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THE IMPACT OF ECONOMIC CHANGES ON THE ITALIAN SOCIAL WELFARE: A MICROSIMULATION APPROACH

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Riassunto

Questa tesi ha lo scopo di valutare la variazione di benessere che si è verificata tra l'anno 2007 ed il periodo gennaio 2008-aprile 2009. Nello svolgere questo lavoro sono stati usati, in sostituzione degli indici dei prezzi, i cosiddetti "pseudo unit values". Questi "indici" che sono stati inizialmente definiti da Lewbel (1989) e poi migliorati da Atella (Atella, Menon and Perali, 2003) riproducono la variabilità dei prezzi usando le quote di spesa nonché gli indici dei prezzi nazionali e provinciali.
Il lavoro stima un sistema di domanda quadratico in cui le variabili demografiche sono considerate usando una tecnica di traslazione. Il modello di domanda risulta fondamentale per diverse ragioni. Prima di tutto i parametri stimati vengono usati per valutare l'importanza dell'approccio definito da Lewbel (1989) ed Atella (Atella, Menon and Perali, 2003). Tale valutazione è stato fatta stimando due sistemi di domanda in cui il primo usa i "pseudo unit values" mentre il secondo usa gli indici dei prezzi. Dal confronto tra le elasticità dei prezzi si può notare che il primo sistema fornisce delle elasticità dirette sempre negative mentre l'altro no. Per tale ragione l'approccio di Lewbel ed Atella risulta più coerente con la teoria economica del secondo. I parametri del sistema, sono stati usati, inoltre, per valutare le differenze di spesa tra le diverse macroregioni italiane nonché le caratteristiche delle famiglie. L'ultima ragione che ha portato alla stima del sistema è legata al modello di microsimulazione. Questi parametri sono infatti fondamentali per l'implementazione del suddetto. Nel dettaglio, il modello di benessere valuta la funzione di benessere sociale, creata da Jorgenson and Slesnick (1984, 1987, 1990), nel 2007 e la confronta con il suo valore, ottenuto attraverso il modello di microsimulazione, del periodo compreso tra gennaio 2008 ed aprile 2009. Dalla differenza tra questi due valori della funzione è possibile valutare la variazione di benessere. Tale variazione viene inoltre suddivisa in una misura di efficienza ed una misura di equità. Concludendo, dall'analisi di questi dati non si registrano significative variazioni nel benessere della popolazione italiana durante i due periodi.

Abstract

This thesis aims at measuring the Italian welfare variation occurred between 2007 and the period January 2008-April 2009. The work has been carried out, using "pseudo" unit values instead of price indices. In particular, the formers are a theoretical result developed by Lewbel (1989) and Atella (Atella, Menon and Perali, 2003) that reproduce the variability of cross sectional price variations using the variability of the budget shares together with the national and provincial price indices.

The study estimates a quadratic demand system demographically modified using a translating term. The parameters estimated have been used for different reasons: the first one is to check the relevance of the "pseudo" unit value specification. This test has been done comparing the results of the model, carried out using "pseudo" unit values, with the outcomes of a demand model implemented using only indices. In particular, the former, presenting compensated own price elasticities that are always negative, results more coherent with the economic theory than the second one that does not present this characteristic. The second reason underlying the estimation of the demand system is to point out the features of the Italian population, highlighting the differences among the Italian macroregions together with the demographic characteristics of the Italian households. Finally, the last basic motive of this estimation is the implementation of the microsimulation model that needs the parameters estimated by the demand system. In particular, this model evaluates the social welfare function, defined using the Jorgenson and Slesnick (1984, 1987, 1990) specification, in the year 2007 and then, using the microsimulation approach, it calculates the welfare during the period January 2008-April 2009. The difference between the level of the two welfare functions has been measured and splitted into an equity measure and an efficiency component. In conclusion, the analysis of these results does not show relevant variations of welfare between the periods considered.

Contents

1 Introduction

During the last few years Italian people have gone through many challenges. Last year consumers were concerned about high basic food prices like bread, milk and pasta prices. Now everybody is concerned about the effects of the financial crisis on the real economy.

Focussing on the former issue, between January 2007 and August 2008 the prices of bread, pasta and milk increased, respectively, by 15%, 28% and 13%[1]. This situation was determined by a huge increase in the main commodities quotations, such as wheat and corn prices. Nowadays these quotations are very low and in grocery stores prices are decreasing.

Moreover, during the same period of time we saw a big increase in oil quotations and a consequent rise in gasoline and energy prices- around 21% for the former and 13% for the latter [2]. As for food, now the situation is going back to normality and these prices are relatively low.

Considering the latter issue, the financial crisis, we can not use the past tenses. The crisis is still a problem for our economy and, more particularly, it is a problem for our families. To have an idea of what is going on, suffice it to say that, in comparison with the first quarter of 2008, the Italian GDP decreased by 5.9 percent during the first quarter of 2009[3].

In the light of these two problems, this thesis aims at evaluating the welfare in 2007 and at comparing it with the well-being in 2008-2009, obtained by a microsimulation model.

In order to measure these changes, researchers can act in two ways. The first approach is to implement a microsimulation model that estimates the distributional effects of the variations: however, being this a partial equilibrium model, it does not allow the relative prices to be endogenised; thus, biased estimates can be created. The second solution is to implement an applied general equilibrium model that does not consider the welfare effects of the changes but evaluates its efficiency gains or losses.

I have decided to use a microsimulation model because I am interested in the shifts of welfare distribution occurred between 2007 and April 2009.

[1] Indici nazionali dei prezzi al consumo per l'intera collettività delle voci di prodotto. http://www.istat.it/prezzi/precon/aproposito/ nicbase95_indici.xls.

[2] Indici nazionali dei prezzi al consumo per l'intera collettività delle voci di prodotto. http://www.istat.it/prezzi/precon/aproposito/ nicbase95_indici.xls.

[3] Istat, stima preliminare del PIL, http://www.istat.it/salastampa/comunicati/in_calendario/stimapil/20090515_00/testointegrale20090515.pdf

The development of this work can be separated into three main phases: definition of prices, estimation of the demand system and measurement of welfare changes.
In more detail, "definition of prices" means the implementation of a particular technique for the derivation of prices used in the demand system. Specifically, I will use a slightly modified Atella's approach (Atella, Menon and Perali, 2003) to the individual specific price indices, as suggested by Lewbel (Lewbel, 1989), hereinafter "Lewbel's prices". In particular, the decision to use "Lewbel's prices" has been influenced by the growing literature on this topic and by the awareness that they can represent a possible solution to the lack of price variability, which is a frequent problem in the estimation of demand systems. In particular, in the survey that I am using, as in many other surveys, there are no information about the prices paid by consumers nor about the quantities bought. The only information available are about the total expenditures for a product, like rice, or a basket of goods, like beef. Researchers use to fix this problem through price indices, assuming price invariance across households, however, this lack of variability generates problems in the measurement of welfare. The approach developed by Lewbel tries to solve this weakness creating a price index for each household that depends only on demographic information. Subsequently, Atella (Atella, Menon and Perali, 2003) has added variability to this specification using regional price indices and transforming these prices in levels. He has achieved the last goal using family expenditures, as I have done for the non food groups. However, for the food groups, I have used real Ismea nominal prices instead of outlays because they were available.

After having obtained the prices, we can focus on the second part of this dissertation: the demand system. In particular, I have estimated a Quadratic Almost Ideal Demand System (QAIDS) that considers demographic variables using the translating technique. These estimates are important for two reasons. Firstly, we can draw a picture of the Italian households and understand the influence of family characteristics on expenditure shares, together with price and income elasticities. Secondly, in this way, it is possible to estimate crucial parameters in the calculation of welfare measures. Moreover, in this part of the work I have carried out an experiment: I have estimated two demand systems, the one using Regional Pseudo Unit Values in Levels (Lewbel's prices) and the other using regional indices. Subsequently, I have compared their elasticities and checked if

Lewbel's prices represent a real improvement of the estimates.

The last part consists of the calculation of the Italian welfare in 2007 and the comparison of this welfare with the well-being of the period between January 2008 and April 2009. In particular, the latter has been calculated using a microsimulation model. The comparison of these two welfares is carried out through the translation of the changes in prices into changes in the money measure of social welfare, which, in turn, can be separated into an efficiency measure, that represents the potential level of well-being available to a society when the resources are equally distributed, and an equity measure, that represents the reduction of welfare due to a non optimal distribution of the available resources.

To sum up, this thesis aims at applying Lewbel's approach in the solution of price variability problems and it aims at contributing to the debate about the Italian welfare variation in the last few years.

2 Before to Start

2.1 Literature Review

The policy experiment carried out in this thesis aims to measure the Italian well-being and its variations during the last months. Since this exercise finds his theoretical basis on welfare economics, the present part of the dissertation is focused on the evolution of the aforementioned discipline.

Welfare economics aims to define the optimal use of resources required to achieve the maximum well-being of a society. This discipline is part of the normative economics that, using value judgment, delineates what "ought" to be. It can be seen as complementary to the positive economics that analyzes the economic phenomena describing what "is". As Delbono and Zamagni (1997) write: "welfare economics exists because the economists wish to connect theory and social problems". The analysis of this discipline requires a distinction between the old welfare economics and the new welfare economics.

The origins of this discipline can be attributed to Jeremy Bentham, as Suzumura (2001) writes "[omitted] it seems fair to say that the real origin of the critical and systematic approach to the economics mechanism design and policy evaluation belongs to the relatively recent past, and it may be safely attributed to the work of Jeremy Bentham". According to Bentham (1789), the goodness of an action should be evaluated by the utility of its consequences and not by the properness of the intentions. With utility he means "any property in [any] a object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness, [omitted] or [omitted] to prevent the happening of mischief, pain, evil, or unhappiness to the parts whose interest is considered". Furthermore, he asserted that the economic policy to prefer is that one that creates the "greatest happiness for the greatest number". In the light of these considerations, the actions of the State must aim to give to everybody the possibility to pursuit his own utility thus the greatest happiness. This idea characterized the work of other utilitarian authors like John Stuart Mill, Alfred Marshall, Francis Ysidro Edgeworth, Henry Sidgwick, and A. C. Pigou. In particular, the last one is considered the main exponent of the old welfare economics. This branch of economics accepts both Cardinal Utility and Interpersonal Comparison of well-beings. The main idea is that individual utilities can be added creating, in this way, a social welfare

measure. The principle to use in the decision among two alternative policies is, therefore, represented by the highest social welfare achieved. They found that social gains are maximized by competitive markets. When there are distortions in the markets that make its inefficient, the government has to intervene to eliminate these problems. Furthermore this discipline uses a partial equilibrium approach and considers the triangle area to the left of the demand curve and above the price a money measure of consumers' utility and the triangle area to the left of the supply curve and below the price an adequate measure of the producers' utility. Changes in these areas can be used to measure social welfare changes (Just, Hueth and Schmitz, 2004).

At the beginning of 1930s in his essay Lionel Robbins (1932, 1935) strongly criticized this approach, in particular, he criticized the Interpersonal Comparability, as Suzumura (2001) writes "what he actually asserted is that "subjective" interpersonal comparisons cannot claim any "objective" interpersonal validity". Furthermore, other critiques came from Samuelson (1942), Pareto (1896) and Lipsey and Lancaster (1956-57). In particular, according to the former, consumer surplus, the basic measure of welfare considered by the old welfare economics, is not always a unique money measure of utility. Therefore, it can create contradiction depending on the use of empirical data. The second critique is based on the Pareto principle according to which a change is recommended only when it makes at least one individual better off and nobody worse off. Therefore, a conceptual framework based on the addition of utility is not recommended. Finally, the last criticism is about the use of the partial equilibrium approach. In particular, Lipsey and Lancaster (1956-57) showed the presence of interaction among different markets considering thus, the partial equilibrium approach to welfare economics inappropriate. In the light of these critical essays, by the beginning of 1940s, the old welfare economics approach was already overcome by the new welfare economics that, claiming the impossibility to measure well-being, abandoned the concept of Cardinal Utility and Interpersonal Comparability. Conversely they focused their attention on Ordinal Utility assuming that people are only capable to rank their preferences. In this situation the sum criterion does not work and to formulate social welfare is necessary to find another approach. The first solution considered was the Pareto Principle (Pareto, 1906). Following this criterion, as we have said previously, a change from a social state to another is recommended - the society is better off - when it makes at least one individual better off and nobody worse

off. Unfortunately, this principle can not be applied when an intervention of political economy cause welfare gains for some people and losses for others.

To increase, therefore, the variety of situations considered by the Pareto Principle Nicholas Kaldor (1939), John Hick (1940), Tibor Scitovsky (1941), and Paul Samuelson (1950) worked on the creation of the compensation criterion. In details, this criterion, initially defined by Kaldor (1939) and Hicks (1940) recommends a change when it makes some people better off and some other people worse off but, by a redistribution of goods or incomes, who have gained is able to compensate who has loosed in a way that, after the transfer, at least one individual is better off and no one is worse off. This approach suffers however of a problem called reversal paradox that had been pointed out by Scitovsky (1941). Briefly, in some cases the compensation criterion is incoherent because a policy can be judged an improvement over another and vice versa. To solve this paradox is necessary to exclude from the analysis the situations where this reversal can occur but, even doing this, Gorman (1955) showed that orderings of policies need not be transitive. A criterion that does not suffer of the reversal or the intransitive problem, as shown by Chipman and Moore (1971), is the Kaldor-Hicks-Samuelson criterion. It says that policy B is preferred to policy A if, for any allocation of aggregate goods under A, it is possible to find an allocation under B that is Pareto superior to it. These conditions are however very stringent and the order of social welfare is often incomplete. Beyond this problem there is a practical problem that consists on how to examine all possible solutions under each scenario.

In the light of these lacks of the compensation criterion, researchers continued to look for a rule to rank all social states. The goal was to find the state representing the social optimum. This concept had been pointed out by the social welfare function of Abram Bergson (1938) and Paul Samuelson (1947). These authors, considering "the pursuit of the logical consequences of any value judgments,.., [is] a legitimate task of welfare economics" (Suzumura, 2001) aimed to measure ethical beliefs. This function known as the Bergson-Samuelson welfare function, depends on the utility of individuals such that a bigger value of it is preferred to a smaller one. The achievement of the maximum social welfare is based on the tangency of the welfare function with the possibility function. In particular, the former ranks different hypothetical sets of social utility from the lowest to the highest and the second one represents the feasible set of utility

combinations imposed by the restraints and allowed by Pareto efficiency. At the tangency of the highest welfare function with the possibility function the maximum welfare is achieved. In this context, it is important to say that the maximum welfare depends on the value judgments that are inside the welfare function.

During this dynamic theoretical discussion, the paper of Kennet Arrow (1951) came out. He showed that there is not a voting system, satisfying reasonable axioms, which transform the set of preferences, expressed by each individual in the society, into a single global societal preference order. In particular, he used the term social welfare function meaning "a process or rule which, for each set of individual orderings R_1, .., R_n, for alternative social states (one ordering for each individual), states a corresponding social ordering of alternative social states, R". The reasonable axioms, defined by Arrows, that can not be satisfied at the same time are: non-dictatorship, unrestricted domain, independence of irrelevant preferences and Pareto efficiency. In particular, the first axiom means that the social choices should not be based solely on the preferences of one man but on the preferences of multiple individuals i.e. "the social welfare function is not to be dictatorial". The second axiom means that the social welfare function, in the creation of a unique and complete ranking of social choices, should account for all preferences among all individuals. Independence of irrelevant preferences signifies that changes in the individuals' ranking of irrelevant alternatives should not have an impact on the rank of the relevant subset. Pareto efficiency specify that the social welfare function has to be sensible at the individual preferences. This implies that if everybody in the society prefers the alternative A over B, so does the resulting preference order. Subsequently, to reinforce the impossibility theorem of Arrow, at the end of 1970s Amartya Sen (1970) showed that the fundamental problem in making social choices is the inability to make interpersonal comparison rather than the lack of cardinality. In particular, he showed that the Arrow impossibility theorem holds under cardinality as well as ordinality if Interpersonal Noncomparability is maintained. On the contrary, he found that interpersonal comparability without cardinality is a way out of impossibility. (Sen, 1979). Summarizing, the Arrow impossibility theorem proved that there are not reasonable rules for combining the rank of various social states, defined by individuals, into a social ranking.

In this situation, when the interpersonal comparison of welfare is excluded,

the only logical foundation for welfare analysis is the Pareto principle of the two Fundamental Theorems of Welfare Economics. The first theorem, which had been defined by Vilfredo Pareto in 1906 (Pareto, 1906), says that every competitive equilibrium or general equilibrium is Pareto optimal. The second one says that when it is possible to redistribute the initial endowments and the property rights, every Pareto-optimal allocation of resources is an equilibrium for a perfectly competitive economy. However this approach can not be applied in practice. To exit from this problem there were two possibilities: to give up one of the four axioms defined by Arrow or to abandon the Ordinal and Noncomparability approach. Sen (1970, 1973, 1977) suggests to renounce at the last one and weight, thus, the gains of some people and the loss of other people. In this way it is possible to create a wide variety of welfare functions.

One of the first to follow this approach was Hammond (1976) that considered the Ordinal Level Comparability. This approach is characterized by policy markers able to rank ordinally welfare levels but not capable to measure the differences of welfare. This condition implies an invariant order of welfares subsequent to the same monotonic transformations of well-beings and it presents weaker invariance restrictions, on the social order, than Ordinal Noncomparability. However, it requires more information. According to this approach, the order of outcomes depends on the welfare of the poorest household, therefore, it is consistent with Ralws' (1971) point of view. In particular, the critique to the utilitarian approach pointed out by John Rawls (1971) can be summarized into two main issues: welfarism and rule of sum-ranking. The former aims to substitute the informational basis of welfarism with social primary goods. These are the goods wished by every rational man such as liberty and opportunities. The second issue is represented by the use in the utilitarian aggregation of the rule of sum-ranking that does not consider the distribution of utility among the population. He proposed an equally distribution of primary goods among the population and allowed a different distribution of them only when the aim is to improve the worse-off household well-being. This proposal of justice is based on the idea that in the original position, when people decide the basic principles of the society without knowing their position in the real life, these principles would be generally accepted.
Going back to the discussion about the weakening of the Ordinal Noncomparability assumption, at the end of 1970s, authors like d'Aspremont and Gevers (1977) and Maskin (1978) broadening the class of possible social orders, moving

farther from the Ordinal Noncomparability approach and using the Cardinal Unit Comparability specification. This assumption implies the comparability among changes in welfare and implies an utilitarian social welfare function that is the sum, weighed or not, of welfare functions. Later on, Roberts (1980) showed that this class can be further enlarged accepting Cardinal Full Comparability that, at difference of the previous specification, presents a social ordering invariant to the same affine transformation of welfare applied to everybody. In summary, the change from the Ordinal Noncomparability to the Cardinal Full Comparability implies the switch from a situation where policy makers are not able to measure and compare welfare to a situation where they are perfectly able to do it. Moreover this change implies the movement from a context presenting the most stringent invariance requirement to one where there are many feasible social welfare functions. In this situation the social function is the sum of two components: average welfare and dispersion. In particular, the former is a measure of efficiency and it results from the sum of the welfare of every person divided by the number of people; while the second aims to consider the inequity among the population, and it is a function of the distance between individual welfare and the average welfare.

In the light of the availability of a welfare function, the attention must be focused on the arguments to use in its definition. In particular, the use of household income has been quite diffused although the use of households, like units of reference, is the second best solution considering the lack of individual welfare information and the use of income (total, per capita or per capita weighted considering economics of scales) presents bias raised from the absence of information on prices and from its bigger variability (life cycle hypothesis) in comparison with consumption that is a better exponent of the standard of living (Slesnick, 1998). Considering these problems many researchers (Deaton and Muellbauer (1980) and King (1983) for instance) have used the money metric utility functions pointed out by Muellbauer (1974). In particular, he estimated econometrically the expenditure function using an expenditure demand system where the change of prices has different effects among the household according to their relative expenditures. Furthermore, the equivalence scales that are fundamentally for the confront between households depend on many household characteristics and not only on the number of household members like in the income approach. These scales answer the question about the expenditure necessary to maintain the same level of welfare as the household characteristics

change. Unfortunately this approach, considered as an argument of the social welfare function presents some problems deriving from the necessity to chose a reference price vector and a ranking of social state needs not invariant to this choice. As a consequence the social welfare function over this distribution needs not be quasiconcave creating adverse implication for distributive considerations. To deal with this problem Jorgenson and Slesnick (1984) proposed to use an indirect utility function to represent social welfare. Although this application considers prices, total expenditure and demographic characteristics, it does not transform household welfare on a money measure of welfare using the expenditure function so it avoid the problem of the previous specification.

To this point we have considered the literature evolution that plays a role in the development of this dissertation. In particular the last two conceptual frameworks are fundamental for this thesis. Furthermore, we have focused the attention on the different conceptual frameworks that evaluate social welfare using normative judgment about measurability and comparability of well-being. However, it is important to say that there is a quite common methodology that measures social welfare without value judgments: the representative agent model. Even though this methodology does not require assumptions about measurability or comparability of welfares it presents many other problems to deal with, so researchers have started to work with value judgments. In fact, the simplest version of this approach assumes identical homothetic preferences for all individuals. As a result, the aggregate quantities consumed are functions of aggregate expenditure and prices and these functions have the same properties of the demand functions of the individual consumer (Jorgenson, 1990). This original and very restrictive version had been relaxed by Gorman (1953) according to which a necessary and sufficient condition to assure the aggregation of consumers demands is that all individual present parallel linear Engel curves. Despite this improvement, Samuelson (1956) proved that aggregate demands can be represented by a rational consumer only if income is distribute in a way to maximize a social welfare function. Unfortunately the distribution of income is very different among the population and this condition does not hold. Subsequently, the conditions pointed out by Gorman had been strongly broader by the work of Muellbauer (1975), that allows aggregation when the individual preferences are identical but non homothetic. Despite this further improvement, the representative agent theory does not consider distributional variability and the representative agent preference can be in contrast with the

preference of the agents represented as showed by Kirman (1992). In the light of the aforementioned lacks researchers have started to use the value judgments that we have explained at the beginning of this section.

Until now we have considered the evolution of social welfare based only on material welfare i.e. consumption or income. However well being is not only material things because it includes health, life expectancy, happiness, freedom, opportunities and many other personal and social conditions. In the light of this consideration there are many researchers that have tried to deal with the "whole" well being. Sen (1985, 1987) suggested to replace the utilities, that are usually maximized, with "capabilities" that represent conditions -i.e. life expectancy, health status and personal liberty- that people value. Commodities are consumed because they are important in the achievement of the "capabilities" from which well-being is derived. In this context, consumption is considered as an instrument and not as a goal. For instance, food is consumed because it furnishes nutrition that gives the capability to live without malnutrition. Although the relevance of these considerations, the empirical application is very difficult. The capabilities of the individual do not always depend on the revealed preference, thus it is difficult to measure how individual evaluate these capabilities. Actually most empirical research analyzes each "capability" alone without trying to unify them in a global measure of welfare (Slesnick, 1998, 2001).

Another approach to the measurement of welfare is represented by the implementation of subjective measures. The main idea of this conceptual framework started by Van Praag (1971) is to evaluate well being using surveys where people answer to question about the amount of money necessary to achieve a predefined welfare. This approach makes researchers able to define subjective poverty lines and family equivalence scales but it presents two problems. The first one is the lack of surveys availability and the second one is the perception of well being that, depending on the psychological status of the respondent, is very variable (Slesnick, 2001).

The last approach considered derives from the evaluation of welfare carried on using individual or household. The first thing to say in this context is that there are almost no information about the individual welfare therefore the majority of the analysis is based on household well being. The theoretical justification to the use of household considers the family as a unique utility maximization

subject where the resources of everybody are pooled together to achieve the unique common goal (Samuelson, 1956) . Another justification is based on the idea that in the family there is a benevolent dictator that allocates good optimally among the family members (Becker, 1981). Unfortunately when there are disparities in the allocation of resources among the family members the use of household well being can create biased results. This situation has been pointed out by many researchers like for example Apps and Savage (1989) or Haddad and Kambur, (1990) as an example. Therefore to deal with this problem many researchers like Chiappori (1988, 1992) and Bourguignon and Chiappori (1992), for instance, formulated game-theoretic models to describe how the resources can be divided among the family components. However, although for some goods the individual consumption can be measured, for other there are not individual information so the intrahousehold distribution has to be inferred. In addition even if data of everything would be available, the individual valuation of the good is necessary and it can be easy for some private goods but not for public good (Slesnick, 2001).

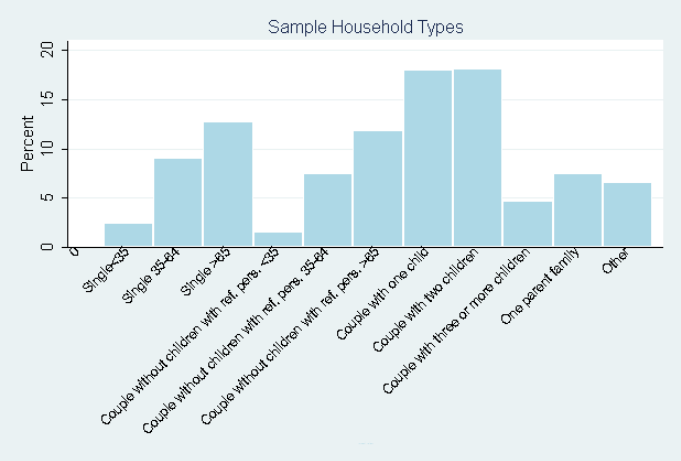
Although the last theoretical frameworks are very interesting, as we have already pointed out, this thesis uses the classic approach at the measurement of well being that is explained in the first part of this review. Maybe the last approaches that will be investigated in the future.

2.2 An Overview of the Sample Data

Before to start the description of the data used in this research it is interesting to have an idea of the entire sample: the Italian Household Survey. This database carries on demographic and expenditure information on a sample of 24.000 families in 2007. The aim of this survey, that Istat reports every year, is to represent the entire Italian population and to take a track of its changes. Therefore, looking at these data we have a general idea of the entire Italian society[4].

[4]In the survey every family has a weight. This weight denotes the number of Italian households represented by the family of the sample. For instance, if the weight of an household in the sample is 1000, in the Country there are 999 families, no recorded in the data, but represented by the first one. Therefore multiplying each family of the sample for his weight and summing these products we can recover the 23.881.224 Italian households.
In this dissertation we will use only the sample data without considering the weights. Therefore, each of the 24.000 families of the sample counts for one. Moreover it is important to say that the sample has been defined using stratification then, even without considering the

Figure 1: Household classification



Focussing on demographic information, the first things to notice are the sample family types. Istat records eleven family types that range from singles to one parent families. As expected the 36 percent of the households are represented by couple with one child or two children but it is interesting to point out that in the seven percent of the families there is only one parent and that many houses are made of people living alone (Figure 1). Among the last group, the most important class is represented by old people, mainly widow.

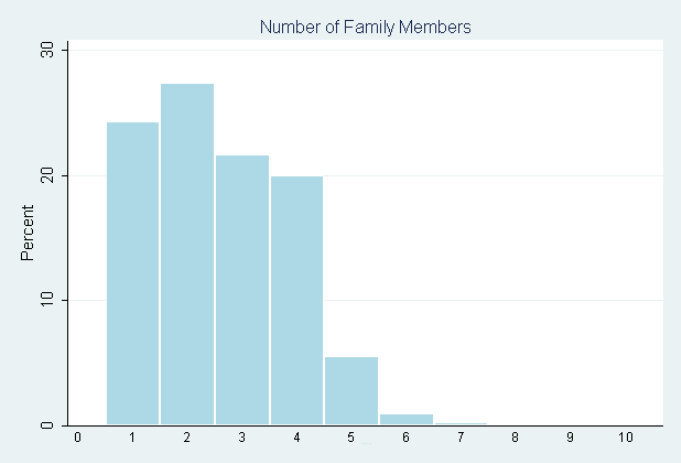
This situation is supported by the analysis of the number of family members (Figure 2). In particular, almost twenty-four percent of households are constituted of one member while only seven percent is composed by five or more components. In average, an Italian family is made of 2.59 people.

This situation is the consequence of a changing society where more people decide to live alone and where a growing number of divorces creates new singles, one parent families and recomposed families. Furthermore, it is important to point out that in some cases divorces, requiring a change of the residential situation and a new approach to work, can aggravate poverty situations or make families more vulnerable.

Another type of family usually considered vulnerable is represented by elderly people. Looking at the data almost thirteen percent of the recorded families are constituted by a single person older than sixty-five years old. This is a consequences of the increase in the average Italian age. In fact, looking at the

weight, it is representative of Italian household variability.

Figure 2: Family Members



distribution of the population age, we can see that nine percent of the population is older than seventy-five years old and almost the twenty percent is older than sixty-five year old. On the other hand only the fifteen percent of the population is younger than eighteen years old (Figure 3).
In this data we have a further proof that Italian population is becoming old as a consequence of a very low born rate and a high life expectation. The average age of the sample population is between 40 and 44 years old. Such situation increases the number of elderly able to live alone that combined with a society that prefer family composed only by children and parents contribute at the creation of many small household.
Elderly people can be interesting to focus our attention on education. In fact, comparing the education of Italian population considered as a whole with the education of people older than fifty-nine years old we can find a big difference. Actually the majority of Italian people has a lower secondary school education and almost 25 percent of the population has a high school diploma. On the other hand, the half of our parents or grandparents has a primary education. This is a foregone conclusion, but it is still interesting to find in the real data the proofs of the enormous change that our society has done after the Second World War (Figure 4).

Moving our attention from demographic characteristics to expenditures, the first thing to notice is the total expenditure distribution (Figure 5). The mean

Figure 3: Age of the Population

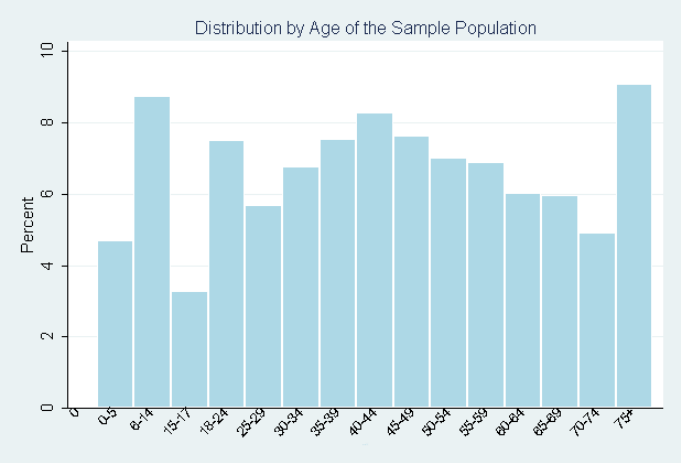
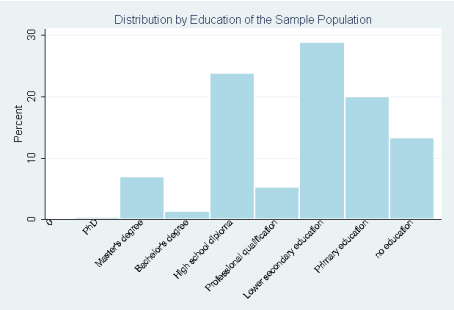
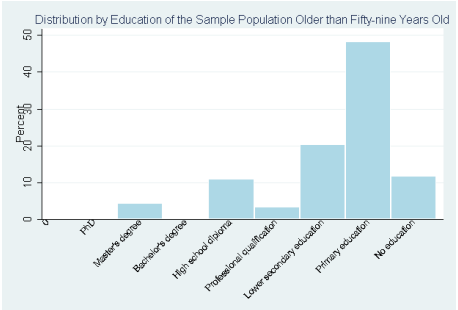


Figure 4: Education





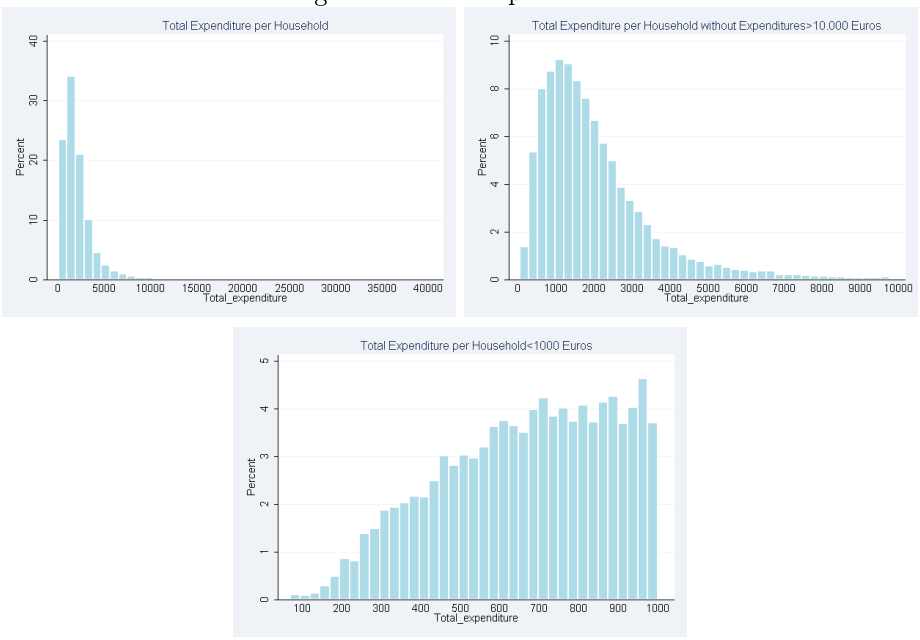
monthly outlay is around 2,151 euros but there is a huge variability since the minimum disbursement is 69 euros and the maximum is 39,970 euros. There are 1,410 families that live with less than 500 euros and they are almost surely below the absolute poverty line. These are only the most evident households below that threshold but a more accurate analysis can find out many other situations. Furthermore we can find 5,748 household that live with less than 1,000 euros each month. On the other hand, the houses showing outlay bigger than 10,000 are 199, usually these families have bought cars, furniture and other durables good during the period considered in the survey.

Considering now the expenditures from another point of view and focusing on the regional variability: the outlays decrease as we move from the Northern to the Southern macroregions. In particular, the highest average expenditure is showed in the North-East macroregion followed by North-West, Center, South and Islands. In details, the mean outlay in the former is around 2,476 euros and the average expenditure in the last one is about 1,648 euros. Looking at this data we can easily deduce that, the Southern regions are poorer than the Northern regions. However to link well-being and expenditure without to consider the prices is a partial analysis. In particular, as it will be showed in the next chapters in the Southern regions prices are lower than in the norther regions and this reduce the huge disparity among welfare that we would deduce only considering total expenditures.

Looking at the expenditures on particular sectors it is easy to note a huge household expenditure variability. In particular, as expected, the sector that looks more stable is food outlay (Table 6) . Its average is 481 euros and it ranges between 0 to 3,298. Since a family can not live without buying food the 59 percent of households that do not record expenditure on food can be considered on a particular situation (parents give them food, they always eat in restaurants or canteens or, more simply, they have not recorded their outlay on food). On the opposite there are 42 houses with expenditures bigger than 2,000 euros. They recorded big outlay for meat, fish and dairy products. These are not big families as we would expected since they range from two to five members. In the impossibility to explain the reasons driving null expenditures or huge outlay, these households have been dropped from the sample that we will use in the policy experiment.

Looking inside the food expenditures we discover that Italian families spend 50 euros each month purchasing a basket of bread, pasta and rice and they spend

Figure 5: Total Expenditures



almost 20 euros to purchase wine, bear and alcoholic beverage. Considering the relevance of the former aggregate in the diet and that of the second one, we would expected a stronger difference among these outlays. The same surprise happens when we consider the expenditure on tobacco. In average we spend 21 euros every month buying cigarettes, cigars and tobacco. Considering together the expenditures on tobacco and those on alcohol beverage the average expenditure achieves 41 euros. As we have said earlier, evaluating the absolutely relevance of bread, pasta and rice in the individual subsistence and the insignificant value of tobacco and alcoholic beverage, the expenditure are very very close.

Looking briefly at the other expenditures we find big variability on clothing and housing. For what that concern the first, the main reason of this situation is a phenomenon by the economist called infrequency of purchases: since the survey records outlays only in a short period of time, many families do not buy anything in that particular moment so recorded expenditures are zero. On the other hand who buys cloths in the period considered of the survey is going to spend more because he is buying something to use in the future. Expenditure on clothing range from zero to 4.315 and it is the result of the above-mentioned particularity and of the habits that, together with family income, play an important role

Figure 6: Food Expenditures

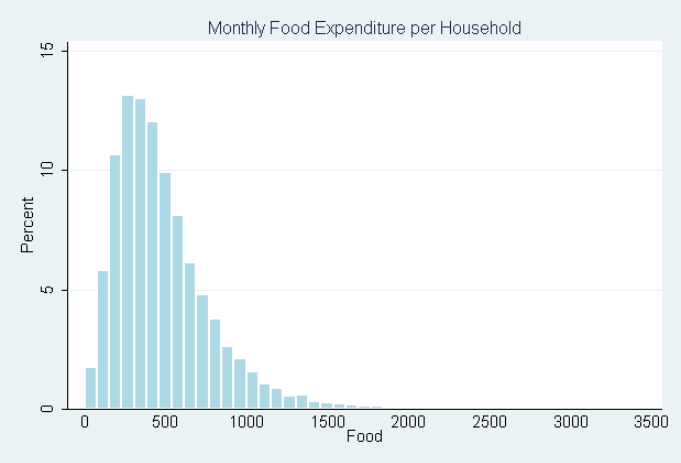


Figure 7: Expenditure on Clothing

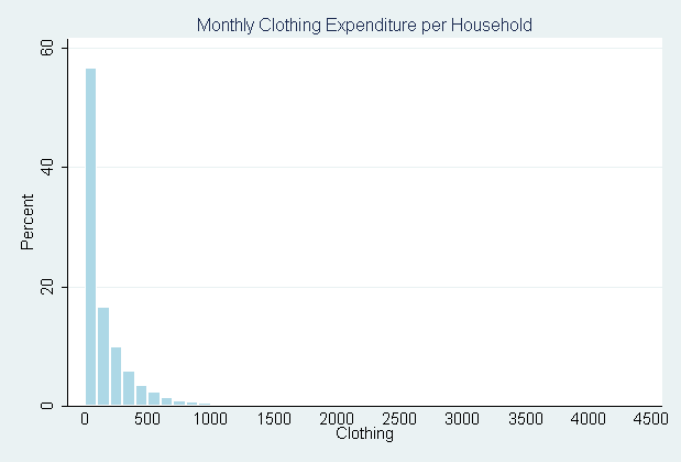


Figure 8: Expenditure on Housing

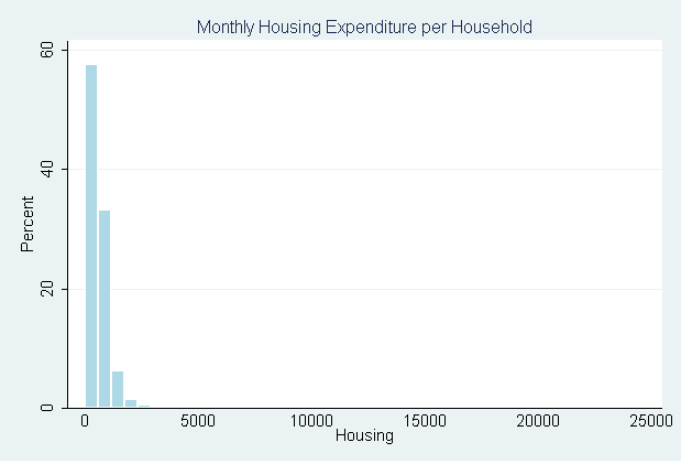
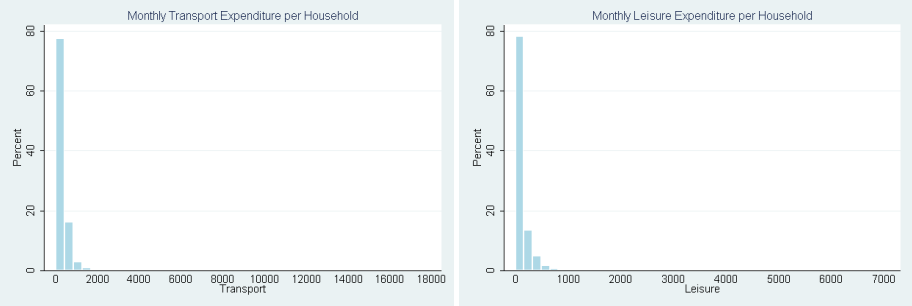


Figure 9: Expenditure on Transport



(Figure 7).

Focusing now the attention on housing expenditure we notice that it ranges from zero to 24.291 euros with an average expenditure of 161 euros (Figure 8). This huge variability is due to two causes. The first one is that it includes both families paying rent or mortgage and homeowner that present for construction big difference since the formers have to pay a monthly and the second one have not to. The second cause of variability is due to the expenditures on durable goods that have been bought during the survey period but that will be used during the future like household appliances, furniture etc.

Looking at the expenditures on transport and leisure we are still in front of a big variability (Figure 9). For both these aggregate the explanation is similar to that of housing. People bought cars or they had holidays during the period of

the survey. Increasing widely, therefore, the variability of the aggregate. Since these expenditures are outlays on durable goods, and their utility is spread among a long period of time, its need to be treated in a particular way: their expenditures have to be shared among the time during which their are used. Furthermore the variability of these expenditures depends on the habits of the different families: who lives in the countryside has to move more than who lives in the city presenting in this way bigger transport costs, and old people spend less money than young people on leisure, for instance. In average the expenditure on transports is 371 euros and the outlay on leisure is 171 euros[5].

[5]We have decided to leave the graphs in its original shape to highlight the variability of the expenditures that otherwise would be difficult to understand.

3 "Lewbel's Prices"

3.1 Introduction

As we have highlighted in the introduction, one of the main problems faced by researchers during the estimation of consumer demand systems is represented by the lack of price variability.

More precisely, in many surveys there are no information about the prices paid by consumers: the only data available are about total expenditures on a basket of goods. In the Italian Household Survey (the survey used in this work), for example, we can find nothing more than the total monthly expenditures for a commodity. In this situation, researchers use national price indices. Unfortunately, these indices do not provide information about regional or group differences, like unit values do. In Italy we have a national monthly consumer price index for a basket of goods and services[6] and very generic regional and provincial price indices for groups of goods[7]. When these indices are used, we assume that in Italy each family pays the same prices for homogeneous goods and we are able to estimate Engel Curves; however, without considering price variations, we can not implement detailed behavioral and welfare applications. In addition, the usage of indices does not allow us to capture complementary and substitution effects because cross-effects are the expression of the differential speed of change of the good-specific price indices through time (Atella, Menon and Perali, 2003).

Moreover, these indices show a very strong serial correlation that further reduces their variability (Holderlein and Mihaleva, 2008).

In his paper "Identification and Estimation of Equivalence Scales under Weak Separability" (Lewbel, 1989c), Lewbel proposes a viable solution for this problem:he suggests to add variability to the consumer price indices using demographic information and constructing, in this way, individual consumer price indices.

This approach seems to be more accurate than the indices approach; in particular, Holderlein and Mihaleva (Holderlein and Mihaleva, 2008), after having

[6] Indici nazionali dei prezzi al consumo per l'intera collettività delle voci di prodotto

[7] Numeri indici dei prezzi al consumo per l'intera collettività - Capoluoghi di provincia - Dati mensili per capitoli di consumo; Numeri indici dei prezzi al consumo per le famiglie di operai e impiegati - Indici nazionali per capitoli di consumo; Numeri indici dei prezzi al consumo per le famiglie di operai e impiegati dei capoluoghi di provincia - Dati mensili per capitoli di consumo; Indici regionali per capitoli di spesa, Indici ripartizionali per capitoli di spesa.

estimated different models using both Stone-Lewbel (SL) prices and indices, state: " The regressions using SL prices are not just more plausible in terms of sign of the coefficient obtained. Also, the precision of our parameter estimates improves dramatically". Furthermore, referring to SL prices, they claim: "negative semidefiniteness, arguably the core property of consumer rationality, appears to be better supported by data now".
Atella comes to the same conclusion (Atella, Menon and Perali, 2003), when, after having estimated a QAIDS through the prices resulting from Lewbel's approach (Regional Pseudo Unit Values in Level) and the indices, he writes: "the matrix of compensated elasticities is negative definite only if pseudo unit values are used. Nominal pseudo unit values, *omitted* , give a set of own and cross price effects that are more plausible".
Subsequently, he estimates the same model using real unit values and states: "in most cases pseudo unit values maintain the relevant characteristics of the distribution of actual unit values".

Given these observations as well as the growing literature on this topic and considering the results that will be exposed in the following chapter, in this dissertation we have decided to use "Lewbel's prices" instead of price indices.

3.2 Methodology

The methodology proposed by Lewbel (1989) and Atella (Atella, Menon and Perali, 2003) is based on two main assumptions: an original function homothetically separable and Cobb Douglas "within group" sub-utility functions. Let us start describing the methodology defined by Lewbel (1989).
Consider a weakly separable utility function $U\left(u_i\left(q_i,a\right),...,u_n\left(q_n,a\right)\right)$ where $U\left(u_i...,u_n\right)$ is the "between group" utility function, and $u_i\left(q_i,a\right)$ for each group i is the "within group" sub-utility function. The index $i=1,...,n$ denotes the aggregate commodity groups, while n_i is the total number of goods q comprising group i. Demographic characteristics a , affects $U(.)$ through the direct effect on the "within group" sub utility functions $u_i\left(q_i,a\right)$.
Define an equivalence scale M_i for a group of goods i as the ratio of a given household's sub-utility functions i relative to the corresponding sub-utility function of a reference household:

$$M_i\left(q_i,a\right)=\frac{u_i\left(q_i,a^*\right)}{u_i\left(q_i,a\right)} \tag{1}$$

Defining a quantity index for group i as $Q_i = u_i(q_i, a^*)$ and rewriting the between-group utility function, we can write

$$U(u_i, ...u_n) = U\left(\frac{Q_i}{M_i}, ..., \frac{Q_n}{M_n}\right) \tag{2}$$

This specification is formally analogous to Barten's (1964) technique to introduce demographics into the utility functions, and, when M_i depends only on a, equation (2) is identical to Barten equivalence scales.

Let X_i^* be the expenditures on group i of the reference household.

Define the price index for group i by $P_i = \frac{X_i^*}{Q_i}$

Let $W_i^* = H_i(P_i, ..., P_n, X^*)$ denote the reference household's budget share demand equation for group i.

Then the budget share demands for any household are given by

$$W_i = H_i(P_1 M_1, ..., P_n M_n, X) \tag{3}$$

that takes the form of Barten equivalence scales, except that the generalized scales M_i depend on the mix of goods comprising each group and on the demographics a.

Furthermore, when the original utility function is homothetically separable there is a function V_i such that $P_i = V_i(p_i, a^*)$; therefore

$$M_i = \frac{V_i(p_i, a)}{V_i(p_i, a^*)} \tag{4}$$

since the V_i functions are linearly homogeneous in p_i, equation (4) shows that when demands are homothetically separable, each generalized equivalence scale M_i depends only on relative prices of goods within group i and on a.

Maximizing $u_i(q_i, a)$ subject to the expenditure $p_i q_i = x_i$ in group i we obtain the budget share of an individual good

$$w_{ij} = h_{ij}(p_i, a, x_i) \tag{5}$$

When demands are homothetically separable, the expenditure x_i drops out of h_{ij} and

$$\ln(V_i(p_i, a)) = p_{ij} \int h_{ij}(p_i, a)\, dp_{ij} \tag{6}$$

for $j = 1, ...n_i$. Since $M_i P_i = V_i$ this construction of V_i can be used directly instead of price data in estimating the demands equations of interest as in equation (3).

Under the assumption that the sub-group utility function can be represented in a Cobb-Douglas form for each group i

$$F_i(q_i, a) = k_i \Pi_{j=1}^{n_i} q_{ij}^{m_{ij}(a)} where \sum_{j=1}^{n_i} m_{ij}(a) = 1 \tag{7}$$

for some function m_{ij}. This makes $w_{ij} = h_{ij}(p_i, a) = m_{ij}(a)$ and

$$V_i(p_i a) = M_i P_i = \frac{1}{k_i} \prod_{j=1}^{n_i} \left(\frac{p_{ij}}{m_{ij}} \right)^{m_{ij}} \tag{8}$$

where

$$k_i = \prod_{j=1}^{n_i} m_{ij} (a^*)^{-mij(a^*)} \tag{9}$$

, which depends only on the choice of the reference demographic levels a.

Assuming with no loss of information, that $p_{ij} = P_i = 1$ for all i and j, price information can be derived just from demographic information.

Since $w_{ij} = h_{ij} = m_{ij}$, we can use the observed budget share data to construct directly, without estimation, the scales

$$M_i P_i = M_i = \frac{1}{k_i} \prod_{i=1}^{n_i} w_{ij}^{-w_{ij}} \tag{10}$$

that can be used like price data in the estimation of group budget share equations.

It is important to point out that we have assumed a Cobb Douglas "within-group" budgeting model but no restrictions are placed on the between-group budgeting model.

Furthermore, an approximation of equation 10 can be obtained using the observed "within-group" budget shares.

Following now Atella's approach (Atella, Menon and Perali, 2003), we can defined Pseudo Unit Value as

$$\widehat{P^i} = M_i P_i = M_i = \frac{1}{k_i} \prod_{i=1}^{n_i} w_{ij}^{-w_{ij}} \tag{11}$$

where k_i is the average of the subgroup expenditure for the ith group budget share.

We can add to this household indices the spatially varying price indices, obtaining, thus, the Regional Pseudo Unit Values

$$\widehat{P_R^j} = \widehat{P^i} P_R^i$$

where P_R^i are the regional price indices.

Subsequently, we can multiply the last indices by the group average expenditures and obtain the Regional Pseudo Unit Values in Levels.

$$\widehat{P_{RL}^i} = \widehat{P_R^i} x^i$$

This work differs slightly from Atella's specification (Atella, Menon and Perali, 2003) in this very part. When we have transformed the Regional Pseudo Unit Values in levels, we have used mean expenditures for non-food groups (like Atella) and Ismea nominal prices for food groups. The decision to use two different sets of data is based on the availability of the real prices. Furthermore, the use of these real values strongly decreases the correlation among "Lewbel's prices".
It is important to notice that these Values correspond to the prices used in the estimation of the demand system.

In order to implement this methodology, it is necessary to create group expenditures (i.e., basically, to create Pseudo Unit Values), regional price indices (i.e., basically, to calculate Regional Pseudo Unit Values) and nominal group prices (which are essential, along with expenditures, in the creation of Regional Pseudo Unit Values in Levels).
Therefore, the following section of this dissertation explains the methodology used to create these data.

3.2.1 Group Expenditures

Household expenditures have been aggregated into nine broad categories: grain products, meat-fish-dairy products, fruits and vegetables, other food products, clothing, housing, transport and communications, leisure-education-health and other non food products.
Let describe the characteristics of each group.
Grain Products
The first group, grain products, includes outlays for bread, rice, biscuits and for different kind of pasta like wheat pasta, egg pasta and stuffed pasta (Table 1). The average monthly expenditure for this group is around 70 euros and it ranges from 1.44 to 387 euros. Among the three group considered, the expenditure for bread is the most important: it represents the 66% of the total outlay. The relevance of this aggregate on welfare is due to the importance of these products in the Italian diet.

Meat, Fish and Dairy Products
The second aggregate includes expenditures on products rich in protein like beef, pork, chicken, horse, fresh and dried fish, shellfish, many types of cheese and

Table 1: Grain Products, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Grain Products	69.99	42.945	1.44	387.33
1_Bread	43.704	26.294	0	205.82
2_Pasta	17.111	17.554	0	148.86
3_Other Cereals	9.175	15.613	0	129.35
N		18279		

milk (Table 2). The monthly average expenditure on this aggregate is around 226 euros: it is higher than the expenditure on grain products and there are two reasons for this: it includes more products and almost every product of this aggregate has a higher price in comparison with the products of the first group. Considering the relevance of the different subgroups in the definition of total expenditure, we can not find a strong polarization of outlays. In particular, four groups display a weight which is slightly smaller than 20% and only the group represented by dairy products has a bigger than 30% relevance.

Table 2: Meat, Fish and Dairy Products, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Meat, Fish and Dairy Products	226.199	138.08	2.25	1113.94
1_Beef	46.051	46.475	0	345.78
2_Pork	37.869	35.59	0	281.7
3_Other Meats	28.726	32.206	0	299.28
4_Fish	45.481	49.636	0	396.34
5_Dairy Products	68.072	45.219	0	345.95
N		18279		

Fruits and Vegetables

The third group includes expenditures on fruits and vegetables, i.e. the expenditures on every kind of fresh fruits (bananas, citruses, cherries, etc), dried fruit, fresh vegetables (tomatoes, legumes, etc) and dried legumes (Table 3). Usually, the price of these products is lower than the price of protein products, so that the average expenditure is lower as well, around 84 euros, with a big variability that depends on each family habits. The most important subgroups are the second one (apples and pears), and the last one (legumes) that, taken together, represent more than 65% of the total outlay.

Other Food Products

This group includes outlays for three different kinds of products: food products

Table 3: Fruits and Vegetables, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Fruits and Vegetables	84.620	57.741	1.1	570.550
1_Citrus and Bananas	16.571	17.02	0	129.67
2_Apples and Pears	27.261	25.607	0	244.26
3_Tomatoes	11.4	12.855	0	144.99
4_Legumes	29.388	24.727	0	210.69
N		18279		

that are not included in the other food groups, like fats, sugar, pastries and salt; alcoholic and non alcoholic beverages, like wine, beer, fruit juices and water; cigarettes (Table 4). The total expenditure of this group is quite high, around 135 euros. This is due to the high impact of alcoholic beverages and cigarettes, that represent more than 25% of the total expenditure. The outlays on non alcoholic beverage and bakery are significant as well.

Table 4: Other Food Products, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Other Food Products	135.253	99.136	0.680	828.5
1_Vegetable Oils	15.749	23.213	0	294.58
2_Vegetable Fats	3.096	5.101	0	49.86
3_Sugar and Jam	9.301	11.105	0	86.8
4_Ice Cream and Pastries	21.561	28.33	0	281.69
5_Salt, Spices and Coffee	18.658	17.987	0	146.84
6_Mineral Water and Juices	23.88	23.967	0	197.28
7_Alcoholic Drinks and Tobacco	43.008	56.033	0	490.03
N		18279		

Clothing

The first non food group, clothing, includes expenditures on clothing and footwear and expenditures on patching, laundry etc. This group is peculiar due to the infrequency of purchases. Indeed, in the survey, it is quite common to find zero expenditure on clothing, the reason being that, when interviewees answer to questions about their expenditures, they have to consider just a limited period of time (one week or one month). As a consequence, some expenditures are null because, in the reference period, they have not bought anything and they are still using something purchased in the non-recorded period. This problem can not be solved using a Tobit model, that would consider zero expenditures as a specific choice of the family, or, better, a corner solution, because these ones are

not corner solutions.

To deal with this problem we have used the Blundell and Meghir approach for durable and semi-durables commodities (Blundell, 1987). These authors provide a generalization of the likelihood function that accounts for both infrequency of purchases and corner solutions. The following is the general likelihood function:

$$\begin{aligned} \ln L &= \sum_{+}[-\ln\sigma_e - \ln\varphi\left(\left(\Phi^1\left(r_i.\alpha\right)y_i - x_i.\beta\right)/\sigma_e\right) + \\ &\quad +2\ln\Phi^1\left(r_i.\alpha\right) + \ln\Phi^2\left(z_i.\theta\right)] \\ &\quad + \sum_{0}\left(1 - \Phi^1\left(r_i.\alpha\right)\Phi^2\left(z_i.\theta\right)\Phi_3\left(x_i.\beta/\sigma_e\right)\right) \end{aligned} \tag{12}$$

where $\varphi()$is the density function, $\Phi^1$is the probability of observing a purchase, $\Phi^2$is the probability of participating in the market, and Φ^3 is the probability of positive expenditures: $y_i^* > 0$ where $y_i^* = x_i.\beta + e_i$ with $e_i \backsim N\left(0, \sigma_e^2\right)$. Since this definition is general, it has to be tailored to the different situations: in the case of infrequency of purchase without corner solutions (the situation considered for clothing), we assumes entire participation in the market and positive expenditures for everybody so: $\Phi^2 = \Phi^3 = 1$. This assumption simplify the general specification in this way:

$$\begin{aligned} \ln L &= \sum_{+}[-\ln\sigma_e - \ln\varphi\left(\left(\Phi^1\left(r_i.\alpha\right)y_i - x_i.\beta\right)/\sigma_e\right) + \\ &\quad +2\ln\Phi^1\left(r_i.\alpha\right)] \\ &\quad + \sum_{0}\left(1 - \Phi^1\left(r_i.\alpha\right)\right) \end{aligned} \tag{13}$$

where the second term represents the decision of making a purchase, while the first one describes the amount of expenditure conditional on the decision of buying something.

We have applied this approach to four expenditure groups: clothing for the entire family (laundry, patching etc), clothing and footwear for men, for women and for babies. The mean expenditure is 154 euros and it ranges from 0.22 to 832 euros. As expected, the most important groups are clothing for men and for women, which amounts to around 30% of total expenditures, while the relevance of the outlay for babies is around 10% (Table 5).

Table 5: Clothing, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
1_No Sex Clothing	24.067	9.476	0.024	82.893
2_Clothing for Men	48.145	33.344	0	300
3_Clothing for Women	55.834	34.463	0	300
4_Clothing for Children	26.501	46.882	0	400
Clothing	154.547	95.452	0.22	832.321
N		18279		

Housing

The sixth group includes housing expenditures, including every house expenditure with the exception of durable goods. Here, we can find outlays for rent, mortgage, water, electricity, different type of heating (from wood to diesel heating) and items for the housework like detergents and gloves.

The expenditures on this aggregate vary seasonally; for example, as is well-known, outlays for heating are much higher in December than in August. Therefore, if the original expenditures are considered, there arise a number of differences among households,due to the fact that some families have been recorded during the cold months and others one during the warm months. To avoid this problem we has created an annual expenditure for each household, adding up the real expenditure recorded for one month, to the expenditures imputed for the other months. This attribution has taken into consideration the following parameters: geographic areas, age and number of sons, number of adults and elderly people, ownership of other houses and the log of total expenditure (sum of every expenditure with exception of imputed rent). Subsequently, we have calculated the average expenditure of each family: in this way, we get outlays more homogeneously distributed during the year.

If we consider the total group expenditure, we notice a huge variability among household outlays: the mean expenditure is around 321 euros but it ranges from 16 to 1,763 euros (Table 6). Having already fixed the problem related to the seasonal variability, we can infer that these valuable differences are due to the disparity among households that rent or are paying the mortgage (enhancing the total disburse) and homeowners.

It is interesting to point out that the most important subgroup in this aggregate is the one composed by heating and electricity, around 56% of the total outlay: the main reason for this lies on the large diffusion of these expenditures in comparison with the polarization of rent and mortgage outlay which, along

with water, represents the 28% of total expenditure.

Table 6: Housing, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
1_Rent, Mortgage and Water	140.872	218.687	0	1483.33
2_Electricity, Gas and Heating	144.071	92.593	12.88	695.73
3_Other Household Products	36.43	36.851	0	199.87
Housing	321.373	244.739	16.504	1763.561
N		18279		

Transport and Communications

The seventh group is represented by transport and communication expenditures. It includes expenditures on private transport (gasoline, oil and vehicle insurances), public transport (train tickets, bus tickets, plane tickets, etc) and communication expenditures (land-line and mobile bills, stamps and postal services).

The mean expenditure of this group is around 335 euros and it shows high variability since it ranges from 0.013 to 1,984. This volatility can be interpreted in the light of some different family parameters, such as house localization (people living in the city center use the car less frequently than people living in the countryside), age of household members (young people use to drive more frequently than elderly people), place of work, etc. As expected, private transport is the most important source of disburse: 46% of total expenditure (Table 7).

Table 7: Transport and Communitation, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Transport and Communication	335.673	263.091	0.013	1983.99
1_Private Transport	192.24	199.981	0	1832
2_Public Transport	23.024	74.367	0	1133.33
3_Car Insurance & Parking	70.865	58.553	0	494.67
4_Phone bills	49.544	41.843	0	536.74
N		18279		

Leisure, Education and Health

The eighth group (leisure, education and health) is a huge group. Among other things, it includes expenditures on education, non-school books, toys, hobbies, cinemas, holidays, pharmaceuticals and physical examinations.

Since some expenditures of this group are characterized by infrequency of purchases, we have dealt with this problem using the technique explained in the

previous paragraph on clothing. In particular, we have applied this approach to the sum of non-school books, notebooks, journals, newspapers, pens and photocopies since, we can find in every family at least one item of this group, purchased during the previous months. In addition, we have considered this problem for the household with children under 18, because school is mandatory before that age, so that every family must have some school expenditures during the year. Subsequently, we have used the same approach for pharmaceuticals since it is common not to record these outlays during a short period of time, even though pharmaceuticals are ordinarily used.

Another problem encountered in the creation of this group relates to holiday expenditures. They are usually very high in comparison with other categories of expenditures and create huge variability in the sample. In order to deal with this problem we have assumed that a family goes on vacation once a year. Therefore, we have divided the expenditure on holiday by twelve (months), spreading the total cost among the year. We have used the same approach also for the cost of courses that are usually paid once a year.

Considering the results of these adjustments, the average expenditure becomes 178 euros and it ranges from 0.3 euro to 1.225 euros (Table 8). Nonetheless,, there remains a high variability, which reflects the different household habits and income.

Table 8: Leisure, Education and Health, Group and Sub-Group Expenditures

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
1_Education	31.88	38.691	0.001	399.967
2_Leisure	69.592	89.547	0	599.190
3_Pharmaceuticals & Physical Exams	76.809	81.533	0.008	597.73
Leisure, Education and Health	178.28	146.652	0.383	1225.704
N		18279		

Other Non Food Products

The last group is a residual one, including expenditures on cafés, restaurants, personal care, and insurance (except for vehicle insurances which are inserted in the transport and communication group). Despite being a residual group, personally, we consider the majority of this aggregate being represented by personal care: for example, going to the restaurant can be interpreted as a way of taking care of oneself, while having breakfast in the cafes means no cups to wash at home and this, from a broader point of view, can be considered as

personal care. The group mean expenditure is around 197 euros and it ranges from 1.82 to 1,687 euros. As for the other groups, there is high variability (Table 9).

Table 9: Other Non Food Products, Group and Sub-Group Expenditures

Variable	Mean	Std. Dev.	Min.	Max.
Other Non Food Products	197.623	194.179	1.82	1687.55
1_Cafè and Resturant	76.736	112.587	0	942
2_Personal Care	115.892	128.447	0	1523.16
N		18279		

3.2.2 Regional Price Indices

In order to create the regional group price indices, as defined by Atella (Atella, Menon and Perali, 2003), two indices are fundamental. The first one is the "Indice Nazionale dei Prezzi al Consumo per l'Intera Collettività", hereinafter National NIC, and the second one is the "Indice Provinciale dei Prezzi al Consumo per l'Intera Collettività", hereinafter Provincial NIC.

The National NIC has been created using the entire collectivity and considering the prices of every good and service bought by Italian families. The entire population is seen as a unique and homogeneous set. This index is available for many products that range from bread to bank services. Altogether, the price variations of three hundred products are available.

Provincial NIC has been calculated using the entire collectivity living in a Province. Consequently, there are as many Provincial NIC as the Italian Provinces. In this index, the disaggregation is very simple: indeed, only twelve product groups are available. Furthermore, it is important to highlight that this index is available for the entire country as well (we can consider Italy as a unique province), and, hereinafter, it will be called Provincial Italian NIC.

In summary, on the one hand, there is a very disaggregated index that does not take into account the regional and provincial variations (National NIC) and, on the other, there is a simple index that takes into account the provincial differences (Provincial NIC).

To add the space variability of the Provincial NIC to the National NIC product variability it is necessary to link these two indices. Let we explain how.

The first step consists on working with Provincial NIC and calculate the Regional NIC as the average of the Provincial NIC: $PNIC_{regio} = mean\,(PNIC_{prov})$ *by region* . Subsequently, finding out the difference among these indices and the Provincial Italian NIC ($pv_{regio} = PNIC_{regio} - PNIC_{italy}$), we have a regional variation.

The second step consists on working with National NIC and groups. Since we are working with nine aggregates we need to create a unique National NIC for each of the nine groups. we have achieved this goal aggregating the indices that I want to include in the different groups and considering the weight of each one. Now, we have a National NIC for each group that, by the way, is equal in every region: NNIC_{group}.

The third step consists in adding the regional variability pv_{regio} (resulting from the Provincial NIC) to the NNIC_{group} index, creating a Regional Price Indices $P_R^i = NNIC_{group} + pv_{regio}$[8] where $i = 1, ...9$ represents the nine groups and $R = 1, ...20$ represents the twenty Italian regions. In this way we have joined the product and the space variability [9] (Table 10).

Table 10: Regional Price Indices

Variable	Mean	Std. Dev.	Min.	Max.
Grain Products	117.736	2.99	114.141	124.318
Meat, Fish and Dairy Products	121.947	1.651	119.606	126.067
Fruits and Vegetables	125.852	1.358	123.133	128.944
Other Food Products	130.457	0.899	128.05	132.491
Clothing	119.848	0.861	118.348	121.997
Housing	134.657	1.297	132.607	137.83
Transport and Communication	125.78	1.647	122.89	129.485
Leisure, Education and Health	113.417	0.676	112.041	115.119
Other Non Food Products	164.156	1.317	162.088	167.219
N		60		

[8] The base year is 1998

[9] Actually, in the model we have not used the Regional Price Indices but their macroregional mean. Therefore on has for each aggregate twelve observations, that represent the time variability (one for each month), and five spacial aggregates (North-West, North-East, Central regions, South and Islands). It total we work with sixty values.

3.2.3 Nominal Prices

The slightly modified Atella's approach (Atella, Menon and Perali, 2003) for the creation of Regional Pseudo Unit Values in Levels requires the definition of nominal prices for food aggregates and mean expenditures for non food groups. More precisely, we work with Ismea nominal prices for grain products, meat-fish-dairy products, fruits and vegetables and other food products and with mean expenditure for clothing, housing, transport and communication, leisure-education-health and other non food products.

The last approach is quite simple since we just need to calculate the mean expenditure of each group by macroregion, month and expenditure quintile. A summary of these data is presented in the tables of the previous section (Table 1-10).
On the contrary, the definition of nominal prices for the food groups is quite complicated.

These prices result from the aggregation of 215 product values available for the 4 Nielsen regions. In detail, in order to calculate the price of each aggregate we have implemented a bottom-up procedure:

1. Consider the products used in the "Indice Nazionale dei Prezzi al Consumo per l'Intera Collettività (National NIC)", hereinafter NIC products;
2. Aggregate the ISMEA prices that can be included in each NIC product and calculate their mean prices, creating thus an Ismea price for each NIC product, hereinafter Ismea-NIC price aggregate.
3. Identify all the prices of the Ismea-NIC price aggregate that have to be included in the different groups, and sum them using the weights of the National NIC Index.

An illustrative example can be very helpful in clarifying what we have done. Consider the first aggregate, grain products.
Looking at the NIC index we can find the national price variation of almost three hundred products and services. Each product has a weight that represents its relevance in the measurement of inflation: for example, the weight of pasta is greater than the weight of rice because the average expenditure on pasta is

bigger than the mean outlay for rice. Since we have to aggregate these prices it is important to consider weight differences.
Obviously, this index does not record the weight of every product. For instance, we can find the index of pasta, that includes the variation of wheat pasta, egg pasta and stuffed pasta, but we can not find the single index of each of these three components. Since in the Ismea data the prices of these three products are recorded, we have calculated their mean prices, thus creating an aggregate similar to the NIC index of pasta that possesses a weight.
After having applied this approach for each food product of the NIC data, every aggregate possesses a weight and we can calculate the price of the group grain products considering the weight differences of the component prices.
Furthermore, to test the decision of creating a unique price for grain products, meat-fish-dairy products, fruits and vegetables and other food products we have implemented a cointegration test. In detail, the goal of this test is to evaluate the cointegration of the different subgroup prices that we want to join in order to create a unique price. This analysis is carried out using a Johansen test that considers as null hypothesis zero cointegration among the variables. More precisely, we have implemented this test for the four food groups (grain products, meat-fish-dairy products, fruits and vegetables and others food products) and for each Nielsen macroregion (North West, North East, Center and South). Considering the first aggregate, the results show cointegration in one region out of four because the price of rice is not cointegrated with the price of pasta, bread and biscuits. This is confirmed by the cointegration test carried out only on pasta, bread and biscuits, that shows cointegration in three regions out of four. Despite this evidence, in the calculation of the unique price of the group grain products, we have considered the price of rice as well, because it influences the aggregate price in a very small measure since it has not much weight.
Let us concentrate now on the second aggregate tested: for meat-fish-dairy products, we find good cointegration in four regions out of four. This test has been implemented dividing the group prices in two categories: price of foods that are very relevant on the total expenditure and price of food which are less important. The prices of the second group have been tested showing cointegration on three macroregions out of four. Then, we have calculated their average price and we have tested the cointegration of the prices included in the first group plus the mean prices of the second aggregate. The main aim of this two-step approach is to give less relevance to those products that, actually, are not very important in the household expenditure and that usually show

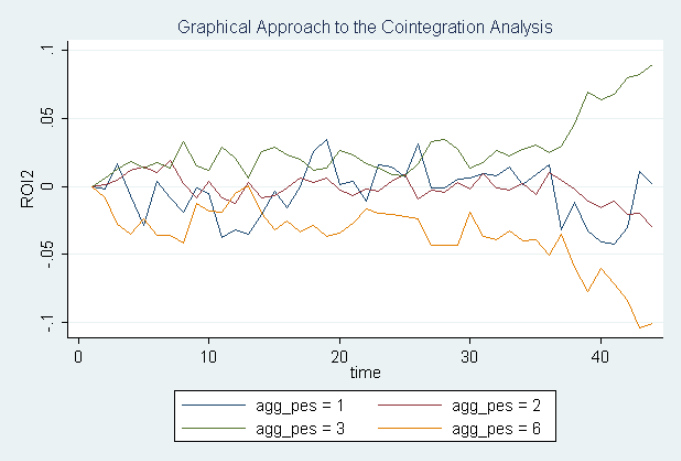
cointegration problems, as, for example, shellfish.
The third aggregate, fruits and vegetables, shows good cointegration (three out of four macroregions) without dried fruit; including the latter, the cointegration decreases to one macroregion. As for the first group, despite this evidence, we have considered the price of dried fruit within the calculation of the aggregate price because its relevance is very moderate.
For the last aggregate, other food products, we have applied a two-step procedure, as for the meat-fish-dairy group. It shows good cointegration: four macroregions out of four. It is important to highlight that we have carried out this test only on the Ismea data that take into consideration food product prices, such as alcoholic and non alcoholic beverages. Unfortunately, this group includes the expenditures on cigarettes too. Since Ismea does not give information about this product price, we have add to the cointegrated group value the price of a pack of ten cigarettes [10].
In addition to this test, in order to understand the different price movements of the subquotas inside the main quota, we have applied the graphical approach used by Lewbel (Lewbel, 1996). This approach is very useful because it allows us to identify the subgroups that create problems in the cointegration analysis. The following graph (Figure 10) shows an example of this analysis.

The prices resulting from this aggregation are summarized in the following tables (Table 11-15). Looking briefly at these statistics, we notice that the average price of grain products is around 3 euros, the value of meat-fish-dairy products is about 9 euros and the prices of fruits and vegetables and other food products are, respectively, around 2 and 4 euros[11]. More precisely, the area where the expenditure on grocery seems higher is the North-Eastern macroregion, that shows the highest average cost of grain products and meat-fish-dairy goods along with high prices of fruits and vegetables and other food. On the other hand, the Southern macroregion shows opposite features: it is characterized by the lowest price of grain and protein products as well as low prices of fruits and vegetables and other food. In between these borderline cases, we can find the average prices of the other areas considered. Moving beyond the analysis

[10] This price is the average price of one Marlboro and one MS pack of ten cigarettes in 2007. These label have been considered because they are the most consumed cigarettes in Italy. Moreover these prices derive from the Unione dei Tabaccai Italiani.

[11] Prices in the Islands are not furnished by Ismea. In particular Sicily is included in the Southern macroregion and Sardegna is included in the Central macroregion. In order to create these values we have calculate the simple mean of the prices in the South macroregion, that represent Sicily, and the prices of the Central macroregion, that represent Sardegna.

Figure 10: A Graphical Approach to the Cointegration



Note: This is the graph of the grain product prices in the North-West Nielsen region and agg_pes=1 indicates rice, agg_pes=2 means bread, agg_pes=3 denotes pasta and agg_pes=7 shows biscuits. This analysis has been carried on for prices between January 2005 and August 2008.

of average prices among macroregions, it is interesting to notice the variability of these values. In fact, the group showing the highest standard deviation is the one composed of other foods. Since it includes various kinds of products, from pastries to cigarettes, this result is normal. For the same reason, the low standard deviation of grain products is fully understood.

Table 11: Prices in the North West Region

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Grain_Products	3.292	0.034	3.234	3.361
Meat_Fish_Dairy_Products	9.324	0.162	9.090	9.561
Fruits_Vegetables	1.774	0.134	1.624	2.107
Other_Food_Products	3.815	0.279	3.419	4.336
N		12		

Table 12: Prices in the North East Region

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	3.421	0.025	3.371	3.461
Meat_Fish_Dairy_Products	9.499	0.227	9.242	10.051
Fruits_Vegetables	1.864	0.129	1.754	2.167
Other_Food_Products	3.951	0.379	3.448	4.693
N		12		

Table 13: Prices in the Central Region

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	3.345	0.059	3.246	3.477
Meat_Fish_Dairy_Products	9.055	0.141	8.898	9.266
Fruits_Vegetables	1.987	0.111	1.829	2.196
Other_Food_Products	4.017	0.239	3.571	4.346
N		12		

Table 14: Prices in the South Region

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	3.012	0.058	2.933	3.116
Meat_Fish_Dairy_Products	8.515	0.089	8.304	8.603
Fruits_Vegetables	1.81	0.106	1.663	2.021
Other_Food_Products	3.817	0.254	3.443	4.106
N		12		

Table 15: Prices in the Islands

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	3.178	0.054	3.111	3.297
Meat_Fish_Dairy_Products	8.785	0.087	8.653	8.935
Fruits_Vegetables	1.899	0.092	1.804	2.059
Other_Food_Products	3.917	0.23	3.605	4.226
N		12		

3.3 Results

Using all the information collected on the previous paragraphs, we can now calculate Pseudo Unit Value (Table 16)

$$\widehat{P^i} = M_i P_i = M_i = \frac{1}{k_i} \prod_{i=1}^{n_i} w_{ij}^{-w_{ij}}$$

Table 16: Pseudo Unit Values

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	0.994	0.148	0.51	1.277
Meat_Fish_Dairy_Products	0.976	0.117	0.461	1.297
Fruits_Vegetables	0.927	0.11	0.466	1.152
Other_Food_Products	1.116	0.277	0.377	2.118
Clothing	1.044	0.08	0.434	1.183
Housing	0.862	0.147	0.435	1.154
Transport_Communication	1.057	0.128	0.505	1.268
Leisure_Edu_Health	0.86	0.135	0.396	1.061
Other_Non_Food	0.851	0.138	0.521	1.105
N		18279		

Regional Pseudo Unit Values (Table 17)

$$\widehat{P_R^j} = \widehat{P^i} P_R^i$$

Table 17: Regional Pseudo Unit Values

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	1.17	0.177	0.599	1.58
Meat_Fish_Dairy_Products	1.191	0.143	0.564	1.611
Fruits_Vegetables	1.167	0.139	0.589	1.484
Other_Food_Products	1.456	0.361	0.494	2.763
Clothing	1.251	0.096	0.521	1.422
Housing	1.161	0.199	0.58	1.584
Transport_Communication	1.329	0.161	0.631	1.627
Leisure_Edu_Health	0.975	0.152	0.451	1.221
Other_Non_Food	1.397	0.227	0.863	1.847
N		18279		

Regional Pseudo Unit Values in Level[12] that are the price to use in the demand system (Table 18).

[12]It is important to point out that there is a big difference between the prices in level calculated using Ismea prices and price in level calculated using mean expenditures. The

$$\widehat{P^i_{RL}} = \widehat{P^i_R} x^i$$

Table 18: Regional Pseudo Unit Values in Levels

Variable	Mean	Std. Dev.	Min.	Max.
Grain_Products	3.788	0.612	1.876	5.463
Meat_Fish_Dairy_Products	10.745	1.371	4.945	16.195
Fruits_Vegetables	2.163	0.309	1.028	3.161
Other_Food_Products	5.671	1.475	1.872	11.776
Clothing	6.408	3.736	0.551	14.198
Housing	12.315	8.922	2.029	41.02
Transport_Communication	14.355	10.206	1.028	43.668
Leisure_Edu_Health	5.894	4.537	0.548	18.502
Other_Non_Food	10.188	9.9	0.560	37.614
N		18279		

Looking briefly at these data, the first thing to notice is the rise of variability that can be achieved moving from the first one, the original Pseudo Unit Values, to the last one, Regional Pseudo Unit Values in Levels. New information are continuously added. Furthermore, it is interesting to point out the differences between the first two values, that are still indices (they range around one), and the values in levels, that closely resemble real prices.

Considering the values that forms part of the demand system: the Regional Pseudo Unit Values in Level, we notice that the transport and communication group is the most expensive aggregate while the fruits and vegetables group is the cheapest one. Furthermore, it should be underlined that the standard deviation of the transport groups is more than 34 times higher than the standard deviation of the fruits and vegetables group. The high variability of the seventh group depends on two main reasons: diversity of the commodities which compose the group, ranging from oil to phone bills, and different habits of households. Further analyzing the data at our disposal, we find that this characteristic is typical of the non food groups. In fact, there is a significant difference between the standard deviations of non food products and the one of food products. This difference depends on the data used to transform the Regional Pseudo Unit Value into Level. In fact, we use real prices for the food groups and mean expenditures for the non food aggregates. It is evident that expenditure

mean idea is that for non food products we are using a monthly mean expenditure while for food products the Ismea prices can be considered like a daily expenditure. Therefore, to uniform these prices we have divided non-food regional pseudo unit values by 30. Creating in this way prices based on daily expenditures.

displays more variability than the real price recorded, during twelve months in the four macroregions. Focussing again on the real prices (recorded in the Ismea data) and comparing them with the Regional Pseudo Unit Value in Levels, we notice that they are quite similar. Therefore the indices defined using Lewbel's technique do not generate any substantial change in the real prices. As they are meant to do, they only add variability.

4 Demand Model

4.1 Introduction

In order to estimate the individual demand functions we have used the quadratic specification of the Almost Ideal Demand System with demographic characteristics considered using the translating technique.
This specification of the demand system is based on both the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980a) and the Quadratic Almost Ideal Demand System (QAIDS) (Banks, Blundell and Lewbel, 1997).

The AIDS model developed by Deaton and Muellbauer (1980a) is based on the Working-Leser functional form.
In details, this law of family expenditure was developed by Working (1943) with the goal to represent the relation between expenditure on food and total outlay through the equation

$$F/T \quad = \quad a - b\, lnT$$

where F is the expenditure for food and T is the total expenditure. In summary, "the proportion of total expenditure that is devoted to food tends to decrease exactly in arithmetic progression as total expenditure increases in geometric progression" (Working, 1943).
Later Leser (Leser, 1963) tested the properties of various functional forms satisfying the additivity conditions and he found that the Working's approach to the laws of family expenditure, since it is very flexible, offers some advantages in comparison with the other functional forms. He supported, therefore, Working's specification and for this reason we call it Working-Leser functional form.
Furthermore, in the Almost Ideal Demand System the authors use Price Independent Generalized Logarithmic (PIGL) preferences that consider market demands as the result of a rational representative consumer decision.
Being more precise, one of the main characteristic of the AIDS, that has contributed to make it famous, is his property of consistent aggregation across consumers. This property derives from the use of PIGL preferences that allow consistency among aggregate relations (at the market level) and micro relations

(at the consumer individual level) when demands and Engel functions are non linear (Wahl, 1994).
This set of preferences can be represented as follows:

$$c(u,p) = \left[a(p)^{\alpha}(1-u) + b(p)^{\alpha} u\right]^{\frac{1}{\alpha}} \tag{14}$$

where $c(u,p)$ is the cost function, $a(p)$ and $b(p)$ are linear homogeneous functions of prices, u is an utility index and α is a constant.
It is straightforward that varying the value of α we can generate different cost functions and, by Shephard's lemma, different demand functions.
In particular, Deaton and Muellbauer in the AIDS use a value of $\alpha \to 0$ so that preferences limit to the PIGLOG form, from which we can derive, using Shephard's Lemma, the demand functions used in the AIDS model.
In this case the cost function, following Deaton and Muellbauer (1980), is:

$$ln\, c(u,p) = (1-u)\, ln\{a(p)\} + u\, ln\{b(p)\} \tag{15}$$

where $a(p)$ represents the cost of subsistence and $b(p)$the cost of bliss.
Giving to $ln\{a(p)\}$ and $ln\, b(p)$ the following particular forms:

$$ln\{a(p)\} = a_0 + \sum_k \alpha_k ln\, p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} ln\, p_k ln\, p_j$$

$$ln\, b(p) = ln\, a(p) + \beta_0 \prod_k p_k^{\beta_k}$$

the AIDS cost function become:

$$ln\, c(u,p) = a_0 + \sum_k \alpha_k ln\, p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} ln\, p_k ln\, p_j + u\beta_0 \prod_k p_k^{\beta_k} \tag{16}$$

where α_i, $\beta_i$and γ^*_{ij} are parameters.

Logarithmic differentiating the latter we find the budget share as a function of prices and utility:

$$w_i = \alpha_i + \sum_j \gamma_{ij} ln\, p_j + \beta_i u \beta_0 \prod p_k^{\beta_k} \tag{17}$$

where

$$\gamma_{ij} = \frac{1}{2}\left(\gamma^*_{ij} + \gamma^*_{ji}\right)$$

Furthermore, assuming an utility-maximizing consumer, so that total expenditure x is equal to total cost $c(u,p)$, we can find the following indirect utility inverting equation 16 as:

$$u(x,p) = \frac{ln\, x - \left(a_0 + \sum_k \alpha_k ln\, p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} ln\, p_k\, ln p_j\right)}{\beta_0 \prod_k p_k^{\beta_k}} \tag{18}$$

and substituting $u(x,p)$ in the budget share (equation 17) we have the AIDS demand function in budget share:

$$w_i = \alpha_i + \sum_j \gamma_{ij} ln\, p_j + \beta_i \frac{ln\, x - \left(a_0 + \sum_k \alpha_k ln\, p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} ln\, p_k ln\, p_j\right)}{\beta_0 \prod_k p_k^{\beta_k}} \beta_0 \prod p_k^{\beta_k} \tag{19}$$

that we can write as:

$$w_i = \alpha_i + \sum_j \gamma_{ij} ln\, p_j + \beta_i ln\left\{x/P\right\} \tag{20}$$

where the price index P is defined as

$$ln\, P = \alpha_0 + \sum_k \alpha_k ln\, p_k + \frac{1}{2}\sum_j \sum_k \gamma^*_{kj} ln\, p_k ln\, p_j$$

Furthermore, to be consistent with the utility theory, in the estimation of the system is necessary to impose:
adding up restrictions $\sum_{i=1}^n \alpha_i = 1$ $\sum_{i=1}^n \gamma_{ij} = 0$ $\sum_{i=1}^n \beta_i = 0$;
homogeneity restrictions $\sum_j \gamma_{ij} = 0$;
and symmetry restrictions $\gamma_{ij} = \gamma_{ji}$.

Seventeen years later Banks, Blundell and Lewbel (1997) defined a Quadratic Almost Ideal Demand System as an improvement of the AIDS[13]. The main idea of this demand system is to provide a better picture of real world. In particular the authors argued that for many commodities the Working-Leser functional form, defining a linear relation between commodity expenditure and income, is too restrictive for some goods - like clothing and alcohol - but it is sufficient for other goods - like fuel and food -. They define, therefore, a form of demand consistent with empirical evidence as:[14]

$$w_i = A_i(p) + B_i(p) + \ln\, q + C_i(p)\, g(q) \tag{21}$$

for goods $i = 1, ...N$ where p is the N-vector of prices, $q = x/a(p)$, x is total expenditure and $A_i(p)$, $B_i(p)$, $C_i(p)$, and $g(q)$are differentiable functions. In this equation the share expenditure is linear in the logarithmic of income when $C_i(p)\, g(q) = 0$ and it allows for nonlinearity when it is different from zero. Briefly it nests the PIGLOG preferences.

[13] It is also consistent with the economic theory and exactly aggregable

[14] We substitute the origina notation to emphasize the link between AIDS and QAIDS. In particular, the original paper expenditure was m and now it is x and the adjusted expenditure was x and now is q.

The rank of the demand system derived from this demand specification is assured by a theorem:

All exactly aggregable demand systems in the form of equation $w_i = A_i(p) + B_i(p) \ln q + C_i(p) g(q)$ *that are derived from utility maximization either have:*

$$C_i(p) = d(p) B_i(p)$$

for some function $d(p)$*(so the rank is less than 3), or they are rank 3 quadratic logarithmic budget share systems having indirect utility functions of the form*[15]*:*

$$\ln u(x,p) = \left\{ \left[\frac{lnx - lna(p)}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{22}$$

where the term $[lnx - lna(p)/b(p)]$ *is the indirect utility function of a PIGLOG demand system (i.e. a system with budget shares linear in log total expenditure), and the extra* λ *is a differentiable, homogeneous function of degree zero of prices* p*.*

The indirect utility function of the theorem is found inverting the cost function that is specified as

$$\ln c(u,p) = \ln a(p) + \frac{u\, b(p)}{1 - u\, \lambda(p)} \tag{23}$$

and assuming a utility-maximizing consumer, so that total expenditure x is equal to total cost $c(u,p)$ we can write:

$$\ln x(u,p) = \ln a(p) + \frac{u\, b(p)}{1 - u\, \lambda(p)} \tag{24}$$

where $\ln a(p)$, $b(p)$ and $\lambda(p)$ are defined as:

$$\ln a(p) = a_0 + \sum_i^n \alpha_i ln\, p_i + \frac{1}{2} \sum_i^n \sum_j^n \gamma_{ij} ln\, p_i ln\, p_j$$

$$b(p) = \prod_i^n p_i^{\beta_i}$$

$$\lambda(p) = \sum_{i=1}^n \lambda_i ln\, p_i$$

and, in addition to the parameters restrictions of the AIDS model, consistency

[15] In the original notation indirect utility was represented by V and now it is indicated by $u(x,p)$.

with the economic theory requires also

$$\sum_i \lambda_i = 0$$

Using all these equations we can define the QAIDS expenditure equation system as:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} ln\, p_j + \beta_i ln \left[\frac{x}{a(p)}\right] + \frac{\lambda_i}{b(p)} \left\{ ln \left[\frac{x}{a(p)}\right]\right\}^2 \tag{25}$$

4.2 Quadratic Almost Ideal Demand System with Demographics

4.2.1 The Model

In this dissertation we use a Quadratic Almost Ideal Demand System demographically modified using a translating modifying term. Therefore, the cost function $C(u,p,c)$, depends on u the utility level, p prices and d demographic characteristics. Following Atella (Atella, Menon and Perali, 2003) and Perali (2003). It is specified as:

$$\begin{aligned} lnC(u,p,d) &= \left[lnA(p) + \frac{\varphi(u) B(p)}{1-\varphi(u)\lambda(p)}\right] + \ln\left[P^T(p,d)\right] = \\ &= \left[lnA(p) + \frac{B(p)}{\varphi^*(u) - \lambda(p)}\right] + \ln\left[P^T(p,d)\right] = \\ &= \ln G(u,p) + \ln\left[P^T(p,d)\right] \end{aligned} \tag{26}$$

where

$$\ln A(p) = \alpha_0 + \sum_i \alpha_i \ln p_i + 0.5 \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j \tag{27}$$

$$B(p) = \beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \tag{28}$$

where $\varphi^*(u) = \frac{1}{\varphi(u)}$is an index that decreases in utility $\varphi(u)$ for some monotonic function $\varphi(.)$and $\lambda(p)$is a differentiable, homogeneous function of degree zero of prices p. In addiction,

$$P^T(p,d) = \prod_{i=1} p_i^{\tau_i(d)} \tag{29}$$

is the translating term where the demographic factors interact with prices.

$$\tau_i(d) = \sum_{k=1}^{n} \tau_{ik} d_k \tag{30}$$

The inversion of the expenditure function gives the modified indirect utility function

$$\ln V(y,p,d) = \left[\left(\frac{lny^* - \ln A(p)}{B(p)}\right)^{-1} + \lambda(p)\right]^{-1} \tag{31}$$

where $\ln y^* = \ln y - \ln P^T$

Roy's identity yields the modified ordinary share equation

$$w_i = \alpha_i + \tau_i(d) + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i [\ln y^* - \ln A(p)] + \frac{\lambda_i}{B(p)} [\ln y^* - \ln A(p)]^2 \tag{32}$$

To be consistent with the economic theory this specification requires:
the adding up and homogeneity restrictions of the QAIDS specification:
$\sum_{i=1}^{n} \alpha_i = 1 \sum_{i=1}^{n} \gamma_{ij} = 0 \sum_{i=1}^{n} \beta_i = 0 \sum_i \lambda_i = 0 \sum_j \gamma_{ij} = 0$ plus
the following restriction on the translating component:
$\sum_i \sum_k \tau_{ik} \ln d_k = 0$ and for each k: $\ln d_r \sum_i \tau_{ir} = 0 \Rightarrow \sum_i \tau_{ir} = 0$ and
the symmetry restrictions $\gamma_{ij} = \gamma_{ji}$.
To calculate the elasticities is necessary to differentiate equation 32 with respect to $\ln y^*$and $\ln p_j$

$$\mu_i = \frac{\partial w_i}{\partial \ln y^*} = \beta_i + \frac{2\lambda_i}{B(p)} \ln\left(\frac{y^*}{A(p)}\right)$$

$$\mu_{ij} = \frac{\partial w_i}{\partial \ln p_j} = \gamma_{ij} - \mu_i \left(\alpha_i + \sum_r \delta_{ir} \ln d_r + \sum_k \gamma_{jk} \ln p_k\right) - \frac{\lambda_i \beta_j}{B(p)} \ln\left(\frac{y^*}{A(p)}\right)^2$$

The budget elasticities are given by $\varepsilon_i = \frac{\mu_i}{w_i} + 1$ so it is

$$\varepsilon_i = \left\{\frac{1}{w_i}\left[\beta_i + \frac{2\lambda_i}{B(p)} \ln\left(\frac{y^*}{A(p)}\right)\right]\right\} + 1$$

The uncompensated price elasticities are $\varepsilon_{ij}^u = \mu_{ij}/w_i - \Lambda_{ij}$so they are:

$$\varepsilon_{ij}^u = \frac{1}{w_i}\left\{\gamma_{ij} - \beta_j\left[\alpha_j + \sum_r \delta_{ir} \ln d_r + \sum_k \gamma_{ij} \ln p_k\right]\right\}$$

$$-\frac{1}{w_i}\left\{\frac{2\lambda_i}{B(p)} \ln\left(\frac{y^*}{A(p)}\right)\left(\alpha_j + \sum_r \delta_{ir} \ln d_r + \sum_k \gamma_{ij} \ln p_k\right)\right\}$$

$$-\frac{1}{w_i}\left\{\frac{\lambda_i \beta_j}{B(p)} \ln\left(\frac{y^*}{A(p)}\right)^2\right\} - \Lambda_{ij} \tag{33}$$

where $\Lambda_{ij}$is the Kronecker operator.
The compensated price elasticities are $\varepsilon_{ij}^c = \varepsilon_{ij}^u + \varepsilon_i w_j$

The demographic elasticities are: $\varepsilon_{ir}^d = \frac{\partial \ln q_i}{\partial \ln d_r} = \frac{\partial \ln w_i}{\partial w_i} \frac{\partial w_i}{\partial \ln d_r}$so they are:

$$\frac{1}{w_i}\left[\delta_{ir}+\gamma_{ij}\delta_{ir}-\beta_i\left(\delta_{ir}\alpha_i+\delta_{ir}\ln p_i+\delta_{ir}\left(\gamma_{ij}\ln p_i\right)\right)\right]$$

$$-\frac{1}{w_i}\left[\frac{2\lambda_i}{B\left(p\right)}\ln\left(\frac{y^*}{A\left(p\right)}\right)\left(\delta_{ir}\alpha_i+\delta_{ir}\ln p_i+\delta_{ir}\left(\gamma_{ij}\ln p_i\right)\right)\right]$$

$$-\frac{1}{w_i}\left[\frac{\lambda_i\left(\beta_i\delta_{ir}\right)}{B\left(p\right)}\ln\left(\frac{y^*}{A\left(p\right)}\right)^2\right]$$

4.2.2 Maximum Likelihood Estimation

The budget share equations of the Quadratic Almost Ideal Demand System demographically modified using a translating term have been estimated by maximum likelihood. In particular, we have added to each equation in 32, an error term $\epsilon \equiv (\epsilon_1, ..., \epsilon_N)$ that captures the variability not explained by the parameters and that is usually assumed to be multivariate normal distributed $\epsilon \sim N\left(0, \left(\sum_N \bigotimes I_H\right)\right)$ with variance-covariance matrix $\sum \equiv \sum_N \bigotimes I_H$ where N is the number of equations, (in this work they are nine) and H is number of the households of the sample (in this thesis they are 18.279). Since the additivity condition implies the singularity of the variance-covariance matrix, it is necessary to drop one of the equations from the system and then to estimate the remaining equations by maximum likelihood. Subsequently, the parameters of the equation that has been dropped are found using the constraints imposed on the system.
The log-likelihood function for the $(N-1)$ equations with $\epsilon^{*'} \equiv (\epsilon_1, ..., \epsilon_{N-1}) \sim N\left(0, \left(\sum^*_{N-1} \bigotimes I_H\right)\right)$ is

$$\ln L = -\frac{H\left(N-1\right)}{2}\ln 2\pi - \frac{1}{2}\ln\left|\sum_{N-1}^{*}\bigotimes I_H\right| - \frac{1}{2}\epsilon^{*'}\left[\sum_{N-1}^{*}\bigotimes I_H\right]^{-1} e^*$$

where $\sum^*_{N-1}$is the variance-covariance matrix of the $(N-1)$ equations expressed in terms of $\epsilon^*$and it is defined as $\sum^* = \frac{1}{H}\sum_{h=1}^{H} e_h^*\left(\theta\right) e_h^{*'}\left(\theta\right)$ where h represents the households and $e_h^*\left(\theta\right) \equiv [w_{1,h} - \hat{w_{1,h}}, ..., w_{N-1,h} - \hat{w_{N-1,h}}]$.
Substituting the expression of $\sum^*_{N-1}$ into the log-likelihood function already defined, the function to be maximize with respect to the parameters θ is:

$$\ln L = -\frac{H}{2}\left\{(N-1)\left[1 + \ln 2\pi + \ln\left|\overset{*}{\sum}\right|\right]\right\}$$

4.3 Data Analysis

As it is explained in the previous paragraph, the estimation of the demand system requires prices, expenditure shares and demographic variables.
The prices used in the estimation do not require extensive explanations. They are the Regional Pseudo Unit Values in Level that have been created in the previous chapter and that are summarized in table 18.
For what that concern expenditure shares (Table 19) the explanation has to be more accurate.
Starting from the grain products group (Figure 11), we notice that its average budget share is about 4.4%. Among the nine groups, this percentage is the smallest. It ranges between a minimum value close to zero and a maximum value of 13.5%. Looking at the distribution of shares we see a positive skewness. In fact, this is one of the main characteristics of every budget share distribution since, in each aggregate, there are some households that present a proportion of expenditure very high in comparison to the majority of families. This creates a very long right tail in the distribution.
Furthermore, considering the Engel curve, we can only confirm the economic theory (among others: Engel 1895, Working, 1943). The expenditure share on basic food decreases as the logarithmic of total outlay arises.
Going ahead and considering the group composed by meat, fish and dairy (Figure 12) products the average budget share is around to 14%. It is more than three times the previous one and it shows also a bigger variability. Its standard deviation is also bigger than the standard deviation of fruits and vegetables (0.0297) (Figure 15) that, however, presents a mean budget share close to 5%. Both these groups have outlay share distributions and Engel curves with a shape similar of that of grain products.
On the contrary, slightly different appears the budget share of the fourth group considered: other food products (Figure 14). In detail, this aggregate shows an increasing Engel curve when the logarithmic of total expenditure is smaller than 5.8 and a decreasing one when it is bigger. This particular shape of the function can be attributed to the goods included in the aggregate like pastries and beverages. When people are very poor, they can not effort any "luxury" food like cake or juice so when the income starts to arise they increase the expenditures

Figure 11: Grain Products

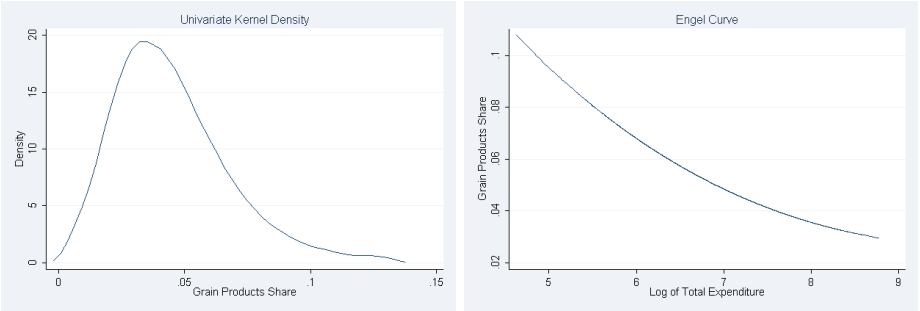
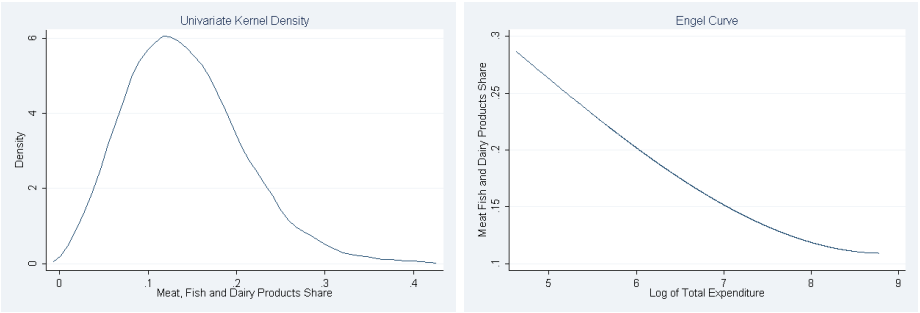


Figure 12: Meat, Fish and Dairy Products



on these foods. Then, when they become richer the share expenditure starts to decrease since total expenditures grows faster than the outlay on this group. For completeness it is important to say that the families with a share expenditures smaller than 5.8 are 150. Therefore the increasing part of the Engel curve is based only on 150 observations over the 18,289 households included in the sample. After this consideration, such result has to be regarded with attention.

At the conclusion of the analysis of this group, it is important to say that its budget share, is about 8%. This value is bigger than both the grain products budget share and the fruits and vegetables expenditure share. This result depends mainly on the inclusion of cigarettes and beverage (alcoholic and no) in the aggregate.
Considering the budget share of clothing (Figure 15), we see a value around to 9% that ranges between a number very close to zero and 26%. The distribution does not show particularities and the Engel curve respects the expectations (among others: Banks, Blundell and Lewbel, 1997; Perali, 2003). Being more

Figure 13: Fruits and Vegetables

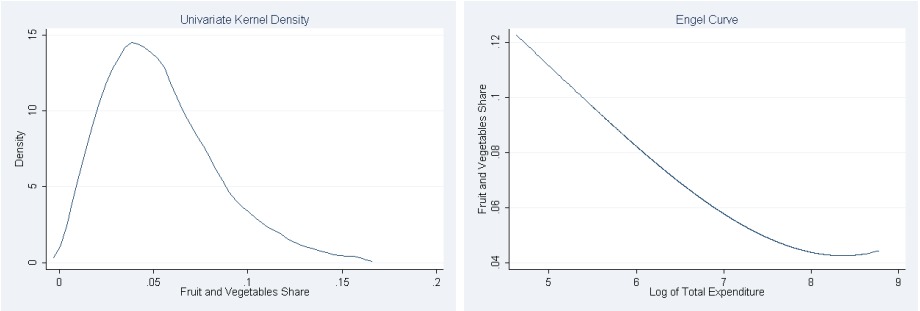


Figure 14: Other Food Group

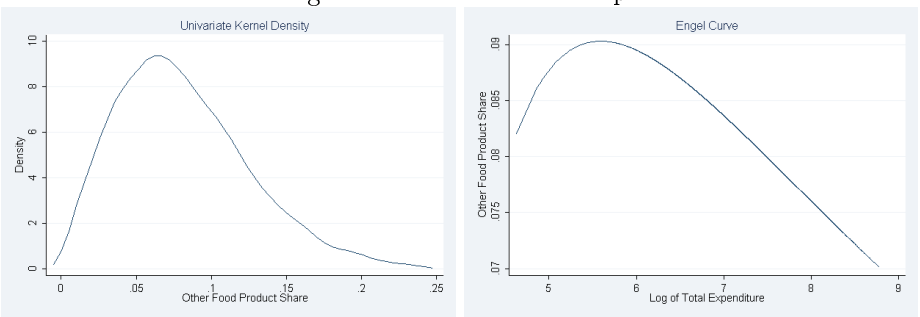


Figure 15: Clothing

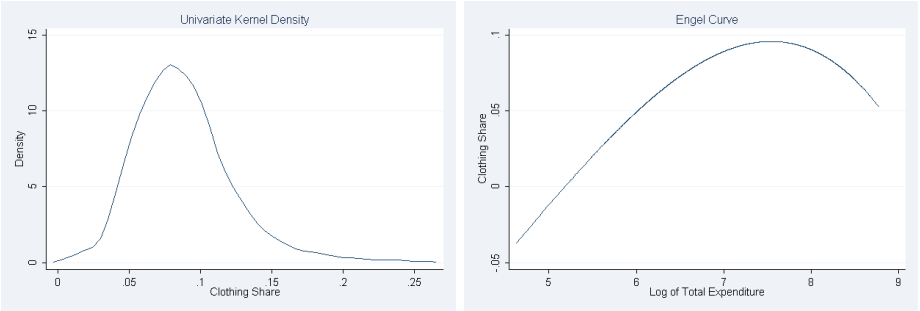
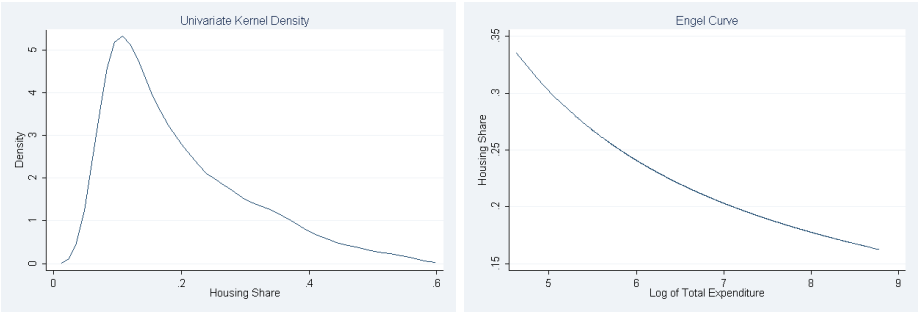


Figure 16: Housing

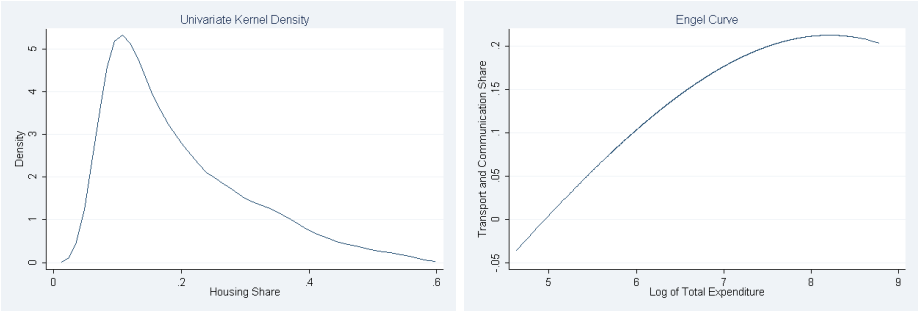


precise, it shows an increasing relation between clothing share and the logarithmic of total outlay for low and medium overall outlays and a decreasing relation between them, when the total expenditure is very high.

Focussing on housing (Figure 16), the first thing to notice is the strong positive skewness of the share distribution. This situation ensues from the high difference between the budget shares of homeowners and those of families paying rents or mortgages. In fact, these fees, having a strong incidence on the family budget, move resources from the other groups of expenditure to housing increasing, in this way, its budget share. Regarding Engel curve we see a negative correlation between share expenditure and the logarithmic of total outlay. In addiction, it is important to say that this group represents almost the 20% of the total outlay ranging form the 2% to the 58%. Housing turn out to be one of the main sources of expenditure for the Italian households.

Another important source of outlay for the Italian families is represented by the transports and communications group (Figure 17). It represents, in average, the 17% of the total expenditure ranging between a value close to zero and 54%.

Figure 17: Transport and Communication



Looking at the distribution of the shares we do not notice relevant particularity. The same happens considering the Engel curve. More precisely, budget share is positive correlate with the logarithmic of total expenditures until medium-high outlay (log of total expenditures close to eight), then the growth of share expenditure tends to reduce and afterwards slightly decreases.

Going ahead and focusing on the group leisure, education and health (Figure 18) we see that, in average, it represents the 10% of the total expenditure ranging from almost zero to the 31%. Considering the distribution, we notice a significant positive skewness that is mainly due to the high variability of the expenditures included in the group and to the relevant diversity within them. Beside the skewness characteristic (that is quite common in the groups), the shape of the Engel curve results very particular. In fact, this function decreases until the logarithmic of the total expenditure achieves a value around 6.5 and then it starts to increase. This particular shape can be explained considering the Engel curves of the three sub-expenditure groups that are included in the aggregate. In fact, they present Engel curves quite different. In particular, as it is showed in the appendix, at the increase of the logarithmic of total outlay the budget share of leisure first decreases and then increases, the outlay share of education first increases and then stabilizes itself, and the expenditure portion of health first arises and then falls (Appendix: Figure 26). In the light of this situation the aggregate Engel curve is the result of the weighted addition of these curves.

Focusing now on the last aggregate: other non food products, we see a budget share around 10% that ranges between a value very close to zero and 33% (Figure 19). The distribution has a quite high positive skewness and the Engel curve presents a shape similar to the previous group. On the contrary, however, the

Figure 18: Leisure, Education and Health

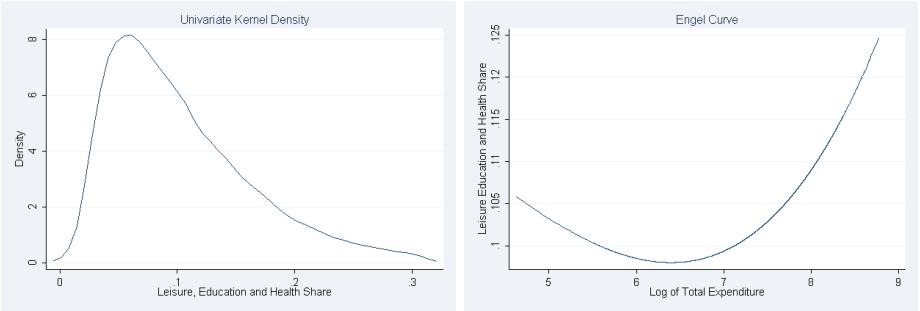
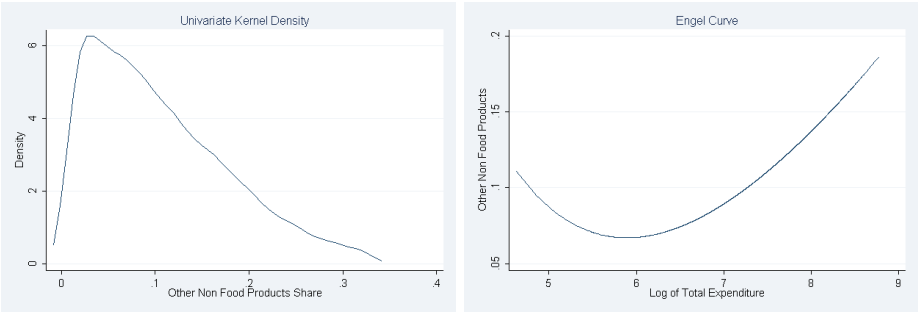


Figure 19: Other non Food Group



two subgroups that compose this aggregate, cafè and restaurant and personal care, show Engel curves of the same shape. Being precise, the former achieves the lowest value when the logarithmic of total outlay is between five and six and the second when it is between six and seven but they are both convex. This particular shape can be interpreted as the stability of costs, on food away from home and personal care, subsequent to a small rise of the total expenditure. This result can be interpreted as the use of the additional money to buy more important items like clothing or transportation. Therefore the budget share of the ninth group decreases. Afterwords, when the total expenditure continue to arise, people start to go to the restaurant, to the hairdresser etc. increasing the buget share of this group.

Changing the topic and considering the last components of the demand systems, demographic variables, we can recognize two different types of household characteristics. The first type includes dummy macroregional variables while

Table 19: Expediture Shares

Variable	Mean	Std. Dev.	Min.	Max.
Grain Products	0.0447	0.0229	0.0006	0.1349
Meat, Fish and Dairy Products	0.142	0.0667	0.0013	0.4181
Fruits and Vegetables	0.0537	0.0297	0.0007	0.1624
Other FoodProducts	0.0812	0.044	0.0005	0.2417
Clothing	0.0884	0.0351	0.0009	0.2619
Housing	0.1958	0.1112	0.0264	0.5849
Transport and Communication	0.1862	0.0991	0	0.5453
Leisure, Education and Health	0.1026	0.0603	0.0018	0.3138
Other Non Food Products	0.1054	0.0733	0.0009	0.3326
N		18279		

the second type includes specific household characteristics.

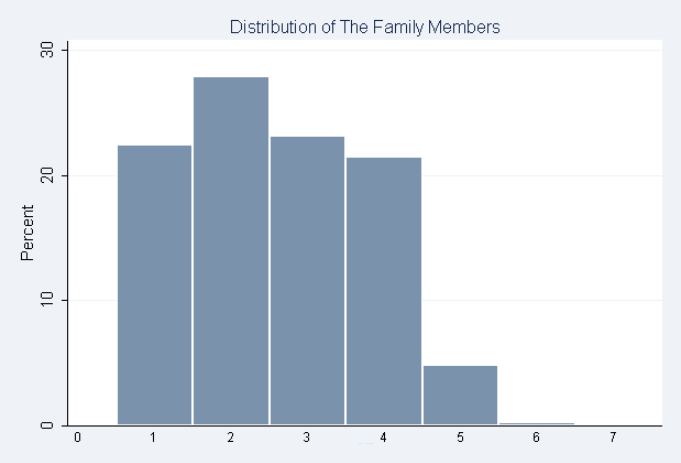
Being more precise, the first group of household characteristics aims to capture the differences among the central macroregion, considered as the reference area, and the other four macroregions i.e. North West, North-East, South and Islands. Using these variables we want to point out the differences of habits and budget expenditures together with the household characteristics linked with the area considerated. The relevance of the areas inside the sample is different because it aims to maintain the distribution of the population in the country, for this reason the households of the North-West macroreagion represent the 23 percent of the sample, as that of the North-East, Centrer, South and Islands counts for the 20%, 19%, 27% and 11% respectively.

Focusing now on the second type of demographics considered in the system, household characteristics, the first variable that we encounter is the number of family members. The Italian average household is composed by 2.6 members and it ranges between one and seven components. Looking at the distribution, the families composed by two members are the most common although the households composed by one, three and four members are very relevant with a percentage of incidence bigger than twenty percent. On the contrary families with five or more components count for less than 5 percent each.

Going beyond the number of family members and focussiong on the household composition we see that the families with children younger that 18 years old represent the 30 percent of the sample while those with elderly people[16] count for the 33 percent. There are more households with an old person than with a

[16]Person older that 64 years old

Figure 20: Household Components



child. As we have already said, the Italian population is aging.

For what that concern the other household variables, we notice that the 28 percent of breadwinner has a primary education while the 24 percent has a secondary education. Furthermore, the families where the wife has a job represent the 22 percent of the sample.

Table 20: Demographic Variables

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
North West	0.233	0.423	0	1
North East	0.203	0.402	0	1
South	0.273	0.446	0	1
Islands	0.112	0.315	0	1
Number of Family Members	2.592	1.201	1	7
Members Youger than 18 Years Old	0.456	0.782	0	4
Members Older than 64 Years Old	0.456	0.71	0	2
1° Education of the Breadwinner	0.285	0.451	0	1
2° Education of the Breadwinner	0.246	0.43	0	1
Wife has a Job	0.223	0.416	0	1
N		18279		

4.4 Results

4.4.1 Parameters

Looking at the parameters estimated by the demand system (Appendix: Table 30) we can briefly summarize the most important results of the estimation.

Considering the price parameters estimated, the first thing to notice it that when the price of cereals increases the share expenditure on this group increases too. This result can be explained in the light of a low price elasticity that involves the stability of consumption even when the prices go up arising, in this way, the budget share of the group considered at the expense of the other aggregates. This characteristic is shown only in this group and in the aggregate other non food products that presents low price elasticity too. However the last one is composed by food away from home and personal care and it is the residual group[17], for these reasons it has to be considered with attention.

Still analyzing the cereal group we see that an increase of clothing and housing prices do not have any influence in the considered group budget share while the price of the protein group, fruits and vegetables aggregate, transport and communication as leisure, education and health seem to have a negative impact. On the other hand, an increase of other food group price arises the grain product budget share.

Briefly looking the other aggregates, we see that there are no relation between the budget share of meat, fish and dairy products and the price of fruits and vegetables. In fact, the last one is not correlated with many group, beside the protein group with clothing, transport and communication as leisure, education and health. From this results we can deduce that the budget share dedicated to the consumption of fruits and vegetables depends more on the habits of households than on the changes in the prices of other products. On the opposite, strictly linked with the price variation of the other groups is the budget share dedicated to other food that does not have any correlation only with fruits and vegetables, as we have already said, and with transport and communication.

Regarding the non food groups, beside what we have already said, we notice no relevance on the housing group budget share, of the leisure, education and health price variation.

[17] Since the additivity condition implies a singular variance-covariance matrix, one equation must be dropped from the system and subsequently its parameters have to be found by the difference of the estimated parameters. In this work the equation dropped is that one representing the group non food products.

Considering the influence of total expenditure on budget shares, the first thing to notice is the significance of almost every parameter[18] representing linear or quadratic outlay. This result can be understood looking at the Engel curves described in the previous paragraph. Even the Engel curve of grain product does not show a perfect linear relation between the logarithmic of total expenditure and the budget share. In the light of this consideration we can say that quadratic specification of the model makes sense. For instance, looking at the relevance of the expenditure considered in quadratic form and focusing on the food aggregate, we notice that the parameter of the fourth group (other food products), in absolute value, is bigger than those representing grain products, meat, fish and dairy and fruits and vegetables. This results can be understood considering the shape of the Engel curves that show a stronger linear relation in the the latter than in the former.

Paying now attention to the demographic parameters that have been estimated by the demand system, we can start considering the value of the first four dummies that represent the variability of expenditures among the country macroreagions. In particular, the parameters of the Southern regions[19] are always bigger than those of Northern regions in every food group as in the clothing aggregate. This means that the Southern households spend an higher part of their total expenditures on the necessity products like food and clothing. On the other hand, the Northern regions[20], present bigger values of the parameters in the housing group, in the aggregate composed by leisure, education and health, and in the aggregate other non food products that includes restaurants, cafes and personal care. It is straightforward that the Northern regions are richer then the Southern regions.
Going ahead and considering the parameters representing household characteristics, focussing on the number of family members, we find a positive sign of the variable in the grain products, meat-fish-dairy and fruits and vegetables aggregates as in the clothing and transport and communications groups. The negative sign is present in the other food products group as in the housing, leisure, education and health group and in other non food products aggregate.

[18] Except the parameter representing a linear relation between the budget share of transport and communication and total expenditure
[19] It includes the South macroreagion and the Islands
[20] It includes the North-West macroreagion and the North-East macroregion

We can conclude that the increase of household members arises the relevance of the basically outlays reducing at the same time non essential expenditures. Considering only the outlays, without paying attention to the role of another component for the happiness of a family, we can say that one more member makes the household poorer.

For what that concern the ages of the family members, the parameters of the variable representing the number of household members younger than eighteen years old, are positive for almost every aggregate. They are negative only for the budget share of fruits and vegetables and transport and communication. We can not deduce any change of welfare deriving from the presence of a young member since the increases of expenditures are transverse. Considering the opposite situation, the presence of old people in the household, we find a positive parameter for every food group as for the leisure, education and health aggregate. The parameters are negative for the expenditures of the groups clothing, housing, transport and communication and other non food products. Analyzing these values we find the presence of habits. Old people buy less cloths, travel less and go less to the restaurant than other people. On the other hand the expenditure of the group leisure, education and health is bigger than that of normal families because elderly people spend more on health.

Considering the impact of education on the expenditure shares, it looks that families with a breadwinner that has primary education spend more on food and housing than households with a head of family possessing secondary education. On the opposite the last one spend more on clothing, transport and communications and other non food products. The parameters of leisure are very close to each other. It seems that families with a breadwinner less educated spend more on basic groups than household with a family head more educated. In fact, looking at the data, the former present a mean expenditure lower than the second one. In conclusion, families with a breadwinner possessing primary education have these parameters signs because they are poorer than the average Italian household.

The last demographic variable considered represents the households in which the wife works. The share expenditure on food and housing is smaller compared with other families. On the contrary, these families spend more on clothing, transport and communication, on the group of leisure, education and health and on other non food products. They have this kind of budget share because they are richer than the average Italian family.

Table 21: Analytical Income Elasticities

Grain P	M-F-D	Fr-Veg	Other F	Clothing	House	Tr-Co	L-E-H	O-N-F
0.4278	0.8002	0.7409	0.9712	1.1021	0.6945	1.2514	1.514	1.1066
0.0015	*0.0003*	*0.0005*	*0.0004*	*0.0004*	*0.0009*	*0.0004*	*0.0019*	*0.0005*

Note: Standard errors are in italics.

4.4.2 Elasticities

Income Elasticities

Income elasticity represents the proportionate change in quantity demanded due to a unit proportionate change in household income leaving price and household characteristics constant. When elasticity is positive and it ranges between zero and one the good is considered "normal" because the quantity demanded increases less than proportionally to the rate at which income increases. When the elasticity has a value bigger than one, the good is considered "luxury"; the quantity demanded increases more than proportionally to the rate in which income increases. Moreover, when the elasticity is smaller than zero the good is considered "inferior" because when income arises the consumption of the good decreases.

In the light of these considerations and looking at the income elasticities showed in table 21[21] we can realize that every food aggregate and housing presents an elasticity smaller than one therefore they are a normal goods. On the other hand clothing, transport and communications, leisure-education-health and other non food products, presenting an elasticity bigger than one, can be considered as luxury aggregate. Among them the more elastic group is the group composed by leisure, education and health. This is due to the high elasticity of the the former subgroup that, as it is known, is very sensitive to the income variations.

Price Elasticities

Price elasticity represents the proportional change in the demand of a good that derives from a one percent variation of the same good price (own price elasticity) or that derives from the price variation of another good price (cross price elasticity). Usually the former is negative because it indicates that the increase of a good price decreases the demand for that good. When the variation is equal to zero there is no relation between price and quantity demand. Therefore the

[21] Standard errors have been calculated using the bootstrapping methodology but, since they are always significant (result that usually does not happen) they have to be recalculated using the Delta method.

Table 22: Analytical Uncompensated Price Elasticities

	Grain P	M-F-D	Fr-Veg	Other F	Clothing	House	Tr-Co	L-E-H	O-N-F
Grain P	-0.6496	-0.0760	0.0051	0.2494	0.0528	0.0469	-0.0128	-0.0135	-0.0936
	0.0007	*0.0002*	*0.0001*	*0.0005*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0003*
M-F-D	0.1512	-1.2368	0.1796	0.1997	0.0531	0.6448	0.2524	0.4018	-0.0101
	0.0002	*0.0004*	*0.0002*	*0.0003*	*0.0002*	*0.0008*	*0.0003*	*0.0005*	*0.0002*
Fr-Veg	-0.0142	0.0161	-1.3044	0.2776	0.0105	0.3935	0.0293	0.0184	-0.2198
	0.0000	*0.0000*	*0.0005*	*0.0004*	*0.0000*	*0.0006*	*0.0000*	*0.0000*	*0.0004*
Other F	0.4020	0.3658	0.4519	-1.6492	0.1462	1.0064	0.3557	0.8251	0.1672
	0.0006	*0.0005*	*0.0007*	*0.0016*	*0.0001*	*0.0018*	*0.0005*	*0.0014*	*0.0001*
Clothing	0.0977	-0.0852	0.0933	-0.1054	-1.0741	0.3033	0.2962	0.3042	0.0605
	0.0001	*0.0002*	*0.0001*	*0.0002*	*0.0002*	*0.0004*	*0.0004*	*0.0004*	*0.0001*
Housing	0.6794	1.2455	0.8255	1.2747	0.8558	-1.8898	0.6154	0.6180	0.9140
	0.0025	*0.0046*	*0.0031*	*0.0047*	*0.0032*	*0.0031*	*0.0023*	*0.0023*	*0.0034*
Tr-Com	-0.0142	0.0591	0.0010	0.0083	0.1159	-0.0471	-1.3187	0.1585	0.0309
	0.0000	*0.0001*	*0.0000*	*0.0001*	*0.0001*	*0.0000*	*0.0003*	*0.0002*	*0.0001*
L-E-H	0.6186	1.1399	0.6510	1.4362	0.9708	0.5381	1.0694	-2.5383	1.0024
	0.0020	*0.0034*	*0.0021*	*0.0042*	*0.0030*	*0.0018*	*0.0032*	*0.0039*	*0.0030*
O-N-F	0.0279	-0.1691	-0.0256	-0.0884	0.0377	0.3102	0.1181	0.2690	-0.8381
	0.0000	*0.0004*	*0.0001*	*0.0002*	*0.0000*	*0.0006*	*0.0002*	*0.0005*	*0.0003*

Note: Standard errors are in italics.

demand is inelastic. When the variation ranges between zero and -1 the demand is relatively inelastic and, on the contrary when it ranges between $-\infty$ and -1 it is relatively elastic. The demand is perfectly elastic when the variation tends to $-\infty$.

Cross price elasticity does not have a particular sign like the own price elasticity. We say that when it is positive the goods are substitutes, when it is negative the goods are complements and when it is equal to zero there is no influence of the price variation of one good to the demand of another good.

Moreover it is important to point out the difference between uncompensated price elasticity and compensated price elasticity. In fact, the former represents the demand variation that considers both the substitution effect and the income effect as the second one considers only the demand variation deriving from the substitution effect.

Looking at table 22 and 23[22] we can see the uncompensated elasticities and the compensated elasticities, in particular focussing on the own elasticities of

[22]Standard errors have been calculated using the bootstrapping methodology but, since they are always significant (result that usually does not happen) they have to be recalculated using the Delta method.

Table 23: Analytical Compensated Price Elasticities

	Grain P	M-F-D	Fr-Veg	Other F	Clothing	House	Tr-Co	L-E-H	O-N-F
Grain P	-0.6338	-0.0601	0.0209	0.2652	0.0686	0.0628	0.0030	0.0023	-0.0778
	0.0006	*0.0003*	*0.0001*	*0.0004*	*0.0000*	*0.0000*	*0.0002*	*0.0002*	*0.0003*
M-F-D	0.2796	-1.1085	0.3079	0.3281	0.1814	0.7732	0.3808	0.5302	0.1183
	0.0001	*0.0005*	*0.0001*	*0.0001*	*0.0002*	*0.0006*	*0.0002*	*0.0003*	*0.0003*
Fr-Veg	*0.0236*	*0.0540*	*-1.2666*	*0.3154*	*0.0484*	*0.4313*	*0.0671*	*0.0562*	*-0.1819*
	0.0001	*0.0001*	*0.0006*	*0.0004*	*0.0001*	*0.0005*	*0.0001*	*0.0001*	*0.0005*
Other F	*0.5160*	*0.4798*	*0.5660*	*-1.5352*	*0.2603*	*1.1205*	*0.4697*	*0.9392*	*0.2813*
	0.0004	*0.0003*	*0.0005*	*0.0018*	*0.0002*	*0.0016*	*0.0003*	*0.0012*	*0.0002*
Clothing	*0.2212*	*0.0383*	*0.2168*	*0.0181*	*-0.9506*	*0.4268*	*0.4197*	*0.4277*	*0.1841*
	0.0001	*0.0003*	*0.0001*	*0.0003*	*0.0003*	*0.0003*	*0.0002*	*0.0003*	*0.0001*
Housing	*0.7709*	*1.3371*	*0.9171*	*1.3662*	*0.9473*	*-1.7983*	*0.7069*	*0.7095*	*1.0055*
	0.0021	*0.0042*	*0.0027*	*0.0043*	*0.0028*	*0.0035*	*0.0019*	*0.0019*	*0.0030*
Tr-Com	*0.2230*	*0.2963*	*0.2382*	*0.2455*	*0.3531*	*0.1902*	*-1.0814*	*0.3957*	*0.2681*
	0.0002	*0.0001*	*0.0001*	*0.0001*	*0.0000*	*0.0002*	*0.0004*	*0.0000*	*0.0001*
L-E-H	*0.7286*	*1.2500*	*0.7610*	*1.5462*	*1.0808*	*0.6481*	*1.1795*	*-2.4283*	*1.1124*
	0.0019	*0.0033*	*0.0020*	*0.0040*	*0.0028*	*0.0017*	*0.0031*	*0.0040*	*0.0029*
O-N-F	*0.1695*	*-0.0275*	*0.1160*	*0.0532*	*0.1793*	*0.4518*	*0.2597*	*0.4106*	*-0.6965*
	0.0002	*0.0006*	*0.0003*	*0.0004*	*0.0002*	*0.0003*	*0.0000*	*0.0003*	*0.0001*

Note: Standard errors are in italics.

the second one we notice values smaller than one for the grain products group, for clothing and for the other non food products aggregate. The other groups present an elasticity bigger than one so they are relatively elastic. Focussing on the magnitude, we can see that among the groups the grain products aggregate is the most inelastic group, its elasticity is smaller than the elasticity of every other group of food. In fact, among the food aggregates, we notice graduality: grain products is the less elastic group, protein group and fruits and vegetables are more elastic and other no food products is even more elastic. This graduation of elasticity can be interpreted at the light of the relevance of the aggregates in the diet. In particular grain products are basic foods so the reactivity to the increase of the price is quite small, proteins and fruits and vegetables, although very important in the diet, are not so fundamental as the first one so they present a bigger elasticity. Finally the last food group, other food product, presents an elasticity bigger then every other food groups because it includes alcoholic beverage, pastries, chocolate and those are "luxury" food so their consumption is more sensitive to price variations.

Focussing on the own elasticities of the no food groups we see that clothing and

transport and communication present elasticities close to one. These values can be understood in the light of the relevance of both these groups in the families expenditures. They can be seen as very important aggregates which consumption is difficult to give up. Considering the other groups, housing and leisure, education and health, they present high elasticities while the aggregate other non food products presents a low elasticity close to that of cereal products. These values are the results of the data variability. For what that concern the former, housing, we would expect a smaller elasticity, in fact housing demand should be inelastic, this result depends on the definition of the aggregate. It comprises rent and mortgage, heating and outlays on items for housework. It is clear that the expenditures are very polarized since homeowner present expenditures only for heating and household items while other families show big expenditures on rent or mortgage. Therefore, expenditures so different among the population create an elasticity very high. For what that concern leisure, education and health, as we have previously pointed out, the expenditures are very different and they are mainly in the leisure group that is characterized by high elasticity. For this reason the group present such a big value. For what that concern the last group, other non food products, we find an elasticity quite small even if considering the expenditures included in the aggregate we would expect a bigger sensitivity, these characteristics of the group have to be deeply investigated.

Focussing our attention on the cross price elasticities, we can notice that the majority are positive, showing in this way, that the goods are substitutes.

Demographic Elasticities

Considering demographic elasticities (Table 24)[23], we can only confirm what we have said on the previous paragraph. In particular, the Northern regions show a demand for food and clothing smaller than that of the Southern regions. On the contrary they show a bigger demand for housing, transport and communication, leisure, education and health and other no food products. Considering the impact of and added member on demand, we notice an increase in the demand of basic foods like cereal products and meat, fish and dairy products. Differently, there is a decrease of other food products that is the "luxury" food aggregate. Considering the impact of an added member on non food groups, we notice an

[23]Standard errors have been calculated using the bootstrapping methodology but, since they are always significant (result that usually does not happen) they have to be recalculated using the Delta method.

Table 24: Analytical Demographic Elasticities

	North W	North E	South	Islands	Ho. M.	Young M.	Old M.	1° Edu	2° Edu	Wife J.
Grain P	0.0459	-0.0389	0.0896	0.0983	0.0971	0.0477	0.0508	0.1340	-0.0623	-0.0635
	0.0001	*0.0001*	*0.0002*	*0.0002*	*0.0002*	*0.0001*	*0.0001*	*0.0003*	*0.0001*	*0.0001*
M-F-D	-0.0435	-0.1380	0.1010	0.0546	0.0313	0.0015	0.0772	0.1109	-0.0484	-0.0371
	0.0001	*0.0002*	*0.0001*	*0.0001*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0000*
Fr-Veg	-0.1097	-0.1183	0.0555	-0.0229	-0.0039	-0.0236	0.1118	0.0736	-0.0466	-0.0700
	0.0002	*0.0002*	*0.0001*	*0.0000*	*0.0000*	*0.0000*	*0.0002*	*0.0001*	*0.0001*	*0.0001*
Other F	-0.0074	-0.0163	0.0745	0.0574	-0.0395	0.0223	0.0395	0.0531	-0.0375	-0.0429
	0.0000	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0001*
Clothing	-0.0228	-0.0337	0.0928	0.0499	0.0893	0.0124	-0.0498	-0.0598	0.0116	0.0570
	0.0000	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0000*	*0.0001*	*0.0001*	*0.0000*	*0.0001*
Housing	0.2042	0.1671	-0.0295	-0.0756	-0.1455	0.1375	0.0035	0.0282	-0.0152	-0.0553
	0.0007	*0.0006*	*0.0001*	*0.0003*	*0.0005*	*0.0005*	*0.0000*	*0.0001*	*0.0001*	*0.0002*
Tr-Com	-0.0745	-0.0385	-0.0917	-0.0351	0.0992	-0.1307	-0.0880	-0.1045	0.0328	0.0187
	0.0001	*0.0000*	*0.0001*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0000*	*0.0000*
L-E-H	0.0460	0.0968	-0.0829	-0.0151	-0.0759	0.0548	0.1056	0.0256	0.0233	0.0318
	0.0001	*0.0002*	*0.0002*	*0.0000*	*0.0002*	*0.0001*	*0.0003*	*0.0001*	*0.0001*	*0.0001*
O-N-F	0.0319	0.1250	-0.0825	-0.0434	-0.1031	0.0342	-0.0526	-0.0502	0.0579	0.0719
	0.0001	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001

Note: Standard errors are in italics.

increase of the expenditure in clothing and transport and communication and a decrease of the demand for the other groups. The presence of a child does not seem to create particular changes on the welfare of the family, while the presence of an elderly person changes the family demand depending on the habits of the old person. The schooling implies an higher income of the households therefore an higher demand of transport and communications, leisure, education and health and clothing. These are the same effects that presence of a working wife. Therefore households with a breadwinner presenting high schooling or a working wife are richer than the average Italian family.

4.5 Elasticities Created Using Regional Indices

Finally, the last part of this chapter aims to compare the elasticities created using Regional Pseudo Unit Values in Level and those created using Regional Price Indices. In particular, we have estimated two demand systems: one using "Lewbel's prices" and another one using regional indices. Subsequently we have calculated their elasticities.

Comparing these indices we see that the second one (regional indices) presents own price elasticities that are positive (Table 25 and 26)[24]. In particular the elasticities of five groups over nine are positive. This result does not have any economic meaning. On the other hand the elasticities resulting from prices created using "Lewbel's approach" do not show this problem, since they are always negative, indicating, in this way, a better representation of the economic theory. In the light of this result we can say that the "Lewbel' approach" is more accurate for the estimation of demand systems and welfare analysis than the "indices approach".

[24]Standard errors have been calculated using the bootstrapping methodology but, since they are always significant (result that usually does not happen) they have to be recalculated using the Delta method.

Table 25: Analytical Uncompensated Price Elasticities with Regional Price Indices

	Grain P	M-F-D	Fr-Veg	Other F	Clothing	House	Tr-Co	L-E-H	O-N-F
Grain P	-0.8945	2.3031	-1.1761	-1.4397	0.4775	0.9778	-1.793	-2.0485	3.0326
	0.0002	*0.004*	*0.0021*	*0.0025*	*0.0008*	*0.0017*	*0.0031*	*0.0036*	*0.0052*
M-F-D	0.7954	-0.0413	0.033	1.5287	0.7225	0.5415	0.1471	1.487	-5.4415
	0.0009	*0.0011*	*0.0000*	*0.0018*	*0.0008*	*0.0006*	*0.0001*	*0.0017*	*0.0066*
Fr-Veg	-0.9806	-0.0968	0.1346	1.0805	8.3178	-1.5852	2.8706	-5.8867	-4.4628
	0.0011	*0.0001*	*0.0013*	*0.0012*	*0.0094*	*0.0018*	*0.0032*	*0.0067*	*0.005*
Other F	-0.8087	2.4835	0.6707	1.5655	-4.9675	0.2819	3.6596	4.2612	-8.162
	0.0006	*0.0019*	*0.0005*	*0.0019*	*0.0038*	*0.0002*	*0.0028*	*0.0032*	*0.0062*
Clothing	0.3111	1.075	4.8476	-4.2833	-2.5421	-0.7082	-1.2919	-2.9905	5.5332
	0.0006	*0.0014*	*0.006*	*0.0051*	*0.0018*	*0.0008*	*0.0015*	*0.0035*	*0.0068*
Housing	0.2457	0.3631	-0.4053	0.1539	-0.3488	-0.9237	-0.5917	0.9204	-0.0942
	0.0002	*0.0003*	*0.0004*	*0.0001*	*0.0003*	*0.0000*	*0.0005*	*0.0007*	*0.0001*
Tr-Com	-0.3789	0.0946	0.8356	1.6197	-0.6288	-0.5952	-0.6972	-3.3509	2.5454
	0.0006	*0.0002*	*0.0009*	*0.0019*	*0.0009*	*0.0009*	*0.0003*	*0.0043*	*0.003*
L-E-H	-0.918	1.9044	-3.0707	3.3746	-2.7988	1.6714	-6.3163	1.7198	3.3063
	0.001	*0.0021*	*0.0034*	*0.0038*	*0.0031*	*0.0019*	*0.007*	*0.0031*	*0.0037*
O-N-F	1.2474	-7.4862	-2.3121	-6.4196	4.7941	-0.2646	4.5423	3.2543	1.4554
	0.0024	*0.014*	*0.0043*	*0.012*	*0.0091*	*0.0004*	*0.0086*	*0.0062*	*0.0047*

Note: Standard errors are in italics.

Table 26: Analytical Compensated Price Elasticities with Regional Price Indices

	Grain P	M-F-D	Fr-Veg	Other F	Clothing	House	Tr-Co	L-E-H	O-N-F
Grain P	-0.8654	2.3322	-1.147	-1.4106	0.5066	1.0069	-1.7639	-2.0194	3.0617
	0.0001	*0.0039*	*0.0021*	*0.0026*	*0.0008*	*0.0016*	*0.0032*	*0.0036*	*0.0052*
M-F-D	0.909	0.0724	0.1467	1.6423	0.8362	0.6552	0.2608	1.6007	-5.3279
	0.0008	*0.001*	*0.0001*	*0.0017*	*0.0007*	*0.0005*	*0.0000*	*0.0016*	*0.0067*
Fr-Veg	-0.9377	-0.0539	0.1775	1.1234	8.3607	-1.5423	2.9134	-5.8438	-4.4199
	0.0012	*0.0002*	*0.0012*	*0.0012*	*0.0093*	*0.0018*	*0.0032*	*0.0067*	*0.0051*
Other F	-0.7255	2.5667	0.7539	1.6488	-4.8842	0.3651	3.7429	4.3445	-8.0787
	0.0007	*0.0018*	*0.0004*	*0.0019*	*0.0038*	*0.0002*	*0.0027*	*0.0032*	*0.0062*
Clothing	0.3943	1.1582	4.9308	-4.2001	-2.459	-0.625	-1.2088	-2.9073	5.6164
	0.0004	*0.0013*	*0.0058*	*0.0052*	*0.0019*	*0.0009*	*0.0016*	*0.0037*	*0.0066*
Housing	0.4203	0.5376	-0.2307	0.3284	-0.1742	-0.7492	-0.4171	1.095	0.0804
	0.0000	*0.0001*	*0.0005*	*0.0000*	*0.0005*	*0.0001*	*0.0007*	*0.0006*	*0.0003*
Tr-Com	-0.1753	0.2982	1.0391	1.8233	-0.4253	-0.3916	-0.4937	-3.1474	2.7489
	0.0007	*0.0002*	*0.0008*	*0.0017*	*0.001*	*0.001*	*0.0001*	*0.0044*	*0.0029*
L-E-H	-0.7961	2.0263	-2.9489	3.4965	-2.6769	1.7933	-6.1944	1.8416	3.4282
	0.0011	*0.002*	*0.0035*	*0.0037*	*0.0032*	*0.0018*	*0.0071*	*0.0029*	*0.0036*
O-N-F	1.3953	-7.3384	-2.1642	-6.2717	4.942	-0.1167	4.6902	3.4022	1.6032
	0.0021	*0.0143*	*0.0046*	*0.0123*	*0.0088*	*0.0007*	*0.0083*	*0.0059*	*0.0044*

Note: Standard errors are in italics.

5 Welfare Measures

5.1 Introduction

This chapter aims at measuring the Italian welfare variation occurred between 2007, the reference year, and the period January 2008-April 2009. The analysis is splitted up into two parts. The first one measures the change of welfare with particular attention to the well-being of low, medium and high expenditure households. The second one evaluates the variation of the Italian welfare in two different time-frames: firstly, between the reference year and the January 2008-September 2008 period (high basic food prices) and, secondly, between the following periods, January 2008-September 2008 and October 2008-April 2009 (economic crisis). The reasons underlying this investigation are to be found on the debate, that took place last year, about the effects on well-being of the basic food price increases along with the oil price raise, occurred between mid 2007 and mid 2008. The stabilization of these prices started during fall 2008, though it has been immediately followed by the financial crisis, whose consequences on welfare are still to be estimated. Now, we will summarize what has happened.

Between May 2007 and June 2008, the FAO Food Price Index increased from 140.3[25]to 213.5[26]. The Cereals Price Index, in particular, rose from 146.4 to 273.7 and the Dairy Price Index augmented from 181.1 to 240.6[27](Figure 21). This situation created many unrests and riots[28]in several poor countries and some governments (e.g. India, Egypt, Pakistan) adopted policies such as banning the cereal exports, increasing export duties and subsidizing cereal imports (FAO, 2008). Although these problems were more evident in poor countries, even Europe felt the consequences of the price increases. From December 2007, until June 2008, the European Union (EU) suspended the import duties on all cereals[29]. Traditionally a net exporter, in 2007-08 the EU became a net importer and the price of food shifted from an annual rate of change of 2.8, in August 2007, to the 8.3 of July 2008[30].The reasons for these severe increases

[25]2002-2004=100

[26]These data, together with some information about the calculation of FAO Food Price Indices are available in: http://www.fao.org/fileadmin/templates/worldfood/Reports_and_docs/Food_price_indices_data.xls

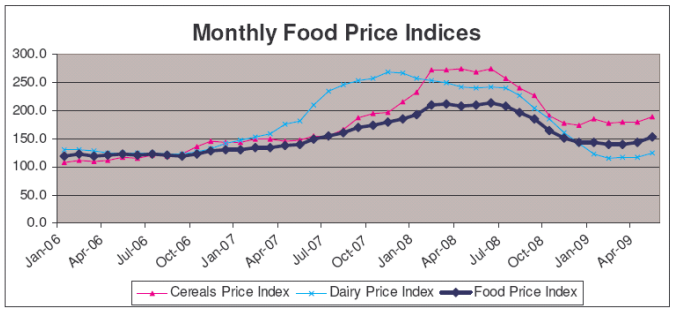
[27]Furthermore Meat Price Index raised from 109.8 to 133.9, Oils and Fat Index increased from 158.1 to 282.7 and Sugar Price Index augmented from:133.8 to 172.1.

[28]Egypt, Cameroon, Côte d'Ivoire, Senegal, Burkina Faso, Ethiopia, Indonesia, Madagascar and Philippines and Haiti

[29]Except oats, buckwheat and millet

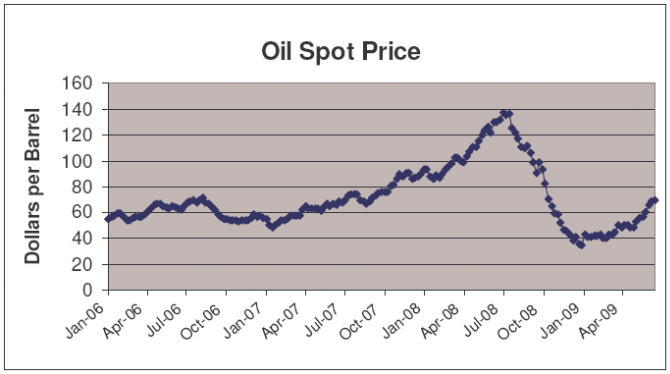
[30]Harmonized Indices of Consumer Prices (HICPs), Monthly data

Figure 21: FAO Food Price Indices



Source: FAO.

Figure 22: Oil Price



Note: Weekly All Countries Spot Price FOB Weighted by Estimated Export Volume.
Source: U. S. Energy Information Administration.

are various and can be divided into two main categories: supply causes and demand causes. Focussing on the supply side, the first thing to notice is the reduction of production caused by bad weather conditions in strategic countries, such as Australia[31]. Furthermore, the world cereal stock hit its lowest level in forty years, generating uncertainty about the future and instability.
Moreover, it is important to focus on the high cost of fuel (Figure 22) and on the freight rate. In detail, the former is very important both in the production of cereals, since it is one of the main components of fertilizers, and in the transport costs. The latter, freight, also represents a transport cost and its relevance in the increase in cereal prices is due to the competition between the transport of minerals and the transport of cereals. In particular, at that time, China was importing large amounts of iron ore[32], making the availability of vessels difficult and expensive.
On the demand side, it is possible to recognize the following factors: the increasing demand of Asia, deriving from a greater income, which changed the consumption habits; the expansion of biofuels markets, that created competition in the use of land either for food or for energy and the role of speculative investors (EBRD, 2008).

Finally, it is important to pay attention to the exchange rate, since many experts consider the depreciation of dollar exchange rate as an important cause of the price increases (Mitchell, 2008 and Timmer, 2008).

This situation started to revert to normality in July 2008 ; in February 2009 the FAO Food Price Index was very close to the value of May 2007 respectively 139.0 and 140.3. Unfortunately, the financial crisis started out in the third quarter of 2008, when the Gross Domestic Product of United States begun to decrease[33]. Therefore, the world shifted form a period of high basic food and oil prices to a phase characterized by lower food and oil prices but economic crisis.

Focussing on the Italian situation, the strong increase in cereal and dairy products has been experienced here as well. For example, from August 2007 to July 2008 the price index[34]of bread jumped from 137.7 to 154.1 and the one for milk

(annual rate of change). These information are available in: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=teicp000&tableSelection=1&plugin=1.

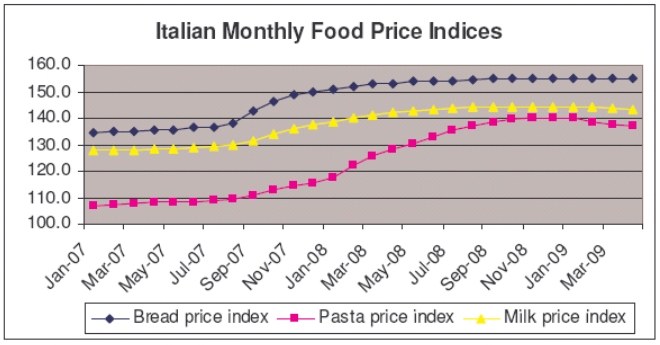
[31] Australia is one of the main exporter of wheat

[32] At present, the growth of China's GDP is slowing therefore the imports are slowing too

[33] III quarter of 2008: -0.5 (percent change from preceding period), IV quarter of 2008: - 6.3, I quarter of 2009: -5.5 http://www.bea.gov/newsreleases/national/gdp/2009/pdf/gdp109f.pdf

[34] "Indici nazionali dei prezzi al consumo per l'intera collettività delle voci di prodotto" with

Figure 23: Italian Food Price Indices



Source: Istat

from 129.7 to 143.5 (Figure 23). However, unlike the FAO Food Price Index, these indices have shown a slight increase during the second part of 2008 and, in the last few months, they have been decreasing to some extent.

As far as the economic crisis is concerned , the Italian GDP started to decrease since the third quarter of 2008[35], exactly as in the United States, but showing a lower magnitude.

In the light of this situation, this thesis aims at measuring the change of Italian well-being occurred during the last sixteen months, due to both high basic food prices and the economic crisis. Furthermore, we have separated the effects of the two causes.

The implementation of this work requires the definition of a social welfare function and its evaluation in different periods of time. However, this function of well-being uses equivalence scales. Let see firstly a brief overview of these scales and secondly the methodology used for the evaluation of the well-being.

5.2 Equivalence scales

Social evaluation and the measurement of inequality and poverty require comparison across households. This comparison has to take into account the "economies of scales" because they characterize the consumption of some goods like house,

base year 1995. http://www.istat.it/prezzi/precon/aproposito/ nicbase95_indici.xls.

[35]III quarter of 2007: 0.7 (percent change from preceding period), IV quarter of 2008: -1.3, I quarter of 2009: -1.8 http://www.istat.it/salastampa/comunicati/in_calendario/contitri/20090610_00/

transport and clothing. Equivalence scales deal with this issue. They answer the to the question "how much additional income is required by an household, showing some demographic characteristics, to achieve the same level of well-being of the reference household?" (Slesnick, 1998). It is possible to answer to this question evaluating the difference between the expenditure of the reference family and the outlay, necessary to achieve the reference household utility level, of the family we want to consider. In math this can be summarized with $\nabla W_k = Y(p, u_r, d_k) - Y(p, u_r, d_r)$ where p indicates prices, u_r indicates the utility of the reference household, d_k and d_r represent respectively the demographic characteristics of the household considered and those of the house of reference. Moreover, this difference can be considered using an index that is defined as the ratio between the former and the latter: $m_0(p, u_r, d_k) = \left(\frac{Y(p,u_r,d_k)}{Y(p,u_r,d_r)}\right)$ (Slesnick, 1998).

In the literature there is not agreement about the equivalence scales to use. When living standards are considered using a per household basis the number and the characteristics of the household components are not relevant and the needs are assumed invariant across households. On the opposite, when well-being is measured in per capita terms, the needs increase linearly at the rising of family members - the equivalence scale is one for one family member, two for two component of the household and so on.
Between these opposite situations we can find many types of equivalence scales. They are based on the idea that households with more members have more needs than the others. However, these needs do not increase linearly at the increasing of family components since there are "economies of scale".
Very common are the per capita adjustment equivalence scales. They are based on the same idea of the per capita equivalence scales but they assign a value smaller than one to the additional person considered. For instance, the Organization for Economic Cooperation and Development (OECD) equivalence scale gives to a family composed by one person an equivalent value of one but the additional person of the family is considered by 0.5 and a children counts for 0.3. Therefore, families with two members and one child have a value of the equivalence scale of 1.8 (1 for the first member, 0.5 for the second component and 0.3 for the child)[36]. This approach is quite simple but it presents some implausible assumptions about economies of scale. In fact, the equivalent scale

[36]OECD-modified equivalence scales http://www.oecd.org/dataoecd/61/52/35411111.pdf

increases by the same amount regardless the original number of family members and it does not take into account regional variability, gender and other important characteristics of the person added to the family (Slesnick, 2001).
Another common type of equivalent scales is represented by the nutritional equivalent scales. This approach is based on the idea that different persons have different nutritional needs, therefore, the cost of maintaining an healthy diet is different. The reference person is an adult man that has a value of one in the scale of equivalence, women, requiring less nutrients, present a value that is smaller than one and the same happens for children. The main problem of this approach regards the fact that experts do not agree about the minimum diet necessary to furnish an healthy life. Therefore there is not agreement about the proportion among different persons scale values. Moreover this approach is based only on the food needs without consider the other important necessities of persons like for example health, school, transport etc (Slesnick, 2001).
Going ahead and focussing the attention on another type of equivalence scales: the subjective equivalence scales (Van Praag et al, 1980, 1982), we can see a very different point of view. These scales are based on the perception that families have about their standards of living. In particular, this approach is based on surveys where households answer to question about the smallest income necessary to live for one month. The comparisons among the incomes of the different types of households creates the equivalence scales. Although this approach is very interesting there are not enough data to implement it on large scale, moreover it aims to compare the subsistence standards of living and it can not be used for the comparison among different welfare levels that are not subsistence levels (Slesnick, 2001).
The last type of equivalent scales considered is represented by the full budget equivalence scales. Its define the total expenditure necessary at the considered household to achieve a defined level of welfare, in comparison with the expenditure necessary, to achieve the same welfare, at the reference family.
The simplest method to create equivalence scales using this approach is attributed to Engel (1895). It is based on the idea that households having the same budget share for food but being composed by different members have the same level of welfare. This supposition is based on the empirical evidence that (a) for households with the same demographic composition the budget food share is inversely correlated with total expenditure and (b) for households presenting the same total outlay, food share increases at the rising of family members. However, despite the acceptance of both evidences, Nicholson (1976)

showed that households different in composition but presenting the same budget food share can possess different levels of welfare (Deaton and Muellbauer, 1986). Furthermore, the demographic variables have the same effect on all commodities and this assumption is very restrictive, as Slesnick writes (1998): "the addition of a child is unlikely to have the same effect on alcohol consumption as it does on the demand for milk". In this context the Engel curve is $x_k/m_0(d_k) = x(Y_k/m_0(d_k))$ where $x_k$is the demand, M_k is the expenditure and $m_0(d_k)$ is the equivalence scale.

Afterwards Prais and Houthakker (1955) solved the problem of the unique effect of demographic variables on all goods, allowing a different impact among the goods. This creates Engel curves in the form $x_{ik}/m_i(d_k) = x_i(Y_k/m_0(d_k))$ where $i = 1, ..., n$ and $m_i(d_k)$ is the commodity specific equivalence scale for the *ith* good. Unfortunately this approach present problems of identification and consistency with the rationality of the consumers (Muellbauer,1980).

To solve this problem Barten (1964) proposed to include equivalence scales on the utility function rather than on the demand function. In this context utility is a function of the quantity consumed deflated by commodity-specific equivalence scales. In math form, $V(p, Y_k, d_k) = V(p^*, Y_k)$ where $p^* = p_i m_i(d_k), ..., p_n m_n(d_k)$ is the vector of prices scaled by the demographic variables. In this context the demands are in the form $x_{ik}/m_i(d_k) = x_i(p^*, Y_k)$. Whenever there is a change in the composition of household members this approach creates two effects: a substitution effect among the products, that are not relevant in the new component consumption, and a scale effect due to the increase of the resources necessary to maintain the standards of living. When the former is bigger than the latter, the addition of one family member decreases the demand. Therefore, this is a lack of the aforementioned specification (Slesnick, 1998). To reduce this problem, Gordman (1976) proposed a specification that incorporates translating[37] and scaling effects since the translating specification reduces the impact of the substitution effect in the reduction of the demand.

Having considered all these specifications it is important to analyze the study of Pollak and Wales (1979) according to which, the information on household expenditures can not be used to measure the welfare effects of changes in the characteristics of the households. They asserted that the demand models are estimated conditional on the existing demographic composition while welfare comparison requires the evaluation of the change in the unconditional utility

[37] The demand is translated by a function of the demographic characteristics

levels. For this reason they concluded that household equivalence scales can not be identified using demand data without further information.
One of the possible solutions to this problem is represented by the equivalence scales that are Independent of the Base (IB) income, or utility level, chosen for the interpersonal comparisons (Lewbel, 1989b), or by those possessing the property of Equivalence Scale Exactness (ESE) (Blackorby and Donaldson, 1991). The existence of the IB/ESE property is assured by an expenditure function in the form $Y(p, V_k, d_k) = B(p, d_k) C(p, V_k)$. Blundell and Lewbel (1991) showed that this restriction is sufficient to identify the equivalence scales using only demand data.

Moreover, the ESE/IB property implies that linear Engel curves are parallel across different household types (Perali, 2003). In addition, since the equivalence scales that possess this property do not depend on income, they do not require homothetic utility functions (Perali, 2003). Finally when this property holds, the welfare comparisons are independent of the reference household type chosen (Ebert and Moyes 2003).

The model
The Quadratic Almost Ideal Demand System demographically modified using a translating term, possess the ESE/IB property as showed in Perali (2003). In particular, looking at the cost function defined in the previous chapter (equation 26) we see that it is separable in the original preference structure $C(p, V_k)$, that does not include demographic characteristics, and in the translating fixed cost term $P^T(p, d)$ that includes all the demographic information. Therefore, welfare comparisons are Independent of the Base level of utility, or income, chosen for the interpersonal comparisons.
Furthermore, as we have already pointed out at the beginning of the chapter two, the QAIDS specification is based on the PIGLOG preferences. Blackorby and Donaldson (1991, 1993) stated that the condition of Equivalence Scale Exactness is sufficient to find a unique equivalence scale only when preferences are not log-linear in some transform of utility. Thus, according to this result, interpersonal comparison can not be revealed by the data when the preference are PIGLOG, like in this situation (Perali, 2003). On the other hand Perali (2003) showed that even when the preferences are PIGLOG the equivalence scales are unique. In the light of this result we can use the QAIDS specification of this model to create the equivalence scales. In details:

$$\ln m_0(u,p,d) = \ln C(u,p,d_k) - \ln C(u,p,d_r) =$$

$$= \left(\ln A(p) + \ln P^T(p,d_k)\right) + B(p)\left[\varphi(u)^{-1} - \lambda(p)\right]^{-1} -$$

$$= \left(\ln A(p) + \ln P^T(p,d_r)\right) + B(p)\left[\varphi(u)^{-1} - \lambda(p)\right]^{-1}$$

that, considering the IB property is equal to:

$$m_0(p,d) = \frac{C(u,p,d_k)}{C(u,p,d_r)} = \frac{P^T(p,d_k)}{P^T(p,d_r)}$$

In this model the reference household is represented by a family with two members living in the central Italy.

5.3 Methodology

As it has been pointed out in the previous section, the QAIDS indirect utility function that considers demographic characteristics using the translating technique possess the IB property. This property implies that

$$C(u,p,d) = G(u,p)\, m_0(p,d)$$

so

$$\ln \frac{C(u,p,d)}{m_0(p,d)} = \ln G(u,p) = \left[\ln A(p) + \frac{B(p)}{\varphi^*(u) - \lambda(p)}\right] \tag{34}$$

where $m_0(p,d)$ is the translating household equivalence scale that estimates the number of household equivalent adults conditional on the demographic variables considered.

Focussing on $G(u,p)$, it is evident that it does not depend on demographics. This characteristic makes $C(u,p,d)/m_0(p,d)$ comparable across households, under IB preferences, and it makes this specification of the expenditure an affine transformation of the welfare level u. Therefore, it can be interpreted as a money metric for utility (Perali 2003, Lewbel 1989b e 1991, Blackorby and Donaldson 1991).

Furthermore, in his paper "Cost of Characteristics Indices and Household Equivalence Scales" Lemma 3 (Lewbel 1991), Lewbel shows that, when the preferences are expressed as in equation 34, it is always possible to construct a social welfare function $S^*(u_1, ..., u_k)$ so that there exists a function $S(C_1/M_1, ..., C_k/M_k)$ that satisfies $S(C_1/M_1, ..., C_k/M_k) = S^*(u_1, ..., u_k)$ for all k. This Lemma also works for the case of indirect utility functions that present Cardinal Full Comparability utility profiles. Thus, following Perali (2003), from equation 34, it is possible to derive the indirect utility function $V(y, p, d)$ and make its logarithm equal to the individual welfare function as

$$W(y, p, d) = \ln V(y, p, d) = \left[\left(\frac{\ln \left(C(u, p, d) / m_0(p, d) \right) - \ln A(p)}{B(p)} \right)^{-1} + \lambda(p) \right]^{-1} \tag{35}$$

$W(y, p, d)$ must be quasiconvex in p and non increasing in p.
Following the same argument above and focussing on $W(y, p, d)$, since the functions A, B and λ do not depend on demographics, $W(y, p, d)$ is an affine transformation of the logarithm of expenditure per household equivalent $ln\left(C(u, p, d)/m_0(p, d)\right)$. This property is invariant to positive affine transformation and it guarantees that individual welfare is a cardinal measure of economic welfare. For this reason, it is possible to refer to $W(y, p, d)$ as the distribution of welfare.

When the individual welfares are available, in order to create the social welfare, it is necessary to decide how to aggregate the single welfares. This aggregation implies a value judgment that depends on the idea of equity.
The welfare function used in this aggregation is the Jorgenson and Slesnick's social welfare function (1984, 1987, 1990) and it is:

$$W(u, x|\rho) = \ln \bar{V} - \gamma(x) \left[\frac{\sum_k m_0(p, d_k) \left| \ln V_k - \ln \bar{V} \right|^{-\rho}}{\sum_k m_0(p, d_k)} \right]^{-\frac{1}{\rho}} \tag{36}$$

where

$$\ln \bar{V} = \frac{\sum_k m_0(p, d_k) \ln V_k}{y_k}$$

and

$$\gamma(x) = \left\{ \frac{\sum_{k \neq j} m_0(p, d_k)}{\sum_k m_0(p, d_k)} \left[1 + \left(\frac{\sum_{k \neq j} m_0(p, d_k)}{m_0(p, d_j)} \right)^{-(\rho+1)} \right] \right\}^{\frac{1}{\rho}}$$

where $m_0(p, d_j) = min_k m_0(p, d_k)$ is the scale for the reference household and the first term of equation 36 is the average of the individual welfare levels. The second term of eq. 36 measures the inequality of the society, given that it calculates the distance of each household welfare from the average well-being. Furthermore, these distances are summed using weights, so that the rules of a social welfare function that considers equality are respected. These weights $a_k(x)$are defined as:

$$a_k(x) = \frac{m_0(p, d_k)}{\sum_k m_0(p, d_k)}$$

Using this approach, at a given level of average welfare, social welfare decreases when the distribution of welfare levels becomes more unequal. Moreover, the weight represented by $\gamma(x)$ is defined in such a way that it reaches the maximum level conditional to the Pareto requirement that an increase in individual welfare increases the social welfare[38].
The parameter ρ measures the aversion to inequality and it is bounded from $(-\infty, -1]$. When $\rho = -\infty$ the second term of equation 36 tends to zero and the social welfare collapse to the utilitarian case. No weight is given to equality. When $\rho = -1$ the society assigns the maximum weight to equity.
The decision about the value of ρ depends on a society's degree of ad version to inequality . It is the same among different policies inside a society but it can be wide-ranging among different societies (Jorgenson and Slesnick 1987).
Coggins and Perali (2000) suggest to link the value of ρ to the distribution of voters in favor of against more equity.
At present, we do not have any information about the Italian propensity on more or less equity so we will give it the maximum weight assuming $\rho = -1$.

Moving from the general framework to a more particular one, and following the approach of Perali (2003), we can define the social expenditure function as the minimum level of total aggregate expenditure required to achieve a particular level of social welfare W at price p as $C(p, d, W) = min\{C : W(w) \geq W, C = \sum_i C_i\}$ where $w = W_i ... W_N$ is the vector of individual welfare functions.
In this situation, it is possible to compare different levels of social welfare using

[38] It is bounded from above at the point when the difference between the increase of the social welfare, deriving from the increase of individual welfare, and the increase of inequality is zero.

the monetary terms obtained through an evaluation of the social expenditure function at a reference prices and a comparison price system.
If we maximize the social welfare subject to a fixed level of aggregate expenditure, we can calculate an efficiency measure that represents the maximum level of welfare obtainable through a lup-sum distribution. At the maximum point, every household equivalent member has the same total expenditure and the social welfare function is reduced to the average individual welfare. This corresponds to the level of indirect utility evaluated at the mean aggregate equivalent expenditure:

$$W = \ln E(V) = \left\{ \left[\frac{ln\left(\sum_{i=1}^{n} C_i^* / \sum_{i=1}^{n} m_0(p, d_i)\right) - ln\, A(p)}{B(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{37}$$

If we solve the last equation for aggregate expenditure, we can find the aggregate social expenditure (as):

$$ln\, C(W, p) = \left(ln\, A(p) + \frac{WB(p)}{1 - W\lambda(p)} \right) \sum_{i=1}^{n} m_0(p, d_i) \tag{38}$$

where $m_0(p, d_i)$ represents the household equivalent member and W can be the actual or potential level of social welfare in the reference and comparison economic situation.
When the *actual level of social welfare,* represented by $W^0\left(p^0, C^0\right)$, is estimated at the reference price p^0, we have the *money measure of social welfare*$C\left(p^0, W^0\right)$.
When the *potential level of social welfare*, represented by $W^2\left(p^0, C^0\right) \geq W^0\left(p^0, C^0\right)$, is evaluated at the reference price, we have the *money measure of efficiency*$C\left(p^0, W^2\right)$.
The distance between the actual and potential money measure of social welfare gives the *money measure of equity*:

$$C\left(p^0, W^0, W^2\right) = C\left(p^0, W^0\right) - C\left(p^0, W^2\right)$$

Looking at this equation form a different point of view, the money measure of social welfare $C\left(p^0, W^0\right)$ is composed of an efficiency measure $C\left(p^0, W^2\right)$ and an equity measure $C\left(p^0, W^0, W^2\right)$.

Furthermore, the distance between the potential and the actual welfare can be summarized using and *index of inequality* defined as:

$$I_r\left(p^0, W^0, W^2\right) = \frac{C\left(p^0, W^2\right) - C\left(p^0, W^0\right)}{C\left(p^0, W^2\right)}$$

Applying the same approach for the comparison situation,

When the *comparison level of social welfare,* represented by $W^1\left(p^1, C^1\right)$, is estimated at the reference price p^0, we have the *money measure of social welfare for the comparison situation* $C\left(p^0, W^1\right)$.

When the *potential level of social welfare of the comparing situation*, represented by $W^3\left(p^1, C^1\right) \geq W^1\left(p^1, C^1\right)$, is evaluated at the reference price, we have the *money measure of efficiency for the comparison situation* $C\left(p^0, W^3\right)$.

The distance between the actual and potential money measure of social welfare in the comparison situation gives the *money measure of equity* of the comparison moment :

$$C\left(p^0, W^1, W^3\right) = C\left(p^0, W^1\right) - C\left(p^0, W^3\right)$$

In addition, the distance between the potential and the actual welfare can be summarized using and *index of inequality* that evaluate this difference using the reference prices as:

$$I_r\left(p^0, W^1, W^3\right) = \frac{C\left(p^0, W^3\right) - C\left(p^0, W^1\right)}{C\left(p^0, W^3\right)}$$

Comparing the two moments, we can define:

The money metric of social welfare, that evaluates welfare changes and is given by the difference between the aggregate expenditure necessary to achieve the reference social welfare $C\left(p^0, W^0\right)$ and the expenditure necessary to achieve the social welfare of the comparison situation with the reference prices $C\left(p^0, W^1\right)$:

$$C\left(p^0, W^0, W^1\right) = C\left(p^0, W^1\right) - C\left(p^0, W^0\right)$$

if it is positive, the social welfare of the comparison situation is bigger.

The money metric efficiency $C\left(p^0, W^2, W^3\right)$, that measures the distance between the potential social welfare of the comparison situation and the potential well-being of the reference situation. This measures aims at identifying the change of welfare growth possibilities and it is defined as:

$$C\left(p^0, W^2, W^3\right) = C\left(p^0, W^3\right) - C\left(p^0, W^2\right)$$

The money metric equity $C\left(p^0, W^0, W^1, W^2, W^3\right)$, that evaluates the distance between the variation of welfare and the variation of potential welfare occurred during the periods considered. In particular, this index increases when the real welfare increases more than the potential welfare, in such a way that it reduces the gap among real welfare and the well-being that would be achieved with an equal distribution of resources. It is defined as

$$C\left(p^0, W^0, W^1, W^2, W^3\right) = \left[C\left(p^0, W^1\right) - C\left(p^0, W^0\right)\right] - \left[C\left(p^0, W^3\right) - C\left(p^0, W^2\right)\right]$$

The quantity index of social welfare, that measures the standard of living and is represented by:

$$Q_A\left(p^0, W^0, W^1\right) = \frac{C\left(p^0, W^1\right) / \sum_{i=1}^{N} m_0\left(p^0, d_i\right)}{C\left(p^0, W^0\right) / \sum_{i=1}^{N} m_0\left(p^0, d_i\right)}$$

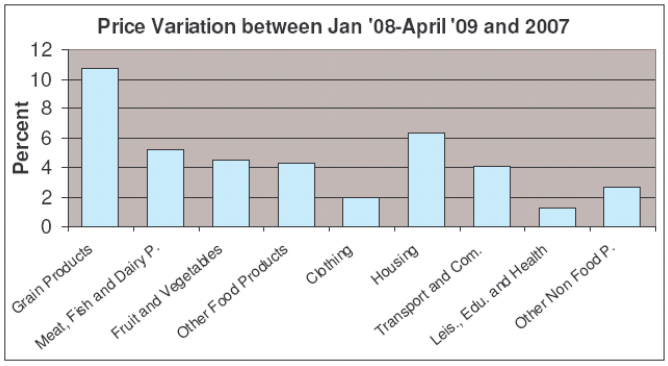
where the numerator represents the aggregate expenditure per household equivalent member required to attain the level of social welfare W^1 at base period price system p^0 and the denominator indicates the expenditure per household equivalent member required to attain the base period level of welfare W^0 at base period price system p^0 .

5.4 Welfare Measures

5.4.1 First Part

The first part of the analysis is focused on the welfare change occurred between 2007 and the time-frame January 2008-April 2009. As we said in the introduction, the last sixteen months have been characterized by high basic food prices, during the first period, and by economic crisis during the second one.
In particular, there has been a heavy increase in the grain product prices (more than 10 percent) and housing prices (6 percent). Furthermore, the prices of transport and communication have strongly increased during the first part of 2008 but, during the last months, they have decreased, minimizing the average variation[39] (Figure 24).

Figure 24: Price Variations between 2007 and the period Jan '08-Apr '09



Source: Our elaboration of Istat data.

The impacts of these price variations on well-being are summarized on table 27 that presents welfare levels and money measures of welfare, along with efficiency and equity components. Before going into details, it is important to say that we have not found a sensible change of welfare between 2007 and the January 2008-April 2009 period. Every change is limited and it does not imply any tangible change of well-being. Bearing that in mind, we can try to see what has happened during the period analyzed (Table 27).

Considering the situation in the reference period, the potential social welfare results bigger than the social welfare, as expected, around 1.03 times it, and the index of relative inequality is around 0.156. This is confirmed by the money measure of efficiency, that represents the expenditure necessary to achieve the maximum potential social welfare, which is bigger than the money measure of welfare. The money measure of equity, as usual, is negative and it represents the loss of welfare due to the unequal distribution of resources.

Starting from the comparison of welfare between the reference period and the comparison period, we notice a small reduction of well-being, since the money measure of welfare in 2007 results bigger than during the comparison period. This reduction is caused by a decrease in efficiency. Furthermore, since the

[39] These price variations have been calculated using the average price variations of the periods considered. In detail, the reference index of 2007 has been calculated using the mean of the 2007 monthly price indices. For each group we have calculated the monthly price index, using the NIC price indices, and we have taken their average, creating, in this way, an annual index. Suddenly, we have done the same for the other periods considered. Having both indices, we have considered the variation of the second period in comparison to the first one (2007) creating in this way the variation of the period considered on the reference period. The variations of the graph are these.

decrease in welfare between the two periods is smaller than the decrease in efficiency, that represents the potential social welfare, we see an increase in the money metric of equity.

In this context, it is interesting to point out the impact on welfare of two different groups of goods: on the one hand, we can consider the group composed by grain products, meat-fish-dairy products, fruits and vegetables, other food products and housing, characterized by a share of expenditure inversely correlated with total expenditure; on the other, we can analyze the aggregate composed by clothing, transport and communication, leisure-education-health and other non food products, characterized by a share of expenditure positively correlated with total expenditure. In more detail, the increase in the first group's prices implies a decrease in the money metric social welfare of -46,326, while the increase in the price of the goods included in the second group, implies an increase in the money metric social welfare of 42,568. The difference between the two groups can be explained in the light of the correlation between total expenditure and quotas of expenditure. In particular, the increase of food and housing prices is more important for poor households than for rich households since the former spend a bigger part of their money on this basic groups. Therefore, the rise of these prices affects more the well-being of poor people than the welfare of rich people, causing an increase in the inequality relating to the distribution of welfare i.e.- the second part of equation 36- that implies a decrease of welfare. On the other hand, an increase in the price of goods that are more important in the expenditure of rich people, like the increase of transport costs, involves a decrease of inequality and a consequent raise of social welfare: the second part of equation 36 decreases and the social welfare arise because there is less inequality

Focussing the attention on the impact of these changes among the society (Table 28), we have divided the sample into three parts: low, medium and high per capita expenditure households.

Looking at the social welfare in the reference situation and comparing it with the value of the potential welfare, we can realize which is the most unequal group. The low expenditure group turns out to be the most unequal one, since the difference between the social welfare and potential welfare is the biggest. This is confirmed by the analysis of the social welfare function component that, as explained in eq 36, is composed of an average welfare component and an inequality component. In particular, the average welfare of low per capita ex-

Table 27: The Variations of Welfare between 2007 and January 2008-April 2009

Overall Italy	**Definition**	**Levels**
Social Welfare Level at Reference Situation p^0	$W^0\left(p^0, C, d\right)$	5.381
Maximum Potential Social Welfare Level at Reference Situation p^0	$W^2\left(p^0, C, d\right) = lnE\left(V^0\right)$	5.552
Money Measure of Welfare	$C\left(p^0, W^0\right)$	26.264*
Money Measure of Efficiency	$C\left(p^0, W^2\right)$	31.139*
Money Measure of Equity	$C\left(p^0, W^0\right) - C\left(p^0, W^2\right)$	-4.874*
Index of Relative Inequality	$I_r = \left(C\left(p^0, W^2\right) - C\left(p^0, W^0\right)\right) / C\left(p^0, W^2\right)$	0.156
Social Welfare Level at Comparison Situation p^1	$W^1\left(p^1, C, d\right)$	5.381
Maximum Potential Social Welfare Level at Comparison Situation p^1	$W^3\left(p^1, C, d\right) = \ln E\left(V^1\right)$	5.551
Money Measure of Welfare	$C\left(p^0, W^1\right)$	26.261*
Money Measure of Efficiency	$C\left(p^0, W^3\right)$	31.098*
Money Measure of Equity	$C\left(p^0, W^1\right) - C\left(p^0, W^3\right)$	-4.837*
Index of Relative Inequality	$I_r = \left(C\left(p^0, W^3\right) - C\left(p^0, W^1\right)\right) / C\left(p^0, W^3\right)$	0.155
Money Metric Social Welfare	$C\left(p^0, W^0, W^1\right) = C\left(p^0, W^1\right) - C\left(p^0, W^0\right)$	-3,468
Money Metric Efficiency	$C\left(p^0, W^2, W^3\right) = C\left(p^0, W^3\right) - C\left(p^0, W^2\right)$	-40,763
Money Metric Equity	$C\left(p^0, W^0, W^1, W^2, W^3\right) =$ $\left[C\left(p^0, W^1\right) - C\left(p^0, W^0\right)\right] -$ $\left[C\left(p^0, W^3\right) - C\left(p^0, W^2\right)\right]$	37,294

Note: * Million of Euros

Table 28: The Variations of Welfare between 2007 and January 2008-April 2009 by Income

	Social Welfare Level at Reference Situation p^0	Maximum Potential Social Welfare Level at Reference Situation p^0	Nominal Aggregate Expenditure*	Household Equivalent Number	Social cost of living index	Real Aggregate Expenditure Per Equivalent Member	Equity Index	Standard of Living
Low Expenditures Household								
2007	5.304	5.527	7.295	6,381	1	1,143	1	1,143
Jan '08-Apr '09	5.304	5.526	7.617	6,387	1.045	1,141	1.001	1,142
Medium Expenditures Household								
2007	5.428	5.529	10.620	6,365	1	1,668	1	1,668
Jan '08-Apr '09	5.428	5.529	11.111	6,367	1.046	1,667	1.000	1,667
High Expenditures Household								
2007	5.392	5.535	13.223	6,289	1	2,102	1	2,102
Jan '08-Apr '09	5.391	5.534	13.780	6,290	1.043	2,099	1.001	2,101

Note: * Million of Euros

penditure households is 5.4059 and it is reduced by the inequity component of 0.10. The groups composed of medium per capita expenditure families and high per capita expenditure households present respectively an inequity component of 0.05 and 0.08[40].

Looking at the social welfare considered, both the social welfare level and the potential social welfare of the low expenditure households groups show the smallest value, as it is expected. This situation keeps being valid even considering the real aggregate expenditure per equivalent number and the standard of living.
An analysis of the impact of price increases, as we have already pointed out, does not reveal evident variations in the well-being of one or more groups. This is mainly due to the contrasting effects of the price variation among the different groups of expenditures. In particular, we have tried to figure out the situation

[40] This is quite normal since the samples have been created considering the per-capita household expenditures and, using the quintile approach, dividing the sample in three parts. Therefore the first and the last quintile include respectively the left tail and the right tail of the distribution, presenting, for this reason more variability of expenditures.

for low expenditure households as we have done for the whole group. Increasing the price of food groups and housing, and leaving the price of other goods unchanged, we have registered a decrease in the average welfare and an increase in inequality, resulting in a decrease in the social welfare. However, when we have carried out the same experiment by changing the price of clothing, transport and communication, leisure-education-health and other non-food products, we have registered a decrease in inequality (mainly due to the variation of clothing and transport and communication groups). The figures shown in the following table are the results of these contrasting forces.

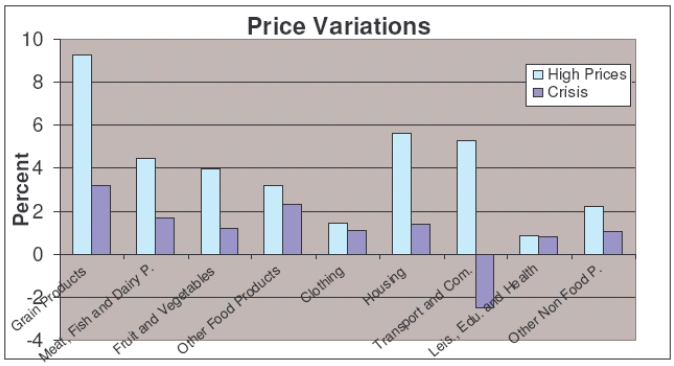
In more detail, both the social welfare and the potential social welfare of the three categories results stable. On the other hand, nominal aggregate expenditure shows an increase as happens for the social cost of living. in particular, the last one present an increase of four percent between the reference period and the comparison period. For what that concern the real aggregate expenditure per equivalent member and the standard of living we notice a slight decrease in the all categories. In conclusion we have not found any relevant changes in the welfare of poor, medium or high per capita expenditure households as it is confirmed by the stability of the equity index.

5.4.2 Second Part

The second part of this chapter aims at identifying the effects on welfare of the two big changes considered in this thesis: high basic food prices and economic crisis. In order to achieve this goal, we have divided the price variations of the previous section (2007 in comparison with January 2008-April 2009) in two parts: the price variation occurred during the first nine months of 2008 (high basic food price period) and the price variation occurred between October 2008 and April 2009 (economic crisis) (Figure 25). In particular, the analysis has been carried out measuring the welfare variation between 2007 and the period January 2008-September 2009 and estimating the variation of well-being between the time span January 2008-September 2008 and the period October 2008-April 2009.

Looking at the graph, we can identify the average price variations occurred between 2007 and January 2008-September 2008. These variations are characterized by a strong increase in the price of grain products (9.22%), dairy-meat-fish products (4.43%), housing (5.60%) and transport and communication (5.26%).

Figure 25: Price Variation between 2007 and Jan '08-Sep '08 and between the last one and October '08-Apr '09



Source: Our elaboration of Istat data.

On the other hand, taking into consideration the price variation occurred between January 2008-September 2008 and October 2008-April 2009, we notice a slight increase regarding almost every price. In particular, the increase in the grain product group prices is one third of the increase occurred during the previous period, while the variation of the price of the group transport and communication has decreased (-2.5%).

Considering the variation of welfare occurred between 2007 and the high basic food prices period (hereinafter first period) and between the latter and the economic crisis moment (hereinafter second period), neglecting the magnitude of the changes, that is very small, we notice two different signs of the welfare changes (Table 29). In particular, welfare has slightly increased during the first period and it has slightly decreased during the second period. More precisely, in both moments, efficiency has decreased: however, during the first period we have registered an increase in equity while in the second period equity has decreased. This results have been strongly influenced by the variation of the transport and communication prices. In particular these prices have strongly increased during the high basic food period and decreased during the economic crisis, thus creating opposite effects on equity. In fact, as we have said in the previous paragraph, when the price of goods that are relatively more important in the expenditure of rich people increases, equity tends to increase, because differences in society are reduced. The second element of the welfare function represented in equation 36 becomes less relevant, determining a reduction of its negative impact on welfare. On the contrary, the economic crisis has been

characterized by a decrease in transport and communication group prices that has acted just the opposite way, increasing inequity and making the second component of equation 36 bigger.

Beyond the sign of the money metric social welfare that is positive in the first period considered and negative in the second one, and beyond the magnitude that is always quite small, it is interesting to point out that the potential welfare is negative. During both the periods considered as in the time-frame analyzed in the previous part, this value is always negative indicating a loss the potential welfare that could be achieved by the society. This result is very interesting because it indicates that we are loosing in prospective even if the real variations of welfare are small.

Looking at the other indices considered, we do not notice any other relevant change of well-being measures and the index of relative inequality does not record any variations.

Table 29: The Variations of Welfare between 2007 and January 2008-September 2009 and between January 2008-September 2009 and October 2008-April 2009

Italy	**Definition**	**2007 - Jan '08-Sept '09**	**Jan '08-Sept '09 Oct '08-Apr '09**
Social Welfare Level at Reference Situation p^0	$W^0\left(p^0, C, d\right)$	5.381	5.380
Maximum Potential Social Welfare Level at Reference Situation p^0	$W^2\left(p^0, C, d\right) = lnE\left(V^0\right)$	5.552	5.558
Money Measure of Welfare	$C\left(p^0, W^0\right)$	26.264*	27.380*
Money Measure of Efficiency	$C\left(p^0, W^2\right)$	31.139*	32.465*
Money Measure of Equity	$C\left(p^0, W^0\right) - C\left(p^0, W^2\right)$	-4.874*	-5.084*
Index of Relative Inequality	$I_r = (C\left(p^0, W^2\right) - C\left(p^0, W^0\right))/C\left(p^0, W^2\right)$	0.156	0.156
Social Welfare Level at Comparison Situation p^1	$W^1\left(p^1, C, d\right)$	5.382	5.379
Maximum Potential Social Welfare Level at Comparison Situation p^1	$W^3\left(p^1, C, d\right) = \ln E\left(V^1\right)$	5.552	5.551
Money Measure of Welfare	$C\left(p^0, W^1\right)$	26.281*	27.348*
Money Measure of Efficiency	$C\left(p^0, W^3\right)$	31.126*	32.432*
Money Measure of Equity	$C\left(p^0, W^1\right) - C\left(p^0, W^3\right)$	-4.875*	-5.084*
Index of Relative Inequality	$I_r = (C\left(p^0, W^2\right) - C\left(p^0, W^0\right))/C\left(p^0, W^2\right)$	0.156	0.156
Money Metric Social Welfare	$C\left(p^0, W^0, W^1\right) = C\left(p^0, W^1\right) - C\left(p^0, W^0\right)$	16,784	-32,754
Money Metric Efficiency	$C\left(p^0, W^2, W^3\right) = C\left(p^0, W^3\right) - C\left(p^0, W^2\right)$	-13,653	-32,369
Money Metric Equity	$C\left(p^0, W^0, W^1, W^2, W^3\right) = \left[C\left(p^0, W^1\right) - C\left(p^0, W^0\right)\right] - \left[C\left(p^0, W^3\right) - C\left(p^0, W^2\right)\right]$	30,437	-384

Note: * Million of Euros

5.5 Conclusions

The main goal of this analysis was to measure the variation of welfare due to high basic food prices and economic crisis. We have studied the impact of these shocks on different types of households and we have separated the effects on well-being of high basic food prices from the consequences of the economic crisis.

Considering the outcomes achieved and explained in the previous paragraphs, we can say that between the reference period (2007) and the comparison periods, there have not been relevant changes in welfare.

As we have already pointed out, these results depend on the contrasting effects on welfare (through the equity component) of the different expenditures considered. Furthermore, the strong increase in prices has had an impact on groups that represent minor parts of expenditure. In particular, we have seen a big increase of the grain product prices: however, this expenditure represents only the 4% of the mean household total expenditure. As a consequence, a rise of this price has a small effect on the population welfare considered as a whole. Moreover, it is important to say that this experiment considers the variation of prices occurred between the reference period (2007) and the following months, but looking at the picture 23 we can easily see that the prices have strongly increased during 2007 as well. Therefore a significant portion of the price rise has already been taken into consideration in the reference year's welfare, reducing, the visible effects of the price rise in the comparison situations.
In conclusion, it is important to say that we have measured the variation of welfare in a short period of time: in consequence, it is quite common not to find relevant variations of well-being. In any case, this exercise can be the starting point for a further analysis of welfare changes carried on in relation to a longer period of time and with a more detailed methodology.

6 Conclusions

When the decision to write this dissertation came out everybody was concerned about high basic food prices that, together with high oil quotations, threatened the stability of well-being. Many months later, when the conclusions of this thesis have been written, population of the world is concerned about the economic crisis. The former issue is not a problem any more.

This thesis started with the goal to evaluate the effects on welfare of the big increases in the prices of basic foods, like bread, pasta and milk. This situation was the consequence of the arises in the main commodities values such as, corn and wheat prices. Furthermore this circumstance, that lasted from mid 2007 to mid 2008, was worsened by the high oil quotations. Thankfully, during the fall 2008 the prices of the main commodities were back to normality as well as the prices of basic foods and the oil quotations. However, another problem came out: the economic crisis. In the light of this situation and with the awareness that welfare can be threatened by both high prices and economic crisis, the goal of this work has been broadened to evaluate the change of well being deriving by both these causes considered together and by each of them. Furthermore, carrying out this analysis, a particular definition of prices has been used and tested: Pseudo Regional Unit Values in Level or easier, "Lewbel's prices".

Focusing now the attention on the results of this work, the first thing to remark is that "Lewbel's prices", the methodology that aims to solve the lack of variability, a common issue in the estimation of demand system, shows good results. In particular, this work has estimated two demand systems: one using price indices and the other one using "Lewbel's prices"; by the confrontation between their elasticities it is possible to say that the latter is more accurate. More precisely, the use of "Lewbel's prices " in the estimation creates own price elasticities that are always negative, and this is coherent with the economic theory. On the opposite, the estimation of the QAIDS using regional indices presents some positive values that are, therefore, incoherent with the economic theory. Although this result is very promising and in line with the literature (Atella, Menon and Perali, 2003 and Holderlein and Mihaleva, 2008) it should be seen as a starting point for more analysis like those carried out in the aforementioned papers.

Now, paying attention to the results of the demand system we can see many important features of the Italian population. Among the most relevant outcomes we can find the confirm a common knowledge. Northern regions are richer than Southern regions. The data show clearly that the consumption of basic goods is higher in the Southern regions than in the Northern regions: food expenditures and clothing outlays represent a bigger part of total expenditures in the South. On the other hand, households living in the North spend more money for the group composed by leisure, education and health, and for the aggregate made by restaurants and personal care. These families spend a bigger part of their income in these groups simply because they are richer as it is straightforward looking at the average total expenditures. Going ahead and considering other important results of the estimation, we notice that in the Italian families a person younger than eighteen years old is less common than a person older that sixty-five years old. In particular, the presence of the latter changes the budget shares of the families because an elderly person has different habits in comparison with the average of the population. In this context it is interesting to notice that an old person increases of the expenditures for the group leisure, education and health. This result can derive by an increase of health care expenditure (that in Italy is almost free for people older than sixty-five years old) but also by an increase of the outlay for leisure. Italian people are aging but there are many people perfectly able to live alone (especially women) and capable to take care of themselves. These people having more free time than everybody else can go on holiday, can travel, go to the gym etc. Furthermore the comparison between families with a breadwinner possessing secondary education and families with an head presenting lower education, shows that the former are richer than the latter.

Finally, considering the variation of well-being between the year 2007, and the period comprised between January 2008 and April 2009, I can not record significant variations of welfare. In the previous chapter I have examined the sign of the variations but their magnitudes are very small. This result does not mean that the welfare is not changed between the period considered but only that I have not found relevant changes. In fact, in the analysis of this result I have to consider the basic assumptions. First of all, I have used as base the year 2007 because it is the most recent available survey and it gives the picture of the most recent welfare but, considering only the comparison goal, it would be better to use the welfare of year 2006 as reference welfare. The reason is quite

simple, prices are increased between 2007 and 2008 so one part of their variation is already included in the year used as reference year. In this way the variation have been smother. Furthermore the period of time considered is very small: one year and half is a short time to find welfare variation and it is even shorter considering the variation of welfare happened during the high price period and the crisis period.

In conclusion, I want to say that this thesis, presenting many concepts that should be deeply pondered, can be seen as a starting point for subsequent analysis that I hope to carry out personally.
Beyond its academic relevance, this work has already done something very important: it has really contributed to create my academic background.

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8 Appendix

Table 30[41]

Parameters	Estimates	Std. err.	Est./s.e.	Prob.
A	0.0726	0.0068	10.6160	0.0000
AA	0.0109	0.0009	12.7240	0.0000
AB	-0.0049	0.0011	-4.4930	0.0000
AC	-0.0019	0.0007	-2.6530	0.0080
AE	0.0071	0.0009	7.9120	0.0000
AF	-0.0001	0.0010	-0.1360	0.8918
AM	-0.0004	0.0012	-0.3080	0.7582
AQ	-0.0026	0.0008	-3.4080	0.0007
AR	-0.0026	0.0010	-2.4980	0.0125
AY1	0.0061	0.0021	2.8250	0.0047
AY2	-0.0026	0.0002	-12.0440	0.0000
B	0.4670	0.0069	67.3520	0.0000
BB	-0.0671	0.0021	-31.9180	0.0000
BC	-0.0004	0.0010	-0.3440	0.7308
BE	0.0029	0.0012	2.3990	0.0164
BF	-0.0206	0.0022	-9.2030	0.0000
BM	0.0743	0.0030	24.5540	0.0000
BQ	0.0113	0.0028	4.1110	0.0000
BR	0.0353	0.0019	18.8390	0.0000
BY1	-0.0887	0.0025	-35.9090	0.0000
BY2	0.0054	0.0003	16.6440	0.0000
C	0.0690	0.0044	15.8600	0.0000
CC	-0.0167	0.0011	-15.3730	0.0000
CE	0.0130	0.0008	16.6770	0.0000
CF	-0.0006	0.0011	-0.5870	0.5571
CM	0.0189	0.0010	18.6550	0.0000
CQ	0.0003	0.0009	0.3570	0.7211
CR	-0.0002	0.0010	-0.2440	0.8076
CY1	-0.0032	0.0012	-2.6580	0.0079
CY2	-0.0010	0.0002	-6.0960	0.0000
E	0.4388	0.0083	53.1340	0.0000
EE	-0.1163	0.0020	-58.8470	0.0000
EF	-0.0229	0.0016	-14.4980	0.0000

[41] A:Grain products. B: Meat, fish and dairy products, C: Fruits and Vegetables, E: Other food products, F: Clothing, M: Housing, Q: Transport and Communication, R: Leisure, education and health, W: Other non food products. Y1: logarithm of total expenditure, Y2: logarithm of total expenditure squared. D1: North West, D2: North East, D3: South, D4: Islands, D5: Number of family member, D6: Number of family member younger than 18 years old, D7: Number of family member older than 65 years old, D8: Breadwinner with primary education, D9: Breadwinner with secondary education, D10: Wife with a job.

EM	0.0781	0.0028	27.9410	0.0000
QE	0.0017	0.0029	0.5940	0.5522
ER	0.0568	0.0021	26.9210	0.0000
EY1	-0.1212	0.0023	-53.8530	0.0000
EY2	0.0112	0.0002	49.7380	0.0000
F	0.2246	0.0139	16.1210	0.0000
FF	-0.0194	0.0028	-6.9700	0.0000
FM	0.0229	0.0036	6.3590	0.0000
FQ	0.0221	0.0019	11.5030	0.0000
FR	0.0230	0.0023	9.9410	0.0000
FY1	-0.0667	0.0048	-13.9520	0.0000
FY2	0.0075	0.0005	15.9050	0.0000
M	-0.1008	0.0201	-5.0230	0.0000
MM	-0.2072	0.0084	-24.6580	0.0000
MQ	-0.0088	0.0040	-2.1930	0.0283
MR	-0.0084	0.0044	-1.9060	0.0567
MY1	0.1725	0.0074	23.2460	0.0000
MY2	-0.0203	0.0009	-23.1840	0.0000
Q	-0.0010	0.0206	-0.0500	0.9604
QQ	-0.0603	0.0031	-19.1770	0.0000
QR	0.0302	0.0030	9.9560	0.0000
QY1	0.0321	0.0074	4.3290	0.0000
QY2	0.0015	0.0008	1.7640	0.0777
R	-0.4502	0.0107	-42.0950	0.0000
RR	-0.1593	0.0032	-50.2400	0.0000
RY1	0.1313	0.0036	36.9680	0.0000
RY2	-0.0090	0.0004	-21.6090	0.0000
AD1	0.0016	0.0005	3.0050	0.0027
AD2	-0.0014	0.0005	-2.5330	0.0113
AD3	0.0031	0.0005	5.8930	0.0000
AD4	0.0034	0.0006	5.4800	0.0000
AD5	0.0035	0.0002	15.9580	0.0000
AD6	0.0017	0.0003	5.4310	0.0000
AD7	0.0018	0.0003	6.1370	0.0000
AD8	0.0047	0.0004	10.5400	0.0000
AD9	-0.0022	0.0004	-5.1670	0.0000
AD10	-0.0022	0.0004	-4.9140	0.0000
BD1	-0.0088	0.0014	-6.1530	0.0000
BD2	-0.0230	0.0015	-15.8590	0.0000
BD3	0.0165	0.0014	12.1620	0.0000
BD4	0.0094	0.0016	5.7980	0.0000
BD5	0.0061	0.0006	10.2730	0.0000
BD6	-0.0008	0.0009	-0.8960	0.3705

BD7	0.0116	0.0008	13.7260	0.0000
BD8	0.0169	0.0013	13.5020	0.0000
BD9	-0.0073	0.0012	-6.0780	0.0000
BD10	-0.0050	0.0013	-3.9590	0.0001
CD1	-0.0061	0.0007	-8.8080	0.0000
CD2	-0.0063	0.0007	-8.8810	0.0000
CD3	0.0027	0.0007	4.0710	0.0000
CD4	-0.0011	0.0008	-1.3680	0.1714
CD5	0.0001	0.0003	0.2250	0.8222
CD6	-0.0015	0.0004	-3.7910	0.0002
CD7	0.0056	0.0004	14.6920	0.0000
CD8	0.0036	0.0006	6.1010	0.0000
CD9	-0.0022	0.0006	-4.0400	0.0001
CD10	-0.0033	0.0006	-5.6720	0.0000
ED1	-0.0036	0.0010	-3.5880	0.0003
ED2	-0.0044	0.0010	-4.3040	0.0000
ED3	0.0105	0.0010	10.7450	0.0000
ED4	0.0084	0.0012	6.9920	0.0000
ED5	-0.0030	0.0004	-7.5370	0.0000
ED6	0.0011	0.0005	2.0460	0.0407
ED7	0.0041	0.0005	7.7070	0.0000
ED8	0.0060	0.0008	7.3270	0.0000
ED9	-0.0045	0.0008	-5.9280	0.0000
ED10	-0.0046	0.0008	-5.5640	0.0000
FD1	-0.0033	0.0008	-4.3000	0.0000
FD2	-0.0050	0.0008	-6.3420	0.0000
FD3	0.0121	0.0008	15.8670	0.0000
FD4	0.0066	0.0009	7.1090	0.0000
FD5	0.0104	0.0003	34.7230	0.0000
FD6	0.0016	0.0004	3.7520	0.0002
FD7	-0.0052	0.0004	-12.6890	0.0000
FD8	-0.0060	0.0006	-9.2740	0.0000
FD9	0.0009	0.0006	1.5810	0.1138
FD10	0.0064	0.0006	10.3260	0.0000
MD1	0.0286	0.0023	12.3760	0.0000
MD2	0.0245	0.0024	10.3730	0.0000
MD3	-0.0064	0.0023	-2.7880	0.0053
MD4	-0.0117	0.0028	-4.2490	0.0000
MD5	-0.0196	0.0010	-19.6320	0.0000
MD6	0.0182	0.0015	12.2470	0.0000
MD7	-0.0006	0.0014	-0.4460	0.6554
MD8	0.0021	0.0020	1.0510	0.2934
MD9	-0.0013	0.0019	-0.6670	0.5046

MD10	-0.0071	0.0018	-3.9180	0.0001
QD1	-0.0167	0.0021	-7.9010	0.0000
QD2	-0.0086	0.0022	-3.9280	0.0001
QD3	-0.0212	0.0021	-10.1590	0.0000
QD4	-0.0084	0.0024	-3.4260	0.0006
QD5	0.0225	0.0009	24.2350	0.0000
QD6	-0.0299	0.0014	-21.6460	0.0000
QD7	-0.0205	0.0013	-16.0460	0.0000
QD8	-0.0240	0.0018	-13.1640	0.0000
QD9	0.0074	0.0018	4.2240	0.0000
QD10	0.0039	0.0017	2.2510	0.0244
RD1	0.0055	0.0012	4.4880	0.0000
RD2	0.0100	0.0013	7.8890	0.0000
RD3	-0.0080	0.0012	-6.5390	0.0000
RD4	-0.0021	0.0015	-1.4160	0.1567
RD5	-0.0076	0.0005	-13.8960	0.0000
RD6	0.0058	0.0008	7.5170	0.0000
RD7	0.0095	0.0007	12.7280	0.0000
RD8	0.0024	0.0012	1.9420	0.0522
RD9	0.0021	0.0011	1.9550	0.0506
RD10	0.0026	0.0012	2.2590	0.0239
W	0.28004	-	-	-
WW	0.01159	-	-	-
WA	-0.00555	-	-	-
WB	-0.03077	-	-	-
WC	-0.01239	-	-	-
WE	-0.02043	-	-	-
WF	-0.00430	-	-	-
WM	0.03057	-	-	-
WQ	0.00599	-	-	-
WR	0.02530	-	-	-
WY1	-0.06199	-	-	-
WY2	0.00721	-	-	-
WD1	0.00275	-	-	-
WD2	0.01420	-	-	-
WD3	-0.00925	-	-	-
WD4	-0.00462	-	-	-
WD5	-0.01239	-	-	-
WD6	0.00386	-	-	-
WD7	-0.00636	-	-	-
WD8	-0.00574	-	-	-
WD9	0.00702	-	-	-
WD10	0.00908	-	-	-

Figure 26: Leisure, Education and Health