abdulai,D.Jain and Sharma(1999) estimated household demand for food in India, while Cagayan, and Astar(2012) analyzed the Engel Curve household food and clothing consumption in Turkey . They estimated the elasticity for food and the elasticity for clothing expenditures. It has been found that both elasticity are estimated to be less than one. Aor (2009) applied nine Functional forms using 1419 household data from Turkey, and the income elasticity of food and clothing expenditures were smaller than one and are significantly different from zero (lewbel, 2006).

Betti (2000) showed clear evidence of nonlinearities in Engel Curves based on Kernel estimates.

Objectives of the study:

The main objectives of the present study are:

1- Examining some of the popular functional form of Engel curves and finding the best model which fits the data from the household survey for Jordan which was conducted in 2010.

2- Analyzing the patterns of consumption in Jordan using the household survey of 2010.
3- Comparing the consumption patterns of the household in the urban areas with the household of rural areas.

Hypotheses:
(1) Family compositions affect the various needs of household.
(2) There are economies of scale to household demand due to the consumption of different commodity groups.
(3) The consumption patterns in urban areas differ from the consumption patterns of rural areas.

Methodology

In order to achieve the above objectives, the following functioned form will be applied to the data. These are as follows.

Functional forms and estimation method:

In principle, there are an infinite number of functional forms to choose from, but in practice, few have actually been used in household budget studies. Some of the popular functional forms are presented and discussed below: see Prais and Howthakker (1955)

1. The linear form:

This form was estimated first by Allen and Bewley (1935). Hence:

$V_i=p_iq_i=a_i+b_im+u_i$…..(1)

Where vi is the expenditure on the i + b commodity, pi is the price of the commodity, qi is the quantity of ith good, m is total expenditure and ui is the disturbance term and ai and bi are parameters to be estimated. Equation (1) satisfies the theory of demand in the sense that the adding-up condition is satisfied. That is, if a set of linear Engel curves are fitted to an additive data set, then the OLS [Ordinary Least Squares] regression estimates will automatically satisfies the following restrictions

$\sum a_i=0$, $\sum b_i=1$, $\sum m_i=0$……..(2)

2. The logarithmic form:

The logarithmic form is the most popular functional form used for estimating Engel curve, because it is easy to estimate and has a constant elasticity. The logarithmic function can be written in the following form;
$\log v_i=A_i-b_i\log m+m_i$……..(3)

In fact, equation (3) violates the adding-up property of demand theory. This could be shown if equation (3) is written in the following form over $vi=Aim^{Bi}$ ……(4)

Summation of equation (4) over i, we will have;

$$\sum v_i = \sum A_i m^{Bi} = m \quad \ldots\ldots\ldots\ldots (5)$$

Therefore, the derivative of equation (5) with respect to m gives:

$$= \sum A_i B_i m^{Bi-1} = 1 \frac{\Delta v_i}{\Delta m} \sum$$

This suggest that $\sum A_i B_i m^{Bi} = m$

Thus, this implies that:

$$\sum A_i m^{Bi} = \sum A_i B_i m^{Bi} \quad \ldots\ldots\ldots (6)$$

Accordingly, equation (6) will only hold if Bi=1 for all commodities (i=1,2,….,n). However, this implies that income elasticity should be equal to 1 (unity) for each commodity group.

3. The semi-log form:

The semi-log form can be written in the following form:

$$v_i = A_i + b_i \log m + u_i \ldots\ldots (7)$$

equation(7) was used first by Prais and Honthakker (1955) and has since became very popular, in particular for estimating Engel curve for food items. This is because the semi-log form makes it possible for a commodity to appear as a luxury at low income levels, and as a necessity at high income levels. But again, the problem with the semi-log is that it fails to satisfy the adding-up condition (Thomas 1987).

4. Working- Leser form:

Working -Leser form was discussed by Working (1943) and Leser (1963) and can be written in the following form:

$$w_i = a_i + B_i \log m + u_i \ldots\ldots (8)$$

where wi is the budget share of ith commodity, di and Bi are parameters to be estimated and the other notations are as defined above. This model has attracted a good deal of attention in the literature. It became more popular since Deaton and Muellbauer (1980) proposed the Almost Ideal Demand System (AIDS), which collapses to the working- leser model for cross-sectional data.

The income elasticity of demand in the context of working lesser form could be obtained by $e_i = 1 + B_i / W_i$ (9)

Therefore, this implies that a commodity with negative Bi is a necessity, while a commodity with a positive Bi is a luxury. As the budget share of a necessity decreases with income, it follows form (8), hence increasing the income would cause the income elasticity of necessity commodities to decrease and luxury commodities to full toward unity. Therefore, as the consumer becomes more affluent, all commodities becomes less luxuries under Working- Leser model (Clements,1987). Therefore,

equation (9) satisfies the adding-up condition which shows that, $\sum a_i=1$, $\sum B_i=\sum m_i=0$

These will be automatically satisfied when OLS is used as a method of estimation.

5. Other functional forms include:

(1) The Hyperbolic form which can be written as:

$V_i=a_i+(b_i/m)+u_i$ (10)

(2) The Log-reciprocal form which can be written as:

$\text{Log } v_i=a_i=(b_i/m)+u_i$ (11)

Data:

The set of data is the grouped data which was classified and grouped from the raw data of Household Expenditure and Income Survey (HEIS) of Jordan for the year (2010).

The HEIS was conducted on the Hashemite Kingdom of Jordan by the Department of Statistics; and its main results have been reported and published, (Department of statistics,2012). The survey was based on a national sample which covered 13866 households and a comprehensive list of commodities. The sample size was considered by the department of statistics to be representative, since it was selected from different social classes and from different locations. Thus, all expenditure was grouped into nine major commodity group as shown in Table (1).

Table (1 Commodity Groups components

Food and Beverages
Cereal product
Meat & poultry
Fish & Sea products
Oil & Fats
Fruits
Vegetables
Dry & canned
Spices
Nuts
Sugar and Tea, Coffee & Cola
Beverages
Other Food Item
Vice
Tobacco & cigarettes
Alcohols
Housing
Clothing
Readymade Men's Clothes
Readymade Women's Clothes
Girls, Boys, Children Clothing

Footwear
Household Operation
Fuels, Electricity and Water
Household Appliances
Cleaning Materials
6- Transportation
7- Medical Care
8- Personal Care
9-Miscellaneous

Engel curves analysis

Some of the functional forms for estimating Engel Curves have been presented. These functional forms will be applied to the grouped data of household expenditure and income. However, one of the main issues which need to be discussed is the independent variable.

It is a usual practice in econometric family budget studies to use total expenditure rather than total family income as the independent variable in the estimation of the Engel elasticity of demand for a commodity. However, various arguments have been put forward to justify, this; Poder (1971) suggested that net family income and not gross family income is relevant for estimating demand relations and since people tend to forget the exact figure of refunds on income tax, they cannot give the exact net income. Moreover, they also deliberately avoid mentioning subsidiary incomes from property and other sources. Furthermore, according to the permanent income hypothesis of Friedman (1957), expenditure patterns are determined by permanent income rather than by actual measured income. Currie (1972) mentioned that since the income level recorded in a particular time period may well be distorted by transitory components, therefore, the better explanatory variable in household budget studies is total expenditure.

Accordingly in the present study, total expenditure will be used as the explanatory variable in the empirical work that follows. This is because it has been found by Lawzi Etal (1990) that Jordanian people deliberately tend to underestimate their income.

The Estimated Results

The Linear Form Results

For both urban and rural sectors, as well as for pooled data, the linear form discussed above has been estimated for each of the nine commodity groups within each sector. Table (2) contains estimates of marginal budget share, b_i, the a_i estimates and the coefficients of determination R^2.

Table (7)
Linear Form Results of Household Expenditure in Jordan (2010)

	Pooled Data			Urban Data			Rural Data		
	ai	Bi	R^2	Ai	Bi	R^2	ai	bi	R^2
Food	186.90 (13.05)	0.10 (0.03)	0.98	170.20 (12.1)	0.11 (0.02)	0.98	175.9 (20.4)	0.094 (0.09)	0.114
Vice	9.15 (3.91)	0.020 (0.002)	0.956	8.21 (2.91)	0.019 (0.002)	0.96	20.14 (3.4)	0.035 (0.090)	0.225
Clothing	4.95 (2.38)	0.07 90.001)	0.96	5.32 (2.21)	0.08 (0.007)	0.97	3.25 (1.41)	0.087 (0.01)	0.769
housing	-36.75 (12.0)	0.30 (0.01)	0.86	- 34.75 (10.22)	0.32 (0.009)	0.89	- 40.82 (10.2)	0.064 (0.07)	0.055
Household operation	4.20 (2.10)	0.10 (0.02)	0.98	6.22 (2.20)	0.10 (0.02)	0.98	8.30 (2.24)	0.0131 (0.03)	0.689
Transportation	-55.2 (8.2)	0.15 (0.002)	0.97	- 50.4 (8.2)	0.15 (0.001)	0.97	- 51.3 (4.40)	0.122 (0.04)	0.491
Health	2.55 (2.20)	0.018 (0.005)	0.43	2.60 (1.98)	0.017 (0.004)	0.65	2.40 (0.92)	0.014 (0.009)	0.165
Personal care	-7.5 (2.4)	0.042 (0.002)	0.96	- 5.6 (1.8)	0.040 (0.001)	0.96	- 6.6 (1.4)	0.103 (0.02)	0.77
Miscellaneous	-108.3 (0.8)	0.202 (0.012)	0.95	- 10.108 (0.4)	0.164 (0.010)	0.97	111.27 ()14.3	0.370 (0.040)	0.876

The estimated results seem to be plausible from a statistical point of view, since all the coefficient parameters are significantly different from zero at the five percent level of significance. This is also true for all the intercept estimates, a_i. Overall fit is relatively high since R^2 are relatively high for most of the equations estimates within the system i.e, the value of R^2 exceed 0.87 for eight out of nine equations.

The value of R^2 seems to be relatively low for only the health equation.

The estimates budget shares $b_{i,}$ satisfies a *priori* knowledge since each b_i estimates is greater than zero and less than unity for all commodity groups. Furthermore, the sum of b_i estimates is equal to unity and the sum of a_i is equal to zero. These results satisfy the additively condition for Engel aggregation which was implied by the utility theory.

The estimated results for the urban sector seem to be plausible from a statistical and economical point of views.

The R^2 suggests that the overall fit is high for all equations; T-ratios indicate that all the marginal budget shares are significantly different from zero at the fives significance level. This is also true for all the intercept term a_i. Again, the estimated marginal budget shares satisfies a *priori* reasoning since each b_i estimates is greater than zero and less than unity for all commodity groups. And the sum of the bi estimates is equal to unity and the sum of a_i is equal to zero.

On the other hand, the estimates results for rural sector are unsatisfactory from a statistical point of view for food, vice, housing and health equations, but they are satisfactory for all other equations.

The logarithmic form results

The estimated results of equation (3) for the total urban and rural areas are presented on Table (4). The coefficients of determination, R^2, for pooled data suggest that the overall fit is good for all commodity groups except for health. The coefficients of determination R^2, range from 0.76 for the vice equation to 0.99 for clothing equation. The t-ratios indicate that all the coefficients estimates are significantly different from zero at the five significance levels. This is also true for all intercept estimates.

The estimated total expenditure elasticities, which are estimated directly from equation (3), bi, show that the demand for food vice, clothing, household operation and health are inelastic, which implies that these commodity groups are necessities. Whereas the demand for the other commodity groups is elastic, thus this means that these commodity groups are luxuries.

The estimated results for the urban data seem to be plausible from a statistical and economical point of views. All the coefficients and the intercepts term are significantly different from zero. Moreover, apart from the health equation, R^2 is relatively very high for all equations. The estimated total expenditures elasticities show again that the demand for food, vice, clothing, household operation and health commodity groups are inelastic.

Table (3) Double- Logarithmic Results of Household Expenditure in Jordan (2010)

	Pooled Data			Urban Data			Rural Data		
	ai	bi	R^2	ai	Bi	R^2	ai	bi	R^2
Food	2.81 (0.24)	0.42 (0.031)	0.93	2.21 (0.22)	0.431 (0.03)	0.95	4.01 (1.02)	0.22 (0.18)	0.21
Vice	- 4.0 (0.63)	0.512 (0.11)	0.70	- 1.22 (0.62)	0.830 (011)	0.82	- 0.19 (1.82)	0.521 (0.20)	0.19
Clothing	- 2.30 (0.21)	1.1 (0.2)	0.98	- 2.31 (0.22)	0.921 (0.03)	0.99	- 1.40 (1.25)	1.21 (0.18)	0.16
housing	- 3.24 (0.029)	1.40 (0.02)	0.98	- 2.62 (0.53)	1.21 (0.11)	0.90	0.29 (2.55)	0.72 (0.42)	0.16
Household operation	- 1.90 (0.21)	1.1 (0.03)	0.99	- 1.48 (0.22)	0.83 (0.03)	0.99	- 4.01 (1.57)	1.50 (0.29)	0.72
Transportation	- 8.85 (1.72)	2.20 (0.24)	0.85	- 8.92 (1.43)	2.15 (0.23)	0.91	- 11.08 (3.02)	2.30 (0.72)	0.15
Health	-3.20 (1.10)	0.90 (0.21)	0.462	- 2.90 (2.4)	0.70 (0.40)	0.26	1.06 (3.15)	1.08 (0.54)	0.30
Personal care	- 6.67 (1.45)	1.54 (0.20)	0.91	- 7.54 (1.0)	1.81 (0.18)	0.91	- 16.73 (3.75)	4.00 (0.52)	0.80
Miscellaneous	- 10.20 (1.15)	3.21 (0.4)	0.93	- 9.42 (1.21)	1.95 (0.22)	0.92	- 20.72 (1.92)	3.70 (0.32)	0.86

The Working Leser Results:

The estimated results of equation (8) for the pooled data, urban and rural sectors are shown in Table (4). Overall fit for the total estimates seem to be unsatisfactory for vice clothing and health as indicated by R^2. However, R^2 for all other commodity groups are relatively high which indicates the fitness of the data. The t-ratios indicate that seven out of nine of the coefficient estimates Bi, are significantly different from zero at the five percent significance level. This is also true for eight of the intercept terms, Υi. As expected, the sum of Υi estimates is unity and the sum of β_i is zero.

The estimated results for the urban areas are nearly the same as the total estimates for most of the equations with little exceptions. But the estimated results for rural areas are relatively poor for most of the equations on the system except for food, personal care and miscellaneous commodity groups.

Table (4) The Working-Leser Results of Household Expenditure in Jordan (2010)

	Pooled Data			Urban Data			Rural Data		
	ai	Bi	R^2	Ai	Bi	R^2	ai	Bi	R^2
Food	1.702 (0.12)	- 0.215 (0.017)	0.94	1.32 (0.02)	- 0.180 (0.012)	0.94	2.58 (0.350)	-0.11 (0.01)	0.86
Vice	0.108 (0.24)	- 0.012 (0.003)	0.48	0.090 (0.015)	- 0.010 (0.002)	0.45	0.15 (0.05)	-0.08 (0.001)	0.42
Clothing	0.10 (0.019)	- 0.005 (0.07)	0.20	0.095 (0.014)	- 0.005 (0.002)	0.25	0.022 (0.072)	-0.005 (0.002)	0.33
housing	- 0.10 (0.03)	- 0.008 (0.003)	0.61	0.022 (0.12)	0.025 (0.022)	0.15	0.34 (0.52)	-0.009 (0.003)	0.42
Household operation	0.14 (0.01)	0.062 (0.008)	0.21	0.182 (0.0161)	- 0.013 (0.002)	0.67	- 0.07 (0.15)	0.03 (0.001)	0.25
Transportation	- 0.36 (0.05)	- 0.004 (0.007)	0.92	- 0.355 (0.032)	0.070 (0.008)	0.91	0.312 (0.21)	-0.01 (0.01)	0.22
Health	0.052 (0.02)	0.013 (0.003)	0.05	0.122 (0.063)	- 0.013 (0.012)	0.15	0.008 (0.004)	0.011 (0.003)	0.21
Personal care	- 0.07 (0.04)	0.042 (0.012)	0.5	- 0.053 (0.021)	0.013 (0.002)	0.53	- 0.345 (0.85)	1.513 (0.06)	0.89
Miscellaneous	- 0.52 (0.09)	0.124 (0.012)	0.88	- 0.413 (0.083)	0.113 (0.017)	0.80	- 1.997 (0.321)	-1.34 (0.42)	0.79

Other Functional Forms Results:

The estimated results for the semi-log, the hyperbolic and the reciprocal forms are presented in Table (5) to Table (7) respectively. The results of the semi-log form for the total and urban fit the data very well for most of the commodity groups (the goodness of fit is high for all commodity groups except for the health equation). Furthermore, the t-ratios indicate that all the b_i estimates are significantly different from zero at the five significant levels. Again, it has been found that the estimated results for rural sector are unsatisfactory for food, vice, housing, transportation and health.

Table (5) Semi Logarithmic Results of Household in Jordan (2010)

	Pooled Data			Urban Data			Rural Data		
	Ai	bi	R^2	Ai	bi	R^2	ai	bi	R^2
Food	- 322 (45.0)	84.7 (3.7)	0.93	- 420.5 (42.0)	105.8 (6.5)	0.97	- 56.0 (150.4)	40.2 (35.7)	0.15
Vice	- 45.5 (13.2)	10.2 (1.8)	0.55	- 48.3 (42.2)	90.1 (2.1)	0.60	- 28.2 (25.6)	6.9 (3.9)	0.22
Clothing	- 1.88 (28.3)	38.4 (1.2)	0.97	- 201.3 (10.2)	38.3 (1.9)	0.97	- 201.1 (42.1)	39.0 (2.6)	0.74
housing	- 720.2 (64.2)	130.2 (9.8)	0.98	- 647.5 (110.6)	134.4 (15.0)	0.86	- 155.3 (194.2)	36.0 (32.0)	0.12
Household operation	- 268.6 (22.3)	52.6 (4.2)	0.94	- 264.3 (25.3)	52.0 (2.2)	0.93	- 320.4 (75.2)	58.5 (12.3)	0.68
Transportation	- 450.3 (41.2)	83.6 (6.7)	0.95	- 502.2 (32.7)	89.6 (4.4)	0.96	- 315.2 (102.1)	56.6 (15.5)	0.51
Health	- 48.2 (21.2)	9.8 (3.2)	0.42	- 34.6 (31.5)	7.8 (5.0)	0.17	- 35.0 (25.2)	6.5 (4.2)	0.20
Personal care	- 118.4 (12.5)	22.3 (2.0)	0.92	115.6 (10.2)	25.3 (2.3)	0.93	- 256.4 (51.9)	45.6 (8.5)	0.72
Miscellaneous	- 743.3 (60.3)	150.4 (14.8)	0.9	- 821.4 (83.2)	145.6 (15.3)	0.91	- 942.1 (130.4)	167.3 (22.1)	0.85

On the other hand, the coefficients of determination R^2, indicate the equation (10) estimated results also fit the data very well for the total and urban areas as shown on Table (6). But again, the estimated results of the hyperbolic form has failed to give good fit for the food, vice, housing, transportation and health commodity groups for rural areas. However, similar results have been obtained using equation (11) which is shown on Table (7).

Table (6) Hyperbolic Results of Household in Jordan (2010)

	Pooled Data			Urban Data			Rural Data		
	ai	bi	R^2	ai	Bi	R^2	Ai	bi	R^2
Food	295 (9.5)	42930 (4153)	0.9 0	320.2 (606)	58322 (425.3)	0.96	235 (25.3)	16740 (15336)	0.1 0
Vice	25.2 (12.1)	4153 (1421)	0.6 2	29.3 (1.9)	5473 (1393)	0.57	20.3 (4.1)	2521 (1702)	0.1 5
Clothing	73.5 (2.6)	16761 (1750)	0.9 2	72.3 (2.5)	19605 (1897)	0.90	70.1 (7.2)	16120 (3265)	0.7 1
housing	232.0 (16.1)	64836 (8221)	0.8 5	252.6 (25.9)	68463 (11530)	0.73	103.2 (31.1)	17550 (13950)	0.1 4
Household operation	108.2 (5.7)	26231 (3210)	0.8 6	108.3 (5.8)	26783 (3250)	0.84	99.1 (12.3)	23772 (5730)	0.6 3
Transportation	128.1 (9.8)	42750 (5140)	0.8 4	138.9 (10.2)	45637 (5431)	0.89	82.9 (16.5)	25640 (8200)	0.5 2
Health	23.3 (2.9)	4812 (1645)	0.3 7	20.2 (5.6)	4224 (2721)	0.13	14.2 (2.3)	3100 (1830)	0.2 2
Personal care	38.2 (2.4)	10803 (1121)	0.8 9	40.2 (1.9)	11820 (972)	0.93	57.2 (9.9)	18120 (4230)	0.6 4
Miscellaneous	225.4 (21.2)	73000 (10741)	0.8 2	225.0 (24.2)	73521 (11423)	0.81	210.3 (25.4)	70120 (10605)	0.8 1

Table (7) The Reciprocal Results of Household Expenditure in Jordan (2010)

	Pooled			Urban			Rural		
	ai	bi	R^2	ai	Bi	R^2	Ai	bi	R^2
Food	6.21 (0.02)	213.2 (20.1)	0.93	6.53 (0.02)	290.1 (16.4)	0.97	6.21 (0.15)	95.3 (72.4)	0.12
Vice	3.41 (0.11)	289.6 (72.1)	0.63	3.45 (0.12)	350.2 (62.1)	0.75	4.10 (0.41)	17.75 (128.3)	0.16
Clothing	4.62 0.07	482.1 (31.1)	0.61	4.62 (0.06)	502.1 (22.1)	0.98	4.62 (0.20)	455.7 (82.1)	0.71
housing	6.61 (0.07)	650.2 (33.1)	0.97	6.31 (0.17)	570.2 (40.9)	0.84	5.30 (0.42)	310.2 (170.1)	0.22
Household operation	4.91 (0.07)	502.2 (39.1)	0.94	4.91 (0.08)	460.1 (35.2)	0.95	5.21 (0.21)	521.2 (117.1)	0.64
Transportation	5.82 (0.30)	1120.4 (122.4)	0.86	6.21 (0.21)	1215.4 (98.2)	0.96	5.61 (0.62)	917.2 (315.1)	0.45
Health	3.42 (0.35)	456.4 (121.3)	0.45	4.10 (0.32)	320.9 (161.3)	0.23	3.11 (0.55)	462.1 (220.3)	0.22
Personal care	4.62 (0.16)	990.3 (81.2)	0.92	4.40 (0.12)	890.1 (65.2)	0.96	6.20 (0.6)	1272.0 (207.1)	0.80
Miscellaneous	7.32 (0.21)	1127.3 (111.2)	0.95	7.21 (0.22)	1120.2 (110.3)	0.91	7.08 (0.51)	1450.3 (206.3)	0.81

Elasticity Estimates

Based on the estimated results illustrated above, Engel elasticities of demand with respect to total expenditure for each commodity group are evaluated at the mean values and presented in Table (8) below. The elasticity estimates indicate the demand for food, vice and health commodity groups are inelastic with respect to total expenditure, hence indicating that these commodity groups are necessities, whereas, the demand for housing, transportation, personal care, and Miscellaneous commodity groups are elastic as estimated by all functional forms. These therefore indicate that the commodity groups are luxuries.

On the other hand, the estimated results of the linear, double-log, semi-log and Working- Leser forms of the elasticities of clothing and household operation are not significantly different from one at the five percent significance level.

It is very important to mention that the elasticity estimates obtained from different functional forms do not differ considerably for goods which have low elasticity such as food and vice. But it has been found that there are considerable differences for the commodity groups which have large elasticities.

The hyperbolic form gives the lowest elasticity estimates, whereas the double-log form gives the highest elasticity estimates, if we excluded working-lesser estimates. This observation was also make by Prais and Houthakker (1955) using the British data.

Table (8) Engel Elasticity Estimates Based on the 2010 Family Expenditure survey (Pooled Data)

commodity groups Linear	Linear	Double Log	Working-Leser	Semi Log	Hyperbolic Form	Reciprocal Form
Food	0.41	0.42	0.43	0.41	0.37	0.37
Vice	0.62	0.58	0.61	0.61	0.53	0.51
Clothing	0.91	0.94	0.94	0.92	0.81	0.84
housing	1.23	1.25	1.25	1.21	1.06	1.13
Household operation	0.95	0.93	0.93	0.94	0.81	0.83
Transportation	1.8	2.21	1.93	1.77	1.53	1.95
Health	0.85	0.88	0.83	0.84	0.73	0.79
Personal care	1.4	1.70	1.6	1.39	1.24	1.55
Miscellaneous	1.9	2.16	2.01	1.90	1.62	1.95

Testing the hypotheses

1- Family composition

It is believed that the size of the family affects the various needs of household. Currie (1972) suggested that the omission of family composition from a household budget study and the relegation of its effect the disturbance term which will result in biased estimates of the total expenditure coefficient if there is any correlation between family composition and family total expenditure. Therefore, family composition as measured by the number of persons will be introduced into the double-log model for each commodity group in order to test the hypothesis that family composition has an effect on Engel curves.

$$\text{Log } V_i = a_i + B_i \log m + \Upsilon i \log n + u_i \quad (12)$$

Where n is the number of persons in the household and the other notations are defined as shown above.

Equation (12) has been fitted to the Jordanian data and the estimated results are presented in Table (9).

The t- ratios indicate that the elasticity estimates with respect to family size for vice, clothing, housing and household operation are not significantly different from zero.

This implies that family size does not affect the demand for these commodity groups. On the other hand, the elasticity estimates with respect to the family size for the other groups are significantly different from zero which suggests that family size affects the demand for these commodity groups.

Tabal (9) Elasticity Estimates of Demand with Respect To Total Expenditure And With Respect To Family Size

	ai	Bi	Υi	R^2
Food	3.06 (1.02)	0.40 (0.12)	-0.04 (0.01)	0.97
Vice	-0.272 (0.825)	0.62 (0.110	-0.05 (0.05)	0.74
Clothing	-2.56 (0.21)	0.92 (0.03)	0.02 (0.15)	0.99
housing	-0.40 (0.41)	1.35 (0.06)	0.01 (0.03)	0.98
Household operation	-0.07 (0.29)	0.94 (0.39)	0.20 (0.02	0.98
Transportation	-13.12 (0.95)	2.40 (0.16)	0.29 (0.05)	0.95
Health	-1.02 (1.42)	0.80 (0.21)	-0.21 (0.07)	0.71
Personal care	-9.23 (1.21)	1.82 (0.16)	0.15 (0.05)	0.92
Miscellaneous	-11.41 (0.91)	2.2 (0.14)	0.20 (0.04)	0.97

2- Economies of Scale

In order to test the hypothesis that there are economies of scale to household size in the consumption of some or all commodity groups, Deaton (1986), suggested the following functional form:

$$\text{Log } q_i = a_i + B_i \text{ logm} + \Upsilon i \text{ logn} + u_i \quad (13)$$

Where q_i is the quantity demanded and the other notations has been defined earlier. Tests were conducted for whether $B_i + \Upsilon i - 1$ is negative (economies of scale), zero (no economies or diseconomies) or positive (diseconomies of scale).

The quantity index for each category is obtained by dividing the expenditure with the corresponding price index in 2010. Therefore, equation (13) can be estimated for each category and the value of $B_i + \Upsilon i$ and their standard errors is calculated which can be obtained as follows:

$$\text{Var}(B_i + \Upsilon i) = \text{Var}B_i + \text{Var}\,\Upsilon i + 2\text{cov}\,(B_i + \Upsilon i) \ldots (14)$$

Then the t-ratios can be used to test whether $(B_i + \Upsilon i)$ is significantly less than one, greater than one or not significantly different from one, noting that this test will only be applied to those commodity groups in which Υi is significantly different from zero.

Table (10) shows the estimated results of equation. The t-ratios indicate that Υi is not significantly different from zero for Vise, Clothing,

Housing and Household operations hereby indicating that family size does not affect per-capita consumption of these commodity groups. Hence, the t-test indicates that there are economies of scale only for food. This suggests that as the size of family increases, per-capita consumption for food decreases. Furthermore, the test indicates that there are diseconomies of scale for transportation, Personal care and Miscellaneous commodity groups. This indicates that as family size increases per-capita consumption for these commodity groups increases. Although, the sum of $B_i + \Upsilon i$ for health commodity group is less than one, the t-test indicates that the sum is not significantly different from unity.

Table (10) Elasticity Estimates Of Demand (quantity) With Respect To Total Expenditure and with Respect to Family Size

	ai	Bi	Υi	R^2
Food	2.85 (0.18)	0.40 (0.02)	-0.04 (0.01)	0.97
Vice	0.95 (0.72)	0.55 (0.10)	-0.07 (0.04)	0374
Clothing	-2.81 (0.28)	0.95 (0.03)	0.02 (0.02)	0.98
Housing	-3.72 (0.46)	1.26 (0.05)	0.01 (0.02)	0.98
Household operation	-2.33 (0.31)	0.92 (0.03	0.02 (0.02)	0.98
Transportation	-12.86 (1.21)	2.21 (0.17)	0.28 (0.05)	0.95
Health	-1.22 (1.60	0.80 (0.21)	-0.24 (0.07)	0.71
Personal care	-9.66 (I.19)	1.80 (0.18)	0.15 (0.06)	0.91
Miscellaneous	-11.23 (0.95)	2.25 (0.12)	0.20 (0.05)	0.96

3- Location of the Household:

In order to test the hypothesis that the location of household has an affect on per-capita consumption for each commodity group, Chow (1960) test will be applied.

The F calculated for food, vice, household operation, transportation and health was found to be less than the critical value of F, so that we accept the hypothesis that the consumption pattern for these commodity groups in urban areas does not differ from consumption pattern of rural areas. On the other hand, F calculated for the other commodity groups was found to be larger than the F critical value, so that we reject the hypothesis that the consumption pattern for clothing, housing, personal care and miscellaneous commodity groups, are the same in urban and rural areas.

Based on t-test, it was found that the size of the family affected the demand for food, transportations, health, personal care and miscellaneous commodity groups. But it was found that the family size does not affect the demand for the other commodity groups under consideration.

Furthermore, it was found that there is economies of scale for food group only and diseconomies of scale for transportation, personal care, and miscellaneous commodity group. It was also found that there is constant return of scale for health group as show in Table (11).

Table (11) t-Ratios For Testing Household Economies, Diseconomies Or Constant Of Scale

	Bi+ Ɣi	Standard Errors of Bi + Ɣi	t-Ratios of Bi + Ɣi
Food	0.36	0.03	-12
Transportation	2.29	0.19	14.2
Health	0.59	0.32	-1.84
Personal care	1.79	0.19	1037
Miscellaneous	2.41	0.15	16.07

Finally, the consumption pattern of for food, vice, household operation, transportation and health commodity groups in urban areas did not differ from the consumption pattern of rural area for these commodity groups. On the other hand, the consumption pattern for clothing, housing, personal care and miscellaneous commodity groups in the urban areas differed from the consumption pattern in the rural area for these commodity groups.

Conclusion

Six functional forms of estimating Engel curves were applied to the Jordanian household data, urban and rural areas as well as the pooled data (total). The estimated results of the linear, the double-log, the semi-log, the hyperbolic and the log-reciprocal forms fit into the data very well for most of the commodity groups for the pooled and urban data. The finding of the study is as follows:

1. The family size does not affect the demand for the Vice, Housing, Transportation and Health Commodity groups. On the other hand, the family size for the other groups is significantly different from zero which suggests that family size affect the demand for these commodity groups.
2. The family size does not affect per-capita consumption of these commodity groups. The t-test indicates that there are economies of scale only for food.
3. The consumption pattern for clothing, housing, personal care and miscellaneous commodity group, are not the same in urban and in rural areas.

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