ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

DEPARTMENT OF STATISTICS

POSTGRADUATE PROGRAM

STATISTICAL ANALYSIS OF THE COST OF CHILDREN IN DIFFERENT ADMINISTRATIVE DIVISIONS AND AREAS OF GREECE, APPLYING EQUIVALENCE SCALES

By

Vasilios G. Kounadis

A THESIS
Submitted to the Department of Statistics
of the Athens University of Economics and Business
in partial fulfilment of the requirements for
the degree of Master of Science in Statistics

Athens, Greece
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ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ΤΜΗΜΑ ΣΤΑΤΙΣΤΙΚΗΣ

ΣΤΑΤΙΣΤΙΚΗ ΑΝΑΛΥΣΗ ΤΟΥ ΚΟΣΤΟΥΣ ΤΩΝ ΠΑΙΔΙΩΝ ΣΕ ΔΙΑΦΟΡΕΣ ΠΕΡΙΟΧΕΣ ΤΗΣ ΕΛΛΑΔΑΣ, ΧΡΗΣΙΜΟΠΟΙΩΝΤΑΣ ΚΛΙΜΑΚΕΣ ΚΑΤΑΝΑΛΩΤΙΚΗΣ ΙΣΟΔΥΝΑΜΙΑΣ

Βασίλειος Γ. Κουνάδης

ΔΙΑΤΡΙΒΗ
Που υποβλήθηκε στο Τμήμα Στατιστικής
του Οικονομικού Πανεπιστημίου Αθηνών
ως μέρος των απαιτήσεων για την απόκτηση
Μεταπτυχιακού Διπλώματος Ειδίκευσης στη Στατιστική

Αθήνα
Φεβρουάριος 2004

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Vasilios G. Kounadis

Approved by the Graduate Committee

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Athens, February 2004

Michael Zazanis, Associate Professor
Director of the Graduate Program

DEDICATION

To my family

ACKNOWLEDGEMENTS

I would like to thank my supervisor Mrs. Alexandra Livada for her guidance and help during the elaboration of my dissertation. I would also like to thank Mrs. Helen Kandilorou for answering to some queries I had and Mr. Panos Tsakloglou for providing me with the 1998-99 HES data.

VITA

I was born in Athens, Greece in December 17, 1978. I finished high school in Athens and in 1993 I moved in Brussels, Belgium with my family for three years. I graduated in 1996 from Kestekidion lycée of Brussels with grade “Excellent” and the same year I entered the Athens University of Economics and Business in the department of Business Administration. I obtained my degree in 2000 with grade “Very Good”. Later that year I was accepted in the post-graduated program in Statistics in the Athens University of Economics and Business. In February 2003, I passed with success all the lessons of the post-graduated program and in December 2003, I finished my dissertation. I speak four languages: Greek, English, French and Italian.

VITA

I was born in Athens, Greece in December 17, [illegible]

ABSTRACT

Vasilios Kounadis

STATISTICAL ANALYSIS OF THE COST OF CHILDREN IN DIFFERENT ADMINISTRATIVE DIVISIONS AND AREAS OF GREECE, APPLYING EQUIVALENCE SCALES

February 2004

Equivalence scales provide answers to question like how much a couple with one little child needs to spend more compared to a childless couple to attain the same welfare level. In this dissertation we estimate equivalence scales using the two-parameter specification of the Engel curve and taking into consideration the regional parameter. The main question being asked is whether we have differences in the cost of children in different administrative divisions and areas of Greece. The presence of heteroskedasticity leads us to the Generalized Least Squares (GLS) method for correcting it and provides us with more efficient estimates for the calculation of equivalence scales. The results are based on the 1998-99 Household Expenditure Survey published by the National Statistical Service of Greece.

ΠΕΡΙΛΗΨΗ

Βασίλειος Κουνάδης

ΣΤΑΤΙΣΤΙΚΗ ΑΝΑΛΥΣΗ ΤΟΥ ΚΟΣΤΟΥΣ ΤΩΝ ΠΑΙΔΙΩΝ ΣΕ ΔΙΑΦΟΡΕΣ ΠΕΡΙΟΧΕΣ ΤΗΣ ΕΛΛΑΔΑΣ, ΧΡΗΣΙΜΟΠΟΙΩΝΤΑΣ ΚΛΙΜΑΚΕΣ ΚΑΤΑΝΑΛΩΤΙΚΗΣ ΙΣΟΔΥΝΑΜΙΑΣ

Φεβρουάριος 2004

Οι κλίμακες καταναλωτικής ισοδυναμίας μας δίνουν απαντήσεις σε ερωτήσεις όπως, πόσο παραπάνω πρέπει να ξοδέψει ένα ζευγάρι με ένα μικρό παιδί σε σχέση με ένα ζευγάρι χωρίς παιδιά, ώστε να εξασφαλίσουν το ίδιο επίπεδο ευημερίας. Σε αυτή την διατριβή εκτιμούμε τις κλίμακες καταναλωτικής ισοδυναμίας χρησιμοποιώντας το δι-παραμετρικό προσδιορισμό της καμπύλης Engel και λαμβάνοντας υπόψη μας την γεωγραφική περιοχή. Η κύρια ερώτηση στην οποία καλούμαστε να απαντήσουμε, είναι κατά πόσο έχουμε διαφορές στο κόστος των παιδιών σε διαφορετικές περιοχές της Ελλάδας. Η παρουσία ετεροσκεδαστικότητας μας οδηγεί στην χρήση της μεθόδου των Γενικευμένων Ελαχίστων Τετραγώνων (GLS), η οποία εξασφαλίζει κατάλοιπα ομοσκεδαστικά και μας παρέχει πιο καλές εκτιμήσεις για τον υπολογισμό των κλιμάκων καταναλωτικής ισοδυναμίας. Τα αποτελέσματα βασίζονται στην έρευνα οικογενειακών δαπανών για τα έτη 1998-99 που δημοσιεύτηκε από την Εθνική Στατιστική Υπηρεσία.

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Chapter 1

INTRODUCTION

The purpose of this dissertation is to estimate the cost of children in Greece taking into account the number of children in the household and the regional variation. We will examine which areas and administrative divisions in Greece seem to be more expensive in the raising of younger and bigger children, comparing the cost of the families with children to the cost of the childless couples. In chapter 2, we present an analysis of the data that we will use and we take a first idea about the mean monthly differences in the expenditures for diverse administrative divisions and families, using analysis of variance. In chapter 3, we present the theory of equivalence scales estimated from observed behavior and we analyze the three major models for the estimation of equivalence scales. These models where proposed by Engel (1895), Rothbarth (1943) and Barten (1964) respectively. Due to lack of additional data, we continue in chapter 4 with the estimation of the Engel model and we introduce the Engel's curves. For the estimation of Engel's model we use at first the semi-logarithmic function of Working-Leser, but since the presence of heteroskedasticity is strong we resort to the double-logarithmic model, which corrects some of the heteroskedasticity. By pooling all the observations together and introducing some demographic variables, such as the number of little and big children in a household, we apply the two-parameter model. This latter specification, helps us to compute the equivalence scales for different administrative divisions and areas using the coefficients of the model. The estimation of the equivalence scales is presented in chapter 5. Since in some cases, when we apply the two-parameter model the Breusch-Pagan test shows that we have a problem of heteroskedasticity, we utilize the Generalized Least Squares (GLS) method for heteroskedasticity correction. This method permits us to have robust estimates, since in finite samples efficiency is as important as consistency. Comparing the corrected and uncorrected equivalences scales we can see their great divergence and that proves that it is wrong to ignore the violation of the assumption of equal error variance. In the last section of chapter 5, in order to see whether the cost of children has increased nowadays, we collocate the results of another paper and we make a comparison. Finally, in chapter 6 we have a conclusion of the results drawn from this dissertation.

Charter 2

DATA ANALYSIS

2.1 Introduction

In order to proceed with our analysis of the cost of children we will use the 1998-99 Household Expenditure Survey (HES) data of Greece. This survey collects detailed information about the expenditure, income and household characteristics of a sample of households resident in private dwellings throughout Greece. Average weekly expenditure on over 600 goods and services can be obtained from the survey and cross classified with household income, household total expenditures, household characteristics and geographical areas. The general objectives for conducting the HES are to identify the net levels and patterns of expenditure of Greek households on a comprehensive range of goods and services purchased for private use and to determine how these levels and patterns vary according to income/expenditure levels and other characteristics of households, such as size, composition and location.

The HES is also used to update the weighting pattern of the Consumer Price Index (CPI) and to ensure that it adequately reflects the spending habits of the Greek population. The CPI is an indicator of the rate of change in prices paid by consumers for the goods and services they buy.

2.2 The 1998-99 Household Expenditure Survey

In this dissertation we use the monthly cross-section consumption expenditure data that consists of incomes and expenditures of a random sample of 6258 households. Every household participates in the HES for three months and the members of the household are bound to note down every expenditure they make, from the most minor to the most expensive. Since each household takes part for only three months, the sample changes every trimester and so we have four different periods.

Since the HESs are not published on a regular basis from the National Statistical Service of Greece, we do not take into account price variation. The sample that we will use in this analysis consists of the households that comprise of a childless couple with head's age less than or equal to 55 years (345 households) and of the households that comprise of a couple with one or more children up to 16 years (1269). The total sample is 1614 households. We should note that couples with heads over 55 years are excluded from the sample for comparative purposes, since in most case studies it is considered that they have different expenditure patterns from those of the rest of the sample.

2.3 Categories of monthly expenditures

In all the Household Expenditures Surveys around the world we have more or less about ten categories of expenditures. The 1998-99 HES data of Greece divides the monthly expenditures of each household in twelve different categories:

1. Food and non-alcoholic beverages
2. Alcoholic beverages and tobacco products
3. Clothing and footwear
4. Housing, water supply, fuel and power of main or secondary residence
5. Durable goods for domestic use and domestic services
6. Medical care and health expenses
7. Transportation
8. Communication
9. Culture and Entertainment
10. Education
11. Hotels, coffeehouses and restaurants
12. Others (personal trimming, security, financial assistances, etc.)

It would be interesting to observe the mean monthly expenditures in drachmas (in parenthesis in Euros) in these categories for the reference group (childless couples), for the couples with one child up to 16 years and for the couples with two children up to 16 years. The results are shown in Table 2.1.

Table 2.1: Mean monthly expenditures in drachmas for couples with children and for childless couples

	Couples with one child up to 16	Couples with two children up to 16	Childless couples
Total Expenditures	683.094 *(€2005)*	707.902 *(€2078)*	653.129 *(€1917)*
Food	100.832 *(€296)*	113.002 *(€332)*	80.275 *(€236)*
Alcohol & Tobacco	20.911 *(€61)*	21.673 *(€64)*	23.833 *(€70)*
Clothing & Shoeing	58.102 *(€171)*	68.263 *(€200)*	56.176 *(€165)*
Housing	138.277 *(€406)*	141.595 *(€416)*	132.570 *(€389)*
Durable Goods	49.548 *(€145)*	48.272 *(€142)*	55.495 *(€163)*
Health	41.572 *(€122)*	37.767 *(€111)*	26.296 *(€77)*
Transportation	90.040 *(€264)*	85.185 *(€250)*	83.563 *(€245)*
Communication	19.041 *(€56)*	18.784 *(€55)*	19.024 *(€56)*
Culture & Entertainment	34.487 *(€101)*	37.823 *(€111)*	27.523 *(€81)*
Education	15.595 *(€46)*	26.410 *(€78)*	4.119 *(€12)*
Hotels & Restaurants	55.570 *(€163)*	58.704 *(€172)*	51.964 *(€153)*
Others	52.641 *(€154)*	48.879 *(€144)*	55.123 *(€162)*

An interesting information provided from Table 2.1, is the difference in the amounts of expenditures between childless couples and couples with one or two children up to 16 years. There is a great divergence in the expenditures for education (15.595 drs for the couples with one child and 26.410 drs for the couples with two children, against only 4.119 drs for childless couples), for food (100.832 drs and 113.002 drs against 80.275 drs respectively) and also, in an inferior level, for health care (41.572 drs and 37.767 drs for the couples with one and two children respectively, against 26.296 drs for the couples without children). Of course, the total mean monthly expenditures have also a remarkable difference (683.094 drs and 707.902 drs for the couples with one or two children respectively, against 653.129 drs for the ones without children).

Proceeding, we will examine if these mean differences are significant for diverse family types, in different administrative divisions, for the total monthly and food expenditures, applying the method of Analysis of Variance.

We must point out, that apart from the mean of the monthly expenditures for each category, we also computed the median that can be useful when having extreme values. In our case the differences where negligible and so, we chose to present the mean monthly expenditures. In order to have a better image on the expenditures, we can compute the percentages that a household devotes for each category in relation to the mean total expenditures. The results are shown in Figures 2.1, 2.2 and 2.3.

Figure 2.1: Percentages of expenditures for diverse categories for couples with one child up to 16 (HES 1998-99)

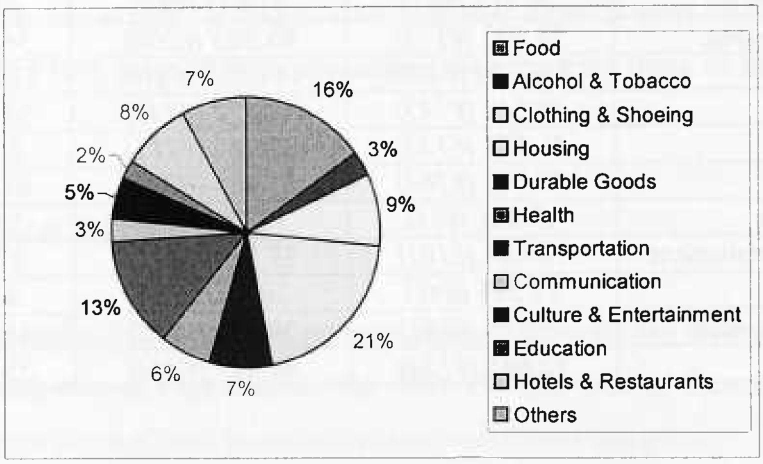
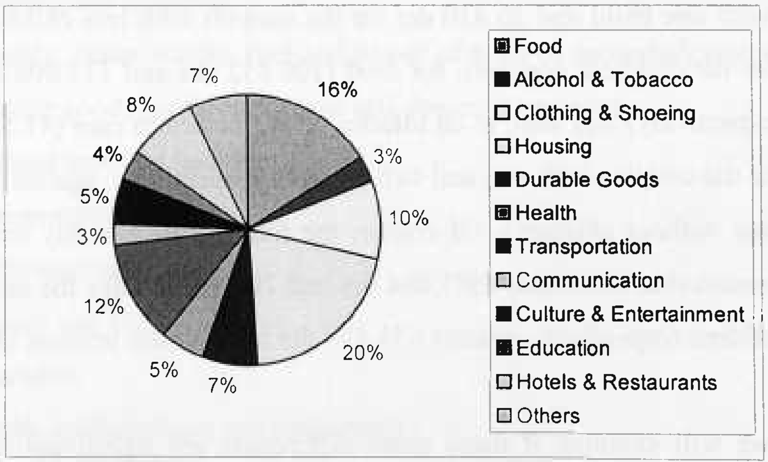
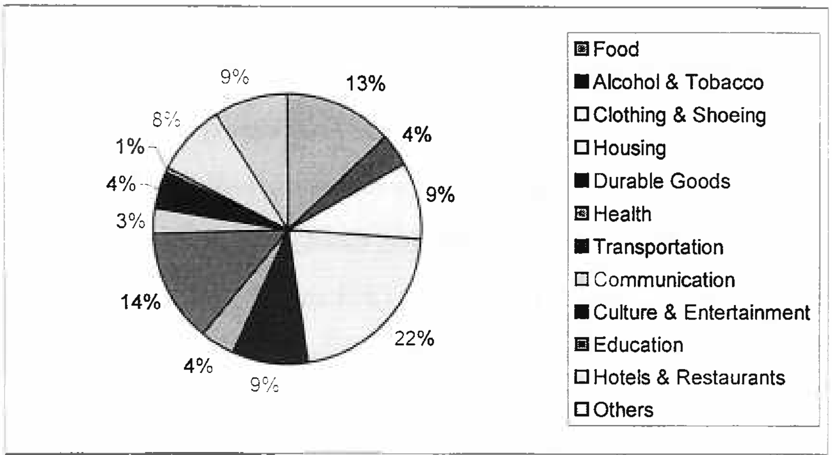


Figure 2.2: Percentages of expenditures for diverse categories for couples with two children up to 16 (HES 1998-99)



As we can see from the above Figures, the three categories with the highest percentages of expenditures in all three cases, are the expenditures for food (16% for the couples with one or two children and 13% for the childless couples), for housing (ranging from 20% to 22%) and for transportation (12% to 14%). The expenditures for housing are quite high as they include the money a household provides for the rent, the water supply, the electricity power and the heating oil. The category transportation, includes the expenditures for petrol and for the acquisition of a car.

Figure 2.3: Percentages of expenditures for diverse categories for couples without children (HES 1998-99)



2.4 Administrative divisions and family types

Since we are interested to measure the cost of children in different administrative divisions in Greece we have to share our sample. The data for the HES were taken using stratified sampling and so the number of cases is analogous to the population (see National Statistical Service of Greece, 2003). In our analysis we have five administrative divisions according to their population size. These administrative areas are:

a. Greater Athens (707 cases)
b. Greater Thessalonica (103 cases)
c. Municipalities with population more than 10000 inhabitants (391 cases)
d. Municipalities and communities with population from 2000 to 9999 inhabitants (183 cases)
e. Communities with population less than 1999 inhabitants (230 cases)

The administrative divisions from (a) to (c) are urban areas, the division (d) is a semi-urban area and finally the division (e) represents the rural areas.

Given that one family with children have differences from another family with more children, or bigger children we have to divide our sample according to the number and the age of the children. The different family types that are the most common and that we will be of our interest in this dissertation are the following:

- Childless couples (345 cases)
- Couples with one little child up to 6 years (254 cases)
- Couples with two little children up to 6 years (109 cases)
- Couples with one little child up to 6 years & one big child 6-13 years (165 cases)
- Couples with one big child 6-13 years (165 cases)
- Couples with two big children 6-13 years (203 cases)
- Couples with one child up to 16 years (488 cases)
- Couples with two children up to 16 years (634 cases)
- Couples with three or more children up to 16 years (147 cases)

From the number of cases for each family type, we ascertain the tendency of Greek young couples to have fewer children. The couples in the 1998-99 data with one little child up to 6 years are 254, while the ones with two little children are only 109. This is not the case for bigger children 6-13 years, where the couples with two children are more than those with one child (203 against 165).

The reduction of births in Greece is also obvious when observing the population by age groups. Thus, according to the census of 1991 we have the following population numbers shown in Table 2.2.

Table 2.2: Population for different age groups
in diverse administrative divisions

Age groups	Country	Greater Athens	Greater Thessalonica	Semi-urban areas	Urban areas
0-4	556.987	154.767	39.351	76.254	148.146
5-9	663.434	185.780	45.500	90.021	176.335
10-14	754.446	218.115	53.367	101.340	198.349
15-19	766.605	222.657	60.509	101.995	200.737
20-24	791.412	249.403	74.458	99.388	190.421
25-30	721.751	232.860	58.896	91.415	177.734

In the whole country as well as in Greater Athens and in Greater Thessalonica, the population of young people is decreasing the last 25 years, while in the semi-urban and urban areas this decrease is noticed for the last 10 years.

2.5 Analysis of Variance

The Analysis of Variance will help us estimate if the region in which a couple (with or without children) lives is statistically more expensive that another region.

2.5.1 Mean monthly total expenditures

At first, we will examine whether, for each of the nine different family types, there is a statistically significant difference in the mean monthly total expenditures according to the administrative division they live in. Table 2.3 shows these figures.

Table 2.3: Mean monthly total expenditures in drachmas for different family types in different administrative divisions (HES 1998-99)

	Greater Athens	**Greater Thessalonica**	**More than 10000 inhabitants**	**2000 to 9999 inhabitants**	**Less than 1999 inhabitants**
Childless couples	742.515 *(€2179)*	620.450 *(€1821)*	577.193 *(€1694)*	541.999 *(€1591)*	549.566 *(€1613)*
One little child below 6	726.442 *(€2132)*	595.805 *(€1749)*	523.764 *(€1537)*	647.303 *(€1900)*	656.524 *(€1927)*
Two little children	988.455 *(€2900)*	508.757 *(€1493)*	587.611 *(€1725)*	674.726 *(€1980)*	613.283 *(€1800)*
One little & one big child	688.547 *(€2021)*	731.671 *(€2147)*	638.863 *(€1875)*	566.353 *(€1662)*	557.169 *(€1635)*
One big child 6-13 years	842.364 *(€2472)*	785.237 *(€2305)*	594.329 *(€1744)*	539.365 *(€1583)*	537.427 *(€1577)*
Two big children	818.690 *(€2403)*	566.243 *(€1662)*	562.225 *(€1650)*	665.084 *(€1952)*	544.827 *(€1599)*
One child up to 16	780.481 *(€2290)*	726.443 *(€2132)*	548.232 *(€1609)*	619.939 *(€1820)*	575.497 *(€1689)*
Two children up to 16	818.043 *(€2400)*	680.816 *(€1998)*	623.581 *(€1830)*	635.149 *(€1864)*	603.948 *(€1772)*
Three or more children	752.441 *(€2208)*	638.405 *(€1874)*	689.597 *(€2024)*	668.708 *(€1962)*	601.121 *(€1764)*

*Note: couples with head up to 55 years

We perform analysis of variance for each of the nine cases, considering the monthly total expenditures as the dependent variable. Since for all cases the assumptions of the linear model (homoskedasticity and normality) are not satisfied, we resort to the Box-Cox transformation. This transformation corrects the heteroskedasticity problem (standardized residuals versus predicted values), and also the non-normality of the standardized residuals (see appendix A).

For all the cases the hypotheses that we want to test are:

H_0 : The mean total expenditures are the same in the five administrative divisions, or in other words $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$.

H_1 : The mean total expenditures differ for at least two administrative divisions, or in other words $\mu_i \neq \mu_j$ for at least $i \neq j$.

Where:

μ_1 is the population mean total expenditure in Greater Athens.

μ_2 is the population mean total expenditure in Greater Thessalonica.

μ_3 is the population mean total expenditure in the municipalities with more than 10000 inhabitants.

μ_4 is the population mean total expenditure in the municipalities & communities with population from 2000 to 9999 inhabitants.

μ_5 is the population mean total expenditure in the communities with population less than 1999 inhabitants.

Assumptions: The populations are normally distributed with means $\mu_1, \mu_2, \mu_3, \mu_4, \mu_5$ and equal variances $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2 = \sigma_5^2 = \sigma^2$

The Table of the analysis of variance shows whether the null hypothesis is rejected or not. At statistically significant level 5%, H_0 is rejected if p-value≤ 0.05. In case where we do not reject the hypothesis H_0, we can use the Least Significance Difference (LSD) method that compares pairs of means, in order to see which pairs of administrative divisions differ.

This could be done by employing the t statistic

$$t_0 = \frac{\bar{y}_i - \bar{y}_j}{\sqrt{MS_E\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}}$$

Assuming a two-sided alternative, the pair of means μ_i and μ_j would be declared significantly different if $\left|\bar{y}_i - \bar{y}_j\right| > t_{a/2,N-a}\sqrt{MS_E\left(1/n_i + 1/n_j\right)}$. This quantity is called least significant difference. To use the LSD procedure, we simply compare the observed difference between each pair of averages to the corresponding LSD. If $\left|\bar{y}_i - \bar{y}_j\right| >$LSD, we conclude that the population means μ_i and μ_j differ.

We perform analysis of variance for each of the nine family types taking into consideration the regional parameter and we compute the least significant differences for multiple comparisons for observed means. The results of all the multiple comparisons are given in appendix A, and in Table 2.4 are shown the pairs that differ.

Table 2.4: P-values and comparisons of pairs of means for nine different family types across five administrative divisions (HES 1998-99)

	P-value	**Pairs that differ (using the LSD method)**
Childless couples	$\leq$0.001	$\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$, $\mu_1 \neq \mu_5$
One little child below 6 years	0.055	*There are no differences between the means*
Two little children below 6 years	0.004	$\mu_1 \neq \mu_2$, $\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$, $\mu_1 \neq \mu_5$
One little & one big child	0.540	*There are no differences between the means*
One big child 6-13 years	$\leq$0.001	$\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$, $\mu_1 \neq \mu_5$
Two big children 6-13 years	$\leq$0.001	$\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_5$
One child up to 16 years	$\leq$0.001	$\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$, $\mu_1 \neq \mu_5$, $\mu_2 \neq \mu_3$, $\mu_2 \neq \mu_5$
Two children up to 16 years	$\leq$0.001	$\mu_1 \neq \mu_2$, $\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$, $\mu_1 \neq \mu_5$
Three or more children up to 16	0.464	*There are no differences between the means*

It is shown in Table 2.4, that only for three types of families the mean monthly total expenditures have not significant difference at level α=5% (critical value 0.05), according to the division they live in. These are the couples with one little child below 6 years, the couples with one little and one old child 6-13 years, and the couples with three or more children up to 16 years. As it concerns the other six types of families, we observe that the mean monthly total expenditures in greater Athens are much higher than in the other divisions, making Athens generally an expensive city to raise children. Especially, for the couples with two little children below 6 years and the couples with two children up to 16 years, the mean total expenditures in greater Athens are higher than in all the other administrative divisions.

Remarkable is that the couples in Athens with two little children spend on average almost 1 million drachmas (€ 2900) every month for their expenditures while in greater Thessalonica they spend only the half (about 500.000 drachmas (€ 1500)). The expenditures for these couples in Athens are higher than in Thessalonica or in the other regions, for all the 12 categories of monthly expenditures, exept for alcohol and tobacco where the amounts are similar. The main differences are found especially in the expenditures for durable goods (furniture, household utensils, electrical appliances) and for transportation (acquisition of a car, petrol, etc.).

Of course, the differences in the mean total expenditures between greater Athens and greater Thessalonica exist only for these couples and for the ones with two children up to 16. For the other seven types of families, Athens and Thessalonica don't seem to have differences. We should also note that Greater Thessalonica, semi-urban areas and rural areas don't have any significant difference between them, except from the case of the couples with one child up to 16. In this occasion, the mean monthly expenditures in Thessalonica are higher than in the municipalities with more than 10000 inhabitants or than the communities with less than 2000 inhabitants.

2.5.2 Mean monthly food expenditures

The second analysis that we perform will show whether there is a statistically significant difference in the mean monthly expenditures for food, for each of the nine different family types, taking into consideration the administrative division they domicile. The mean expenditures for food for each family type are presented in Table 2.5.

Table 2.5: Mean monthly food expenditures in drachmas for different family types in different administrative divisions (HES 1998-99)

	Greater Athens	**Greater Thessalonica**	**More than 10000 inhabitants**	**2000 to 9999 inhabitants**	**Less than 1999 inhabitants**
Childless couples	82.185 *(€241)*	60.778 *(€178)*	80.480 *(€236)*	73.985 *(€217)*	86.861 *(€255)*
One little child below 6	94.624 *(€278)*	95.084 *(€279)*	90.339 *(€265)*	90.377 *(€265)*	96.547 *(€283)*
Two little children	128.955 *(€378)*	96.936 *(€284)*	106.771 *(€313)*	125.574 *(€369)*	133.468 *(€392)*
One little & one big child	103.457 *(€304)*	97.033 *(€285)*	94.475 *(€277)*	98.018 *(€288)*	103.804 *(€305)*
One big child 6-13 years	111.281 *(€327)*	112.503 *(€330)*	103.193 *(€303)*	99.772 *(€293)*	97.683 *(€287)*
Two big children	129.687 *(€381)*	101.802 *(€299)*	107.043 *(€314)*	99.182 *(€291)*	104.756 *(€307)*
One child up to 16	101.318 *(€297)*	98.849 *(€290)*	96.136 *(€282)*	92.439 *(€271)*	100.375 *(€295)*
Two children up to 16	121.767 *(€357)*	100.312 *(€294)*	103.956 *(€305)*	106.054 *(€311)*	115.516 *(€339)*
Three or more children	145.268 *(€426)*	118.155 *(€347)*	156.805 *(€460)*	138.933 *(€408)*	143.292 *(€421)*

Like in the previous case (*2.5.1*) with the total expenditures, the hypotheses that we'll test are the following:

H_0 : The mean food expenditures are the same in the five administrative divisions, or equivalently $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$.

H_1 : The mean food expenditures differ for at least one administrative division, or equivalently $\mu_i \neq \mu_j$ for at least $i \neq j$.

Where:

μ_1 is the population mean food expenditure in Greater Athens.

μ_2 is the population mean food expenditure in Greater Thessalonica.

μ_3 is the population mean food expenditure in the municipalities with more than 10000 inhabitants.

μ_4 is the population mean food expenditure in the municipalities and communities with population from 2000 to 9999 inhabitants.

μ_5 is the population mean food expenditure in the communities with population less than 1999 inhabitants.

Performing analysis of variances and achieving homoskedasticity and normality of the residuals, with the use of the Box-Cox transformation, we obtain the results shown in Table 2.6. We use again the Least Significance Difference (LSD) method in order to compare the pairs of means.

Table 2.6: P-values and comparisons of pairs of means for nine different family types across five administrative divisions (HES 1998-99)

	P-value	Pairs that differ (using the LSD method)
Childless couples	0.021	$\mu_1 \neq \mu_2$, $\mu_3 \neq \mu_2$, $\mu_4 \neq \mu_2$
One little child below 6 years	0.500	*There are no differences between the means*
Two little children below 6 years	0.328	*There are no differences between the means*
One little & one big child	0.775	*There are no differences between the means*
One big child 6-13 years	0.159	*There are no differences between the means*
Two big children 6-13 years	0.007	$\mu_1 \neq \mu_2$, $\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$
One child up to 16 years	0.121	*There are no differences between the means*
Two children up to 16 years	≤ 0.001	$\mu_1 \neq \mu_2$, $\mu_1 \neq \mu_3$, $\mu_1 \neq \mu_4$
Three or more children up to 16	0.464	*There are no differences between the means*

From the above Table, we can see that only for three types of families there is a significant difference concerning the expenditures for food. For the other types of families, it seems that wherever they live they have less or more the same level of expenditures for food.

As it concerns the families that have significant differences, we can say that the childless couples in greater Thessalonica spend less money for food than the ones in greater Athens or in the municipalities and communities with more than 2000 inhabitants. This could mean that foodstuffs for a couple without children in Thessalonica are cheaper or that they simply prefer to spent their money for other purposes. Other two types of families with significant differences concerning the food expenditures and the region they live in, are these with two big children 6-13 years and these with two children up to 16 (the first comprises to the latter). The couples who have two big children and live in greater Athens seem to give more money for foodstuffs than in Thessalonica or than in the municipalities and communities with more than 2000 inhabitants (the same goes also for the couples with two children up to 16). Finally, it is remarkable that there isn't any sign of difference between greater Athens and communities with population less than 1999 inhabitants.

Chapter 3

THEORY OF EQUIVALENCE SCALES

3.1 Introduction

During the last few years a rising number of articles and books has been dedicated to the construction of household equivalence scales. A concise definition of the term 'equivalence scale' is given by Grootaert (1983). According to him, "equivalence scale is an index number [which]… indicates at reference prices the cost differential for a household, due to different household size and composition, to reach the indifference curve of the reference household". They have applications in a number of areas concerning welfare comparisons across households, such as, in the design of tax and welfare policies, in studies of inequality, poverty and others.

In the literature, there are three main approaches for the construction of equivalence scales. The first one uses nutritional needs in order to determine the size of the scales (see Visaria (1980)), even that needs are generally regarded as a social rather than a physiological concept. The second approach uses survey questionnaires directly asking the households questions about preferences or hypothetical choices (see Kapteyn and Van Praag (1976) and Goedhart et al (1977)), introducing a very strong subjective factor in the creation of the scales. Finally, the third approach facilitates the estimation of equivalence scales from observed expenditure patterns of households. This latter approach will be analyzed in this dissertation, estimating the equivalence scales for the cost of children.

3.2 The theory of equivalence scales estimated from observed behavior

The definition of Grootaert (*3.1*) suggests that equivalence scales can be used in order to measure changes in welfare across persons as a result of changes in demographic characteristics. In case where labor supply is determined by external factors, welfare is obtained from the consumption of goods and services. This consumption is translated into welfare as a function of several characteristics of the consuming unit (in our case the household) such as environmental and demographic factors. Thus, if all the households have the same utility function, differences in preferences between households can be attributed to observable characteristics and, ceteris paribus, if two demographically identical households have identical behavior they are presumed to enjoy identical welfare levels.

At this point we should note two elements. Firstly, since only the parents are present both before and after the arrival of the children to the household or the departure of the children from the household, the welfare we are interested in keeping constant in our analysis is the parents' welfare. Secondly, since the time horizon of this analysis is a short one, the concept of welfare used here is short-run welfare and assumes diachronic modification of preferences over the life cycle. Children have some needs, the satisfaction of which obliges their parents to reduce their consumption and, therefore, their own welfare. However, having children may engender the expectation of future benefits for their parents and, so, the parents may increase their consumption in the short-run and thus increases their welfare. What is not assumed is that the welfare of the parents may increase at each level of consumption because of the existence of the children.

From a welfare analysis point of view, households are considered unequal not only in terms of their income but also in terms of their size, member composition and other demographic characteristics. So, families with children of the same income as childless ones are likely to have lower living standards because of the financial burden of raising children. The cost of children in this case can be measured with the concept of equivalence scale (Muellbauer (1974), Browning (1992)). A household equivalence scale allows for different households to be brought into equivalence. It describes the relation of expenditures required by people in different household types to reach the same living standard. Equivalence scales constitute a useful conceptual tool for designing economic policy that would put on equal footing (bring into equivalence) the living standards of families of different size and composition (Pashardes (1991), Lyssiotou (1997)).

The models of equivalence scales derived from observed behavior assume that the direct utility function of the parents is given by

$$u = u(q,\ \boldsymbol{a}) \tag{1}$$

where u is utility, $\boldsymbol{q}$ is the vector of commodities consumed by the household and $\boldsymbol{a}$ is the vector of household's demographic characteristics. Associated with this utility function is a cost function for any household h, providing with the minimum level of expenditure X, required to reach the utility level u at prices $\boldsymbol{p}$ when $\boldsymbol{a}$ is given. This cost function is the following:

$$c(u,\ \boldsymbol{p},\ \boldsymbol{a}) = X \tag{2}$$

In order to obtain the equivalence scale, we can select a reference price vector $\boldsymbol{p}^k$ and a reference utility level u^k, and divide the cost function of any household h by the cost function of the reference household k.

$$m^h = c(u^k,\ \boldsymbol{p}^k,\ \boldsymbol{a}^h)/\ c(u^k,\ \boldsymbol{p}^k,\ \boldsymbol{a}^k) \tag{3}$$

The direct utility involved in equations (1), (2) and (3) is unobservable. However, a system of demand equations is associated with them linking commodity expenditures to total expenditure, prices and demographic characteristics. Using Shephard's lemma we derive the compensated demand functions

$$p_i q_i = \partial\, c(u,\ \boldsymbol{p},\ \boldsymbol{a})/\partial\, lnp_i \tag{4}$$

and then, substituting indirect utility $v(X,\ \boldsymbol{p},\ \boldsymbol{a})$ for direct utility $u(\boldsymbol{q},\ \boldsymbol{a})$ we obtain the uncompensated demand functions, whose components are observable:

$$p_i q_i = \partial\, c[v(X,\ \boldsymbol{p},\ \boldsymbol{a}),\ \boldsymbol{p},\ \boldsymbol{a}]/\partial\, lnp_i = f(X,\ \boldsymbol{p},\ \boldsymbol{a}) \tag{5}$$

We should note of course, that even complete knowledge of the system of demand equations is insufficient to recover complete information about the cost function. For this purpose some identifying assumptions are needed, in order to estimate the equivalence scales. So, in the cost function enter different assumptions concerning the demographic variables and this leads to different models of equivalence scales. The most well known models are the single-equation model of Engel (1895) and the single-equation model of Rothbarth (1943), while some other models require the estimation of a complete system of demand equations. The most noted of the latter is Barten's model (1964).

In this dissertation we will analyze in depth Engel's model using the 1998-99 Household Expenditure Survey (HES) data of Greece and we will also present, in theory only due to lack of additional data, Rothbarth's model and Barten's model.

3.3 Models of equivalence scale for the cost of children

There are a great number of studies concerning the estimation of household equivalence scales. In the course of these studies importance has been given to empirical investigations of the expenditure behavior of households using single-equation or demand equations systems. The first who dealt with the construction of equivalence scales was Engel (1895). He noticed, as we mentioned earlier, that poorer households devote a higher proportion of their total expenditure to food than richer households. This observation is used as an indirect indication of welfare. About fifty years later (1943) Rothbarth introduced the notions of 'adult goods' and 'other goods', proposing an alternative of Engel's model. Rothbarth's model became very popular and has been estimated in several forms. Finally, another important progress in this area is Barten's (1964) attempt to estimate equivalence scales using a complete system of demand equations.

3.3.1 The Engel model

The first model of equivalence scales goes back to the 19th century, when Engel (1895) indicated that richer households devote a lower proportion of their total expenditure to food compared to poorer households. He also pointed out that the average inclination of smaller households to consume food is lower than the one of larger households when they are at the same level of total expenditure. Hence, two households with the same foodshare are assumed to enjoy the same level of welfare irrespective of differences in size, composition and total expenditure. Comparing the total expenditures of the two households at the same share of food, we can obtain an index of the cost of maintaining the second household relative to the cost of maintaining the first (reference) household. Practically, this index is the equivalence scale.

Before continuing with the description of Engel's model, we assume for convenience that the reference household consists of one adult only. In that case, the equivalence scale can be thought of as the number of adult equivalents of the household under examination. According the Engel model (see Deaton and Muellbauer (1980)), the cost function of any household h with demographic characteristics a^h is the following one:

$$c(u, \mathbf{p}, \mathbf{a}^h) = m(\mathbf{a}^h)\, c(u, \mathbf{p}) \tag{6}$$

where $m(\mathbf{a}^h)$ is the number of equivalence adults of the household under examination and $c(u, \mathbf{p})$ is the cost function of the reference household (one adult). Of course, for the reference household k we have $m(\mathbf{a}^k) = 1$. The direct utility function of household h becomes:

$$u^h = u(\mathbf{q}^h, \mathbf{a}^h) = u[\mathbf{q}^h / m(\mathbf{a}^h)] \tag{7}$$

where, $\mathbf{q}$ is the vector of commodities consumed by the household. The demand functions per equivalent adult are:

$$q_i^h / m(\mathbf{a}^h) = g_i\,[X^h / m(\mathbf{a}^h), \mathbf{p}] \tag{8}$$

which can presented in budget share form:

$$W_i^h = \frac{p_i q_i^h}{X^h} = \frac{p_i g_i[X^h / m(\mathbf{a}^h), \mathbf{p}]}{X^h / m(\mathbf{a}^h)} \tag{9}$$

The equation (9) is a function of $X^h / m(\mathbf{a}^h)$ and not of X^h or $m(\mathbf{a}^h)$ separately. So, if all households face the same price vector and both the reference household k and the household h have the same foodshare W_f, they should be at the same welfare level. This means that the equivalence scale is given by:

$$\frac{X^h}{m(\mathbf{a}^h)} = \frac{X^k}{m(\mathbf{a}^k)} \Rightarrow m(\mathbf{a}^h) = \frac{X^h}{X^k} \tag{10}$$

In this model the indicator of welfare is the foodshare W_f. This derives from equation (6) by differentiating ln $c(u, \mathbf{p}, \mathbf{a})$ with respect to ln p_f (where p_f is the price of food). In other words:

$$W_f^h = \partial \ln c(u^h, \mathbf{p}^h, \mathbf{a}^h) / \partial \ln p_f = \partial [\ln m(\mathbf{a}^h) + \ln c(u^h, \mathbf{p}^h)] / \partial \ln p_f$$
$$= \partial \ln c(u^h, \mathbf{p}^h) / \partial \ln p_f \tag{11}$$

Assuming that the prices are constant, W_f^h is directly related with u^h and therefore it is an indicator of welfare. We should also note that the same analysis could be employed to any budget share and not only foodshare.

3.3.2 The Rothbarth model

Half a century after the introduction of the Engel model, Rothbarth (1943) proposed an alternative model. According to this one, the goods and the services consumed by a household, can be separated into two different groups. The first one contains those consumed exclusively by adults while the second group comprises those goods and services that are generally consumed both by adults and children. The group of 'adult goods' consists of commodities such as adult clothing and footwear, alcohol, tobacco, meals out, entertainment etc. The level of adults' welfare is determined by their consumption of adult goods. If two households with the same number of adults spend the same amount of money on adult goods, they are considered to be equally prosperous regardless of their size and total expenditure. An important difference between Engel and Rothbarth's models is that instead of the multiplicative form of the Engel cost function, the Rothbarth model assumes an additive cost function. So we have:

$$c(u, \mathbf{p}_A, \mathbf{p}_B, \mathbf{a}_c) = \beta(u, \mathbf{p}_B, \mathbf{a}_c) + \gamma(u, \mathbf{p}_A, \mathbf{p}_B) \tag{12}$$

where $\mathbf{p}_A$ *and* $\mathbf{p}_B$ are the price vectors for 'adults goods' and 'other goods' respectively and $\mathbf{a}_c$ is the vector of demographic characteristics of children only. The first part of the right section (β) is considered as the cost of children, while the second part (γ) as the fixed costs. Since the goods are divided into two categories, total expenditure X, consists also of expenditure for adult (X_A) and other (X_B) goods. In other words:

$$X = X_A + X_B = \mathbf{p}_A \mathbf{q}_A + \mathbf{p}_B \mathbf{q}_B \tag{13}$$

Given equation (12) the expenditure on adult goods is:

$$X_A = \sum_{i \in A} p_i \partial\gamma(u, \mathbf{p}_A, \mathbf{p}_B) / \partial p_i = \theta(u, \mathbf{p}_A, \mathbf{p}_B) \tag{14}$$

Assuming that the prices are the same for all households, X_A and u are related and therefore, X_A is an indicator of welfare. Of course, if the reference household is the childless couple $\beta(u^k, p_B^k, a_c^k) = 0$. In this case, the equivalence scale is given by:

$$m^h = [\beta(u^k, p_B^k, a_c^h) + \gamma(u^k, p_A^k, p_B^k)] / \gamma(u^k, p_A^k, p_B^k) \tag{15}$$

3.3.3 The Barten Model

The single equation models for the cost of children (Engel's and Rothbarth's models) indisputably assume that the needs of children comparative to those of adults and economies of scale in consumption are the same for every commodity. Though, a child is most likely equivalent to more adults in the consumption of some goods or services (for example foreign languages, milk, chocolates) than in the consumption of others (i.e. tobacco, alcohol). So, it would be useful to construct commodity-specific equivalence scales m_i , as well as a general equivalence scale m. The first who introduced this idea were Prais and Houthakker (1955). The problem was that their model of equivalence scales had a severe identification problem and the estimated scales were determined by the restrictions exogenously intruded on it (see Deaton and Muellbauer (1986)). Barten presented in 1964 his model of equivalence scales, which is the only one that is consistent with utility maximization theory.

According to Barten the direct utility function can be described as:

$$u = u(q_1 / m_1(\boldsymbol{a}),\ q_2 / m_2(\boldsymbol{a}),\ \dots ,\ q_n / m_n(\boldsymbol{a})) \tag{16}$$

Where u is a measure of parent's welfare and $q_i / m_i(\boldsymbol{a})$ is the quantity of commodity i consumed by the parents, when the household's consumption of this good is q_i. Therefore, $m_i(\boldsymbol{a}) = 1$ when children don't consume commodity i, and for the reference household (reference couple) all the m_i are set to one.

Suppose $q_i^* = q_i / m_i(\boldsymbol{a})$ and $p_i^* = p_i\, m_i(\boldsymbol{a})$. p_i^* is the price to the parents of one unit of consumption of commodity i, known as the 'effective price'. The cost function associated with equation (16) is:

$$c(u, p_1^*, p_2^*, \dots , p_n^*) = X \tag{17}$$

The household demand functions are given by:

$$q_i = m_i\, g_i(u, p_1^*, p_2^*, \dots , p_n^*) \tag{18}$$

where g_i is the compensated demand function of the reference household. So, a reformulation of the household's problem is to maximize $u(\boldsymbol{q}^*)$ subject to $\Sigma\, p_i^* q_i^* = X$. We obtain the general equivalence scale:

$$m^h = c(u^k, \boldsymbol{p}^*) / c(u^k, \boldsymbol{p}^k) \tag{19}$$

Gorman (1976) argues that in the structure of Barten's model, it should be definitely recognized the existence of some fixed costs $\Sigma p_i \gamma_i(a)$, associated with the presence of children in the household. In other words, the equation (17) should be the following one:

$$c(u, p_1^*, p_2^*, \ldots, p_n^*) + \Sigma p_i \gamma_i(a) = X \tag{20}$$

Respectively, equation (18) should be modified to:

$$q_i = m_i g_i(u, p_1^*, p_2^*, \ldots, p_n^*) + \gamma_i(a) \tag{21}$$

An important characteristic of equations (18) and (21) is that they both permit a scaling up of the reference demands by m_i (needs of children) and substitution due to changes in relative prices. So, from one side having children makes the goods consumed by them relatively more expensive for the parents and therefore, there is a substitution away from these goods. On the other hand, children need to consume these goods and hence, there is an increase in the household demand for them.

3.4 Advantages and disadvantages of the models

Each of the three models presented in the paragraph 3.3 have assets and drawbacks. The Barten model has the advantage of being the only model of equivalence scales consistent with the utility theory. On the other hand its major disadvantage is its estimation, as we need to estimate a complete system of demand equations. Moreover, we want more than one Household Expenditure Survey because in the case of a single HES without price variation the commodity-specific equivalence scales cannot be estimated in absolute terms, but only relative to each other. Another disadvantage of Barten's model is that it assumes that all the households consume all types of commodities. Of course this problem could be faced by using broad commodity groups.

The Engel model, even that is the most widely used, has the disadvantage of sometimes overstating the true cost of children. On the other hand, the Rothbarth model may understate the cost of children. This can be clearer using an example. Suppose that a household obtains another child and is compensated in money so as to preserve its previous level of welfare. Since children are mainly food-consuming, we expect that a very large part of the compensation will be spent on food. So, the marginal household consumption on food will be higher than the average and the foodshare will rise. In this case Engel's method will show that household's welfare has declined. This means that overstates the cost of children and the estimated equivalence scales are biased upwards.

As it concerns the Rothbarth model it is difficult to believe that parents do not obtain any welfare from the consumption of goods jointly consumed with their children. Additionally, some of the commodities considered as adult goods are not very responsive to changes in income or in total expenditures (i.e. alcohol and tobacco). Hence, these commodities may not create the best commodity group for obtaining income effects and so, the estimated Rothbarth equivalence scales may be biased downwards.

Finally, the methodology of equivalence scales was strongly criticized by Pollak and Wales (1979) who argue that although it is useful for applied demand analysis, it cannot be used for welfare comparisons since the existence of children makes parents not only to change their consumption behavior but also to designate again their indifference curves.

Chapter 4

THE ESTIMATION OF THE ENGEL MODEL

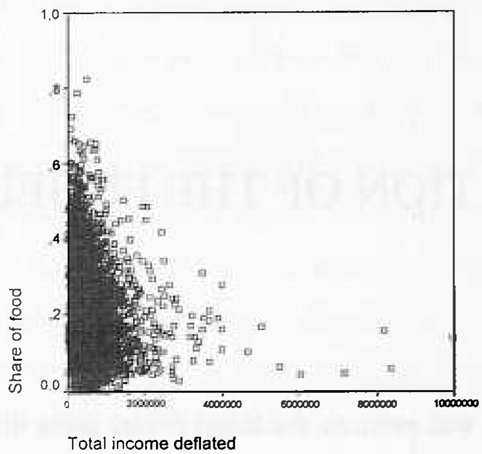
4.1 Introduction

In the fourth chapter we will estimate the Engel model using diverse specifications. In paragraph 4.2 we give the definition of the Engel curves and we present some of them taken from our data. In the paragraph 4.4 we present the semi-logarithmic function, in 4.6 the double-logarithmic function and in 4.7 we analyze the two parameter model. Finally, in paragraph 4.5 we present the Breusch-Pagan test for the existence of heteroskedasticity and in 4.3 we give some interesting figures for the proportion of income spend on food for various nations.

4.2 Engel's Curves

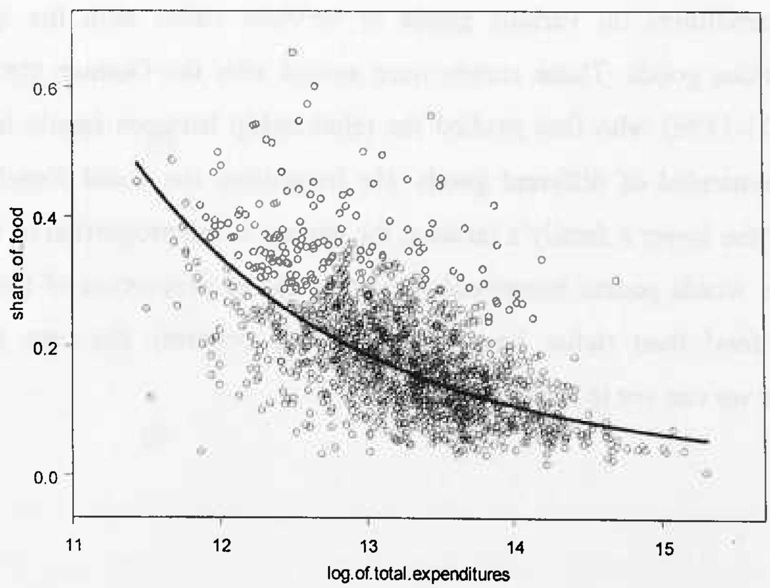
The graphs showing the quantity of a good demanded for each household's income are known as *Engel curves*. Sometimes Engel curves show the relationship between income and expenditures on various goods or services rather than the quantity purchased of various goods. These curves were named after the German statistician Ernst Engel (1821-1896) who first studied the relationship between family incomes and quantities demanded of different goods. He formulated the noted *Engel's law*, which states that the lower a family's income, the greater is the proportion of it spent on food. In other words poorer households devote a higher proportion of their total expenditure for food than richer households. This is certainly the case for our household data as we can see in Figure 4.1.

Figure 4.1: foodshare for various income levels



As mentioned earlier, there is the possibility of having labor supply determined by exogenous factors. In this case, welfare is derived from the expenditures for goods and services. From Figure 4.2, we can observe that as the total expenditures increase, the proportion of the expenditures devoted for food decreases. This is obvious also from the slope of the curve that certifies Engel's law.

Figure 4.2: Engel curve for share of food



The Engel curve is very often positively sloped, so that the quantity of the good demanded rises with income. In this case the good is called *normal.* The elasticity of the Engel curve is the income elasticity of demand. If this elasticity for a good is greater than 1 we call it a *luxury* and if it is less than 1 we call it a *necessity.* The Engel curve need not always be positively sloping. There are cases where it can be negatively sloped, so that an increase in income leads to a decrease in the quantity demanded. In this occasion the good is an *inferior* one and the Engel curve will be downward sloping. This is the case for the foodshare shown in Figure 4.2. We should note of course that no good is an inferior good at all income levels. A good can be a luxury at low-income levels, a necessity at middle-income levels and an inferior good at very high-income levels.

It would be interesting to observe the shape of the Engel curve for other goods such as the expenditures for health and for education. The results for the share of health for different levels of expenditures, and the share of education for different levels of expenditures are shown in Figure 4.3 and Figure 4.4 respectively.

Figure 4.3: Engel curve for share of health

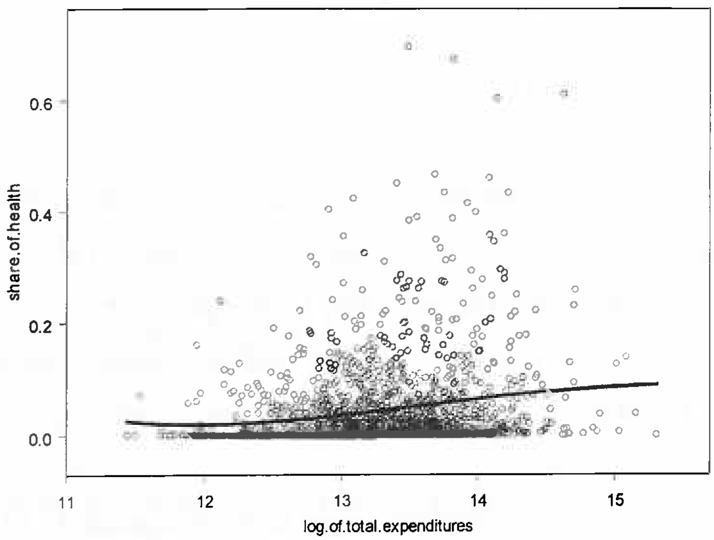
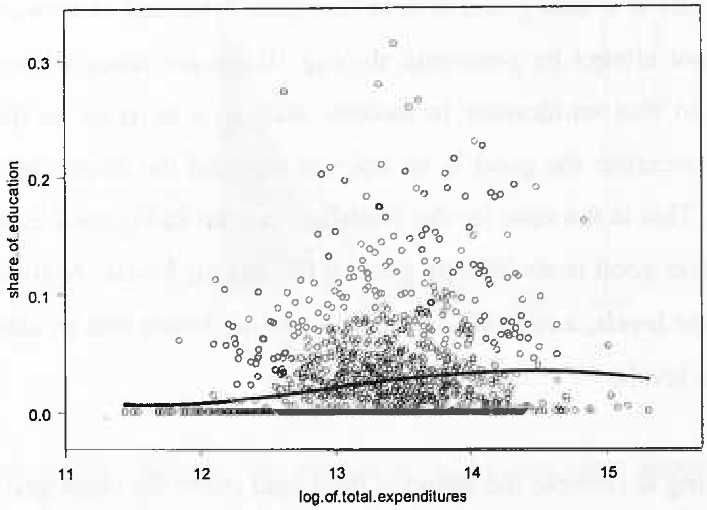


Figure 4.4: Engel curve for share of education



As we can see from the above Figures, the Engel curve is upward sloping, especially as it concerns the expenditures for health. It is obvious, that households with high level of welfare tend to consecrate more money for their health. The same goes for the money given for education, since wealthier families can easier provide their children, or generally their members, with the possibility of expanding their intellectual horizons.

4.3 Food shares for various countries

Engel's conclusion concerning his famous law was based on a budget study of 153 Belgian families and was later verified by a number of other statistical inquiries into consumer behavior. We should note that according to several researches it is believed that the higher the proportion of income spent on food in a nation, the poorer the nation is taken to be. In Table 4.1 the food shares for various countries are presented.

As we can see from Table 4.1, this allegation seems to be substantial. In India and in Philippines, for example, which are countries considered as poor, more than 50% of income is spent on food on the average, while in the United States, this percentage doesn't surpasses the 9%. Generally, apart from the USA and Canada, the countries that seem to be wealthier are those coming from Northwest Europe. On the other hand the countries of Africa and Asia appear to be poorer. In Greece, according to Table 4.1, the percentage of income spent on food on the average, reaches the 18%.

Table 4.1: Share of personal consumption expenditures spent on food, by selected countries, 1999

United States	8.6	New Zealand	15.1
United Kingdom	9.7	Puerto Rico	15.2
Canada	10.0	Italy	15.2
Netherlands	11.5	South Korea	16.5
Germany	11.5	Greece	17.9
Ireland	12.1	Iceland	18.1
Sweden	12.6	Poland	21.7
Austria	12.9	Botswana	29.8
Denmark	12.9	South Africa	30.8
Belgium	12.9	Venezuela	33.4
Finland	13.0	Iran	35.1
Hong Kong	13.4	Philippines	51.3
France	14.6	India	52.0

Source: Computed by Birgit Meade (202-694-5159), ERS, mainly from data provided by the UN System of National Accounts.

4.4 The semi-logarithmic function

In order to proceed to the estimation of the Engel model, we have to select a functional form for the Engel curve for the budget share of food. We first try the semi-logarithmic function of Working-Leser's form, which is believed to fit better the data (see Philips (1974)). The equation takes the following form:

$$W_f^h = a_0 + a_1 \ln X^h \qquad (22)$$

where X^h is the total expenditure of household h, W_f^h is the foodshare of household h and $h = 1,\ldots, n$.

As we mentioned in Chapter 2, the households that we are interested in consist of nine different family types. The couples without children, the couples with one or two little children up to 6 years, the couples with one or two big children 6-13 years, the couples with one little and one big child, and the couples with one, two, or more than three children up to 16 years. The reference household is the childless couple. We put together all the observations for each of the nine household types and we employ Ordinary Least Squares (OLS) in order to estimate equation (22). The results that we receive are presented in Table 4.2 (see appendix B).

Table 4.2: Engel curve for the budget share of food for different family types

Family types	a_0	a_1	$\bar{R}^2$	Breusch-Pagan test
Childless couple	1.365	-0.092 *(14.96)*	0.393	38.31 *(failed)*
One little child up to 6	1.444	-0.096 *(12.66)*	0.386	68.33 *(failed)*
Two little children up to 6	1.595	-0.104 *(8.85)*	0.417	68.48 *(failed)*
One little & one big child	1.512	-0.100 *(11.02)*	0.423	49.56 *(failed)*
One big child 6-13 years	1.432	-0.094 *(9.67)*	0.361	40.72 *(failed)*
Two big children	1.376	-0.089 *(10.71)*	0.360	74.05 *(failed)*
One child up to 16	1.475	-0.098 *(17.54)*	0.386	54.11 *(failed)*
Two children up to 16	1.441	-0.094 *(20.21)*	0.392	44.95 *(failed)*
Three or more children	1.737	-0.112 *(8.02)*	0.302	35.73 *(failed)*

Note: absolute t-values are shown in parentheses

The column with the values of the intercept a_0 represents the mean monthly total expenditure for food for each household type. As we can see from this Table, the families with the highest mean monthly total expenditure are the families with three and more children, these with two little children and the families with one little and one big child. In other words, as it was expected the households with many children seem to devote a larger proportion of their expenditures for food.

The column of a_1 in Table 4.2 indicates the coefficients of $\ln X^h$. It is obvious that their values confirm Engel's law, since an increase in the total expenditures, leads to a decrease in the budget share of food. Their values range from –0.089 to –0.112. The families with a higher value of a_1 are more liable to an increase or a decrease of the expenditures. It is interesting to notice that the family types with the highest values of the coefficients of $\ln X^h$ are the ones who also had the highest mean monthly total expenditure. So, the coefficients a_1 are proportional to a_0.

As it concerns the percentage of variance explained by the independent variable, we can see that it is rather good ranging from 30.2% to 42.3%. We should also note that in all cases the estimates are statistically significant at 1% level of significance. However, the *t*-ratios presented in the parentheses are not valid due to the presence of heteroskedasticity shown in the last column (Breusch-Pagan test (1979)).

4.5 Breusch-Pagan Test

Considering a single equation model, Breusch and Pagan proposed a powerful test against a general form of heteroskedasticity. Supposing that u_h is the error associated with the endogenous variable W_f^h, we have:

$$u_h = W_f^h - E(W_f^h) \tag{23}$$

We want to test the hypotheses:

$H_0 : E(u_h^2) = \sigma^2$ for all households

$H_1 : E(u_h^2) = \sigma_h^2 = f(Z_h' \gamma)$

where $\gamma = (\gamma_0, \gamma_1, \ldots, \gamma_k)'$ is a k+1 vector of parameters, f is an arbitrary function assumed to possess first and second order derivatives and $Z_h' = (1, Z_{1h}, \ldots, Z_{kh})$ is a k+1 vector which may include some of the predetermined variables of the model. Thus, the null hypothesis can be written as:

$$H_0 : \gamma_1 = \gamma_2 = \gamma_3 = \ldots = \gamma_k = 0$$

Assuming that $\hat{W}_f^h$ is as an inter-sample prediction of the dependent variable W_f^h, its corresponding residuals will be $\hat{u}_h = W_f^h - \hat{W}_f^h$. We also define as *ESS* the explained sum of squares from the regression of $\hat{u}_h^2$ on the variables $(1, Z_{1h}, \ldots, Z_{kh})$.

The Breusch-Pagan test statistic is:

$$B\text{-}P = ESS / 2(\hat{\sigma}^2)^2 \tag{24}$$

Where $\hat{\sigma}^2 = \left(\sum_{h=1}^{n} \hat{u}_h^2\right) \Big/ n$, and *B-P* is asymptotically distributed as chi-square variable with *k* degrees of freedom, or in other words $B\text{-}P \sim X_k^2$. If $B\text{-}P > X_k^2$ then we reject the null hypothesis of homoskedasticity.

In order to perform the Breusch-Pagan test we find first the residuals from the regression of model in equation (22). Then, we define the variables that we will use in the regression of $\hat{u}_h$, so as to find the explained sum of squares (*E*). The variables that we are interested in, are those that are highly correlated with the residuals $\hat{u}_h$, and as a result, also with the foodshare.

Those variable are the following: Expenditures for clothes, housing, durable goods, transportation, culture, hotels and other expenditures. Also, mode of insurance, health insurance and organization of insurance, wife's age, working head and working wife, occupation of household members, level of studies, hours worked during previous week, type and years of purchase/acquisition of dwelling and current value of residence.

From Table 4.2 we can see than for all family types $B\text{-}P > X_{1-a,k}^2$ and so the hypothesis of homoskedasticity is rejected.

4.6 The double-logarithmic model

Since the model $W_f^h = a_0 + a_1 \ln X^h$ of equation (22), shows heteroskedasticity for every household type, we will use a model that could correct it. This is the double-logarithmic equation and has the following form:

$$\ln W_f^h = a_0 + a_1 \ln X^h \tag{25}$$

As previously, using OLS in order to estimate equation (25) and pooling all the observations for each of the above nine household type, we take the results shown in Table 4.3 (see appendix B).

As we can see from this Table, the family types with the highest mean monthly expenditure for food are the couples with one little and one big child, the couples with two little children, the couples with three and more children and the childless couples. It is interesting to notice that apart from the couples without children, the other three types of families are the same with the highest three of equation (22).

Table 4.3: Engel curve for the budget share of food for different family types

Family types	a_0	a_1	$\overline{R}^2$	Breusch-Pagan test
Childless couple	6.266	-0.629 *(15.23)*	0.402	13.24 *(not failed)*
One little child up to 6	5.771	-0.577 *(13.17)*	0.405	41.95 *(failed)*
Two little children up to 6	6.310	-0.602 *(10.51)*	0.503	38.14 *(failed)*
One little & one big child	6.328	-0.614 *(12.40)*	0.482	38.86 *(failed)*
One big child 6-13 years	5.653	-0.563 *(11.03)*	0.424	47.19 *(failed)*
Two big children	5.094	-0.514 *(10.76)*	0.372	22.58 *(not failed)*
One child up to 16	5.961	-0.589 *(19.43)*	0.436	28.34 *(not failed)*
Two children up to 16	5.633	-0.556 *(21.52)*	0.422	35.19 *(failed)*
Three or more children	6.005	-0.589 *(9.53)*	0.381	44.21 *(failed)*

Note: absolute t-values are shown in parentheses

The coefficients of $\ln X^h$ are again in line with theory. The family type which seems to be more prone to a decrease of the budget of foodshare in case the expenditures increase, are the childless couples. On the other hand, the family type which is less inclined to an increase/decrease of total expenditures are the couples with two big children.

The Breusch-Pagan test statistic for the existence of heteroskedasticity, presented on the last column of Table 4.3, shows that only for three household types the hypothesis of homoskedasticity is not rejected. For the other six cases, $B\text{-}P > X^2_{1-a,k}$ and so, we do not accept the null hypothesis of homoskedasticity. However, it seems that the double-logarithmic model succeeded to correct up to a point, the presence of heteroskedasticity. We have to indicate also the improvement of R^2 adjusted, for all the nine cases from 10 to 85%. This shows definitely that this model is a better one, but since we still have heteroskedasticity we should proceed by correcting it, in order to have robust estimates.

4.7 The two parameter Engel curve

Apart from the specifications of Engel's curve in equations (22) and (25), we also estimate the two-parameter Engel curve (see Deaton (1981, 1985) and Tsakloglou (1988, 1991)). In this specification, we bring together all households observations, and we also introduce some demographic variables, such as the number of little and big children in each household. This leads to the supposition that each additional child has some fixed needs that increase household's foodshare by a constant amount. So, the Engel specification becomes:

$$\ln W_f^h = a_o + a_1 \ln X^h + a_2 L^h + a_3 B^h \qquad (26)$$

where L^h is the number of little children up to six years for household h, B^h is the number of household's big children six to thirteen years and $h = 1,\ldots, n$.

The estimated equation (26) is:

$$\ln W_f^h = 5.531 - 0.567 \ln X^h + 0.125\, L^h + 0.155\, B^h \qquad (27)$$

As we can observe, there is a positive impact of the existence of children in a family, on the dependent variable W_f^h. It also seems that bigger children have higher food requirements than younger children, which was predictable.

We mentioned in Chapter 2, that in our analysis we have five administrative divisions according to their population size. These administrative areas are Greater Athens, Greater Thessalonica, municipalities with population more than 10000 inhabitants, municipalities and communities with population from 2000 to 9999 inhabitants and communities with population less than 1999 inhabitants. The first three administrative divisions are urban areas, the municipalities and communities with population from 2000 to 9999 inhabitants are considered as a semi-urban area and the last division is the rural area.

We split our sample according to the division in which each household appertains, we use Ordinary Least Squares, and we obtain the results shown in Table 4.4 (see appendix B).

Table 4.4: Two-parameter foodshare Engel Curves
for various administrative divisions in Greece

	Cases	a_o	a_1	a_2	a_3	$\overline{R}^2$	Breusch-Pagan test
Greater Athens	707	5.895	-0.597 *(22.94)*	0.114 *(4.58)*	0.191 *(9.65)*	0.459	47.54 *(failed)*
Greater Thessalonica	103	6.637	-0.665 *(8.83)*	0.207 *(3.90)*	0.238 *(4.09)*	0.501	22.16 *(not failed)*
Municipalities with inhabitants > 10000	391	3.620	-0.420 *(11.04)*	0.109 *(3.40)*	0.129 *(5.07)*	0.275	41.96 *(failed)*
Munic. & communities inhabitants 2000-9999	183	5.476	-0.557 *(10.62)*	0.124 *(3.10)*	0.106 *(3.35)*	0.393	46.24 *(failed)*
Communities with inhabitants < 1999	230	5.901	-0.583 *(13.10)*	0.131 *(3.48)*	0.096 *(3.47)*	0.438	13.29 *(not failed)*

As we can see from Table 4.4, the parameters' signs are in line with theory, since a little or a big child increase the budget share of food and an increase in the total expenditure decreases the budget share of food. From the above Table we notice that in the divisions with large population (greater Athens, greater Thessalonica and municipalities with population more than 10000 inhabitants), the cost of big children is higher than the one of little children, and especially in Athens. On the other hand in the municipalities and communities with population up to 9999 inhabitants, the cost of little children is higher that the cost of bigger children.

It would be interesting to perform OLS dividing the households accordingly to the area they reside. So, we have the urban, semi-urban and rural areas and the country, which includes all the households (childless couples and couples with children). The results are shown in Table 4.5 (see appendix B).

Table 4.5: Two-parameter foodshare Engel Curves for various areas in Greece

	Cases	a_o	a_1	a_2	a_3	$\overline{R}^2$	Breusch-Pagan test
Country	1614	5.531	-0.567 *(32.50)*	0.125 *(8.10)*	0.155 *(12.60)*	0.430	18.01 *(not failed)*
Urban areas	1201	5.236	-0.548 *(26.81)*	0.123 *(6.62)*	0.173 *(11.43)*	0.416	48.16 *(failed)*
Semi-urban areas	183	5.476	-0.557 *(10.62)*	0.124 *(3.10)*	0.106 *(3.35)*	0.393	46.24 *(failed)*
Rural areas	230	5.901	-0.583 *(13.10)*	0.131 *(3.48)*	0.096 *(3.47)*	0.438	13.29 *(not failed)*

In Table 4.5 we notice that big children cost much more than little children in urban areas, while in semi-urban and rural areas little cost more than big children. For all the equations the $\overline{R}^2$ is quite big ranging from 39.3% to 43.8%. We should also remark that some cases succeed to pass the test of homoskedasticity of Breusch-Pagan but since we still have problems of heteroskedasticity, the estimated coefficients could be inefficient and *t*-ratios not valid (Maddala, 1982). In the following chapter we will correct the equivalence scales from heteroskedasticity using the Generalized Least Squares estimator.

Chapter 5

ESTIMATION OF EQUIVALENCE SCALES

5.1 Introduction

In this chapter we will estimate the equivalence scales using different specifications. In paragraph 5.2 we compute the equivalence scales employing the double-logarithmic model for alternative predetermined monthly expenditure levels. In 5.3 we take into consideration the regional parameter and we estimate the equivalence scales with the two-parameter model. In paragraph 5.4 we introduce the Generalized Least Squares (GLS) method for the correction of heteroskedasticity and in 5.5 we present its estimation technique. Paragraph 5.6 provides the equivalence scales corrected for heteroskedasticity and finally in 5.7 there is a comparison with the results of the 1987-88 HES.

5.2 Equivalence scales using the double-logarithmic specification

The next step is to construct the equivalence scales for children. This will be done using the estimates presented in Table 4.3, by comparing the foodshare of each family type with the foodshare of the reference household (childless couple), at some predetermined expenditure level. So, the estimation is based on equation (10), $\frac{X^h}{m(a^h)} = \frac{X^k}{m(a^k)} \Rightarrow m(a^h) = \frac{X^h}{X^k}$, where for a given value of total expenditure X^k the childless couple (reference household) has a W_f^k foodshare, while the h^{th} household (with children) can afford the same foodshare at the total expenditure X^h. Thus, the children's equivalence is $X^h / X^k = m^h$.

In order to compute the equivalence scales, we have to determine the value X^h. For this purpose we choose three alternative predetermined monthly expenditure levels.

The first is X^k = 653.129 drachmas, which is the mean monthly total expenditure for the reference group, provided by our data. Since the standard deviation is 457.902, we choose the value X^k = 200.000 representing the lower income groups, and 1.100.000 representing the higher income groups.

For the reference group the estimated equation is: $\ln W_f^k = 6.266 - 0.629 \ln X^k$, and in case X^k = 653.129 then $\ln W_f^k$ = -2.156. We have to find in which level of expenditure X^h, for each household type, we can afford this particular foodshare (-2.156). For example, for the couple with one little child below six, X^h = 925.696 drachmas and so, the equivalence scale m^h = 1.417. This means that one little child costs 41.7% of the total expenditure of the childless couple. Following this pattern and using the coefficients of Table 4.3, we construct the equivalence scales for all our family types and for the three expenditure levels. The results are shown in Table 5.1.

Table 5.1: Engel equivalence scales
for the cost of children (HES 1998-99)

Family type	Monthly expenditures	Equivalence scales
Couple with one little child up to 6 years	200.000 (€587)	1.274
	653.129 (€1917)	*1.417*
	1.100.000 (€3228)	1.486
Couple with two little children up to 6 years	200.000 (€587)	1.860
	653.129 (€1917)	*1.961*
	1.100.000 (€3228)	1.988
Couple with one little and one big child	200.000 (€587)	1.491
	653.129 (€1917)	*1.534*
	1.100.000 (€3228)	1.554
Couple with one big child 6-13 years	200.000 (€587)	1.408
	653.129 (€1917)	*1.617*
	1.100.000 (€3228)	1.719
Couple with two big children 6-13 years	200.000 (€587)	1.569
	653.129 (€1917)	*1.895*
	1.100.000 (€3228)	2.098
Couple with one child up to 16 years	200.000 (€587)	1.365
	653.129 (€1917)	*1.479*
	1.100.000 (€3228)	1.532
Couple with two children up to 16	200.000 (€587)	1.591
	653.129 (€1917)	*1.858*
	1.100.000 (€3228)	1.989

5.3 Equivalence scales using the two-parameter specification

Since we are also interested in the regional parameter, we can construct equivalence scales for various administrative areas and regions in Greece, using the coefficients of Table 4.4 and Table 4.5. The difference from the previous equivalence scales is that for every area or region we have different budget share of food. Taking as X^k, the total monthly expenditure of the childless couple (653.129), we receive the results presented in Table 5.2.

As we can see, there are big differences between the cost of big and little children. For the young children we observe that their cost in Athens is the smallest comparing to the other divisions, while in Thessalonica is the highest. One little child costs in Athens 21% of the total expenditure of the childless couple. On the contrary, big children cost more in the urban areas (37.1% of the total expenditure of the childless couple versus 17.9% in the communities with less than 1999 inhabitants).

Table 5.2: Equivalence scales for the cost of children taking into consideration the regional parameter (HES 1998-99)

	One little child up to 6 years	**One big child 6-13 years**	Two little children up to 6 years	Two big children 6-13 years	One child below 6 and one child 6-13
Country	1.247	1.315	1.554	1.728	1.639
Urban areas	1.252	1.371	1.567	1.880	1.716
Semi-urban areas	1.249	1.210	1.561	1.463	1.511
Rural areas	1.253	1.179	1.568	1.390	1.476
Greater Athens	1.210	1.377	1.465	1.896	1.667
Greater Thessalonica	1.365	1.430	1.864	1.994	1.953
Municipalities with inhabitants > 10000	1.296	1.360	1.680	1.848	1.762
Munic. & communities inhabitants 2000-9999	1.249	1.210	1.561	1.463	1.511
Communities with inhabitants < 1999	1.253	1.179	1.568	1.390	1.476

We should note that the two models, the double-logarithmic and the two-parameter Engel Curve, give different results. The figures in the row that show the equivalence scales for the whole country when pooling all the observations together, are much different from the ones of Table 5.1. Those latter are taken after having divided the household in diverse family types. So, we come to the conclusion that different methods can lead to different results.

5.4 The GLS method for correcting the heteroskedasticity

According to the standard statistical theory (see Goldberger (1964)), the least squares estimators are not efficient in the presence of heteroskedasticity. We tried to eliminate it by using the double-logarithmic equation, but we still have heteroskedasticity in some cases. Furthermore, the estimated standard errors are not consistent estimates underestimating usually considerably the true standard error of the estimators. The combination of these two effects is likely to confuse and invalidate any inferences drawn from our data.

In some studies (see Tsakloglou 1988) the t-ratios of the coefficients are corrected using the method suggested by White (1980). Though, the method of White corrects only the standard errors and not the estimator. Given that we have a finite sample, in order to compute the equivalent scales we should have, not only efficient but also consistent parameters. For this purpose, it is suggested (see Livada, Kandilorou and Tzortzopoulos) to use the Generalized Least Squares (GLS) estimator, which is similar to the method of Weighted Least Squares.

Having spotted the existence of heteroskedasticity we have to precisely specify its source. For cross-sectional data and micro-units there are two general specifications of the variance generating process. The traditional specification and the Hildreth-Houck (1968) random coefficient model.

The first specification assumes that the variances are generated from an error process which has nothing to do with the structural form of the system. The second specification assumes that the response to a change in an explanatory variable is not the same for all micro-units (in our case the households). So, the coefficients of the structural form or some of them are specified as joint random variables with a constant variance matrix. This gives an heteroskedastic specification that requires different prediction and policy evaluation techniques.

As it concerns our models, the double logarithmic ($\ln W_f^h = a_0 + a_1 \ln X^h$) and the two-parameter Engel Curve ($\ln W_f^h = a_o + a_l \ln X^h + a_2 L^h + a_3 B^h$), we do not have a prior reason to prefer the one or the other specification. Probably, some heteroskedasticity in our case, is attributed to a pure error generating process and some is attributed to random coefficient variation. The last source indicates that the response of the dependent variable to a change in the explanatory variable is not the same for all micro-units (households). This specification is similar to the one considered by Amemiya (1977) in the context of a single equation model (see Magdalinos and Symeonidou (1989) and Kandilorou (1989)).

The estimated coefficients belong to the class of GLS estimators, which are consistent and asymptotically efficient. The standard errors estimated according to the standard least squares theory are consistent estimates of the true standard errors.

5.5 Estimation Technique under Heteroskedastic Specification

Assuming that f is the identity function, the functional form used in correcting the heteroskedasticity is similar to the specification considered by Amemiya. So, we have

$$\sigma_h^2 = Z_h' \gamma \tag{28}$$

for every h.

In the previous chapter, while estimating the value of the Breusch-Pagan test, we regressed the squared residuals $\hat{u}_h^2$ on the variables $Z_h' = (1, Z_{1h}, \dots, Z_{kh})$. Supposing that $\hat{\gamma} = (\hat{\gamma}_0, \hat{\gamma}_1, \dots, \hat{\gamma}_k)'$ is the estimated coefficient vector, then the corresponding variance estimator is:

$$\hat{\sigma}_h^2 = Z_h' \hat{\gamma} \tag{29}$$

The estimator $\hat{\gamma}$ is consistent, but not asymptotically efficient. On the other hand, the standard errors of $\hat{\gamma}_h$ calculated according to the standard least squares theory are not consistent estimates of the true standard errors. However, the estimators $\hat{\sigma}_h^2$ can be used to evaluate the efficient generalized least squares (GLS) estimator by following the steps:

(i) We divide the variables $\hat{u}_h^2$, 1, Z_{1h}, Z_{2h}, … , Z_{kh} by $\hat{\sigma}_h^2$

(ii) We regress the transformed variable $\hat{u}_h^2 / \hat{\sigma}_h^2$ against $1/\hat{\sigma}_h^2$, $Z_{1h}/\hat{\sigma}_h^2$, $Z_{2h}/\hat{\sigma}_h^2$,…, $Z_{kh}/\hat{\sigma}_h^2$. The least squares estimate of the coefficients, $\tilde{\gamma}=(\tilde{\gamma}_0,\tilde{\gamma}_1,...,\tilde{\gamma}_k)'$, is a consistent and asymptotically efficient estimator of γ. The estimates of standard errors by least squares are consistent estimate of the true standard errors. Therefore, we have a variance equation which can be used to provide estimates of the error variance for any particular observation. This equation is:

$$\tilde{\sigma}_h^2 = Z_h' \tilde{\gamma} \tag{30}$$

(iii) We obtain $\tilde{\sigma}_h$, which is the square root of $\tilde{\sigma}_h^2$, and

(iv) We divide all the variables appearing in equations (25) and (26) by $\tilde{\sigma}_h$, and then ordinary least squares (OLS) method is applied to the transformed data.

Of course, the Generalized Least Squares method will be used only for the cases where the Breusch-Pagan test failed. In the rest of them, where no heteroskedasticity was detected, we will keep the same coefficients. This alternative estimation is very important for our case, as we are not only interested to the corrected t-values but also to the corrected coefficient, which play the vital role for the estimation of the equivalence scales.

5.6 Equivalence scales corrected for heteroskedasticity

We proceed in our analysis by regressing the two-parameter specification of Engel curve, dividing all of its variables by $\tilde{\sigma}_h$. In other words the new model is:

$$\frac{\ln W_f^h}{\tilde{\sigma}_h} = \frac{a_0}{\tilde{\sigma}_h} + \frac{a_1 \ln X^h}{\tilde{\sigma}_h} + \frac{a_2 L^h}{\tilde{\sigma}_h} + \frac{a_3 B^h}{\tilde{\sigma}_h} \tag{31}$$

We pool again all the observations together for the regional types in which the Breusch-Pagan test failed and we receive the results shown in Table 5.3.

Table 5.3: Two parameters foodshare Engel Curves corrected for heteroskedasticity for various administrative divisions and areas

	a_0	a_1	a_2	a_3	$\overline{R}^2$
Country	No heteroskedasticity				
Urban areas	4.295	-0.477 *(28.43)*	0.123 *(6.61)*	0.173 *(11.45)*	0.438
Semi-urban areas	5.419	-0.553 *(10.66)*	0.124 *(3.10)*	0.106 *(3.35)*	0.394
Rural areas	No heteroskedasticity				
Greater Athens	1.462	-0.255 *(16.22)*	0.090 *(2.73)*	0.118 *(4.57)*	0.469
Greater Thessalonica	No heteroskedasticity				
Municipalities with inhabitants > 10000	7.060	-0.684 *(23.28)*	0.128 *(5.22)*	0.183 *(9.37)*	0.416
Munic. & communities inhabitants 2000-9999	5.419	-0.553 *(10.66)*	0.124 *(3.10)*	0.106 *(3.35)*	0.394
Communities with inhabitants < 1999	No heteroskedasticity				

From Table 5.3, we can see that the parameters' signs follow again the theory and also, the percentage of the variation in the dependent variable explained by the independent variables ($\overline{R}^2$) has increased. Since we succeeded to obtain homoskedasticity, we can now estimate the equivalence scales. In Table 5.4 are shown the corrected equivalence scales as well as the equivalence scales that did not need to be modified.

As we can see from Table 5.4, generally in the whole country, big children seem to cost more than the little ones (7%). This is certainly the case for urban areas, where one big child costs 43.8% of the total expenditure of the childless couple in 1999, while one little child costs 29.5%. On the other hand in semi-urban and in rural areas, the cost of young children is higher comparing to the cost of big children. One little child costs 23.1% of the total expenditure of the childless couple in semi-urban areas and 25.3% in rural areas, while one big costs 21.1% and 17.9% respectively.

We must point out, that the cost of little children vary in the three different areas from 23.1% to 29.5% of the total expenditure of the childless couple in 1999, while for the big children this divergence is much higher (17.9% for the rural areas to 43.8% for the urban areas). This great difference could be attributed to the fact that young children and babies have specific needs for food (creams, milk), while big children in cities and in villages have certainly other customs of nutrition. In Athens, in Thessalonica and in big cities, bigger children have the possibility of going to the supermarkets and buy wherever they want at any time, while in the villages this is not a habit. Furthermore, the households that reside in the countryside can produce themselves some products for nourishment (fruits, greens) that will cost them much less money.

Table 5.4: Equivalence scales for the cost of children corrected for heteroskedasticity taking into consideration the regional parameter (HES 1998-99)

	One little child up to 6 years	**One big child 6-13 years**	Two little children up to 6 years	Two big children 6-13 years	One child below 6 and one child 6-13
Country	1.247	1.315	1.554	1.728	1.639
Urban areas	1.295	1.438	1.675	1.966	1.810
Semi-urban areas	1.231	1.211	1.535	1.446	1.515
Rural areas	1.253	1.179	1.568	1.390	1.476
Greater Athens	1.421	1.586	1.912	2.170	2.031
Greater Thessalonica	1.365	1.430	1.864	1.994	1.953
Municipalities with inhabitants > 10000	1.205	1.306	1.453	1.707	1.575
Munic. & communities inhabitants 2000-9999	1.231	1.211	1.535	1.446	1.515
Communities with inhabitants < 1999	1.253	1.179	1.568	1.390	1.476

More analytically, as it concerns the rural areas we observe that Athens is more expensive than Thessalonica or than the municipalities and communities with more than 10.000 inhabitants for both little and big children. In Greater Athens the cost of one little child is 42.1% of the total expenditure of the childless couple, in Greater Thessalonica 36.5% and in the municipalities and communities with more than 10.000 inhabitants 20.5%. The cost of big children is even higher, reaching the 58.6%, 43% and 30.6% respectively.

Apart from the two-parameter model, we tried to use the GLS method also in the double-logarithmic specification, in order to correct the heteroskedasticity and improve the robustness of the estimates.

Applying the estimator to this model, we come to an impasse. The coefficients obtained give outrageous results as it concerns the equivalence scales and we conclude that there must be a problem. Since in the GLS method at one point we regress the residuals (dependent variable) to the variables correlated with them, we risk to have an almost linear relation between some of the explanatory variables. This situation is known as multicollinearity.

In order to test the existence of multicollinearity we can find the quantities VIF (Variance Inflation Factors) that are defined as:

$$VIF(i) = 1/\left(1 - R^2(i)\right)$$

If there is multicollinearity then $R^2(i)$ will be close to 1 and the quantity VIF will be very large. Generally, if VIF > 10 then we have definitely a problem. In our case, we take that the quantity VIF is large and so we cannot obtain credible results. A solution would be to leave outside the regression some of the explanatory variables, but even in that case, we still have unreliable results. Probably, there exist also some other econometric problems that are not to be analyzed in this dissertation.

5.7 Comparing the equivalence scales

At this point, after having estimated the equivalence scales for the cost of children using the 1998-99 HES, it would be interesting to compare them with the ones estimated from the 1987-88 HES (see Livada, Kandilorou and Tzorzopoulos (1996)). The equivalence scales for both cases are shown in Table 5.5.

From this Table, it is obvious that the cost of little children has increased in Greece by 9% during the last 10 years. This increase is higher in the rural areas, where one young child in 1998 costs 23.2% more than a young child in 1988. The cost of little children has also increased a lot in Greater Athens and in Greater Thessalonica (19.7% and 12.6% respectively). Only in the municipalities and communities with 2000 to 9999 inhabitants and in the municipalities with more than 10000 inhabitants this increase is a small one (3.5% and 2.6%).

Table 5.5: Equivalence scales using the 1987-88 and the 1998-99 Household Expenditure Surveys

Regions- Administrative areas	Couples with one little child up to 6 years		Couples with one big child 6 to 13 years	
	1998-99	1987-88	1998-99	1987-88
Country	1.247	1.157	1.315	1.339
Urban areas	1.295	1.213	1.438	1.344
Semi-urban areas	1.231	1.196	1.211	1.296
Rural areas	1.253	1.021	1.179	1.213
Greater Athens	1.421	1.224	1.586	1.354
Greater Thessalonica	1.365	1.239	1.430	1.331
Municipalities with inhabitants > 10000	1.205	1.179	1.306	1.386
Munic. & communities inhabitants 2000-9999	1.231	1.196	1.211	1.296
Communities with inhabitants < 1999	1.253	1.020	1.179	1.213

On the other hand, the cost of bigger children has decreased a little (-2%). This reduction of course, exists only in the semi-urban and rural areas (-8.5% and -3.4% respectively). In the urban areas the cost of big children has increased (9.4%). This increase is greater in Athens (23.2%) and smaller in Thessalonica and in the municipalities with more than 10000 inhabitants (9.9% and 6.9% respectively).

This decrease in the semi-urban and rural areas should make us think. Generally, the estimated equivalence scales obtained from the two-parameter model seem to be accurate, but this last result sounds a bit strange. An explanation could be that nowadays bigger children in the villages have changed their nutrition habits and prefer to spend more money for other activities. Nevertheless, this is only a speculation and probably the problem is lies in the estimation of the equivalence scales.

Coming at the end of this dissertation, we should point out that even methods tested and accepted, like the one for the estimation of the equivalence scales, can have serious problems and their results can easily be questioned by a researcher.

Chapter 6

CONCLUSION

This dissertation provided us with some useful results concerning the cost of children in different administrative divisions. Apart from that, we ascertained that different statistical methods give different results. More specifically, the two-parameter model that concluded all the observations together and the double-logarithmic model that used some of these observations each time, gave us diverse equivalence scales. Furthermore, studying the cost of children it is clear that nowadays in Greece it is quite expensive to raise a child and especially a big one aged from 6 to 13 years. In particular, the urban areas are the most expensive comparing to semi-urban and rural areas. Indeed, the last decade the cost of big children in urban areas has increased about 10%. The cost of little children up to six years is quite high in all regions. In the whole country their cost has increased by 9% in ten years. At the end of the eighties, in rural areas this cost was minimal, but now it has also increased in this regions. We should point out that the method of equivalence scales analyzed in this dissertation is not panacea and we ought to be cautious about the results.

Taking into consideration the fact that young couples today do not give birth to children as often as they used to, we could say that a probable reason for this phenomenon is the constant increase of the cost of children and the additive financial difficulties that a child creates to a couple. Of course, we should not affront the child as a burden for a couple, since the additional cost in money that will inevitably result a birth of a child cannot be compared with the joy and excitement a new child can offer.

Appendices

Appendix A

The appendix A contains the Tables of Analysis of Variance for comparing the means, considering at first as dependent variable the mean monthly total expenditures (YNEW) and second, the mean monthly food expenditures (YFOOD). The dependent variables YNEW and YFOOD have derived using the Box-Cox transformation. In the appendix are also presented the plots of standardized residuals versus the predicted values that show if we have problem of heteroskedasticity and the P-plots, which indicate the normality of the residuals.

I. MEAN TOTAL EXPENDITURES

1. Childless couples

Table A1: Analysis of variance of mean total expenditures for the childless couples

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,043E-06[a]	4	2,608E-07	4,924	,001
Intercept	1,015E-04	1	1,015E-04	1916,208	,000
region	1,043E-06	4	2,608E-07	4,924	,001
Error	1,801E-05	340	5,297E-08		
Total	1,662E-04	345			
Corrected Total	1,905E-05	344			

a. R Squared = ,055 (Adjusted R Squared = ,044)

Figure A1: Box-Cox plot for childless couples

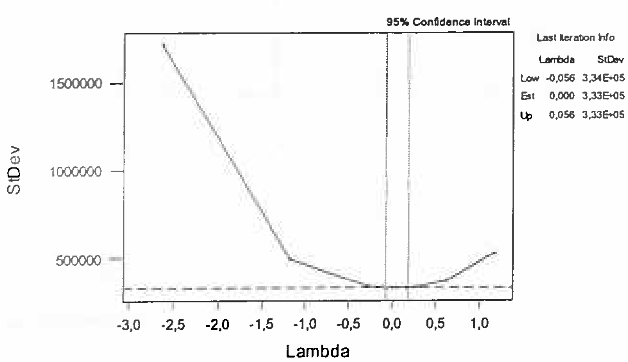


Figure A2: Standardized residuals versus predicted values

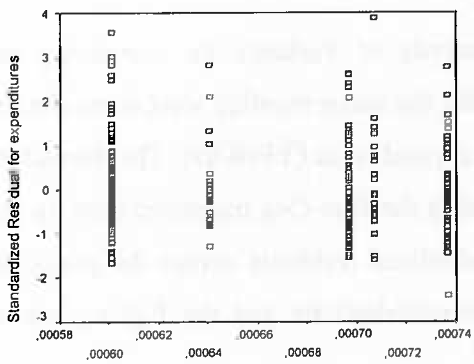


Figure A3: P-Plot of standardized residuals

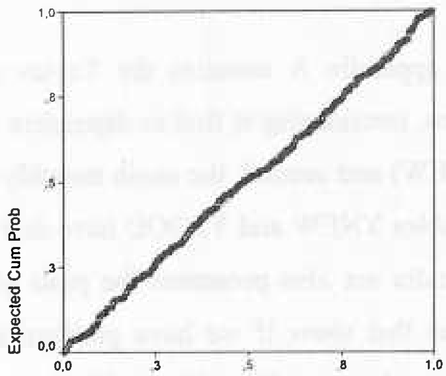


Table A2: Least Significant Differences in the mean total expenditures for childless couples

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	-,00003909	,0000493565	,429
	Urban 10.000 habitants and over	-,00009572*	,0000326079	,004
	2.000 to 9.999 habitants	-,00010628*	,0000456390	,020
	up to 1.999 habitants	-,00013561*	,0000365497	,000
Greater Thessalonici	Greater Athens	,000039092	,0000493565	,429
	Urban 10.000 habitants and over	-,00005663	,0000535252	,291
	2.000 to 9.999 habitants	-,00006719	,0000623265	,282
	up to 1.999 habitants	-,00009652	,0000560139	,086
Urban 10.000 habitants and over	Greater Athens	,000095721*	,0000326079	,004
	Greater Thessalonici	,000056629	,0000535252	,291
	2.000 to 9.999 habitants	-,00001056	,0000501179	,833
	up to 1.999 habitants	-,00003989	,0000420091	,343
2.000 to 9.999 habitants	Greater Athens	,000106278*	,0000456390	,020
	Greater Thessalonici	,000067186	,0000623265	,282
	Urban 10.000 habitants and over	,000010557	,0000501179	,833
	up to 1.999 habitants	-,00002933	,0000527675	,579
up to 1.999 habitants	Greater Athens	,000135613*	,0000365497	,000
	Greater Thessalonici	,000096521	,0000560139	,086
	Urban 10.000 habitants and over	,000039892	,0000420091	,343
	2.000 to 9.999 habitants	,000029335	,0000527675	,579

Based on observed means.

*. The mean difference is significant at the ,05 level.

2. Couples with one little child below 6 years

Table A3: Analysis of variance of mean total expenditures for the couples with one little child

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3,455E-07[a]	4	8,638E-08	2,343	,055
Intercept	5,634E-05	1	5,634E-05	1527,852	,000
region	3,455E-07	4	8,638E-08	2,343	,055
Error	9,181E-06	249	3,687E-08		
Total	1,101E-04	254			
Corrected Total	9,527E-06	253			

a. R Squared = ,036 (Adjusted R Squared = ,021)

Figure A4: Box-Cox plot for couples with one little child

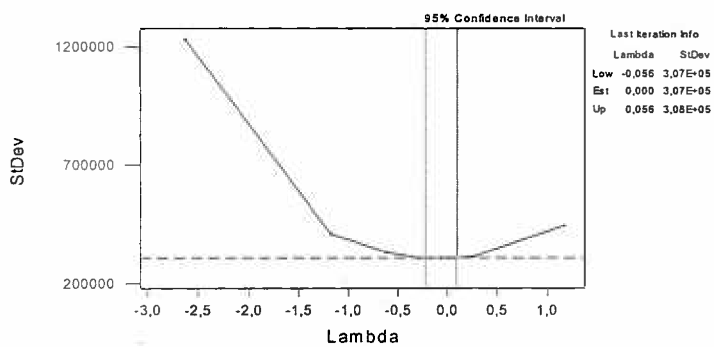


Figure A5: Standardized residuals versus predicted values

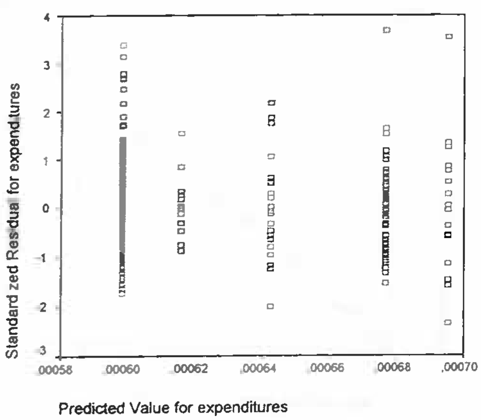
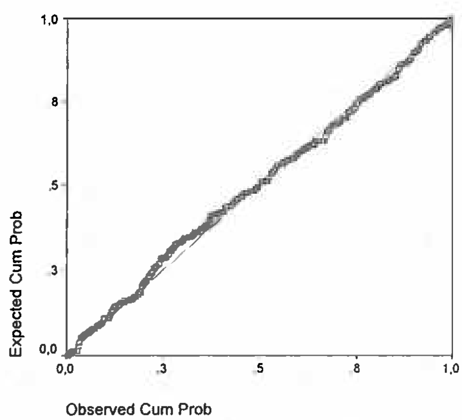


Figure A6: P-Plot of standardized residuals



3. Couples with two little children below 6 years

Table A4: Analysis of variance of mean total expenditures for the couples with two little children

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,599E-03[a]	4	3,997E-04	4,096	,004
Intercept	,900	1	,900	9219,224	,000
region	1,599E-03	4	3,997E-04	4,096	,004
Error	1,015E-02	104	9,757E-05		
Total	1,219	109			
Corrected Total	1,175E-02	108			

a. R Squared = ,136 (Adjusted R Squared = ,103)

Figure A7: Box-Cox plot for couples with two little children

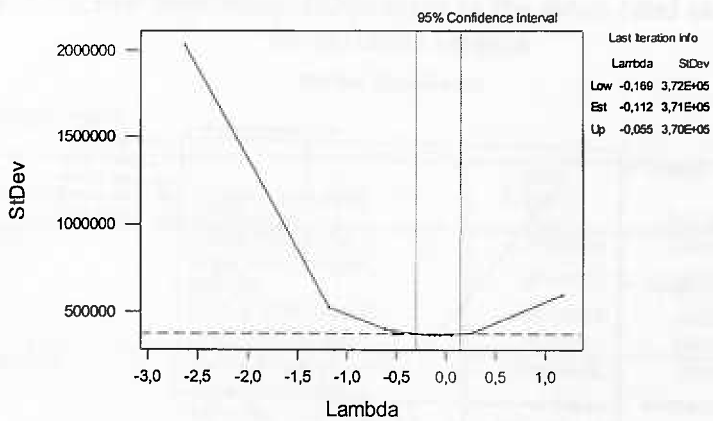


Figure A8: Standardized residuals versus predicted values

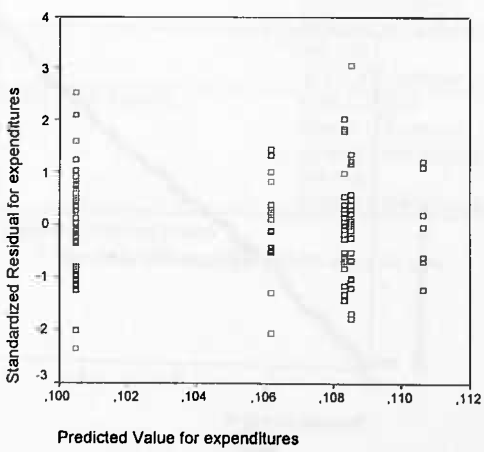


Figure A9: P-Plot of standardized residuals

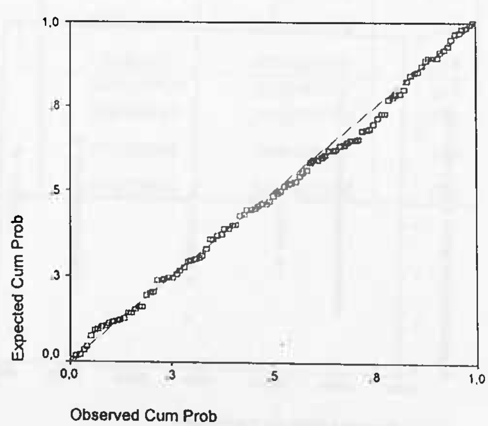


Table A5: Least Significant Differences in the mean total expenditures for couples with two little children

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	-,0102*	,00404	,013
	Urban 10.000 habitants and over	-,0078*	,00257	,003
	2.000 to 9.999 habitants	-,0057*	,00285	,047
	up to 1.999 habitants	-,0081*	,00265	,003
Greater Thessalonici	Greater Athens	,0102*	,00404	,013
	Urban 10.000 habitants and over	,0023	,00426	,586
	2.000 to 9.999 habitants	,0045	,00444	,317
	up to 1.999 habitants	,0021	,00431	,626
Urban 10.000 habitants and over	Greater Athens	,0078*	,00257	,003
	Greater Thessalonici	-,0023	,00426	,586
	2.000 to 9.999 habitants	,0021	,00316	,502
	up to 1.999 habitants	-,0002	,00298	,941
2.000 to 9.999 habitants	Greater Athens	,0057*	,00285	,047
	Greater Thessalonici	-,0045	,00444	,317
	Urban 10.000 habitants and over	-,0021	,00316	,502
	up to 1.999 habitants	-,0024	,00322	,467
up to 1.999 habitants	Greater Athens	,0081*	,00265	,003
	Greater Thessalonici	-,0021	,00431	,626
	Urban 10.000 habitants and over	,0002	,00298	,941
	2.000 to 9.999 habitants	,0024	,00322	,467

Based on observed means.

*. The mean difference is significant at the ,05 level.

4. Couples with one little child below 6 years and one big child 6-13 years

Table A6: Analysis of variance of mean total expenditures for the couples with one little & one big child

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,225E-02	4	3,062E-03	,780	,540
Intercept	445,097	1	445,097	113303,6	,000
region	1,225E-02	4	3,062E-03	,780	,540
Error	,629	160	3,928E-03		
Total	708,906	165			
Corrected Total	,641	164			

Figure A10: Box-Cox plot for couples with one little & one big child

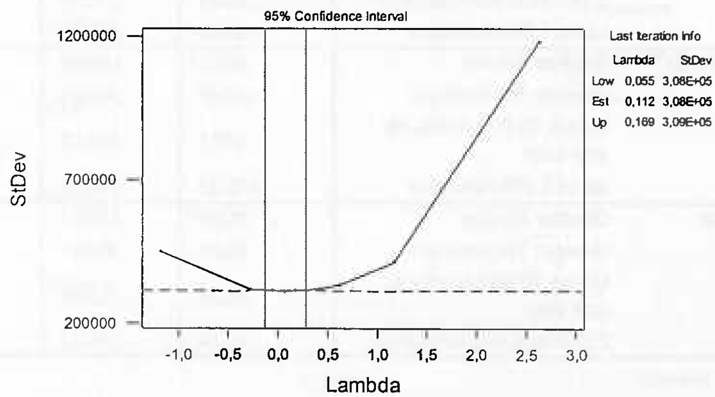


Figure A11: Standardized residuals versus predicted values

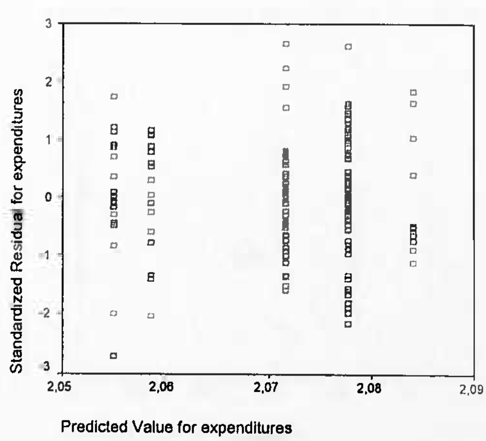
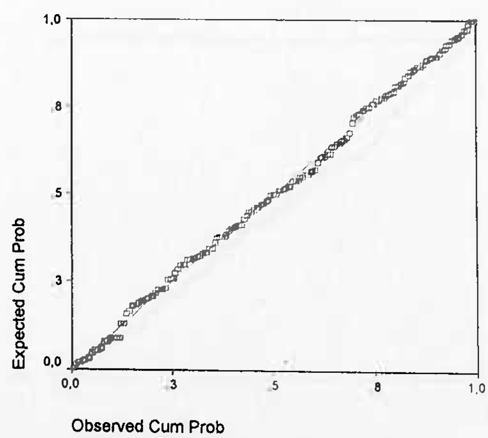


Figure A12: P-Plot of standardized residuals



5. Couples with one big child 6-13 years

Table A7: Analysis of variance of mean total expenditures for the couples with one big child

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2,409E-03	4	6,024E-04	5,393	,000
Intercept	1,097	1	1,097	9819,077	,000
USE	2,409E-03	4	6,024E-04	5,393	,000
Error	1,787E-02	160	1,117E-04		
Total	1,896	165			
Corrected Total	2,028E-02	164			

Figure A13: Box-Cox plot for couples with one big child

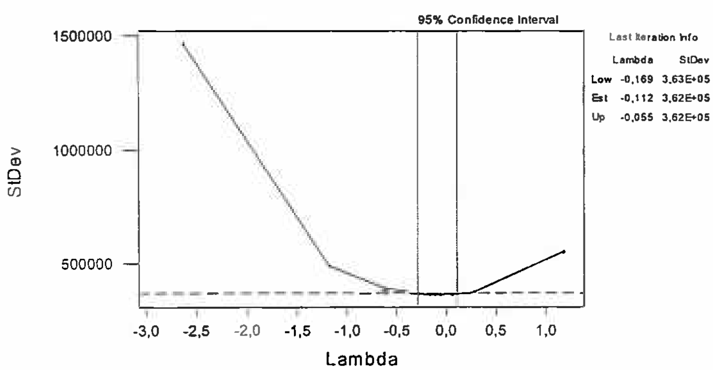


Figure A14: Standardized residuals versus predicted values

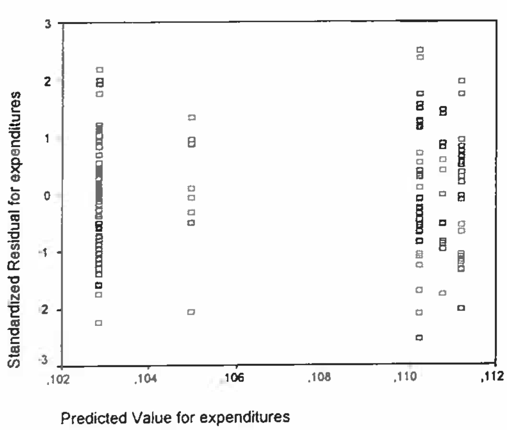


Figure A15: P-Plot of standardized residuals

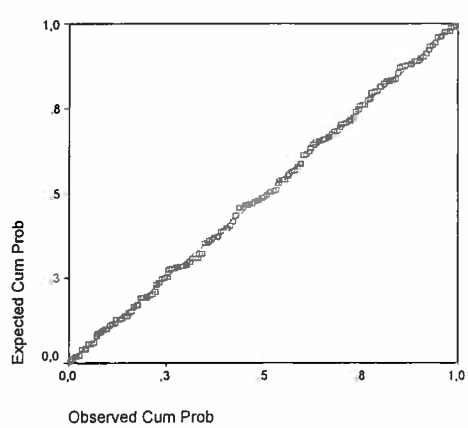


Table A8: Least Significant Differences in the mean total expenditures for couples with one big child

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	-,0021	,00372	,570
	Urban 10.000 habitants and over	-,0074*	,00206	,000
	2.000 to 9.999 habitants	-,0079*	,00317	,013
	up to 1.999 habitants	-,0084*	,00243	,001
Greater Thessalonici	Greater Athens	,0021	,00372	,570
	Urban 10.000 habitants and over	-,0053	,00390	,178
	2.000 to 9.999 habitants	-,0058	,00458	,207
	up to 1.999 habitants	-,0062	,00411	,131
Urban 10.000 habitants and over	Greater Athens	,0074*	,00206	,000
	Greater Thessalonici	,0053	,00390	,178
	2.000 to 9.999 habitants	-,0005	,00337	,876
	up to 1.999 habitants	-,0010	,00269	,722
2.000 to 9.999 habitants	Greater Athens	,0079*	,00317	,013
	Greater Thessalonici	,0058	,00458	,207
	Urban 10.000 habitants and over	,0005	,00337	,876
	up to 1.999 habitants	-,0004	,00361	,905
up to 1.999 habitants	Greater Athens	,0084*	,00243	,001
	Greater Thessalonici	,0062	,00411	,131
	Urban 10.000 habitants and over	,0010	,00269	,722
	2.000 to 9.999 habitants	,0004	,00361	,905

Based on observed means.

*. The mean difference is significant at the ,05 level.

6. Couples with two big children 6-13 years

Table A9: Analysis of variance of mean total expenditures for the couples with two big children

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8,032E-02	4	2,008E-02	6,061	,000
Intercept	556,616	1	556,616	168002,8	,000
USE	8,032E-02	4	2,008E-02	6,061	,000
Error	,656	198	3,313E-03		
Total	878,430	203			
Corrected Total	,736	202			

Figure A16: Box-Cox plot for couples with two big children

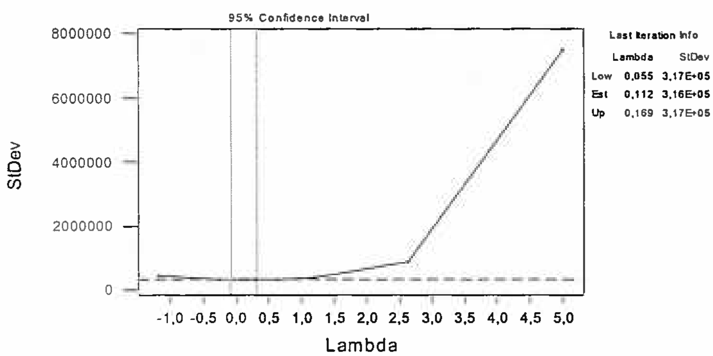


Figure A17: Standardized residuals versus predicted values

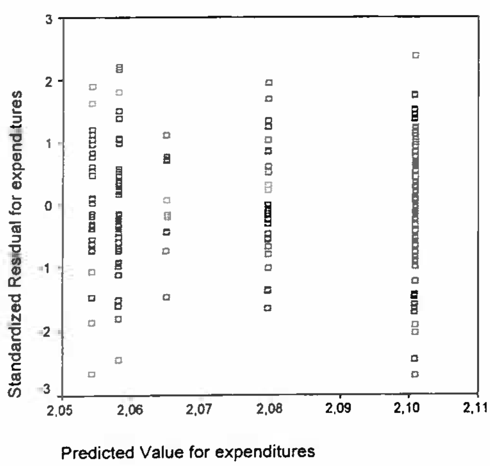


Figure A18: P-Plot of standardized residuals

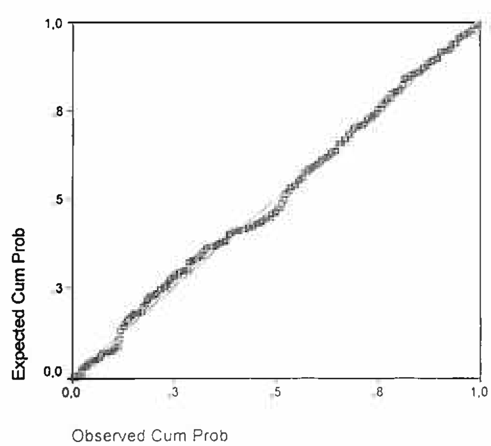


Table A10: Least Significant Differences in the mean total expenditures for couples with two big children

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	,0357	,01842	,054
	Urban 10.000 habitants and over	,0424*	,01042	,000
	2.000 to 9.999 habitants	,0212	,01219	,084
	up to 1.999 habitants	,0463*	,01251	,000
Greater Thessalonici	Greater Athens	-,0357	,01842	,054
	Urban 10.000 habitants and over	,0067	,01928	,728
	2.000 to 9.999 habitants	-,0146	,02029	,474
	up to 1.999 habitants	,0106	,02048	,605
Urban 10.000 habitants and over	Greater Athens	-,0424*	,01042	,000
	Greater Thessalonici	-,0067	,01928	,728
	2.000 to 9.999 habitants	-,0213	,01345	,116
	up to 1.999 habitants	,0039	,01374	,776
2.000 to 9.999 habitants	Greater Athens	-,0212	,01219	,084
	Greater Thessalonici	,0146	,02029	,474
	Urban 10.000 habitants and over	,0213	,01345	,116
	up to 1.999 habitants	,0252	,01512	,098
up to 1.999 habitants	Greater Athens	-,0463*	,01251	,000
	Greater Thessalonici	-,0106	,02048	,605
	Urban 10.000 habitants and over	-,0039	,01374	,776
	2.000 to 9.999 habitants	-,0252	,01512	,098

Based on observed means.

*. The mean difference is significant at the ,05 level.

7. Couples with on child up to 16 years

Table A11: Analysis of variance of mean total expenditures for the couples with one child up to 16

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3,600E-03	4	9,000E-04	9,012	,000
Intercept	3,356	1	3,356	33603,365	,000
USE	3,600E-03	4	9,000E-04	9,012	,000
Error	4,824E-02	483	9,987E-05		
Total	5,616	488			
Corrected Total	5,184E-02	487			

Figure A19: Box-Cox plot for couples with one child up to 16

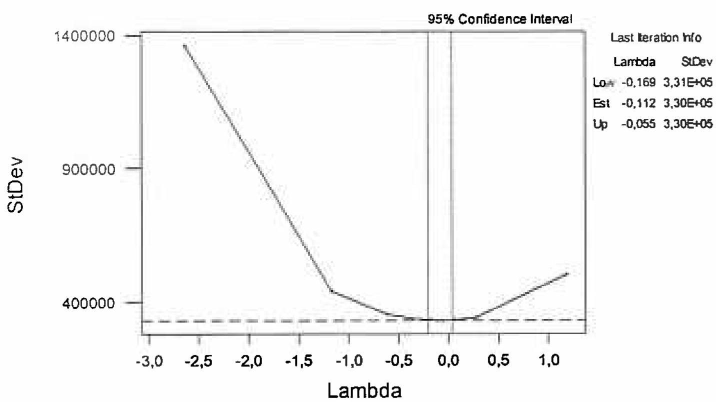


Figure A20: Standardized residuals versus predicted values

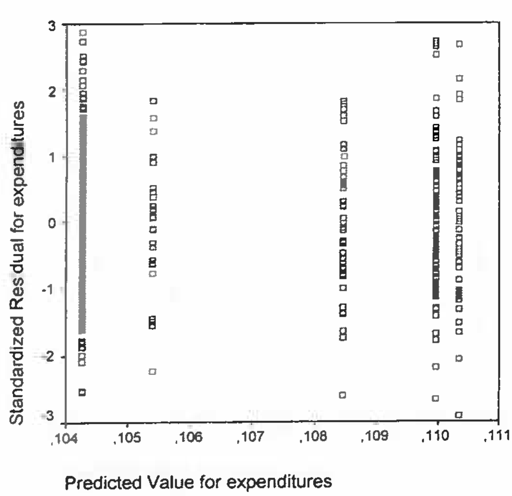


Figure A21: P-Plot of standardized residuals

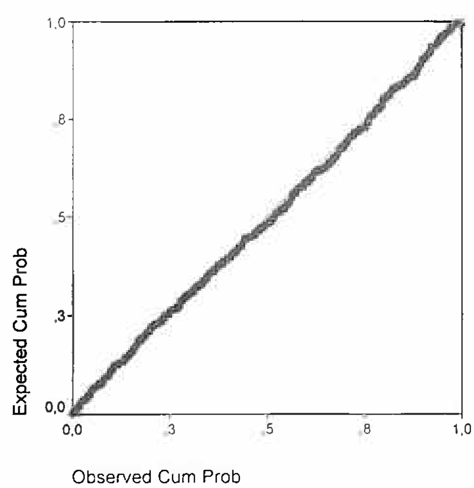


Table A12: Least Significant Differences in the mean total expenditures for couples with one child up to 16

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	-,0011	,00194	,563
	Urban 10.000 habitants and over	-,0057*	,00112	,000
	2.000 to 9.999 habitants	-,0042*	,00162	,010
	up to 1.999 habitants	-,0061*	,00149	,000
Greater Thessalonici	Greater Athens	,0011	,00194	,563
	Urban 10.000 habitants and over	-,0046*	,00204	,026
	2.000 to 9.999 habitants	-,0031	,00236	,191
	up to 1.999 habitants	-,0050*	,00227	,029
Urban 10.000 habitants and over	Greater Athens	,0057*	,00112	,000
	Greater Thessalonici	,0046*	,00204	,026
	2.000 to 9.999 habitants	,0015	,00175	,396
	up to 1.999 habitants	-,0004	,00163	,812
2.000 to 9.999 habitants	Greater Athens	,0042*	,00162	,010
	Greater Thessalonici	,0031	,00236	,191
	Urban 10.000 habitants and over	-,0015	,00175	,396
	up to 1.999 habitants	-,0019	,00201	,351
up to 1.999 habitants	Greater Athens	,0061*	,00149	,000
	Greater Thessalonici	,0050*	,00227	,029
	Urban 10.000 habitants and over	,0004	,00163	,812
	2.000 to 9.999 habitants	,0019	,00201	,351

Based on observed means.

*. The mean difference is significant at the ,05 level.

8. Couples with two children up to 16 years

Table A13: Analysis of variance of mean total expenditures for the couples with two children up to 16

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	,134	4	3,353E-02	9,170	,000
Intercept	1885,120	1	1885,120	515563,5	,000
USE	,134	4	3,353E-02	9,170	,000
Error	2,300	629	3,656E-03		
Total	2750,755	634			
Corrected Total	2,434	633			

Figure A22: Box-Cox plot for couples with two children up to 16

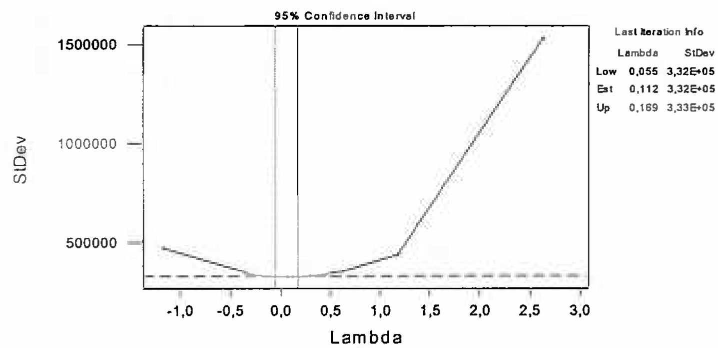


Figure A23: Standardized residuals versus predicted values

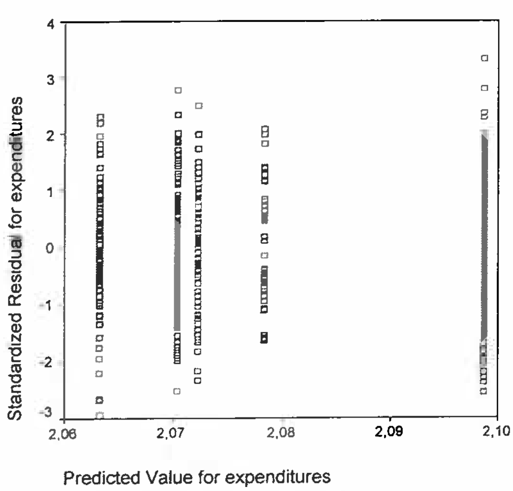


Figure A24: P-Plot of standardized residuals

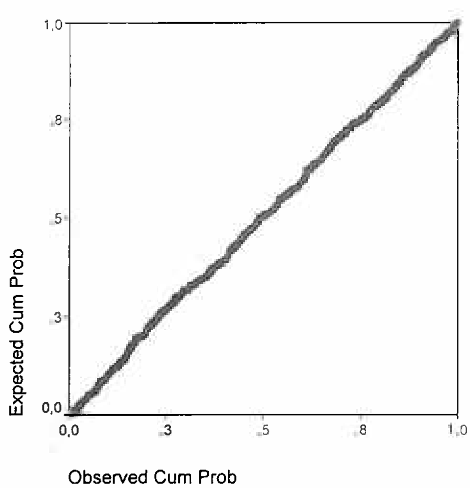


Table A14: Least Significant Differences in the mean total expenditures for couples with two children up to 16

Multiple Comparisons

Dependent Variable: YNEW
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	,0204*	,00984	,039
	Urban 10.000 habitants and over	,0283*	,00605	,000
	2.000 to 9.999 habitants	,0265*	,00779	,001
	up to 1.999 habitants	,0354*	,00750	,000
Greater Thessalonici	Greater Athens	-,0204*	,00984	,039
	Urban 10.000 habitants and over	,0079	,01029	,440
	2.000 to 9.999 habitants	,0061	,01140	,594
	up to 1.999 habitants	,0150	,01121	,180
Urban 10.000 habitants and over	Greater Athens	-,0283*	,00605	,000
	Greater Thessalonici	-,0079	,01029	,440
	2.000 to 9.999 habitants	-,0019	,00835	,822
	up to 1.999 habitants	,0071	,00809	,381
2.000 to 9.999 habitants	Greater Athens	-,0265*	,00779	,001
	Greater Thessalonici	-,0061	,01140	,594
	Urban 10.000 habitants and over	,0019	,00835	,822
	up to 1.999 habitants	,0090	,00945	,344
up to 1.999 habitants	Greater Athens	-,0354*	,00750	,000
	Greater Thessalonici	-,0150	,01121	,180
	Urban 10.000 habitants and over	-,0071	,00809	,381
	2.000 to 9.999 habitants	-,0090	,00945	,344

Based on observed means.

*. The mean difference is significant at the ,05 level.

9. Couples with three or more children up to 16 years

Table A15: Analysis of variance of mean total expenditures]
for the couples with three or more children

Tests of Between-Subjects Effects

Dependent Variable: YNEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2,871	4	,718	,903	,464
Intercept	6194,790	1	6194,790	7789,458	,000
USE	2,871	4	,718	,903	,464
Error	112,930	142	,795		
Total	13301,260	147			
Corrected Total	115,801	146			

Figure A25: Box-Cox plot for couples with three or more children

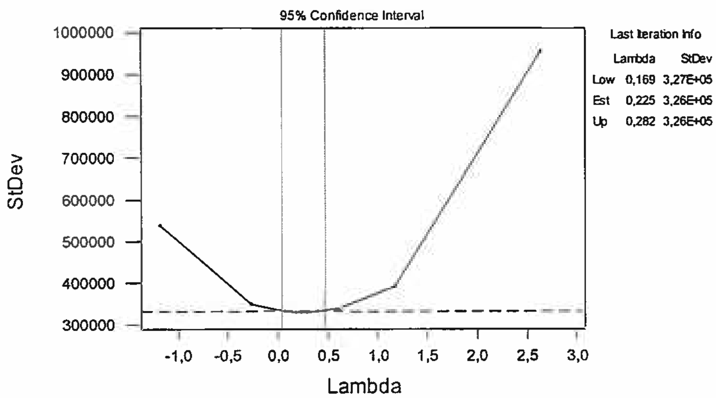


Figure A26: **Standardized residuals versus predicted values**

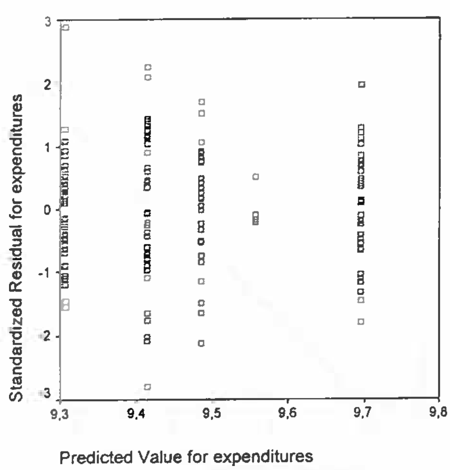
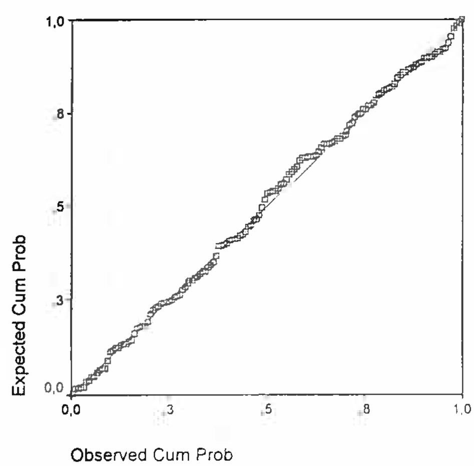


Figure A27: P-Plot of standardized residuals



II. FOOD EXPENDITURES

1. Childless couples

Table A16: Analysis of variance of mean food expenditures for the childless couples

Tests of Between-Subjects Effects

Dependent Variable: expeditures for food

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3,802	4	,951	2,935	,021
Intercept	9580,875	1	9580,875	29579,564	,000
USE	3,802	4	,951	2,935	,021
Error	110,127	340	,324		
Total	15254,141	345			
Corrected Total	113,929	344			

Figure A28: Box-Cox plot for childless couples

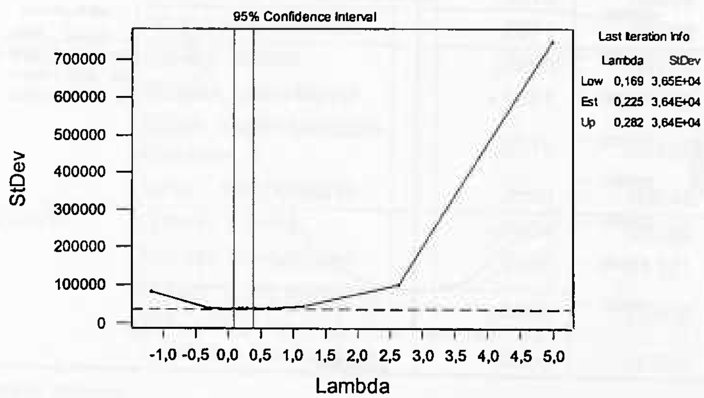


Figure A29: Standardized residuals versus predicted values

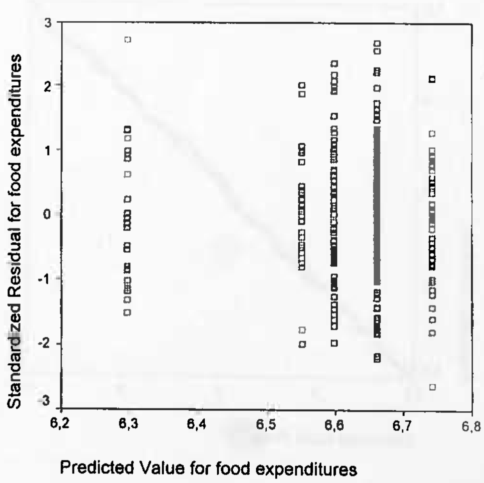


Figure A30: P-Plot of standardized residuals

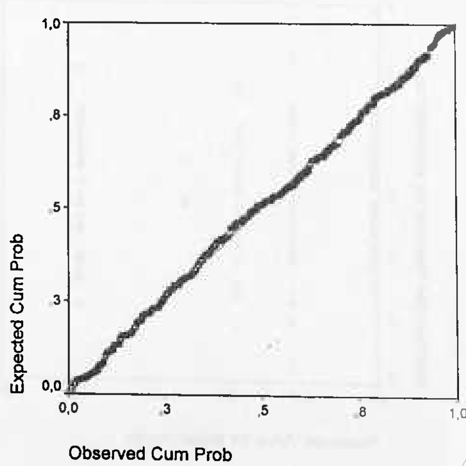


Table A17: Least Significant Differences in the mean food expenditures for childless couples

Multiple Comparisons

Dependent Variable: expeditures for food
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	,3637*	,12205	,003
	Urban 10.000 habitants and over	,0623	,08063	,441
	2.000 to 9.999 habitants	,1090	,11286	,335
	up to 1.999 habitants	-,0793	,09038	,381
Greater Thessalonici	Greater Athens	-,3637*	,12205	,003
	Urban 10.000 habitants and over	-,3015*	,13236	,023
	2.000 to 9.999 habitants	-,2547	,15412	,099
	up to 1.999 habitants	-,4431*	,13851	,002
Urban 10.000 habitants and over	Greater Athens	-,0623	,08063	,441
	Greater Thessalonici	,3015*	,13236	,023
	2.000 to 9.999 habitants	,0468	,12393	,706
	up to 1.999 habitants	-,1416	,10388	,174
2.000 to 9.999 habitants	Greater Athens	-,1090	,11286	,335
	Greater Thessalonici	,2547	,15412	,099
	Urban 10.000 habitants and over	-,0468	,12393	,706
	up to 1.999 habitants	-,1884	,13048	,150
up to 1.999 habitants	Greater Athens	,0793	,09038	,381
	Greater Thessalonici	,4431*	,13851	,002
	Urban 10.000 habitants and over	,1416	,10388	,174
	2.000 to 9.999 habitants	,1884	,13048	,150

Based on observed means.

*. The mean difference is significant at the ,05 level.

2. Couples with one little child below 6 years

Table A18: Analysis of variance of mean food expenditures for the couples with one little child

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	,858	4	,215	,842	,500
Intercept	6397,993	1	6397,993	25104,399	,000
USE	,858	4	,215	,842	,500
Error	63,459	249	,255		
Total	11992,688	254			
Corrected Total	64,317	253			

Figure A31: Box-Cox plot for couples with one little child

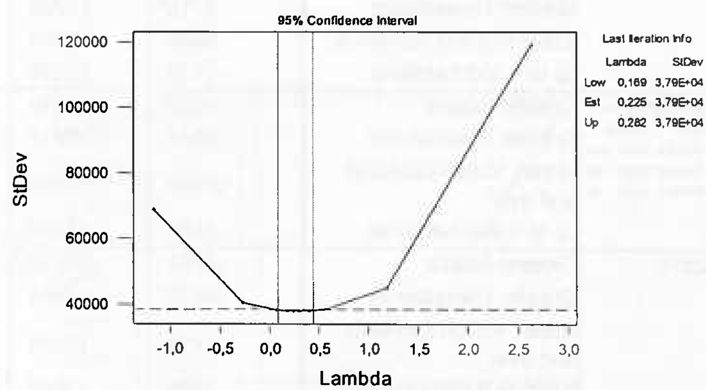


Figure A32: Standardized residuals versus predicted values

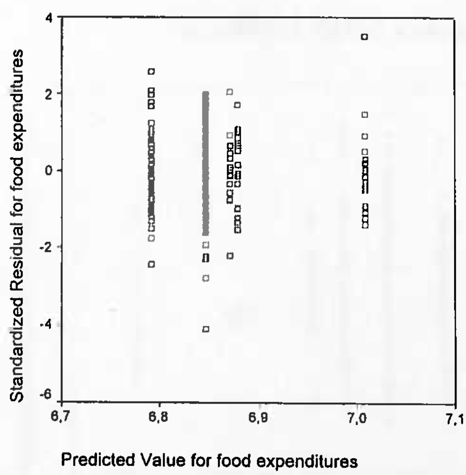
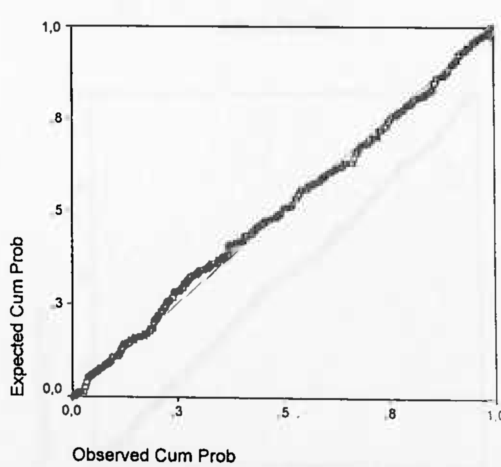


Figure A33: P-Plot of standardized residuals



3. Couples with two little children below 6 years

Table A19: Analysis of variance of mean food expenditures for the couples with two little children

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8,898E-03	4	2,224E-03	1,172	,328
Intercept	282,347	1	282,347	148711,6	,000
USE	8,898E-03	4	2,224E-03	1,172	,328
Error	,197	104	1,899E-03		
Total	392,202	109			
Corrected Total	,206	108			

Figure A34: Box-Cox plot for couples with two little children

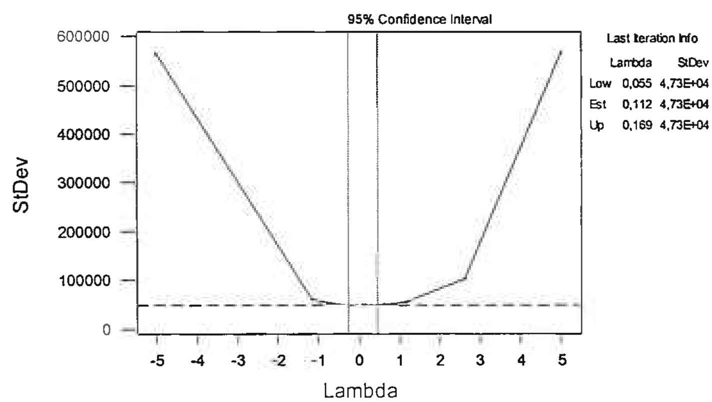


Figure A35: Standardized residuals versus predicted values

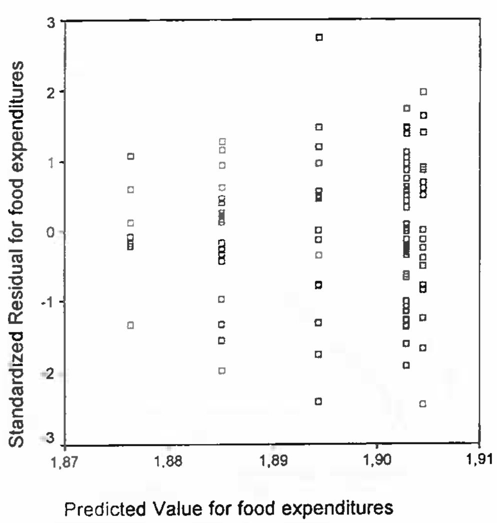
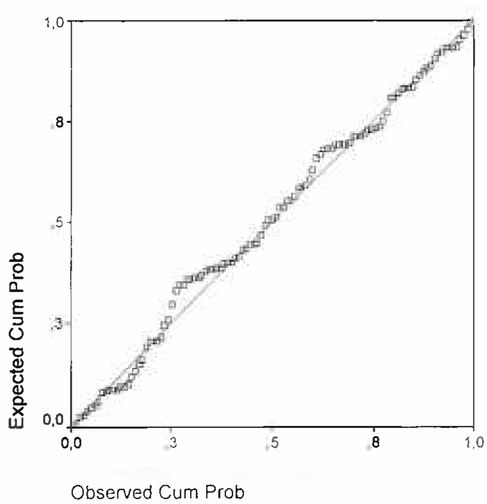


Figure A36: P-Plot of standardized residuals



4. Couples with one little child below 6 years and one big child 6-13 years

Table A20: Analysis of variance of mean food expenditures for the couples with one little & one big child

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13,865	4	3,466	,446	,775
Intercept	64801,214	1	64801,214	8339,354	,000
USE	13,865	4	3,466	,446	,775
Error	1243,285	160	7,771		
Total	104516,258	165			
Corrected Total	1257,150	164			

Figure A37: Box-Cox plot for couples with one little & one big child

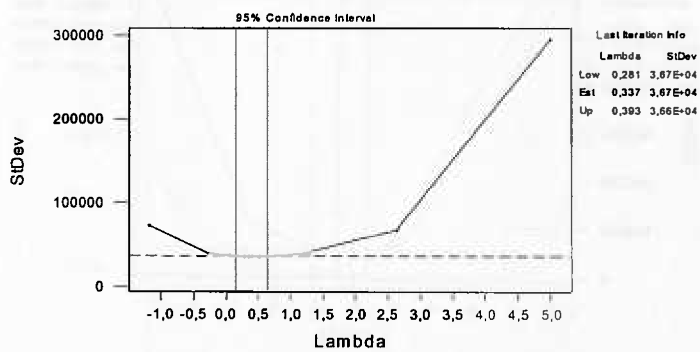
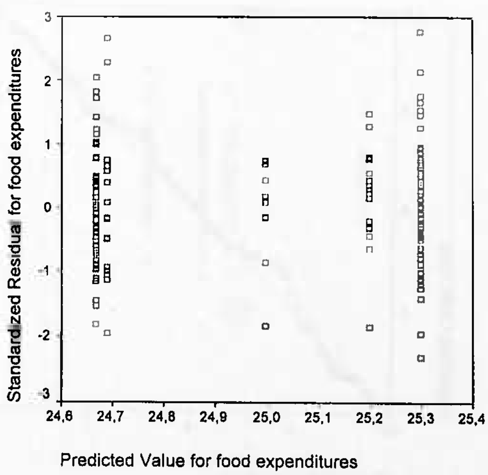
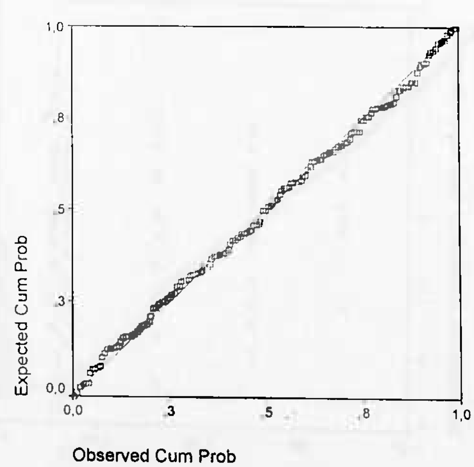


Figure A38: Standardized residuals versus predicted values

Figure A39: P-Plot of standardized residuals





5. Couples with one big child 6-13 years

Table A21: Analysis of variance of mean food expenditures for the couples with one big child

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,866E-04	4	4,664E-05	1,672	,159
Intercept	,148	1	,148	5294,149	,000
USE	1,866E-04	4	4,664E-05	1,672	,159
Error	4,463E-03	160	2,789E-05		
Total	,267	165			
Corrected Total	4,649E-03	164			

Figure A40: Box-Cox plot for couples with one big child

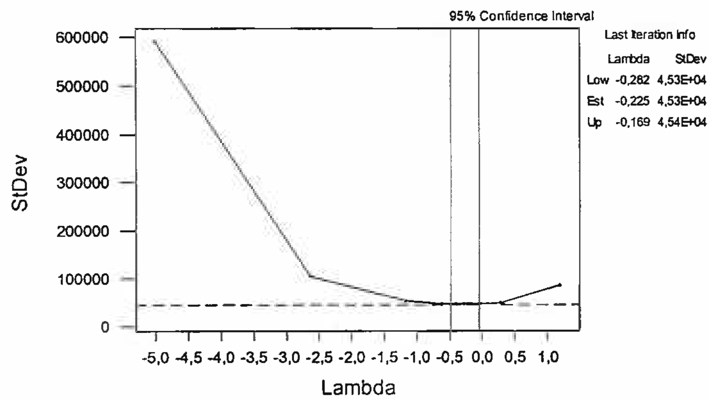


Figure A41: Standardized residuals versus predicted values

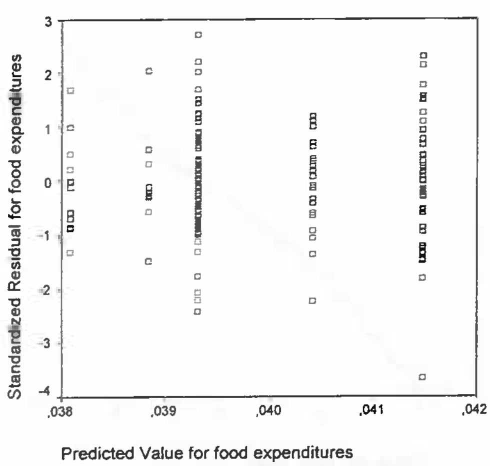
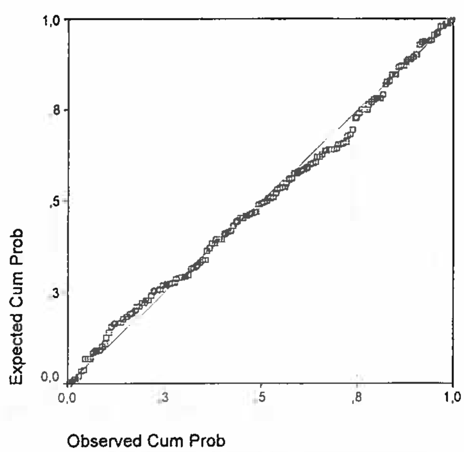


Figure A42: P-Plot of standardized residuals



6. Couples with two big children 6-13 years

Table A22: Analysis of variance of mean food expenditures for the couples with two big children

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2,293E-03	4	5,731E-04	3,591	,007
Intercept	35,775	1	35,775	224155,5	,000
USE	2,293E-03	4	5,731E-04	3,591	,007
Error	3,160E-02	198	1,596E-04		
Total	55,723	203			
Corrected Total	3,389E-02	202			

Figure A43: Box-Cox plot for couples with two big children

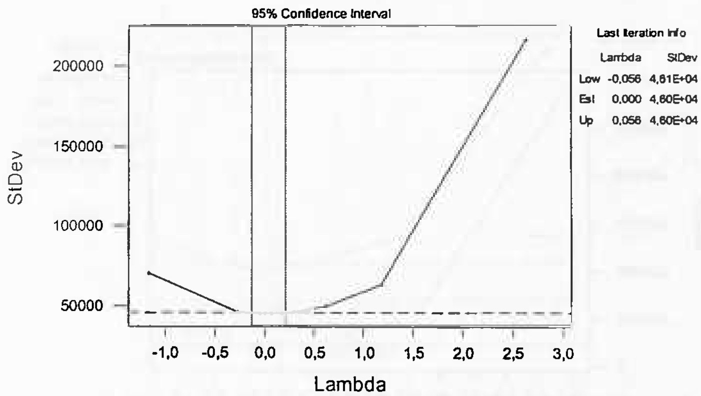


Figure A44: Standardized residuals versus predicted values

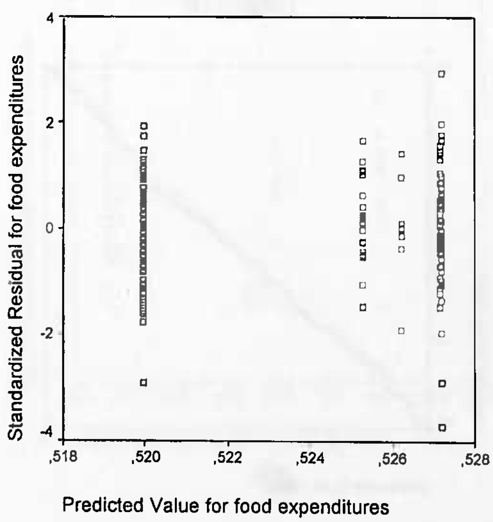


Figure A45: P-Plot of standardized residuals

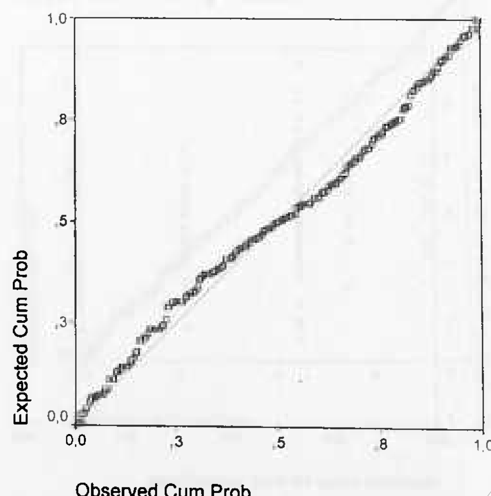


Table A23: Least Significant Differences in the mean food expenditures for couples with two big children

Multiple Comparisons

Dependent Variable: YFOOD
LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	-,0063	,00404	,122
	Urban 10.000 habitants and over	-,0072*	,00229	,002
	2.000 to 9.999 habitants	-,0072*	,00267	,008
	up to 1.999 habitants	-,0053	,00274	,054
Greater Thessalonici	Greater Athens	,0063	,00404	,122
	Urban 10.000 habitants and over	-,0010	,00423	,821
	2.000 to 9.999 habitants	-,0009	,00445	,835
	up to 1.999 habitants	,0009	,00450	,833
Urban 10.000 habitants and over	Greater Athens	,0072*	,00229	,002
	Greater Thessalonici	,0010	,00423	,821
	2.000 to 9.999 habitants	,0000	,00295	,991
	up to 1.999 habitants	,0019	,00302	,528
2.000 to 9.999 habitants	Greater Athens	,0072*	,00267	,008
	Greater Thessalonici	,0009	,00445	,835
	Urban 10.000 habitants and over	,0000	,00295	,991
	up to 1.999 habitants	,0019	,00332	,573
up to 1.999 habitants	Greater Athens	,0053	,00274	,054
	Greater Thessalonici	-,0009	,00450	,833
	Urban 10.000 habitants and over	-,0019	,00302	,528
	2.000 to 9.999 habitants	-,0019	,00332	,573

Based on observed means.

*. The mean difference is significant at the ,05 level.

7. Couples with on child up to 16 years

Table A24: Analysis of variance of mean food expenditures for the couples with one child up to 16

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,297E-03	4	3,243E-04	1,837	,121
Intercept	80,471	1	80,471	455815,4	,000
USE	1,297E-03	4	3,243E-04	1,837	,121
Error	8,527E-02	483	1,765E-04		
Total	136,031	488			
Corrected Total	8,657E-02	487			

Figure A46: Box-Cox plot for couples with one child up to 16

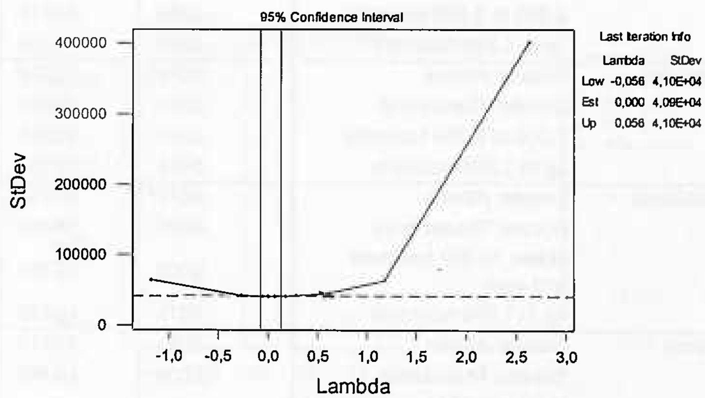
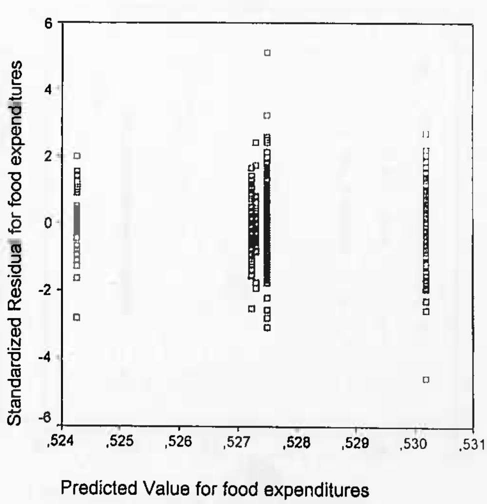
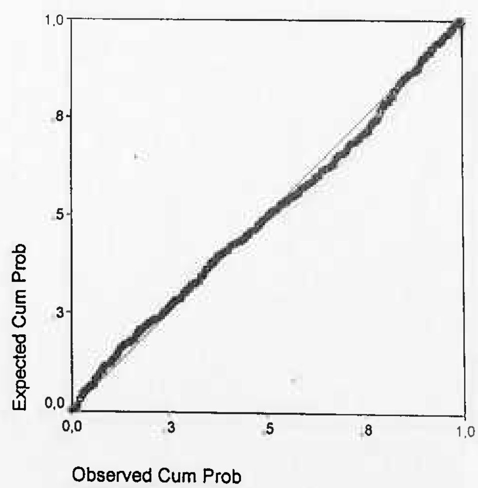


Figure A47: Standardized residuals versus predicted values

Figure A48: P-Plot of standardized residuals





8. Couples with two children up to 16 years

Table A25: Analysis of variance of mean food expenditures for the couples with two children up to 16

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5,395	4	1,349	5,661	,000
Intercept	21062,788	1	21062,788	88407,997	,000
USE	5,395	4	1,349	5,661	,000
Error	149,856	629	,238		
Total	31003,232	634			
Corrected Total	155,251	633			

Figure A49: Box-Cox plot for couples with two children up to 16

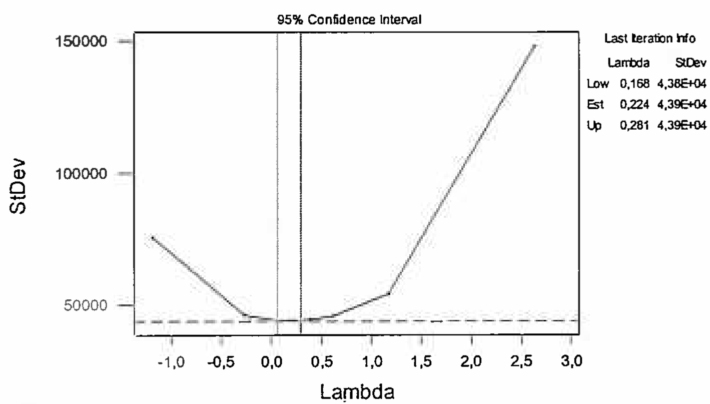


Figure A50: Standardized residuals versus predicted values

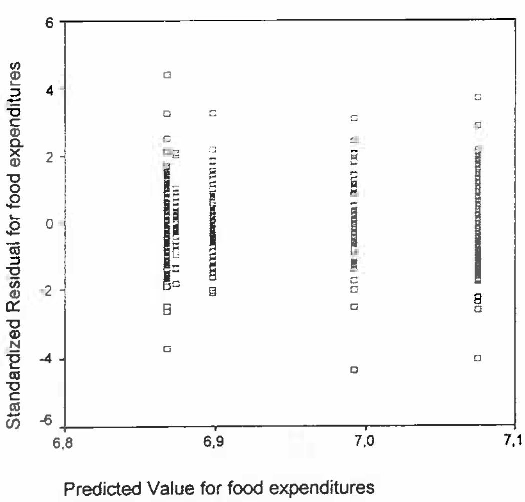


Figure A51: P-Plot of standardized residuals

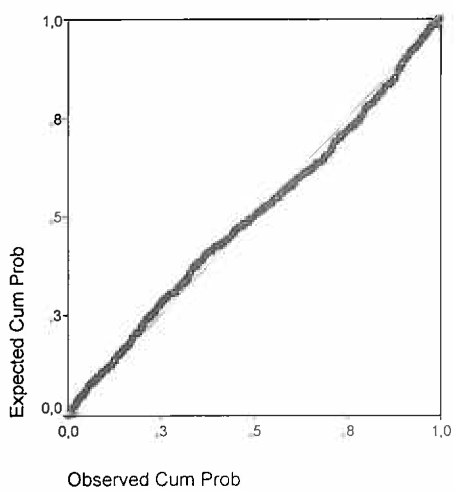


Table A26: Least Significant Differences in the mean food expenditures for couples with two children up to 16

Multiple Comparisons

Dependent Variable: YFOOD

LSD

(I) Size of municipality or Community	(J) Size of municipality or Community	Mean Difference (I-J)	Std. Error	Sig.
Greater Athens	Greater Thessalonici	,2007*	,07944	,012
	Urban 10.000 habitants and over	,2064*	,04883	,000
	2.000 to 9.999 habitants	,1762*	,06285	,005
	up to 1.999 habitants	,0826	,06055	,173
Greater Thessalonici	Greater Athens	-,2007*	,07944	,012
	Urban 10.000 habitants and over	,0057	,08309	,945
	2.000 to 9.999 habitants	-,0245	,09203	,790
	up to 1.999 habitants	-,1180	,09047	,193
Urban 10.000 habitants and over	Greater Athens	-,2064*	,04883	,000
	Greater Thessalonici	-,0057	,08309	,945
	2.000 to 9.999 habitants	-,0302	,06741	,654
	up to 1.999 habitants	-,1238	,06526	,058
2.000 to 9.999 habitants	Greater Athens	-,1762*	,06285	,005
	Greater Thessalonici	,0245	,09203	,790
	Urban 10.000 habitants and over	,0302	,06741	,654
	up to 1.999 habitants	-,0935	,07632	,221
up to 1.999 habitants	Greater Athens	-,0826	,06055	,173
	Greater Thessalonici	,1180	,09047	,193
	Urban 10.000 habitants and over	,1238	,06526	,058
	2.000 to 9.999 habitants	,0935	,07632	,221

Based on observed means.

*. The mean difference is significant at the ,05 level.

*9. Couples with **three** or more children up to 16 years*

Table A27: Analysis of variance of mean food expenditures for the couples with three or more children

Tests of Between-Subjects Effects

Dependent Variable: YFOOD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7,064E-05	4	1,766E-05	,099	,982
Intercept	18,416	1	18,416	103702,3	,000
USE	7,064E-05	4	1,766E-05	,099	,982
Error	2,522E-02	142	1,776E-04		
Total	39,306	147			
Corrected Total	2,529E-02	146			

Figure A52: Box-Cox plot for couples with three or more children

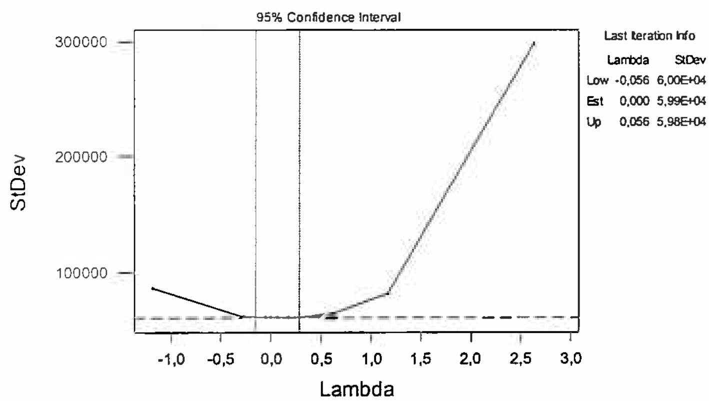


Figure A53: Standardized residuals versus predicted values

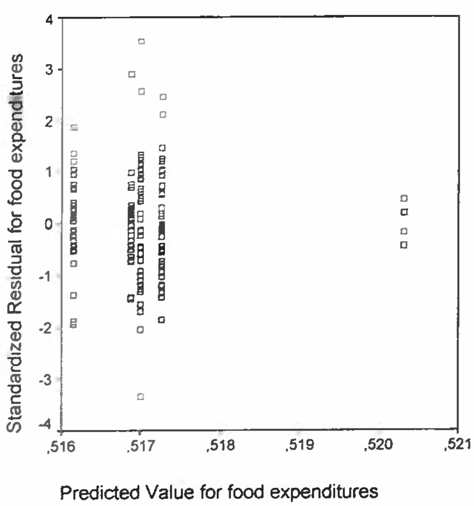
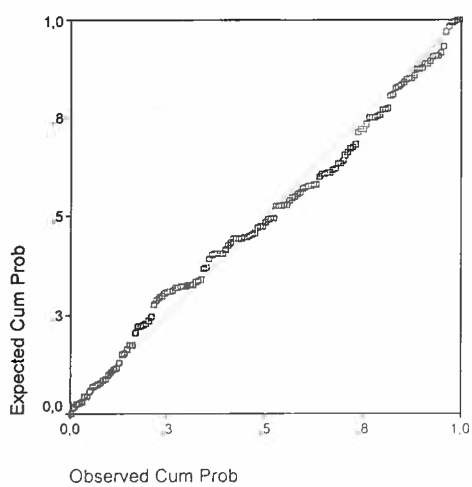


Figure A54: P-Plot of standardized residuals



Appendix B

In appendix B we indicate the coefficients taken from the regression of the models, which we used to estimate the equivalences scales. Our models are firstly the semi-logarithmic function, secondly the double-logarithmic specification and finally the two-parameter model.

I. THE SEMI-LOGARITHMIC MODEL

Table B1: **Coefficients of the semi-logarithmic** model **for the childless couples**

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,365	,081		16,853	,000
	LOGEXPEN	-9,165E-02	,006	-,628	-14,961	,000

a. Dependent Variable: Share of food

Table B2: Coefficients of the semi-logarithmic model for the couples with one **little child**

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,444	,100		14,369	,000
	LOGEXPEN	-9,60E-02	,008	-,624	-12,662	,000

a. Dependent Variable: Share of food

Table B3: Coefficients of the semi-logarithmic model for the couples with two little children

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,595	,158		10,108	,000
	LOGEXPEN	-,104	,012	-,650	-8,847	,000

a. Dependent Variable: Share of food

Table B4: Coefficients of the semi-logarithmic model for the couples with one big child

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,432	,129		11,097	,000
	LOGEXPEN	-9,39E-02	,010	-,604	-9,672	,000

a. Dependent Variable: Share of food

Table B5: Coefficients of the semi-logarithmic model for the couples with two big children

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,376	,111		12,427	,000
	LOGEXPEN	-8,91E-02	,008	-,603	-10,711	,000

a. Dependent Variable: Share of food

Table B6: Coefficients of the semi-logarithmic model for the couples with two big children

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,376	,111		12,427	,000
	LOGEXPEN	-8,91E-02	,008	-,603	-10,711	,000

a. Dependent Variable: Share of food

Table B7: Coefficients of the semi-logarithmic model for the couples with one child up to 16

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,475	,074		19,936	,000
	LOGEXPEN	-9,77E-02	,006	-,623	-17,539	,000

a. Dependent Variable: Share of food

Table B8: Coefficients of the semi-logarithmic model for the couples with two children up to 16

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,441	,062		23,191	,000
	LOGEXPEN	-9,42E-02	,005	-,627	-20,208	,000

a. Dependent Variable: Share of food

II. THE DOUBLE-LOGARITHMIC MODEL

Table B9: Coefficients of the double-logarithmic model for the childless couples

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6,266	,546		11,479	,000
	LOGEXPEN	-,629	,041	-,635	-15,228	,000

a. Dependent Variable: LOGSHFOO

Table B10: Coefficients of the double-logarithmic model for the couples with one little child

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,771	,581		9,938	,000
	LOGEXPEN	-,577	,044	-,639	-13,172	,000

a. Dependent Variable: LOGSHFOO

Table B11: Coefficients of the double-logarithmic model for the couples with two little children

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6,310	,765		8,248	,000
	LOGEXPEN	-,602	,057	-,713	-10,508	,000

a. Dependent Variable: LOGSHFOO

Table B12: Coefficients of the double-logarithmic model for the couples with one big child

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,653	,678		8,332	,000
	LOGEXPEN	-,563	,051	-,654	-11,026	,000

a. Dependent Variable: LOGSHFOO

Table B13: Coefficients of the double-logarithmic model for the couples with two big children

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,376	,111		12,427	,000
	LOGEXPEN	-8,91E-02	,008	-,603	-10,711	,000

a. Dependent Variable: Share of food

Table B14: Coefficients of the double-logarithmic model for the couples with two big children

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,376	,111		12,427	,000
	LOGEXPEN	-8,91E-02	,008	-,603	-10,711	,000

a. Dependent Variable: Share of food

Table B15: Coefficients of the double-logarithmic model for the couples with one child up to 16

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,961	,402		14,816	,000
	LOGEXPEN	-,589	,030	-,661	-19,425	,000

a. Dependent Variable: LOGSHFOO

Table B16: Coefficients of the double-logarithmic model for the couples with two children up to 16

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,633	,345		16,344	,000
	LOGEXPEN	-,556	,026	-,650	-21,523	,000

a. Dependent Variable: LOGSHFOO

III. THE TWO-PARAMETER MODEL

Table B17: Coefficients of the two-parameter model for the couples who reside in Greater Athens

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	5,895	,349		16,878	,000
	Ln(Expenditures)	-,597	,026	-,636	-22,94	,000
	Children below 6 years old	,114	,025	,131	4,578	,000
	Children aged from 6 to 13	,191	,020	,277	9,651	,000

a. Dependent Variable: Ln(Share of food)

Table B18: Coefficients of the two-parameter model for the couples who reside in Greater Thessalonica

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	6,637	1,004		6,611	,000
	Ln(Expenditures)	-,665	,075	-,619	-8,829	,000
	Children below 6 years old	,207	,053	,282	3,901	,000
	Children aged from 6 to 13	,238	,058	,295	4,091	,000

a. Dependent Variable: Ln(Share of food)

Table B19: Coefficients of the two-parameter model for the couples who reside in municipalities with more than 10000 inhabitants

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3,620	,502		7,212	,000
	Ln(Expenditures)	-,420	,038	-,476	-11,04	,000
	Children below 6 years old	,109	,032	,150	3,404	,001
	Children aged from 6 to 13	,129	,025	,224	5,072	,000

a. Dependent Variable: Ln(Share of food)

Table B20: Coefficients of the two-parameter model for the couples who reside in municipalities and communities with 2000-9999 inhabitants

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,476	,689		7,947	,000
	Ln(Expenditures)	-,557	,052	-,618	-10,62	,000
	Children below 6 years old	,124	,040	,188	3,097	,002
	Children aged from 6 to 13	,106	,032	,203	3,349	,001

a. Dependent Variable: Ln(Share of food)

Table B21: Coefficients of the two-parameter model for the couples who reside in communities with up to 1999 inhabitants

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,901	,582		10,1	,000
	Ln(Expenditures)	-,583	,045	-,652	-13,1	,000
	Children below 6 years old	,131	,038	,176	3,477	,001
	Children aged from 6 to 13	,096	,028	,176	3,472	,001

a. Dependent Variable: Ln(Share of food)

Table B22: Coefficients of the two-parameter model for the couples who reside in the whole country

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,531	,232		23,9	,000
	Ln(Expenditures)	-,567	,017	-,611	-32,5	,000
	Children below 6 years old	,125	,015	,157	8,099	,000
	Children aged from 6 to 13	,155	,012	,244	12,6	,000

a. Dependent Variable: Ln(Share of food)

Table B23: Coefficients of the two-parameter model for the couples who reside in urban areas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,236	,273		19,204	,000
	Ln(Expenditures)	-,548	,020	-,592	-26,81	,000
	Children below 6 years old	,123	,019	,150	6,619	,000
	Children aged from 6 to 13	,173	,015	,260	11,433	,000

a. Dependent Variable: Ln(Share of food)

Table B24: Coefficients of the two-parameter model for the couples who reside in semi-urban areas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,476	,689		7,947	,000
	Ln(Expenditures)	-,557	,052	-,618	-10,62	,000
	Children below 6 years old	,124	,040	,188	3,097	,002
	Children aged from 6 to 13	,106	,032	,203	3,349	,001

a. Dependent Variable: Ln(Share of food)

Table B25: Coefficients of the two-parameter model for the couples who reside in rural areas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,901	,582		10,1	,000
	Ln(Expenditures)	-,583	,045	-,652	-13,1	,000
	Children below 6 years old	,131	,038	,176	3,477	,001
	Children aged from 6 to 13	,096	,028	,176	3,472	,001

a. Dependent Variable: Ln(Share of food)

Finally, we present the Tables of the coefficients after having utilized the GLS estimator for the correction of heteroskedasticity. Where B is the dependent variable Ln(share of food)/ $\tilde{\sigma}_h$, B1 is the Ln(Expenditures)/ $\tilde{\sigma}_h$, B2 is the number of little children $L^h/\tilde{\sigma}_h$ and B3 is the number of big children $B^h/\tilde{\sigma}_h$.

Table B26: Coefficients corrected of heteroskedasticity of the two-parameter model for the couples who live in Greater Athens

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,462	,210		6,970	,000
	B1	-,255	,016	-,629	-16,215	,000
	B2	,090	,033	,108	2,730	,007
	B3	,118	,026	,182	4,569	,000

a. Dependent Variable: B

Table B27: Coefficients corrected of heteroskedasticity of the two-parameter model for the couples who live in municipalities with more than 10000 inhabitants

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7,060	,394		17,915	,000
	B1	-,684	,029	-,641	-23,277	,000
	B2	,128	,024	,149	5,220	,000
	B3	,183	,019	,267	9,368	,000

a. Dependent Variable: B

Table B28: Coefficients corrected of heteroskedasticity of the two-parameter model for the couples who live in municipalities and communities with 2000-9999 inhabitants

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	5,419	,682		7,950	,000
	B1	-,553	,052	-,619	-10,656	,000
	B2	,124	,040	,188	3,097	,002
	B3	,106	,032	,203	3,349	,001

a. Dependent Variable: B

Table B29: Coefficients corrected of heteroskedasticity of the two-parameter model for the couples who live in urban areas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4,295	,224		19,169	,000
	B1	-,477	,017	-,616	-28,434	,000
	B2	,123	,019	,147	6,612	,000
	B3	,173	,015	,255	11,447	,000

a. Dependent Variable: B

Table B30: Coefficients corrected of heteroskedasticity of the two-parameter model for the couples who live in semi-urban areas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	5,419	,682		7,950	,000
	B1	-,553	,052	-,619	-10,656	,000
	B2	,124	,040	,188	3,097	,002
	B3	,106	,032	,203	3,349	,001

a. Dependent Variable: B

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