Restructuring Italian Utility Markets: Household Distributional Effects

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NOTA DI LAVORO 134.2005

NOVEMBER 2005

IEM – International Energy Markets

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Summary

Competition in public utility sectors has been encouraged in recent years throughout Europe. In this paper we try and analyse the welfare effects of these reforms in Italy, with particular attention to water and energy goods. The first step is to introduce a sensible measure of affordability of public utilities and to see how many households fall below a critical threshold. This issue is analysed stressing how climatic conditions dramatically affect households' expenditure and how the affordability of utility bills varies a lot from region to region. So far, utilities' reforms do not seem to have produced negative effects on the weaker group of households.

Keywords: Consumer behaviour, Public utilities, Regulation, Gas, Electricity, Water

JEL Classification: D12, L51, L97

The authors gratefully acknowledge the financial support from the MIUR Project N°2002131535_004 and the helpful research assistance by S. Vergalli and C. D'Alpaos. We wish to thank A. Barone, A. Cavaliere, G. Certomà, M. Hviid, M. Florio, G. Muraro, C. Poletti, P. Ranci, U. Trivellato, C. Waddams and seminar participants at Pavia and Padova Universities, and at the Earie Conference 2005, for their useful comments.

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1 Introduction

In Italy, as in other European countries, regulatory reforms in public utilities have been introduced since the beginning of the '90. Progress in European integration, technological developments and the deterioration of public finances represent the main driving forces of this wide reform process. Moreover, the importance of competition as a factor which foster price decreases and promotes efficiency has been more widely recognised, while the natural monopoly and competitive elements are more clearly distinguished. Thus, the current process is characterised by (a) liberalisation aimed at allowing the entry of new operators and (b) distinction ("unbundling") between naturally monopolistic segments and (potentially) competitive ones. Sometimes we also observe a change in ownership from public to private hands.

Given that these utilities are considered essential services, equity considerations make it particularly desirable that their provision at affordable prices is warranted. As a household's expenditure in utility services increases with income, but less than proportionally - demand elasticity with respect to income is positive, but typically very low – tariff changes produce relevant distributional effects. Therefore, reforms must strike a balance between the pursuit of efficiency and equity objectives.

The economic literature on the effects of regulatory reforms on household utility markets mainly develops over two strands. The first one investigates these effects in particular industries: the distributional impact of reforms is assessed by Wolak (1996) in US telecommunication, by Waddams Price and Hancock (1998) and Waddams Price (2005) in UK energy markets, by Gòmez-Lobo (1996) in the UK gas market. Florio (2004) analyses more general welfare consequences of the whole UK privatisation programme. Another part of the literature focuses on the definition of fuel poverty and/or the affordability of public utility bills in different countries and evaluates the impact of different schemes of distributive grant. Healy (2001) describes fuel poverty in different European countries; McKenzie and Mookherjee (2003) analyse the effect of privatisation and restructuring of private utilities in four Latin American countries, showing how the effects on consumers are quite mixed but usually favourable.

Italian reforms have not given clear results so far, and in this paper we first try and provide some evidence on the incidence of expenditure for basic utilities (water, electricity, natural gas, and other fuels for home heating) for Italian households. This is a necessary step before any tentative evaluation of the effects of the liberalisation of the utility markets on households' welfare. We then propose a definition of utility poverty (a poverty line referred to expenditure in basic public utilities) and estimate the phenomenon in Italy, trying to show how liberalisation has affected weaker households.

To understand our choice of sectors, one should consider that among the different services involved in the process of utilities restructuring in Italy, we have different stories. Telecommunications are heavily liberalised, competition – although limited by the presence of a dominant firm – operates quite widely, and consumers benefit from considerable service improvements as well as price decreases. This can now be considered a competitive sector (although with notable imperfections) and regulation is taking a secondary role.

Public transport is instead way behind, both locally and nationally. The restructuring of the train service has only begun, with mainly cosmetic interventions on

the dominant firm, absence of a clear regulation (prices are still set by a Governmental body with very obscure criteria), only an embryo of competition for the market[1]. Public subsidies are still widespread, and market orientation is a principle present only on paper.

Other sectors – such as water and energy – seem to be more interesting, as technological progress cannot get rid of regulation altogether, but restructuring is fairly well developed. This is why we concentrate on these cases, where the concern for the consumers is still strong, but where however the principle that prices should cover costs is well rooted. This quite naturally raises a question of whether consumers suffer for the elimination (or reduction) of public subsidies, or rather benefit from greater efficiency, and of how these possible costs and benefits are spread across the population.

More precisely, we study the distribution of expenditure and shares over total expenditure, conditional on demographic, climate and welfare indicators; we provide evidence on the inadequacy of the thresholds used by the official absolute poverty lines for heating and electricity expenditures; and we discuss the relevance of the standard sustainability thresholds for water expenditure for the Italian case.

First of all, we can see that the average family spends for the different basic utility services 5 to 6% of its total expenditure. This figure varies both with regional income and with climatic conditions. Moreover, while electricity prices for small consumers are uniform nationally, we can document a substantial variability of water and gas prices across Italian regions.

After this analysis of data, we provide evidence on the inadequacy of the thresholds used by the official absolute poverty lines for heating and electricity expenditures; and we discuss the relevance of the standard sustainability thresholds for water expenditure for the Italian case. We propose a definition of a (relative) affordability line, which we differentiate by family size, region and climatic area. More precisely, we study the distribution of expenditure and shares over total expenditure, conditional on demographic, climate and welfare indicators;

We can show that about 15% of Italian families fall below this line. Given a minimum consumption level, defined by the affordability line at the beginning of the period considered, we then investigate how utility poverty evolves over time because of price and income variability. This indicates that over the period 1997-2002 the restructuring of Italian utilities has not damaged consumers, especially in energy sectors. In the water sector the need to fund large investment has made price increases necessary, and this certainly affects consumers' welfare in a non negligible way.

The next section discusses the concepts of poverty which can be used in this analysis. Section 3 describes the development of liberalisation reforms in Italy and the new regulation in water and energy. Section 4 illustrates the data and the methodology of our analysis. Section 5 shows the main results on the distributional effects of utilities restructuring. Section 6 discussing possible extension of the present analysis concludes the paper.

[1] A very similar story could be told about local transport services.

2 Public utilities and poverty

The relevance of public utilities in the consumption basket of households is widely recognised, so that public service obligations are usually imposed on firms operating in these sectors. The attention by the literature on whether people can afford a proper level of basic services and the impact of utility prices on consumers' welfare is thus quite rich. To this end, numerous different approaches may be considered legitimate. In particular, the notion of fuel poverty is often introduced, referring to the problems connected to consumers' ability to afford gas and electricity. Although here we focus on water as well, it may be useful to start our discussion from this notion.

One of the first definitions of fuel poverty is given by Lewis (1982) as *"the inability to afford adequate warmth in the home"*. Boardman (1991) refined this definition to *"the inability to afford adequate heat because of energy inefficiency in the home"*. Operationally, the British Government assumes that *"a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would require to spend more than 10% of its income on all household fuel use."* (DEFRA, 2001).

There is no doubt that fuel poverty is a manifestation – and indicator – of deprivation and social exclusion. But its role in the debate on households' welfare is due to the fact that fuel poverty is originated by an interaction between low income, relatively high fuel consumption (possibly due to climatic reasons) and poor thermal efficiency in housing. To assess the relative importance of these factors, let consider the evidence provided by Healy (2001), who exploits the 1996 edition of the European Community Household Panel to compare subjective and objective indicators of fuel poverty across European countries.

Table 2-1: Subjective and objective indicators of fuel poverty status.

	% of Households Declaring				
	Inability to Afford Adequate Heat in the Home	Inability to Pay Utility Bills	Lack of Adequate Heating Facilities	Damp Walls &/or Floors	Rotten Window Frames
D	1.4	1.5	3.7	6.4	4.2
DK	2.8	2.4	4.1	6.5	5.8
NL	2	1.2	6.9	9.8	9.8
B	2.8	6.9	8.1	12.3	8.7
L	3.5	2.8	5.6	7.2	4.4
F	7	7.3	10.3	14.6	9.7
UK	5.3	1	9.1	12.2	11.6
IRL	6.5	6.1	7.6	8.9	7
I	20.6	4.5	16.1	4.8	5.2
EL	46.8	1.4	30.8	18.5	8.5
E	53.3	3.7	1.3	20.4	6.4
P	73.8	1.7	40.1	33.5	25
A	2.2	1.1	6.7	8.3	4.4
FIN	4.7	11.4	3	3.9	2.5
EU-14	16.6	3.8	11	12	8.1

Source: Healy, 2001.

Table 2-1 show that 16.6% of European households declare not to be able to afford adequate heat in the home (20.6% of Italian households), with the warmer southern countries recording the highest share of households with self-reported heating problems. The fraction of households facing problems with utility bills is only 3.8% (4.5% in Italy), but 11% of the households lack adequate heating facilities (16.1% in Italy). That means, for instance, that income benefits, "fuel stamps" or subsidized tariffs alone might be not effective in reducing fuel poverty. According to Healy (2001) *"fuel poverty requires additional help to be eradicated; the most effective way to do this is to invest in the capital stock (the home itself, its heating system and energy-using equipment)."* But *"low-income homes realise the benefits of such programmes as increased household warmth, while better-off homes take the benefits as fuel savings, leading to the conclusion that many low-income households exhibit fuel-poor characteristics."*

Studying how fuel poverty affects different households - for demographic and housing characteristics - is crucial to choose the best policy mix to fight against social exclusion. Tariff structures are among the instruments available to the policy maker, in particular when, as in the case of Italy, the liberalization of the utilities market is at its beginning.

In fact, fuel poverty is recognized as an issue by some European governments (Great Britain and Ireland among others), and official statistics are available for those countries (see DEFRA, 2001 for the UK). At the best of our knowledge, there is no official definition of fuel poverty in Italy. Official statistics on poverty rely on total expenditure: a household is defined as relatively poor if its total expenditure falls below the relative poverty line, and the absolutely poor families are those whose consumption falls below the absolute poverty line. The two concepts of poverty are very different: the relative poverty line for a couple is given by the average *per capita* expenditure; the absolute poverty line has been estimated by the Italian Poverty Commission in 1997 and it is based on a basket of goods and services considered to be essential for a decent standard of living (ISTAT 2004). Both lines take into account differences in family size, and the absolute poverty line is adjusted every year by simply using the Consumer Price Index. Both have advantages and pitfalls: the relative poverty line can be easily identified and estimated, but it is not particularly useful to set policy targets (when the expenditure distribution moves because of a recession, the poverty line automatically moves downward, and the number of relatively poor might be almost unaffected by the recession event); the absolute poverty line is useful for policy purposes, it refers to a clear cut idea (the basket of essential goods), but it is difficult to identify and to estimate in practice.

The reference basket used to define the absolute poverty line includes heating, electricity, and water. Therefore, this basket explicitly sets a minimum expenditure in utilities, which is deemed to be necessary for a decent standard of living. This is what the British government does by estimating the cost *"to maintain a satisfactory heating regime"*, which in turn is set by the World Health Organization, and by using it in its definition of fuel poverty[2].

[2] The Italian Poverty Commission (Istat, 2004) uses a similar standard approach for food.

In Italy there is no official estimate of this minimum amount[3], so the Italian Poverty Commission fixed the minimum expenditure for heating and electricity to be equal to the first quartile of the national distribution of the expenditure for natural gas and electricity, conditional on household size. That is, the Commission resorted to what may indeed be considered as a *minimum socially acceptable expenditure* needed for not being poor; this is not related to a minimum standard of living defined by medical and/or physical parameters[4], so that absolute and relative poverty measures are mixed.

Water is another necessary good whose consumption may cause social concern. The OECD (2003) shows (see Table 2-2) that water affordability can be an issue also in major industrialized countries. Countries in which households spend a higher share of their income for water, are not necessary those in which water affordability is an issue: in the Netherlands 1.42% of Dutch households income was spent for water in 1999, v. 0.85% for England and Wales in the same period. The Organization arguments that *"three main factors probably affect perception that affordability is, or is not, a significant issue. First, is the extent of relative poverty (...). Second, if good water resources are plentiful and household water services relatively cheap (...). Third, past neglect of water service infrastructure may lead to high water charges to recoup rehabilitation costs, putting a significant burden on a particular generation ...."*

Italy's poverty indicators displayed relatively worse figures (i.e. its head-count ratios and income gap ratio were above the average of the countries considered), but this was compensated by the fact that in the mid-1990s water was cheap and investment in water services infrastructure had been negligible for a long time.

Table 2-2: Government perception of affordability problems and measures/structures in place.

	Affordability problems	No affordability problems
Affordability measures/structures directly applied to water bills in place	Belgium, UK, France, Mexico, Portugal, Spain, Turkey	Australia, Ireland, Japan, Italy, US
No such affordability measures/structures directly applied to water bills in place		Austria, Denmark, Germany, Norway, Sweden, Canada, Finland, Iceland, Netherlands, Switzerland

Source: OECD (2003)

As in the case of fuels, it is difficult to define a suitable indicator of affordability. One option is to look at the number of households that spend more than 3% of their budget for water bills. This threshold was first introduced in 1999 by the UK

[3] Government, workers and consumers unions use in their simulations the "standard" annual consumption for natural gas for Northern (1400 mc) and Southern (900 mc) households. These figures have to do with the average consumption, not to the minimum necessary consumption.

[4] Moreover, as we will stress later, the Italian definition contains a serious limitation in this measure, which does not consider – for instance – the climatic conditions of each area of the country.

government *"for illustrative purposes"*, and it is about the 1999/00 average ratio of the expenditure on water charges over income of the households in the three lowest-income decile groups. The US Environmental Protection Agency defines the affordability threshold as the 2.5% of the median household income. The 2.5% limit was obtained by comparing the cost of household public water supply with other household expenditure and that of alternative risk-averting behaviour (e.g. treatment at household level, home delivery of bottled water). In both cases the thresholds do not refer to any minimum quantity of water considered to be necessary for avoiding health risks and social exclusion. In Italy there are few studies on households' water expenditure (see Barone, 2004, and Peruzzi, 2003) and no official definition of affordability. Water charges are not explicitly included in the absolute poverty line, and few statistics are available on the quantities consumed by the households (see ISTAT , 2003).

In the following, we suggest a unified approach to study deprivation phenomena related to the consumption of necessary utilities such as water, electricity and heating. The basic idea is that if a household needs to spend more than a given share of its budget to afford what is considered to be a minimum expenditure for not being deprived with respect to that utility, then that household has an affordability problem and it can be considered in water, electricity or fuel poverty.
In order to implement this idea, we first need to define the *minimum expenditures*. We have two possibilities:

1. we can adopt the absolute poverty framework and refer to medical and/or physical parameters to define the minimum quantity q_h^A for the household type *h* (where the types *h* differ at least for family size).
2. we can choose to work in a relative poverty framework and define the minimum quantity q_h^S as the minimum acceptable consumption for not being socially excluded.

The first option is the one adopted in the British context for the definition of fuel poverty, and it is difficult to apply it in Italy as there are no households surveys useful to estimate q_h^A. Nevertheless *"educated guesses"* for q_h^A may be useful as well. The second one is implicitly adopted by the Italian Poverty Commission for electricity and heating, and we shall discuss in Section 5 to what extent their estimates can be considered satisfactory for our purposes.

Once the minimum expenditure is fixed, the threshold for the budget share needs to be chosen, that is, we have to decide the maximum budget share (w_h) above which the household is considered to have an affordability problem with respect to that specific utility. If E_{ih} denotes the total expenditure, the household has and affordability problem if

$$\frac{p\left(q_h^A\right)q_h^A}{E_{ih}} > w_h$$

where $p\left(q_h^A\right)$ is the price paid for the quantity q_h^A for households of type *h*. The price depends on quantity and household type because prices are non linear and they vary across areas. In practice, we choose w_h to be equal to the average of the ratio on the left hand side for low income households, which in turn are defined as those whose equivalent total expenditure is below the 25th percentile.

Notice that we do not consider whether the *actual* consumption of the household is affordable, but whether the minimum quantity q_h^A or q_h^S – which can be larger or smaller that the quantity actually consumed by the household i of type h (q_{ih}) – can be purchased without budget problems. This makes our results about water affordability potentially different from those based on the study of the inequality

$$\frac{p(q_{ih})q_{ih}}{E_{ih}} > 3\%$$

considered so far, for instance, by OECD (2003).

In Section 5 we provide our estimates of the minimum acceptable expenditure for not being socially excluded in Italy and of the budget share threshold for affordability of the water and energy tariffs in 2002.

3 Utilities restructuring in Italy

The market design in the European utility sectors has recently evolved, leaving more space to competition. This is supposed to benefit consumers by enhancing productive efficiency and technological innovation – and in turn inducing lower prices - and by increasing the variety and quality of products/services. Within this set-up, the privatisation and liberalisation of utility sectors have started in Italy with some caution, given that Italy has been traditionally attached to public ownership of public utilities and direct control of services.

Quite naturally, the starting conditions and technological constraints vary greatly from sector to sector, and analogously the degree of competition which could be implemented varies across sectors. Markets are difficult to open up when there are natural monopolies where the capacity of the infrastructural elements is limited or when the service has been heavily subsidised in the past. If economies of scale or of scope between the vertical stages are relevant, the greater efficiency of vertical integration may outweigh the benefit from "unbundling" – which is often seen as a pre-condition of competition[5].

This quite naturally raises a question of whether consumers suffer for the elimination (or reduction) of public subsidies, or rather benefit from greater efficiency, and of how these possible costs and benefits are spread across the population. To address this question, in what follows we briefly present the features of the reforms specifically belonging to the Italian water, electricity and gas sectors, mainly focussing on how reforms have affected price changes.

3.1 Water

The water service has always been considered a local service, and only since 1990 (law 142/90) may the service be provided by limited companies. In such a fragmented sector data have always been little more than approximations, but it is reckoned that in 1996 about 8,100 independent subjects were managing at least one part of the water service in the country[6]. About 50% of the population was getting water services directly

[5] It is worthwhile to stress here that network utility such as electricity, water and gas are characterised by natural monopoly which is essential for the delivery of the service to final consumers.

[6] Bardelli and Muraro (2003).

by municipal offices. Direct provision by municipalities was particularly common in sewage, in the South and in small centres.

Prices were determined locally, with little national co-ordination or compelling national guidelines. Traditionally, water prices have been extremely low, with a strong tendency to consider water as a necessary service that should have been provided independently of market logic and even disregarding the financial equilibrium of service providers, who have been heavily subsidised. In this set-up, the linkage between the "regulator" (the local authority) the supplier (many times, the local authority itself) has traditionally been extremely strong.

The Italian water and wastewater services system was profoundly reformed by Law 36/1994 (the Galli Law) to give water companies better incentives for efficient production and pricing. This law intervened on an extremely fragmented sector, where thousands of small operators served extremely small portions of the country. Very often, in the same area different operators would intervene in different stages of the water cycle (from abduction to purification and disposal). In this perspective, the key elements of the reforming law are as follows:

- the functional integration of the various activities of the water cycle within a water system zone ("integrated water service": all those services dealing with supplying water - fetching, transporting and distributing - for domestic use and with the collection and treatment of wastewater);
- the territorial integration, through the definition of Optimal Territorial Basins (ATO - Ambiti territoriali ottimali - i.e. users' basins of relevant size aiming to the exploitation of economies of scale and scope) where a single operator should manage the whole integrated water service under the supervision of a Basin Authority (AATO), which acts as local regulator;
- the sharp distinction between the planning and control function and the management functions in the perspective to promote the entry of private operators in providing the service (aiming at reaching competition for the market);
- the creation of a central supervising body (Comitato per la vigilanza sull'uso delle risorse idriche), which operates within the Ministry of the Environment, and which only exerts the surveillance over the sector. In particular, notice that prices are not determined by this body, but have to follow a general rule dictated by the law, and implemented by each AATO.

This national act, to be completed by regional legislation, was slowly implemented until the late 2000; then, it has recorded a significant acceleration mainly determined by other legislative actions and judicial decisions[7].

By June 2003, out of 91 ATO envisaged by the law of 1994, 84, with a population of 54 million inhabitants – 94% of the total Italian population – have an operative ATO Authority.

Each ATO Authority, which represents the interest of the municipalities and provinces within the basin, has responsibility for: technical and economic analysis of the local water and wastewater systems; selecting the relevant operator in the ATO (concessionaire); long-term planning for the long term sector within the ATO, by means of a Master Plan (Piano d'Ambito) including the investment programme to be agreed with the concessionaire; supervising the concessionaire's performance vis-à-vis the

[7] For a discussion see OECD (2001), p.119-121, downloadable from http://www.oecd.org/dataoecd/44/1/33691325.pdf

Master Plan; ensuring the operation of the tariff system in accordance with the provisions of the Galli Law.

The Master Plan is discussed and agreed by the ATO authority and the concessionaire and plays a fundamental role in the organization and management of the integrated water system: starting from the analysis of the existing local infrastructure and production capacity, the Plan sets out service standards, investment needed to match those standards, the concessionaire's operating cost in managing the integrated water services, as well as the ongoing evolution of the ATO's tariffs.

The regulation of water tariff which belongs to the Law 36/1994 allows the concessionaire to generate a level of annual revenues that grants an adequate coverage of cost of capital and return on investments and is dynamically adjusted with a price-cap mechanism that limits annual increases in the ATO average tariff. In particular, the tariff scheme incorporates operating costs (net of a 0.5-2% annual efficiency gain), depreciation of assets and investments at the maximum rates by law, and 7% return on investments. The tariff adopted by the concessionaire has to be approved by the ATO Authority, which makes a decision on the basis of a benchmarking analysis of the variable costs of the company[8].

The new tariff applies the "full cost recovery principle ", i.e the consumer's tariff will reflect the full cost of service. This principle, along with the high investment planned for the whole integrated water service[9], will determine an increase in tariffs, which could be relevant for consumers. Given the greater market orientation of the sector, cross subsidies - which were widespread in past management by municipalities - can no longer be allowed: this, in turn, partially may compensate consumers by saving in terms of municipal costs (i.e.: less local taxes or increased supply of other public utility services), but calls for investigation on distributive effects.

3.2 Energy

3.2.1 Natural gas

The main feature of the Italian market for natural gas is the presence of a strong dominant firm (Eni). This situation was only partially due to legislative decisions, and in principle – at least since 1996 – some competition was allowed even upstream. Prices were determined by a governmental body (CIPE), until the independent regulator in charge of both electricity and gas (AEEG) was created in 1995.

The Italian liberalisation plan (Letta Decree, law 164/00, following the EU Directive 98/30/CE) was approved in August 2000. At that moment, the gas market was still dominated by Eni: 90% of national production and of imports; almost 100% of long distance transport capacity and storage facilities, 73% of primary distribution to large industrial clients and 67% of that to thermoelectric generators, 33% of secondary distribution. Despite being in the stock market since 1995, Eni is still controlled by the

[8] The typical tariff used by the Italian water companies is a two part tariff, with a fix and a variable component. The benchmark analysis – which is carried out following the so called "Metodo Normalizzato" - determines reference for firm's performance only with respect to the variable part of the tariff.

[9] A recent forecast of investments by the Supervising Committee on the Use of Water Resources (2004, p.2) for the integrated system for water service is about 51 billion euro, where about 28 billion euro are in the sewage and treatment segments (Co.Vi.Ri 2004, Rapporto Annuale sui Piani d'Ambito).

Treasury with more than 30% of the shares. The main elements of the Letta Decree are the following.

a) The unbundling principle has been implemented only through legal separation of the different activities within the Eni group. This has left unchallenged the dominance of Eni into the Italian market.
b) Third Party Access is introduced with regulated tariffs defined by the regulator; transport capacity requests by operators burdened with take-or-pay obligations must be given precedence in defining the access order.
c) Antitrust ceilings are introduced in the interim period of liberalisation: no operator can enter more than 75% of gas into the national transport network; this threshold will be reduced by 2% each year until 2010, with a final market share of 61%. Moreover, from January 2003 to December 2010 no firm will be permitted to sell more than 50% of gas to final customers.
d) Since January 2003 all customers are eligible, with complete demand opening.
e) The tariffs for franchise customers and for the transport, distribution and storage activities are set by the regulatory authority (Aeeg) according to a non discriminatory and cost reflective standard. The Authority implements its intervention within the general lines of the energy policy designed each year by the government.

Although the Italian plan introduces some measures to reduce the role of the incumbent firm in the liberalised segments through antitrust ceilings, it did not consider the possibility of forcing Eni to divest part of its t.o.p. long term contracts.

In gas, the transition towards a competitive environment is extremely slow. This is due to the existence of long term contracts which allow the dominant incumbent firm to still control the market. The partial unbundling of the Eni group, that will operate with different companies in all the segments of the industry, maintaining an extremely high market share all over the market, represents the most pervasive problem in the liberalisation process. Moreover, given the almost total dependence of Italy on imported gas, the linkage between energy policy and foreign policy makes the introduction of competition very slow.

The gas distribution system is expanding slowly, but here we observe an opposite phenomenon to the one we observe upstream. While upstream we have a gradual introduction of competition, and hence a slow trend towards fragmentation of supply, in distribution we have an increased consolidation, carried out through acquisitions of small distributors and the gradual disappearance of cases where the local authority is the direct provider of the service.

In 1997, Italy was served by 732 different distributors, 80.6% of them present only in one province (Italy is divided in 120 provinces), while only 4 of them were serving more than 10 provinces; in 2003, “only” 453 distributors operate, 74% of them operating only in one province. Given the expansion of the service in this period, total population in locations were gas is available has increased from 48,2 million to 52 million. Therefore, while in 1997 the average gas distributor served a population of 65.900 people, in 2003 it serves 114.800 people. It is also interesting to notice, however, that while the average size increases considerably, significant niches where the service is provided directly by the municipality still remain (about 60 cases around Italy, for a total population of about 450.000 units).

As for the public-private balance, it is estimated that entities in public hands serve an increasing area of the country. While in 1997 private firms were serving about 64% of the population, in 2003 this percentage has decreased to about 58%; notice that this remains true, despite that in the "private" sector we consider Italgas, which is part of the Eni group, and EnelGas, both controlled by the Treasury. The apparent expansion of the public sector is a combination of two phenomena; on the one hand, the expansion and the new investments have been carried out mainly by local public utilities, and on the other one local public utilities have acquired some very small local private firms (Ref, 2004).

Although the timetable of demand opening is quite quick, only in late 2004 has some competition effectively started in some areas of Italy for small customers. The implementation of the principle of liberalisation at the local level, however, requires one to solve complex interactions with the reform of local public services that is still not completed. Therefore, the Authority still maintains the control of prices for small customers.

Prices are regulated with a price cap (RPI-x) since 2001, and the x factor for the first regulatory period has been set equal to 3%. The price formula contains elements of price increase which aim to compensate firms for "unpredictable" events, to reward them for their activities of demand control and for quality improvements. There is no unique national tariff (unlike in electricity).

3.2.2 Electricity

Until 1999 the Italian electricity market was characterised by the presence of a vertically integrated dominant firm, Enel, owner of 80% of generating capacity, of the transmission network, of most of distribution (about 93% of the final market was served under regulated prices by Enel). In the downstream segment some small, local public utilities were present, especially in large cities in the Centre – North of the country (e.g., Milan, Turin, Rome, Brescia). All customers before 1999 were forced to buy electricity from their local distributor.

Analogously to gas, the sector was regulated directly by the Ministry until 1995, when an independent energy regulatory authority (Aeeg) was created, with the power to determine prices on the basis of a RPI-x scheme.

The implementation of the EC Directive on electricity was given by the Bersani Decree (Law 79/99) in February 1999. The privatisation of Enel started in November 1999, but the government still controls more than 30% of the company.

The Law 79/99 envisaged a strong vertical separation between the transmission network – which remained under the management of a public system operator called Grnt – and the rest of the system[10]. Access to the transmission network is open to third parties on the basis of conditions set by the regulatory Authority.

[10] This aspect is unfortunately being changed in 2004. The *management and full control* of the transmission network is in the hands of an independent system operator (the Gestore della rete di trasmissione nazionale, Grtn) which remains State owned. However, the *ownership* of the network initially remained with Enel (a company called Terna). The unification of the network owner and the system operator is under way, and should be completed in October 2005. A privatisation of the unified TSO is envisaged, but the details of the operation are still undecided. In order to preserve the neutrality of the TSO, some limit (5%) to the participation of electricity firms to the control of the TSO will be introduced.

The wholesale market was supposed to be organised as a Pool market, along the initial British example, run by a market operator, Gme, owned by Grtn. Bilateral physical contracts were supposed to be exceptions, requiring a permission by the Authority. The market was supposed to start operating at the beginning of 2001; the Pool has however started its operations only in April 2004. A major reform of the initial framework for wholesale transactions has been introduced in 2003, whereby bilateral contracts have become the normal way of exchanging electricity in Italy, so that the electricity exchange will remain totally marginal (not more than 10% of transactions are expected to take place through this market)[11].

In order to reduce Enel's market power upstream, no firm is allowed to own more than 50% of total installed power or to sell more than 50% of total energy, including imports. To this end, Enel formed three companies which have been sold in public auctions. The buyers are consortia of smaller Italian independent producers or public utilities, with the participation of some large foreign producers such as Endesa (Spain), Edf (France), Tractebel (Belgium).

Prices are free in the wholesale segment and in the sale to "eligible" customers and are regulated on the basis of an RPI-x system elsewhere. Distributors selling energy to franchise (non eligible) customers must buy the energy for these customers through a Single Buyer, which is also part of the State owned Grtn group.

The thresholds for eligibility were established in order to accelerate the process of market opening relative to the dates set in the Directive. Since May 2003, all clients consuming at least 0.1 GWh per year are eligible. Eligible clients represent at the moment more than 70% of total energy sold in the country. This market increases quite rapidly, competition is considerable, with Enel losing quite rapidly its traditional dominant position, and substantial entry is taking place. Although no other large operator is actually emerging, market fragmentation is increasing.

Italy has always maintained the idea that the regulated price should be the same throughout the country (single tariff). Prices to non eligible customers are regulated by the energy Authority, which began its operation in 1996. Until 1999, the previous price system has been simply "cleaned", eliminating some subsidies and clarifying the complex structure of charges and surcharges. Since January 2000, price regulation follows a RPI-x system. The x factor has been set equal to 4% in the first regulatory period (2000-2003)[12]. In the second period (2004-2007) the x factor is no longer referred directly to final prices. Its value is set at 3,5% for the price of distribution and 2,5% for transmission (and it only refers to the part of the price which is related to

[11] No other Western country has taken this long to actually implement a system of this type. Two main reasons may probably justify this delay. The first one is that the reform has left Enel with about 50% of production, a dominant position which was bound to undermine the ability of competition to be effective. The second reason is probably that Italy depends largely (16% of total consumption) on imported energy, coming from France, which is substantially cheaper. The initial project envisaged that this energy should have been exchanged in the wholesale market, so that all customers would have ended up paying the same price. This possibility was seen with hostility by large industrial customers, which historically have privileged access to imported energy. The current system confirms this privilege, and the opposition of large industries has thus achieved its goal

[12] In September 2002 the Italian Government decreed to block for 6 months the price dynamics decided by the Authority, also deciding that from that moment onwards – against what was decided in 1995 – the Government had the right to set principles that the Authority had to follow in deciding future price adjustments.

operational costs, and not to the total price); the dynamics of final prices will vary accordingly, depending on how wholesale prices and other costs evolve.

3.3 Utility prices – regional comparisons

Water prices across Italy display a substantial variability, as shown by the following Figure 1 where are presented water expenditures for a standard consumption of 200 m^3/year in the Italian largest seven towns: in 2004, the water expenditure (Euro/m^3) in Milan is about half of that in Bari and Florence. The water marginal price – the black line in the Figure 3-1 – records among these towns even higher gaps.

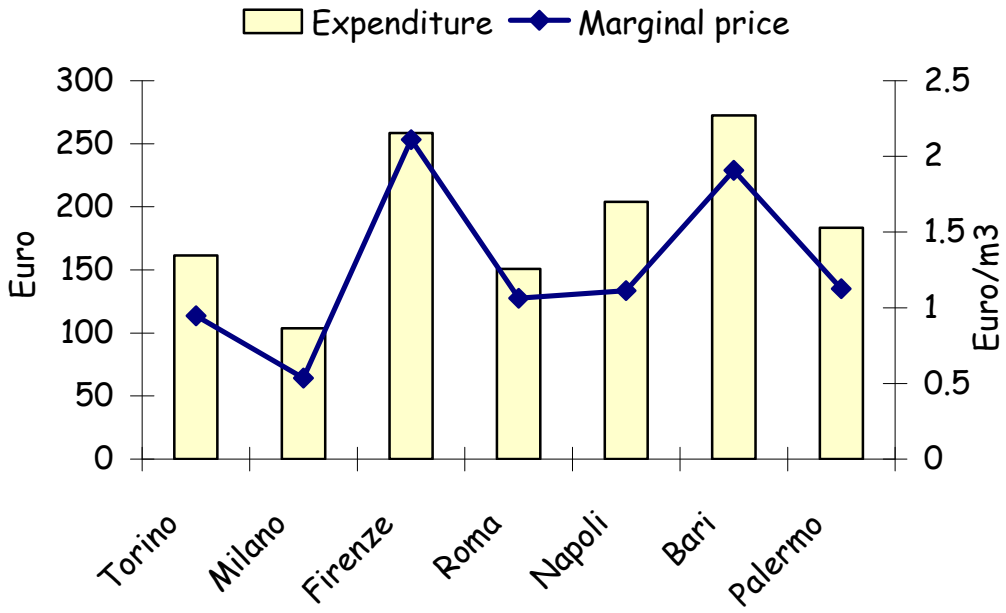

Figure 3-1: Water expenditure and prices (Euro/m^3, consumption of 200 m^3/year, 2004). Source: Data from local water authorities, 2004

These differences in water tariffs become larger when expected price dynamics are considered. As presented in the previous Section 3.1, the Master Plan - which is agreed by the local regulator authority and the water concessionaire – contains the long term planning for tariff, reflecting (in application of the full cost recovery principle) the investments needed to match standards of service. It follows that where large investments are planned, large increase in water tariffs results. As shown in Figure 3-2 in the period between 2004 and 2019 water tariff will record an increase of 65% in Milan, 33% in Florence, 32% in Turin, 21% in Rome.

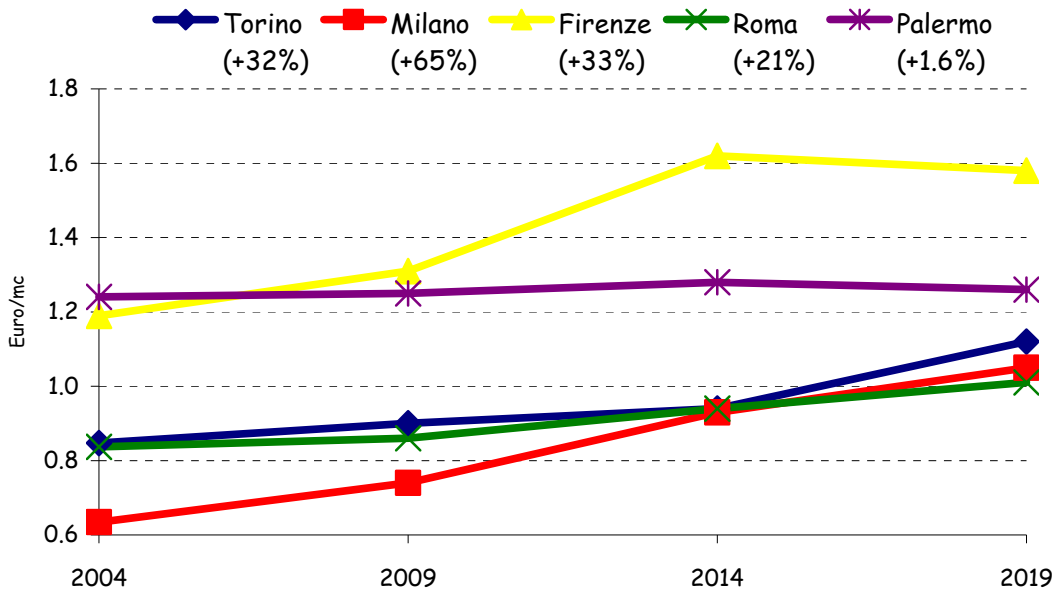

Figure 3-2: Expected price dynamics. Source: Data from local water authorities, 2004

Something similar holds for natural gas. Considering an average consumption of 1400m^3, Figure 3-3 shows that in Palermo the expenditure for natural gas is about 33% larger than that in Napoli. Understanding these differences is puzzling, as the natural gas tariff is composed by a price for gas – which is regulated by the national authority (AEEG), previous Section 3.2.1 - and a tax – which is locally determined. Comparing the local differences in both components, it appears that the tax level seems to act as a buffer in the total tariff level: in Figure 3-3, with the exception of Bari, taxes are lower where the gas price is higher, and viceversa.

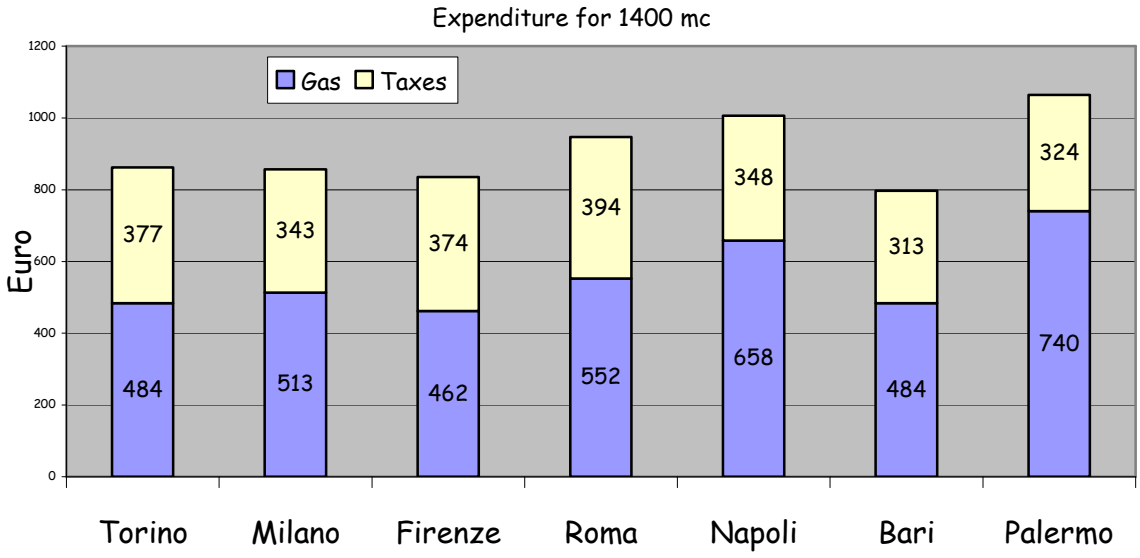

Figure 3-3: Expenditure for gas average consumption (1400 m^3). Source: AEEG, 2004.

Figure 3-4 shows how the relevance of expenditure for actual average consumption becomes lower for towns located in the South of Italy. The black line indicates the actual level of comsumption in the different towns (m3, right hand axis).

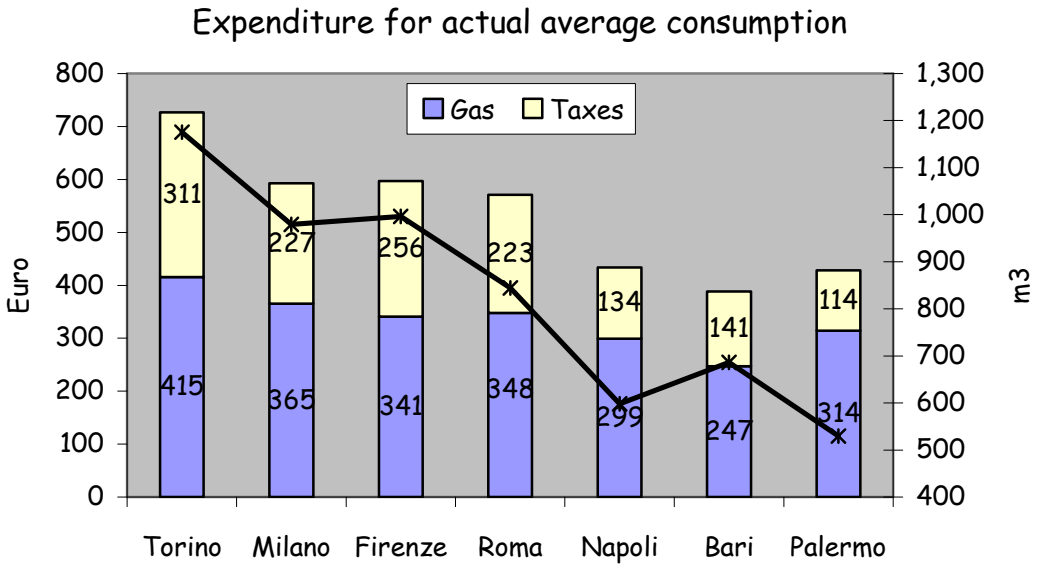

Figure 3-4: Expenditure for actual average consumption levels, 2004. Source: AEEG, 2004.

In electricity, small customers still face a single final price for the whole country, whose dynamics are shown by the following graph.

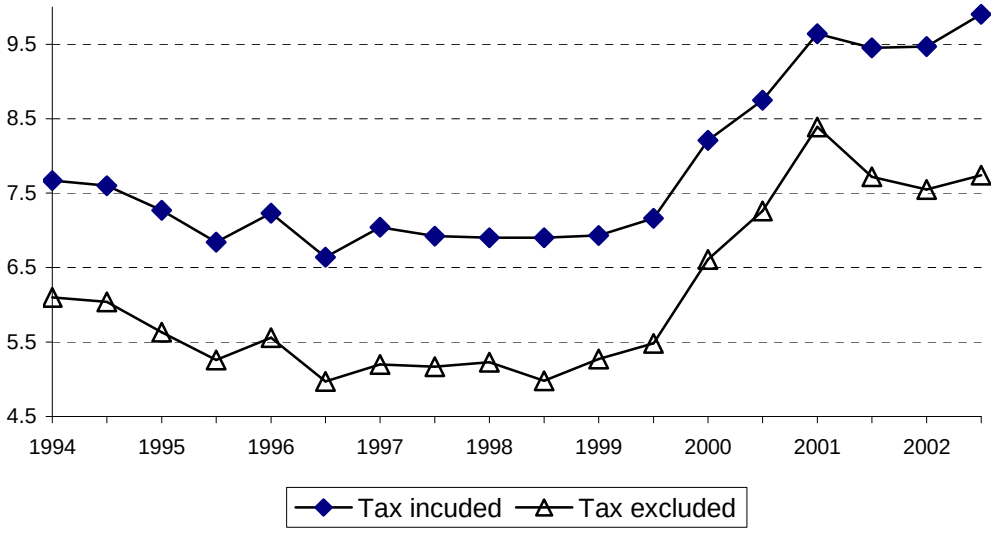

Figura 3-5: Average national price for electricity (Euro/100 kWh) for a consumption of 1200 kWh/year. Source: Eurostat

3.4 The dynamics of utility prices for small customers

How has this system performed? In different sectors we could tell different stories, of course. Water has the need to cover large investments, whose cost must be compensated by price increases. Energy sectors could be characterised by falling prices because of greater efficiency, but they are obviously affected by international fuel prices and by the limitations to competition in the national upstream segments.

The final outcomes are depicted in Figure 3-6, which documents the evolution of the relevant monthly price indexes for final consumers from January 1997 to September 2003.

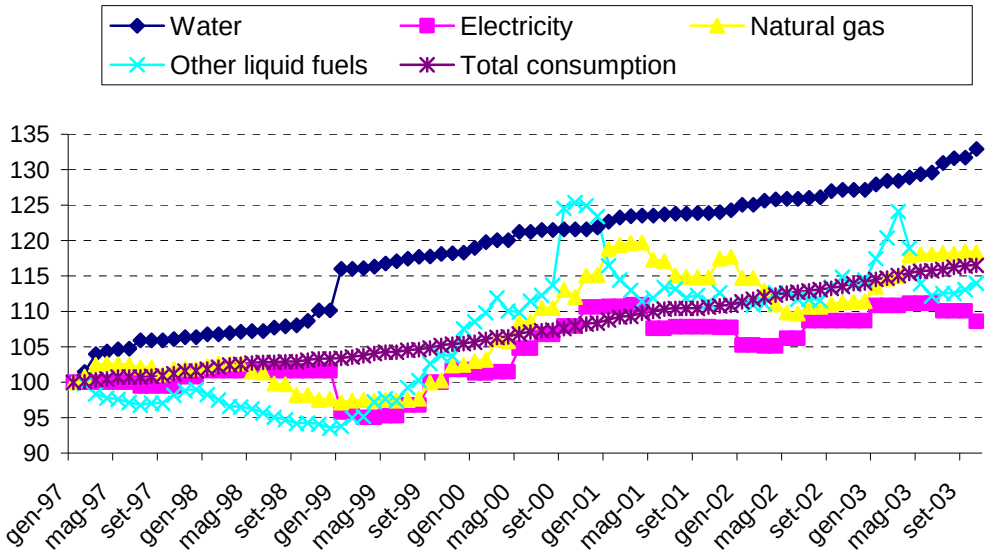

Figure 3-6: Price dynamics for basic utilities and for total household consumption. Source: Istat

According to the national price index for water expenditure, water charges increased by 32.9% during the period, while the total expenditure index growth was only 16.5%. The difference is almost completely due to two episodes: the first occurred in February and March 1997 with an increase of water prices of 1.4% and 2.5% over the previous month; the second happened in January 1999, with a sudden monthly increase of 5.3%[13]. Between these periods water prices increased at the same rate as the general total expenditure index.

Electricity prices are revised bimonthly by the national Authority (AEEG), and did not show any variation from February to June 1997, from February to December 1998, and from August to December 2002. The electricity index is also characterised by a sudden drop of 5.7% in January 1999 due to the Authority's decision 161/98 which has reformed electricity prices, eliminating an extra fuel charge (component A1 of the final price). Since 1999 prices move following an RPI-x scheme set by the energy authority.

[13] This was due to the addition of VAT to the part of water price which covered sewage costs.

We can easily see that energy prices for households have not increased much in real terms. More precisely, while real electricity prices decreased over this period, gas prices have moved on average in line with inflation. *Prima facie*, it would seem that the new regulation of energy sectors has produced reasonable results for final consumers, while the new regime on water prices – entailing a drastic reduction in subsidies and the need to strengthen investments – required a clear price increase.

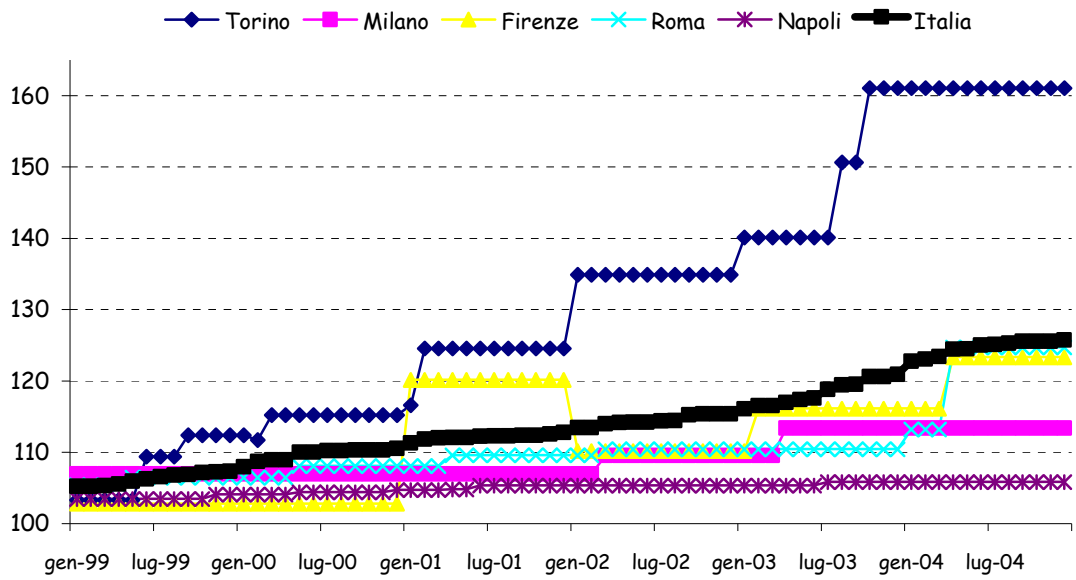

Figure 3-7: Local and national household CPI for water. Source: ISTAT

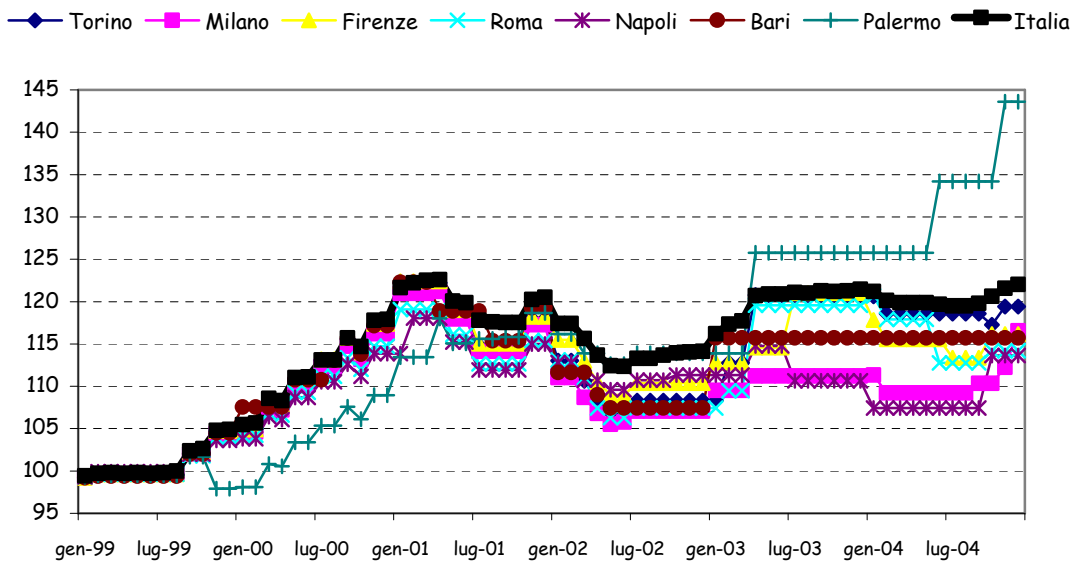

Figure 3-8: Local and national household CPI for natural gas for heating. Source: ISTAT

3.5 Comparison between final prices and production prices

In order to better understand the effectiveness of restructuring of utility sectors, it may be useful to compare final prices with indices of production prices, whenever possible, namely electricity and gas.

Figure 3-9 shows the trend for natural gas household consumer price index in Italy and the gas price in the European primary market: the household Italian price shows much less variability than the price in the European primary market. The household Italian price increases substantially from 1999 to 2001, and this corresponds to a steep increase in the international gas price and to the beginning of the Italian liberalization plan. After 2002, the Italian natural gas price shows a similar trend to that recorded for the European primary natural gas market.

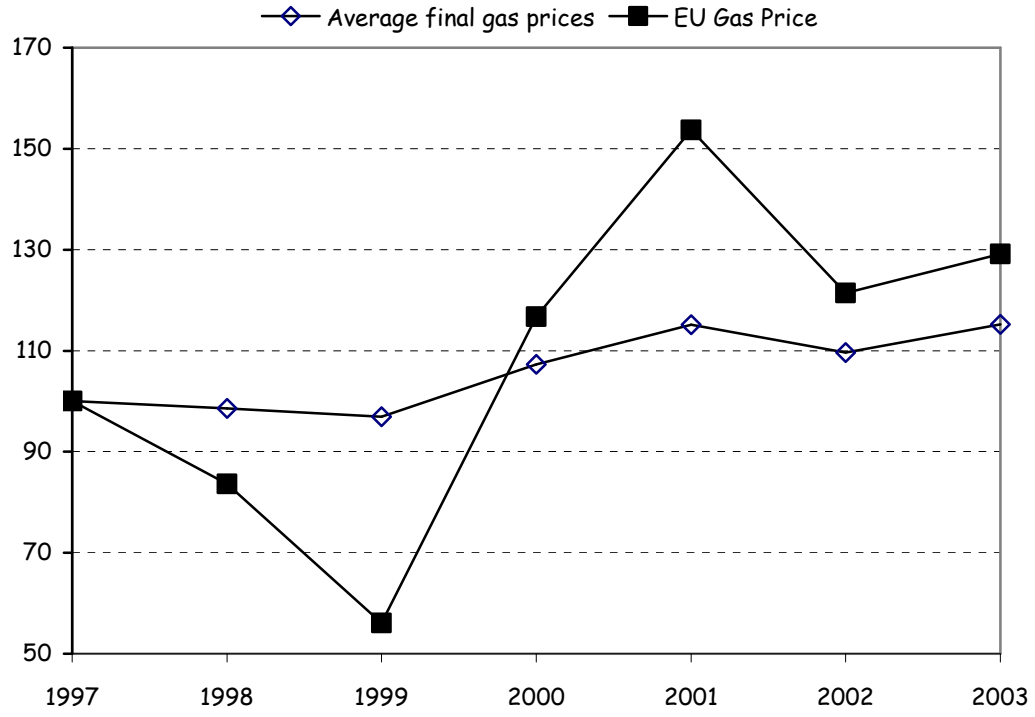

Figure 3-9: Natural gas household consumer prices and European primary natural gas markets (1997=100). Sources: ISTAT and Eurostat

In Figure 3-10 the Italian household consumer price for electricity is graphed along with the production cost index (Ct) for the Italian thermo-electric plants. Here, again, consumer prices do not seem to absorb the changes in electricity cost of production, protecting the consumers from increases in primary input prices.

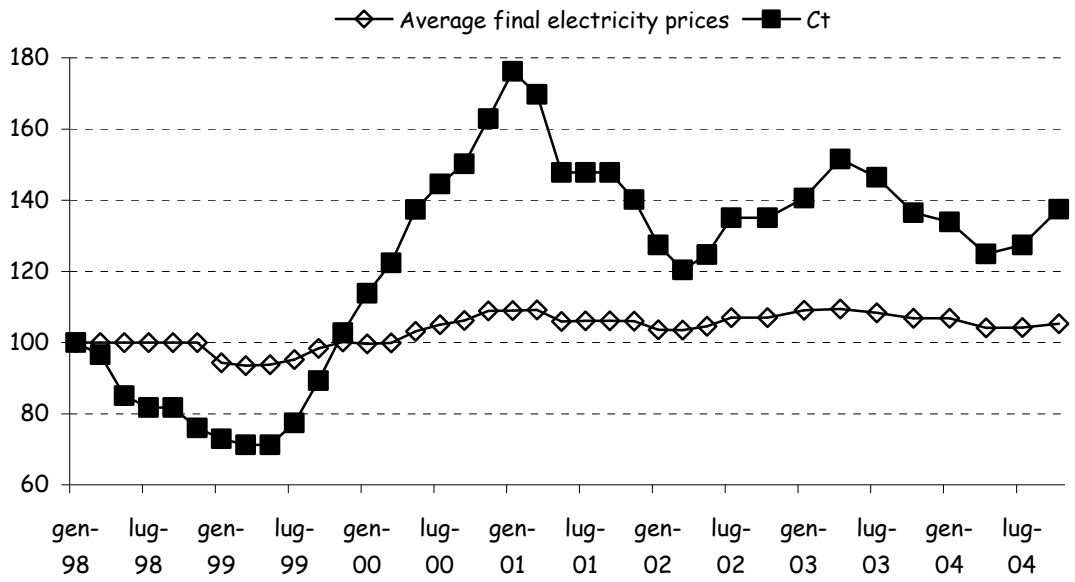

Figure 3-10: Electricity household consumer prices and electricity cost of production using fossil fuels (1998=100). Sources: ISTAT and AEEG

4 The data

Our main data sources are the ISTAT Surveys on Family Budgets (SFB) from 1997 to 2002. These surveys (which correspond to the British FES and the CEX in the US, with independent samples of about 20,000 households per year, representative of the Italian population) provide detailed information on expenditure and demographics, some information on stock of durables and housing conditions and almost unreliable information on income. The 2002 wave also contains data about heating efficiency and perceived sustainability of expenditure for utilities. All data are collected through a face to face interview (plus a weekly diary) during which the households are asked if the house they live in has potable water, electricity and heating (if yes, the type of technology and fuel are asked). Households should provide information about the amount of the latest bill for electricity and natural gas, and on the expenditure during the three months before the interview for water, other fuels (LPG, kerosene, diesel oil, coal and wood) and centralized heating. Data on ordinary and extraordinary maintenance works are collected for the three months prior the interview. Information on main and secondary home of residence are clearly separable.

The ISTAT data allow us to assign (almost) each household to its region of residence. We cannot identify more precisely the area the household lives in. This is a limitation of our data, because more detailed information on the place of residence would allow us to better understand the climate the household has to cope with and the infrastructure endowment it can exploit: within the same region, municipalities on the sea costs have a different climate than municipalities on the mountains (think for instance to the southern regions of Calabria and Basilicata); and the natural gas network is much less diffused in the mountain areas.

Moreover, unfortunately, ISTAT does not provide official regional price indexes; therefore, although we are aware that there is a not negligible regional variability for water and energy prices, at this stage of the work we rely on the national price indexes to compare expenditure amounts of different years.

Given that fuel and water consumption are strongly correlated with climate conditions, we present many of the statistics conditional on climate regions. We identify four different regions according to the estimated *Degrees-days* index. This is defined by law (D.P.R. 26 agosto 1993, n. 412) as the sum over the conventional period the heating is on of the positive differences between 20 C^o and the external temperature, that is $\sum_t (20 - T_t) \times 1(20 > T_t)$ where T_t is the average external temperature for day t. ENEA (National Institute for Alternative Energy) provides this figure at municipality level and it is the official index the authorities look at to define the thermal year, i.e. in practice when households are allowed to switch their heating on and are supposed to switch it off. We compute a regional index as weighted average of municipality indexes, with weights given by municipality population. We therefore group the 20 administrative regions in four different classes:

1. warm regions, with average degrees-days index not greater than 1300 (Campania, Sicily and Sardinia, 19.2% of Italian households)
2. tepid regions, with average degrees-days index between 1300 and 1800 (Liguria, Lazio, Puglia, Calabria, 21.6% of Italian households)
3. cool regions, with average degrees-days index between 1800 and 2300 (Tuscany, Umbria, Marche, Abruzzi, Molise and Basilicata, 12.9% of Italian households)
4. cold regions, with average degrees-days index above 2300 (Piedmont, Valle d'Aosta, Lombardia, Trentino Alto Adige, Veneto, Friuli Venezia Giulia and Emilia Romagna, 46.4% of Italian households)

Notice that there is a northern region classified as "tepid" (Liguria) and southern regions (Molise, Abruzzi and Basilicata) classified as "cool" (Campania, a neighbouring region of the previous ones, is instead classified as warm). This stresses how by using the region as unit of analysis we are in fact aggregating relatively warmer and colder areas, but this problem is inevitable, given the structure of ISTAT data, which are never provided at a less-than-regional basis.

The choice of the heating technology and in general the consumption of energy and water are strictly related to the kind and quality of the utility networks the households can rely on. In order to describe the infrastructural endowments of the regions we use a set of indicators provided by Ministry of Economy and Finance, Department for Development Policies (mainly estimated using the ISTAT Multiscope household surveys), aggregated using population weights.

5 The results

As fuel poverty is an interaction between low income, relatively high fuel consumption and poor capital stock (thermal inefficient housing and energy-using equipments) we start our analysis of the households' welfare by providing a picture of the housing conditions of Italian households. In Table 5-1 we pool together all the waves of the SFB from 1997 to 2002 (changes over time are negligible if not otherwise stated). In the first panel we show that the infrastructural endowments of the four areas are quite heterogeneous, with the households in the cold, northern regions that can enjoy

better natural gas, electricity and water networks. The housing stock has substantially different characteristics across areas: home ownership is more frequent in the northern regions (which might cause more extraordinary maintenance works and better walls, floors and frames in the same area); in the warmer regions single family houses are more diffused, overcrowding[14] is much more likely than in the rest of Italy, 1.8% of dwellings do not have indoor showers, 2.7% do not have potable water and 27.8% do not have any heating system. Climate differences can help explain part of this heterogeneity, which is also due to differences in the infrastructural endowments. But still, we can interpret these figures as evidence that the housing stocks of warmer and tepid regions are poorer than those of the cool and cold regions. That means, that we can probably expect to have more energy efficient housing stocks in the cool and cold regions, than in the rest of Italy.

Table 5-1: Infrastructural indicators and housing conditions. Averages for the 1997-2002 period.

	Warm	Tepid	Cool	Cold	*Italy*
Infrastructural indicators:					
% population connected to the natural gas network (2002)	65.4	83.7	93.9	96.8	*86.6*
Average number of interruptions in power provision	6.1	5.4	4.0	2.5	*4.0*
% households claiming insufficient water services	27.1	17.4	13.6	7.4	*14.3*
Average cubic meters of water monthly charged per person (1999)	5.8	6.5	5.4	6.6	*6.2*
Housing conditions:					
% of households owning their house	66.9	72.1	76.1	71.4	*71.3*
% of households living in moderate-low cost accommodation	84.7	82.3	82.9	78.1	*81*
% of households living in a rural house	3.6	3	5.7	4.8	*4.3*
% of households living in a single family house	35.5	28.1	28	27	*29.1*
Average age of the house	38.7	42.1	44	41.4	*41.4*
Average number of years since moving in	21.2	20.6	21.7	20.2	*20.7*
Average number of rooms (kitchen included)	4.2	4.1	4.6	4.3	*4.3*
% of households in overcrowded accommodation	12.9	9.2	3.5	5.5	*7.5*
% of households living without indoor WC	0.4	1.5	0.6	0.7	*0.8*
% of households living without indoor shower	1.8	1.6	1	0.7	*1.1*
% of households living without potable water	2.7	1.4	0.7	0.4	*1.1*
% of households living without hot water	0.7	0.8	0.4	0.6	*0.7*
% of households living without any heating system	27.8	7.1	1.9	1	*7.6*
% of households carrying out extraordinary maintenance works in the 3 months before the interview	4.2	5.8	6.3	8.0	*6.6*
% of households with poor brightness room problems (2002)	13.8	10.4	7.9	6.5	*8.9*
% of households with damp walls and/or floors (2002)	9.1	7.3	7.6	8.3	*8.1*
% of households with rotten window frames (2002)	5.9	4.5	3.7	3.9	*4.4*

Sources:

- **Infrastructural indicators from Ministry of Economy and Finance database, except data on water from ISTAT (2003)**
- **Housing conditions: our computation from SFB 1997-2002**

The type and quantity of energy consumed by the households depend on their technological endowment, i.e. on the type of heating and the quantity of household

[14] Eurostat defines a household to live in a overcrowded accommodation if the ratio between number of cohabitating persons and number of available rooms is greater than one.

appliances available. The choice is dictated by the combination of income and infrastructural constraints.

Table 5-1 [15] shows that heating is rarely left to single room-specific apparels in the houses of the cool and cold regions; about ¾ of centralised systems use natural gas and one half of them also produce hot water. In the warmer regions the heating technology is different: the use of LPG, coal, wood and electricity is widespread, and the electric boiler is the standard way to heat the water. Almost all households have a fridge and a washing machine, while other appliances are not so diffused, and this might cause heterogeneity in energy consumption.

Table 5-2: Household technological endowment. Averages of the 1997-2002 period

	Warm	Tepid	Cool	Cold	*Total*
% of households heating the water with					
An electric boiler	58.1	42.5	16.8	12.8	*28.4*
A gas boiler	20.9	25.7	20.2	33.9	*27.9*
The heating system	20.2	31.1	61.8	51.7	*42.3*
Households with some heating:					
% with:					
Centralised condominium heating	12.9	25.61	11.5	30.7	*24.3*
Independent (centralised) heating system	57.3	63.9	81.7	64.3	*65.5*
Single apparels (no centralized system)	29.8	10.5	6.8	5	*10.1*
% using as heating fuel:					
Heating gasoil	15.1	16.3	11.8	18.4	*16.5*
Natural gas	36.9	61.7	74	73.2	*65.4*
Liquid Propane Gas	30.2	10	7.1	3.6	*9.5*
Coal, wood and other solid fuels	8.6	8	6.3	3.7	*5.7*
Electricity and others	9	3.5	0.7	0.9	*2.7*
% of households with					
Electric stoves/oven	53.9	59.7	74.2	67.5	*64*
Non electric stoves/oven	66.8	64.9	52	62.9	*62.7*
Fridge and freezer	*99*	*99*	*99*	*99*	*99*
Dishwasher machine	16.1	25.4	37.2	36.1	*30.1*
Washing machine	95.2	95.7	96.2	96.7	*96.1*
Vacuum cleaner	55.6	65.8	71.5	83	*72.6*
Electric heaters and hoods	80.5	73.3	66.4	71.2	*72.8*
Air conditioning apparels	9	6.8	5.7	11	*9*

Table 5-3 provides a picture of total household expenditure[16], and expenditure for water, electricity, natural gas and other fuels (LPG, diesel oil, coal and wood), in 2002. We always compute the statistics on utility expenditures considering only those households that reported some expenditure at the interview.

There are mainly two reasons why households may not report any expenditure for the utilities. The first is that not all the households use natural gas and or other fuels: households may choose alternative technologies or their neighbourhoods may not be connected to the natural gas network. In this case a zero expenditure corresponds to no

[15] Unless otherwise indicated, from now on data come from our estimates based on Istat SFB (1997-2002).

[16] We follow the official definition of economic consumption, and therefore we refer to total expenditure, net of any mortgage refunds, life insurance and private pension premium, and expenditure for extraordinary maintenance works.

consumption and should be considered as the household's optimal choice, given its technological endowment. As we are interested in short run effects, we consider households technological endowment as fixed, and therefore we are only interested in the consumption (and welfare) of those households with positive expenditure.

The second reason why households may report no expenditure for some utility is related to the frequency they are billed for their consumption. In fact, for natural gas and electricity the amount of the last bill is asked (whenever it was paid), but for water and other fuels the households are asked to report the amount spent during the last 3 months. This implies that all those households that, for instance, pay for the water or the central heating twice a year may report zero expenditure. In this case a zero expenditure does not imply no consumption.

Assuming that the billing frequency is exogenous with respect to consumption, we can consider the statistics computed for the sub-sample of respondent with positive expenditure to be consistent estimates for the whole sample of users. Therefore, in Table 5-3 and Table 5-4 all statistics refer to those households using that specific utility, and exclude non users. As already specified, water and electricity are used by almost 100% of the population. For natural gas and other fuels we divide the users between those for which that fuel represents the main source for heating and the others (that use gas or other fuels only for cooking and/or as secondary heating sources).

On average, Italian households spent € 2126.27 a month in 2002, about € 17 for water and the double for electricity. In 2002, the households heating their homes with natural gas spent € 840, those using LPG, diesel oil, coal or wood € 872.

Table 5-3: Total monthly expenditure and monthly expenditure in utilities of the Italian households, 2002 averages.

	Water	Electricity	Natural gas		Other fuels		Total expenditure
			For heating	Not for heating	For heating	Not for heating	
Warm	18.98	39.55	39.74	26.46	37.09	34.30	1761.33
Tepid	17.89	34.58	51.10	24.14	64.24	45.59	1965.17
Cool	18.94	33.78	69.25	44.86	93.27	60.91	2203.17
Cold	16.32	32.17	83.24	29.28	121.39	76.74	2340.77
Italy	17.55	34.36	70.10	28.09	72.65	62.18	2126.27

The living standards of the areas are strongly differentiated: the typical household living in the northern cold regions spent, on average, in 2002 32.9% more than the typical household living in the southern, warm part of Italy. Notice that in this way we compare cold, richer regions with warm poorer regions. Although they are richer, households living in cold regions spend less than the other for water and electricity: the typical households in the warm area spend about 15% and 25% more for water and electricity than households in the cold area. Notice that while the first difference may be due to different prices for the water, the second indicates different quantities of energy consumed, as the price for electricity is homogenous throughout the national territory. This is consistent with the fact that households of these two areas have different stocks of durables: in the warm areas electric water boilers and electric heaters are more diffused than in the cold regions. Vice-versa, as expected, northern households spend more for natural gas and other fuels: households using natural gas or

other fuels for heating and living in the cold regions spend more than the double of those living in the warm or tepid areas.

The incidence of the expenditure for utilities on the households' budgets also varies across areas: the median budget share for water was 0.61% in the cold areas v. 0.95% in the warm regions, the 3.1% or 3.8% for heating fuels in cold areas (using gas or other fuels respectively) compare with the 1.9% or 1.2% in warm regions.

Table 5-4: Median shares of expenditure in utilities of the Italian households, 2002 (%)

	Water	Electricity	Natural gas		Other fuels	
			For Heating	Not for heating	For Heating	Not for heating
Warm	0.95	2.31	1.87	1.51	1.15	0.89
Tepid	0.78	1.74	2.08	0.77	1.81	1.59
Cool	0.72	1.51	2.75	1.33	3.22	2.13
Cold	0.61	1.34	3.07	0.77	3.79	2.31
Italy	0.72	1.59	2.61	0.95	1.79	1.99

Part of the differences in water and electricity expenditure between areas is somewhat reduced when we consider per capita expenditure (see Table 5-5): in 2002 the individuals in warm regions spent almost the same amount for water than the individuals in the cold area, and only 3.7% more in electricity. Considering household sizes has an opposite effect when we focus on heating fuels: the average per capita expenditure for heating in the cold area was 2.6 to 3.8 times that in the warm area, depending on the type of fuel.

Table 5-5: Average per capita monthly expenditure, 2002

	Water	Electricity	Natural gas		Other fuels		Total expenditure
			For Heating	Not for heating	For Heating	Not for heating	
Warm	6.72	13.78	13.26	10.51	12.54	10.07	613.63
Tepid	6.51	13.05	19.33	11.43	22.00	15.94	742.07
Cool	7.33	13.06	26.68	19.48	34.97	22.99	851.77
Cold	6.68	13.29	34.18	12.94	47.70	28.08	966.60
Italy	6.76	13.31	27.41	12.29	25.91	22.01	823.58

Table 5-3 and Table 5-5 therefore show that although northern cold regions are richer than the southern warm area, southern households spend more in water and electricity than the northern ones: however, in per capita terms the expenditure for these utilities are almost equal across areas. For water this does not imply that individuals consume almost the same quantity of water in different part of Italy, as we know that prices are quite different (higher in the South) and that ISTAT estimates per capita consumption of water are larger in the cold areas than in warm ones (see Table 5-1 and ISTAT 2003).

5.1 The 1997-2002 period

Over the period covered by our analysis three relevant changes can be observed.

First of all, a greater diffusion of natural gas; between 1997 and 2002, the number of households served by natural gas networks increased[17] by 33% in Calabria, 21% in Molise and Sicily, 18% in Puglia, 16% in Basilicata, 14% in Campania and 12% in Trentino – Alto Adige. We currently have about 52 out of 57 million of the Italian population served by the gas network.

Second, among those served by natural gas, several households changed their heating systems from other fuels to natural gas: overall, the percentage of households using heating gasoil to heat their homes fell from 18.5% in 1997 to 9.6 in 2002, while the fraction of households using natural gas for heating increased from 56.7% to 67.5% during the same period (Table 5-6).

Table 5-6: Percentage of households using diesel oil or natural gas as main fuel to heat their homes

	Warm		Tepid		Cool		Cold		Italy	
	Heating gasoil	Gas	Heating gasoil	Gas	Heating gasoil	Gas	Heating gasoil	Gas	Heating gasoil	Gas
1997	12.9	22.8	19.6	53.6	13.4	71.0	21.7	68.1	18.5	56.7
1998	13.3	25.0	15.9	56.9	14.0	68.9	20.0	69.7	17.1	58.2
1999	13.3	19.6	17.9	50.5	13.1	71.9	20.3	69.2	17.5	56.0
2000	9.9	30.7	15.0	56.6	10.2	74.8	17.2	72.8	14.5	61.6
2001	9.6	28.2	13.5	59.6	11.9	70.4	17.8	73.7	14.6	61.6
2002	6.4	32.7	9.1	65.9	7.3	78.0	12.0	80.2	9.6	67.5

Third, the composition and the size of the stock of electricity consuming apparels owned by the households changed over time (Table 5-7). The number of families using air conditioning more than doubled, going from 6% of the households in 1997 to 13.1% in 2002 (from 4.5% to 15.1% in the warm area). At the same time the percentage of families with an electric boiler reduced form 31.5% to 23.9% (from 64.4% to 51% in the warm area).

Table 5-7: Percentage of households owning an air conditioner (A/C) and an electric boiler (%)

	Warm		Tepid		Cool		Cold		Italy	
	A/C	Boiler	A/C	Boiler	A/C	Boiler	A/C	Boiler	A/C	Boiler
1997	4.5	64.4	4.5	46.6	4.0	18.5	7.8	14.5	6.0	31.5
1998	6.6	58.2	5.7	44.6	4.9	19.0	8.2	13.7	6.9	29.6
1999	7.3	63.8	5.4	49.6	5.9	16.4	9.6	12.6	7.8	30.8
2000	9.4	54.1	7.4	42.0	5.4	16.1	11.3	13.1	9.4	27.5
2001	11.1	54.5	8.3	36.3	5.9	15.8	13.4	12.3	10.9	25.8
2002	15.1	51.0	9.3	33.8	7.9	14.9	15.8	10.1	13.1	23.9

These changes in infrastructural endowments and the technologies adopted by the households should be taken into account when we consider the evolution of utility expenditure over the period 1997 – 2002 (Table 7-1 and Table 7-2 in Appendix). While

[17] Data from Ref. (2004).

in every year of this period Italian national income has increased, Italian households increased their total expenditure in the first four years, while in 2001 and 2002 they experienced a marked reduction in real terms expenditure, in particular in the warm and cold regions.

Given this situation, we now want to analyse households' expenditure both in current and in constant 1995 prices. To this end, we deflate expenditure in utilities with the commodity specific consumer price index[18]. We use national price indices because the Central Statistical Office (ISTAT) does not release any regional commodity specific price index. If the price dynamics of the single areas were remarkably different from the national dynamics, then inter-temporal comparisons within and between areas would be of difficult interpretation. This is not an issue for electricity prices, whose dynamics are centrally determined, it could be for water, natural gas[19] and other fuels. For the time being, we assume that the dynamics of utility prices is homogeneous over the territory (we do not need to assume that the prices are the same, but only that their changes are). Under this assumption, the utility expenditures at 1995 prices do not provide any clear evidence of significant changes in the quantities consumed during the period considered, with the exception of the expenditure for electricity in the cool and cold regions.

The incidence of expenditure in utilities on total household expenditure varies over time and with the area of residence. Large changes in relative prices can cause remarkable changes in the budget share if the households do not (or cannot) adjust their demand promptly. So, the budget share (current prices) for water went from 0.87 in 1997 to 0.95 (+9%) in 2002 in the warm regions, and from 0.53 to 0.61 (+15%) in the cold area (see Table 7-3 in the Appendix). The electricity budget share (current prices) rose from 1.15% to 1.34% in the cold area and form 1.34% to 1.51% in the cool area, but this is likely to be mainly due to quantity changes (constant prices shares increased even more).

5.2 Family size, "economies of scale" and poverty

Conditioning on family size is crucial to understand to what extent households can exploit "economies of scale". If we want to evaluate the welfare of a household on the basis of its expenditure, we have to take into account that a couple of individuals does not need to spend twice what a single spends to reach the same welfare. This is true in general, but in particular when we consider utilities, that are mainly devoted to the production of (intra-household) public goods, such as lighting and heating. In **Table 7-4** 13 we compare households of different size and different area in year 2002. We start restricting our attention to year 2002, because differences between years are mainly due to differences in relative prices, not to quantity variations.

Later on we shall discuss how variations in prices have affected the different types of households. If we consider total expenditure, a 4 member household in the warm regions spends 1.60 times what a couple spends, while in the cold regions the ratio is only 1.39. These ratios vary with the commodity we consider: they are between 1.3 and 1.5 for water and electricity, between 1.15 and 1.4 for gas and other fuels (lower in

[18] For other fuels we compute the expenditure at 1995 using the "Other liquid fuels" CPI if diesel oil or LPG, and the total expenditure CPI for coal and wood.

[19] Gas prices are subject to a revenue cap since 2000. However, firms are free to change their price structure.

those regions where heating expenditure is predominant), suggesting that economies of consumption are stronger for gas and other fuels than for water and electricity. As a consequence, all the per capita expenditures in utilities (and consumption) are strictly decreasing with family size.

Although there are economies of consumption, larger households consume more. This implies that, in a world in which almost all utilities have increasing block tariffs, larger households face higher marginal prices. This holds even if consumption by larger families may be more "efficient", as it contributes to the welfare of a larger number of individuals. Consider the case of water in the cold area: a single person spends on average 11 Euro per month, while the per capita monthly expenditure for an individual in a 4 member household is less than a half (5.4 Euro). Given that they both face a price increasing blocks tariff, the difference in terms of quantity of water consumed is even more striking. But nevertheless, a single will pay his next shower less than what it will be paid by anyone in the 4 member household. Similar results hold for all the utilities, which raises a fairness and an efficiency issue for the block tariffs which do not take into account family size.

The distribution of the budget shares for water, electricity, gas and other fuels are such that 80% of the households allocate less than 1% of their budgets to water and less than 3% to electricity, about 80% of natural gas users spend less than 6% for this utility, while the fraction of users spending more than 5% of their budget for other fuels is larger than 20%. In Table 7-5 and Table 7-6 we report the 2002 medians of the utilities budget shares. We compute these statistics by area, family size and households' poverty status.

As already specified, we define a household to be relatively poor if its total expenditure falls below the relative poverty line, and we identify the absolutely poor as those households whose consumption falls below the absolute poverty line (see Section 2). There is not a clear, constant relation between the share of expenditure for utilities and the family size, as it depends on the different rate of growth of total expenditure and utility expenditures with households' size. The poorer households spend a larger fraction of their budgets for utilities: the median shares for the absolute and relative poor families are almost the double of those of the whole population. Given that water, electricity and gas are not close substitutes in the short run (i.e. given the technological endowment of the households), we can estimate the median incidence of the three utilities together to be the sum of the median incidence of the single utilities: taking water, electricity and gas together the absolutely poor households spent about 9.7% of their budget for these utilities in the cold regions and 9.1% in the warm region, compared to 4.75% and 5.06% for the whole population in the same areas.

5.3 The affordability issue

In Section 2 we presented the main indicators adopted to study the affordability of utilities and we suggested new indices suitable for the Italian case. We now provide a first attempt to operationally define and estimate the minimum socially acceptable expenditure $p\left(q_h^S\right)q_h^S$. This amount is the same one used by the Italian Poverty Commission as component of the reference basket for the absolute poverty line. For heating, they evaluated $p\left(q_h^S\right)q_h^S$ to be equal to the 25th percentile of households

expenditure for natural gas for those households with single apparels or an independent (centralised) heating system. Given that they refer to a socially acceptable minimum expenditure, we need to bear in mind that what is socially acceptable in a warm region not be acceptable in a cold area, simply because of differences in external temperatures. Technically, using an expenditure distribution not conditional on the area of residence of the households may be misleading because the fraction of households using natural gas to heat their homes is not homogeneous across the national territory (see previous Table 5-3), because a remarkable percentage of southern households do not heat their home, and because households in the cold area spend much more for heating than families in the warm (southern) regions (see Table 7-1 - Table 7-4 in the Appendix).

Table 5-8: 1997 Poverty Commission's estimates of the heating and electricity components of the absolute poverty line. Updated to 2002 values using commodity specific consumer price indexes.

	Minimum monthly family expenditure			
	Heating		Electricity	
# of members	Euro	% of absolute poverty line	Euro	% of absolute poverty line
1	18.9	4.98	9.6	2.53
2	23.7	4.17	12.9	2.26
3	28.3	3.49	17.3	2.13
4	29.0	2.82	21.7	2.11
5	31.1	2.40	27.2	2.10
6 or more	34.0	2.0-2.7	29.6	1.8-1.9

Source: Poverty Commission, ISTAT (2004)

If we compare the shares for gas, other fuels and electricity for the poor households in Table 7-5 in Appendix - with the shares reported in Table 5-8 above, we see that following the criterion of the Poverty commission the incidence of heating for poor families in the cold areas is badly underestimated, while the same ratio is overestimated for the poor households in the warm regions. A similar result holds for electricity. This is the consequence of adopting a unique national threshold in a context where territorial differences are strong and also driven by climatic heterogeneity. In what follows, we therefore adopt a different threshold: we define the minimum amount necessary for having a decent heating as the 25th percentile of the 1997 distribution of the expenditure for gas and other fuels for those households having a heating system, conditional on family and area of residence.

Table 5-9: 25th percentile of water, electricity, gas and other fuels expenditure, by family size and area, 1997, Euro

	Water				Electricity				Heating (Gas and other fuels)			
# members	Warm	Tepid	Cool	Cold	Warm	Tepid	Cool	Cold	Warm	Tepid	Cool	Cold
1	5.34	5.16	5.16	3.62	12.14	10.33	9.04	7.75	7.40	8.52	17.22	11.10
2	6.03	6.03	6.20	5.16	16.27	12.91	12.65	10.85	9.04	12.14	22.90	18.06
3	8.61	6.89	7.23	6.89	20.66	16.78	15.49	15.49	11.19	13.77	28.41	22.08
4	8.61	8.61	8.61	8.26	22.21	20.66	18.59	19.37	12.74	15.49	30.99	25.82
5 or more	10.33	9.12	8.95	8.61	28.41	24.53	21.95	25.82	12.91	18.85	35.29	22.38

With this definition, the amount considered to be socially acceptable for heating in the cold area is twice the corresponding amount for the warm area. To obtain the threshold shares with respect to which we define a household to be in fuel poverty, we need to compute the ratio between the amounts in Table 5-9 and total family expenditure ($p(q_h^S)q_h^S / E_{ih}$) and to take its average for those households falling in the left tail of the distribution of the equivalent total family expenditure for the area of residence. With the same rationale we can estimate the minimum socially acceptable expenditure and the threshold budget shares also for water and electricity.

We report our estimates in Table 5-10, which can be read as follows: a family living in the cold area is in fuel poverty if the ratio between its expenditure for fuels in Table 5-9 and its total expenditure is above 2.06%.

Table 5-10:Threshold budget shares for water, fuel and electricity poverty

	Threshold budget shares (%)		
Area	Water	Electricity	Heating
Warm	1.19	2.97	1.66
Tepid	0.93	2.07	1.72
Cool	0.88	1.77	3.19
Cold	0.64	1.42	2.06

According to this measure, in 1997 about 9% of the households were in water, electricity and fuel poverty according to our definition (see Table 7-7): overall there were about 2.4 million households (10.6% of the households; 5.3 million individuals, 9.2% of the population) facing an affordability problem with at least one of the utility considered, 500,000 living in the warm regions, 1,000,000 in the cold ones (see Table 7-9)[20]. As we discussed in Section 2, affordability is a combination of poor income, poor housing conditions and inefficiency; so it is not surprising that families with affordability problems are more frequent among smaller households even though these households are not those more likely to be relatively poor.

It can now be useful to compare our results with the picture resulting if one applied the affordability threshold of 3% for the water budget shares, used among others by OECD (2003) and Peruzzi (2003), which assume that a household has a water affordability problem if its water bill is more than 3% of its budget:

$$\frac{p(q_{ih})q_{ih}}{E_{ih}} > 3\%$$

To fix a 3% threshold is equivalent to say that in Italy water affordability is an issue for the warm regions where 8.9% of household spend more than 3% of their budget for water in 2003 (see Table 7-8). Things do change remarkably, in particular for the cold regions, if we say that there is an affordability issue when the households need to spend more than a given share to buy a quantity of water that is considered socially

[20] In the UK there were 5.5 million households in fuel poverty in 2001, DEFRA (2001).

acceptable to avoid social exclusion: the fraction of household with water affordability problem rises from 2.94% to 9.96% using the 3% threshold.

5.4 The affordability over time

Considering the 1997's reference basket, as defined in the previous Section 5.3, in what follows we update its value using the current national price index; we then determine the percentage of families which results over the threshold level defined in Table 5-10. In Figure 5.1, the household with affordability problems in heating, water and electricity from 1997 to 2003 is represented.

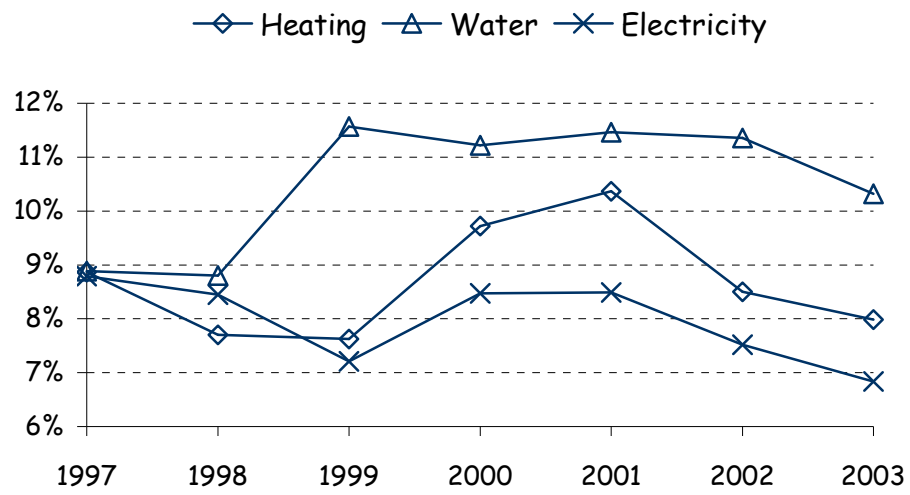

Figure 5-1: Households with affordability problems in heating, water and electricity.

Referring to water sector and looking at the future, Italy will probably join the group of countries whose officials perceive an affordability problem, but at the same time will abandon the measure and the structures directly applied to water bills. In fact, the ongoing reform of water sector provides substantial incentives for new infrastructural investments (which will need to be paid off), abolished the "minimo garantito" (i.e. a subsidized minimum quantity), and included sanitation and sewerage cost as a component of the water tariff.

In Figure 5-2 the relationship between the affordability index as computed for each utility and its relative price is showed. For all utilities, the affordability index – the star line – moves together with that utility's relative price. It is only in 2003 that the two indices move differently, because for that year the higher utility prices are more than compensated by the higher level of total expenditure.

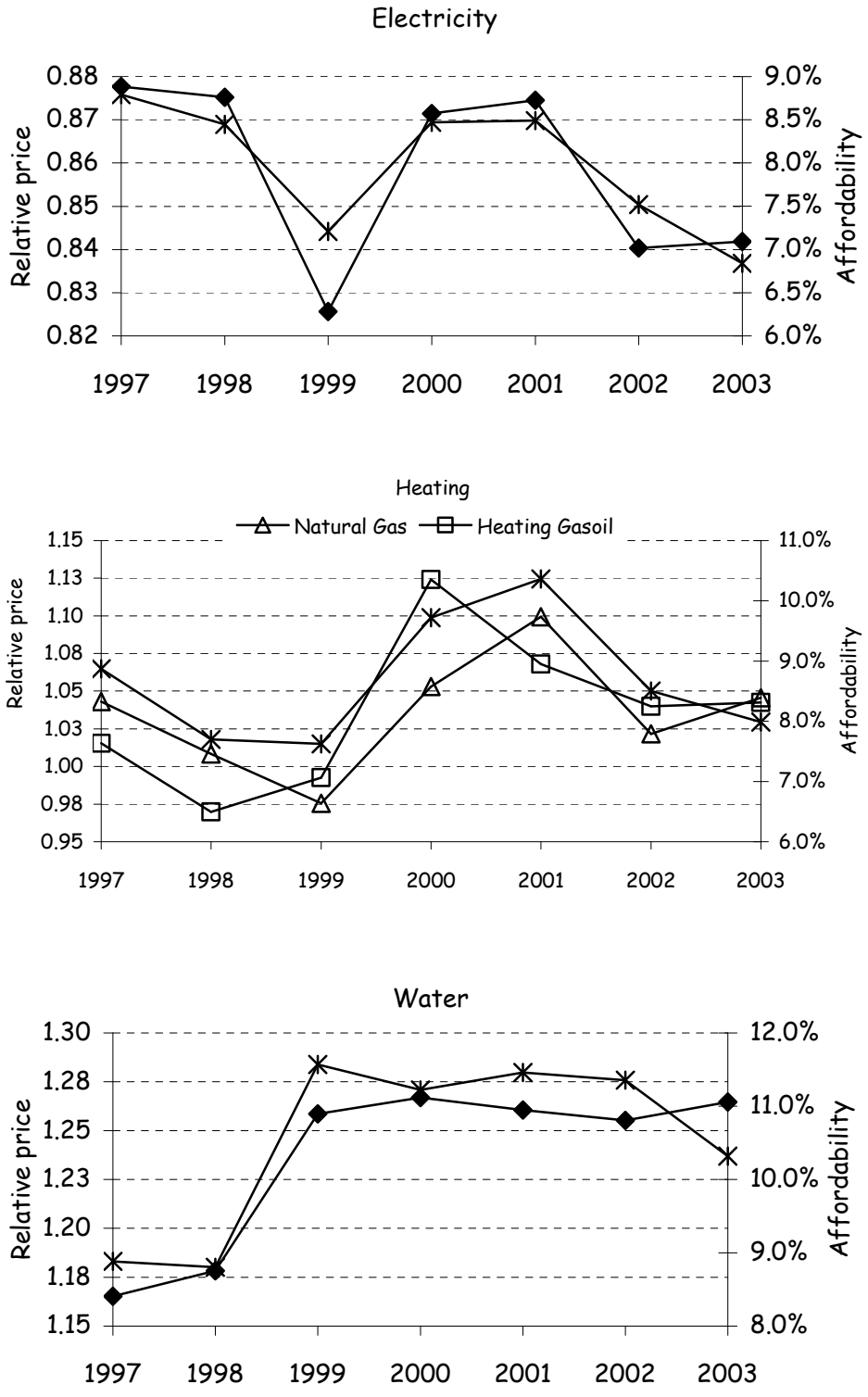

Figure 5-2: Affordability indexes for water, heating and electricity and utility relative prices over time.

Comparing now the 2003 affordability levels in heating, water and electricity for the different Italian regions with those recorded in 1997 (see Table 7-7 and Table 7-8), we find that the largest increase refers to water in the tepid region; while the largest decrease to electricity in cool regions.

Furthermore, households with one or two members are those who witnessed the largest reduction of the affordability indices for electricity and heating, while households with more than 3 members are those who suffered most the increase in water prices (again, see Table 7-7 and Table 7-8). This is due the fact that the relative weights of fixed and variable costs for households change with the family size, and that the reforms have affected the utility tariffs differently with respect to this.

Can we say that the liberalisation process has made the affordability problem worse? For these sectors, the answer so far seems to be negative. Although the evidence is still preliminary and no clear trend can be shown, the share of households with problems for *at least one* utility does not increase, and possibly decreases.

Indeed, if one looks at price dynamics, one sees that gas and electricity prices have moved in line with inflation; despite the increase in oil prices; so far the energy regulator has been able to protect Italian customers. On the other hand, water prices exploded between 1997 and 2003 (+33% in nominal terms, about 15 points above inflation), and this may get even worse soon, given the relevant investments envisaged in the water sector in the near future. However, as electricity and gas have a larger share of expenditure than water, on average the percentage of households with affordability problems appears to be on the decrease.

6 Extensions

In the present analysis we have shown that reforms in the Italian utility markets have not exacerbated the affordability issue. However, the picture changes depending on the definition adopted (Section 2). We have provided a preliminary estimate of the minimum socially acceptable expenditure in utilities – gas, electricity and water - as it is used by the Italian Poverty Commission for the reference basket in the definition of the absolute poverty line.

However, unlike the Italian Poverty Commission, the present analysis has used a threshold which is conditional on family and area of residence; that is, we have defined the minimum amount necessary for having a decent heating to be the 25th percentile of the 1997 distribution of the expenditure for gas and other fuels for those households having a heating system, conditional on family and area of residence. The same reasoning is then applied to thresholds for water and electricity. Our results have highlighted how climatic regions and family size are relevant in the estimate of the percentage of households with affordability issue.

In 1997 there were overall about 2.4 million households (10.6% of the households; 5.3 million individuals, 9.2% of the population) facing an affordability problem with at least one of the utility considered, 500,000 living in the warm regions, 1,000,000 in the cold ones. In 2003 the situation is not terribly different, which indicates that utility reforms so far have not harmed weaker households.

Referring the affordability measure to the number of family components, we have observed – as it can be expected – that: a) fixed costs determine a decrease in the

affordability measure for family with less than three members (i.e.: scale economies in consumption); b) the number of components is particularly relevant for electricity (i.e.: above 3 components the affordability measure rapidly increases).

The analysis we have presented in this paper is still preliminary. To have a clearer understanding of how utility reforms had an impact on households one should probably have a clearer notion of how average prices vary across Italian regions, an information which appears difficult to obtain, especially for water and gas.

Among the possible extensions that we can anticipate, an analysis of the effects of future price reforms on households' welfare would be particularly interesting. If one can forecast that in the near future some utility prices will have to increase, the issue of how to design tariffs in order – for instance – to minimise negative consequences on poorer households – given the revenue constraint – becomes particularly relevant.

7 Appendix

Table 7-1: Average household monthly expenditure, by year and area

Total Expenditure

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	1564.43	1840.70	1894.02	2203.87	1963.49	1474.17	1734.30	1784.54	2076.67	1850.12
1998	1687.27	1893.96	1960.93	2213.99	2011.46	1559.27	1750.18	1811.90	2045.85	1858.72
1999	1681.54	1792.88	2068.26	2256.96	2022.99	1528.71	1629.75	1880.26	2051.75	1839.04
2000	1746.16	1877.84	2074.84	2374.50	2110.74	1548.08	1664.63	1839.67	2105.16	1871.30
2001	1716.73	1814.41	2113.80	2369.80	2094.88	1480.71	1565.09	1823.39	2044.21	1807.03
2002	1761.33	1965.17	2203.17	2340.77	2126.27	1482.53	1654.16	1854.29	1970.20	1789.68

Water

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	15.67	15.04	13.96	13.49	14.27	12.69	12.17	11.29	10.91	11.54
1998	15.28	15.92	16.79	14.54	15.25	11.99	12.49	13.17	11.41	11.97
1999	17.05	17.77	16.51	16.27	16.74	12.31	12.85	11.92	11.76	12.10
2000	16.87	19.34	16.74	15.96	16.88	11.81	13.52	11.71	11.17	11.81
2001	18.58	20.51	19.17	15.43	17.54	12.71	14.04	13.12	10.56	12.01
2002	18.98	17.89	18.94	16.32	17.55	12.72	12.00	12.70	10.95	11.77

Electricity

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	37.12	31.96	26.90	28.39	30.64	39.85	34.31	28.88	30.47	32.89
1998	36.76	32.26	29.01	29.36	31.37	38.81	34.07	30.63	31.00	33.12
1999	39.51	31.12	29.25	29.13	31.56	43.53	34.30	32.25	32.11	34.79
2000	36.98	31.02	29.07	29.77	31.32	37.69	31.58	29.61	30.30	31.89
2001	37.99	31.48	31.09	32.56	33.17	37.48	31.06	30.65	32.12	32.72
2002	39.55	34.58	33.78	32.17	34.36	39.63	34.65	33.84	32.23	34.42

Gas

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	34.50	42.47	59.39	67.06	57.79	31.18	38.36	53.64	60.59	52.21
1998	33.14	43.78	60.73	72.24	60.79	30.22	39.93	55.43	65.93	55.47
1999	36.36	44.47	68.61	70.40	62.23	34.02	41.57	64.16	65.84	58.19
2000	37.64	44.33	65.54	74.79	63.43	31.94	37.65	55.71	63.57	53.91
2001	37.01	42.38	62.56	73.00	61.49	29.00	33.14	48.94	57.04	48.07
2002	36.80	47.82	68.33	79.02	66.02	30.34	39.33	56.26	65.01	54.33

Other Fuels

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	26.57	48.57	71.99	89.64	55.51	24.72	45.14	66.92	83.31	51.60
1998	31.11	49.45	79.30	92.60	58.24	29.39	46.79	74.85	87.67	55.08
1999	27.45	54.34	73.56	104.03	59.71	25.34	50.08	67.44	95.82	54.99
2000	30.49	53.57	81.30	99.30	60.90	24.82	43.84	66.93	80.48	49.60
2001	29.08	55.43	86.57	105.79	62.91	23.78	45.75	71.54	86.40	51.60
2002	29.65	56.50	82.41	106.13	61.71	24.22	46.44	67.49	86.68	50.49

Table 7-2: Average per capita monthly expenditure, by year and area

Total Expenditure

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	538.55	692.30	736.80	854.51	738.82	507.48	652.28	694.21	805.20	696.16
1998	583.14	718.11	773.95	864.25	762.33	538.91	663.59	715.13	798.61	704.45
1999	587.11	683.72	814.57	884.70	770.72	533.75	621.51	740.53	804.26	700.64
2000	613.27	719.40	821.03	940.15	810.23	543.70	637.72	727.98	833.51	718.32
2001	607.79	698.21	840.93	946.16	809.96	524.23	602.27	725.39	816.17	698.67
2002	613.63	742.07	851.77	966.60	823.58	516.50	624.63	716.88	813.58	693.20

Water

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	5.41	5.68	5.39	5.20	5.37	4.38	4.59	4.36	4.21	4.34
1998	5.35	6.14	6.62	5.62	5.80	4.20	4.82	5.19	4.41	4.55
1999	6.03	6.97	6.51	6.35	6.43	4.36	5.04	4.70	4.59	4.65
2000	6.00	7.18	6.66	6.24	6.43	4.20	5.02	4.66	4.36	4.50
2001	6.57	7.46	7.55	6.13	6.69	4.50	5.11	5.17	4.19	4.58
2002	6.72	6.51	7.33	6.68	6.76	4.51	4.37	4.92	4.48	4.53

Electricity

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	12.77	12.01	10.47	11.01	11.53	13.71	12.89	11.23	11.82	12.37
1998	12.70	12.23	11.45	11.46	11.89	13.41	12.91	12.09	12.10	12.55
1999	13.80	11.87	11.52	11.42	12.02	15.21	13.08	12.70	12.59	13.25
2000	12.98	11.88	11.50	11.78	12.02	13.23	12.09	11.72	11.99	12.24
2001	13.44	12.12	12.37	13.00	12.82	13.26	11.95	12.19	12.82	12.65
2002	13.78	13.05	13.06	13.29	13.31	13.81	13.08	13.08	13.31	13.33

Gas

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	11.70	16.28	23.41	26.59	22.38	10.57	14.70	21.14	24.02	20.22
1998	11.15	16.90	23.70	28.63	23.51	10.16	15.41	21.64	26.13	21.45
1999	12.08	17.23	26.98	28.16	24.26	11.30	16.11	25.23	26.34	22.69
2000	13.11	17.35	26.07	30.06	24.91	11.12	14.73	22.16	25.55	21.17
2001	12.40	16.73	24.99	29.66	24.26	9.72	13.08	19.55	23.18	18.96
2002	12.73	18.54	26.44	32.63	26.08	10.49	15.25	21.77	26.84	21.46

Other fuels

	Current prices					Constant prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	8.96	17.43	27.17	31.77	19.49	8.33	16.20	25.25	29.53	18.11
1998	10.73	17.70	31.43	33.17	20.77	10.14	16.74	29.67	31.41	19.64
1999	9.62	19.95	28.03	37.21	21.45	8.88	18.39	25.70	34.27	19.76
2000	10.67	19.34	31.03	35.55	21.80	8.69	15.83	25.54	28.81	17.75
2001	10.44	19.82	34.09	38.15	22.83	8.54	16.36	28.17	31.16	18.73
2002	10.05	19.81	31.23	40.96	22.05	8.21	16.29	25.57	33.45	18.04

Table 7-3: Median households' utility budget shares, by year (%)

Water

	Current Prices					Constant Prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	0.87	0.66	0.64	0.53	0.62	0.75	0.57	0.55	0.45	0.54
1998	0.87	0.64	0.72	0.55	0.65	0.74	0.55	0.62	0.47	0.55
1999	0.91	0.78	0.68	0.60	0.69	0.72	0.62	0.54	0.48	0.55
2000	0.89	0.80	0.75	0.58	0.69	0.71	0.63	0.59	0.46	0.55
2001	0.99	0.90	0.76	0.56	0.71	0.78	0.71	0.60	0.44	0.56
2002	0.95	0.78	0.72	0.61	0.72	0.75	0.62	0.58	0.49	0.57

Electricity

	Current Prices					Constant Prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	2.41	1.67	1.34	1.15	1.46	2.75	1.90	1.53	1.31	1.67
1998	2.19	1.56	1.38	1.16	1.42	2.51	1.78	1.58	1.33	1.63
1999	2.43	1.69	1.37	1.15	1.45	2.94	2.04	1.66	1.40	1.75
2000	2.20	1.69	1.34	1.16	1.44	2.52	1.92	1.53	1.34	1.65
2001	2.28	1.73	1.45	1.28	1.54	2.61	1.98	1.65	1.46	1.76
2002	2.31	1.74	1.51	1.34	1.59	2.76	2.07	1.80	1.60	1.89

Gas

	Current Prices					Constant Prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	1.75	1.92	2.92	2.45	2.30	1.69	1.84	2.80	2.35	2.20
1998	1.68	1.94	2.68	2.73	2.38	1.67	1.91	2.68	2.72	2.35
1999	1.64	2.01	2.97	2.65	2.42	1.69	2.05	3.05	2.73	2.49
2000	1.72	1.87	2.79	2.63	2.33	1.63	1.76	2.62	2.48	2.21
2001	1.81	1.93	2.60	2.67	2.35	1.64	1.77	2.37	2.43	2.14
2002	1.80	1.89	2.70	2.81	2.39	1.77	1.86	2.65	2.75	2.34

Other Fuels

	Current Prices					Constant Prices (1995=100)				
	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1997	0.94	1.59	2.72	2.51	1.34	0.93	1.58	2.71	2.48	1.33
1998	0.94	1.38	3.15	2.55	1.35	0.98	1.42	3.18	2.59	1.40
1999	0.94	1.68	2.67	2.34	1.33	0.94	1.69	2.65	2.36	1.34
2000	1.03	1.53	2.77	2.54	1.45	0.91	1.40	2.57	2.37	1.32
2001	0.99	1.77	3.45	2.58	1.49	0.93	1.69	3.29	2.51	1.40
2002	1.00	1.69	2.84	3.15	1.51	0.96	1.64	2.75	3.04	1.46

Table 7-4: Average family and per capita monthly expenditure, by family size and area, 2002.

Total Expenditure

	Household					Per Capita				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	991.84	1282.71	1337.16	1459.16	1325.77	991.84	1282.71	1337.16	1459.16	1325.77
2	1434.71	1776.13	1877.75	2238.24	1962.38	717.35	888.07	938.88	1119.12	981.19
3	1936.31	2254.23	2613.65	2797.54	2510.60	645.44	751.41	871.22	932.51	836.87
4	2305.41	2505.00	2939.86	3113.04	2740.45	576.35	626.25	734.96	778.26	685.11
5 or more	2339.30	2493.34	3172.04	3238.58	2730.07	440.14	475.47	597.81	620.65	518.08

Water

	Household					Per Capita				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	13.47	12.59	13.03	11.06	12.06	13.47	12.59	13.03	11.06	12.06
2	16.68	15.66	18.05	14.74	15.80	8.34	7.83	9.02	7.37	7.90
3	20.03	18.98	20.05	18.77	19.23	6.68	6.33	6.68	6.26	6.41
4	22.61	21.82	23.78	21.63	22.22	5.65	5.45	5.94	5.41	5.55
5 or more	25.14	24.05	26.23	25.10	25.01	4.66	4.61	4.91	4.85	4.74

Electricity

	Household					Per Capita				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	27.08	24.39	22.17	20.04	22.47	27.08	24.39	22.17	20.04	22.47
2	34.88	31.80	28.76	29.71	30.80	17.44	15.90	14.38	14.85	15.40
3	43.26	37.28	38.21	37.93	38.75	14.42	12.43	12.74	12.64	12.92
4	45.23	42.42	44.58	43.83	43.92	11.31	10.60	11.15	10.96	10.98
5 or more	53.10	47.10	50.80	50.82	50.64	9.99	8.98	9.57	9.74	9.61

Gas

	Household					Per Capita				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	26.13	36.78	48.75	63.04	51.74	26.13	36.78	48.75	63.04	51.74
2	32.46	46.81	67.01	79.11	66.95	16.23	23.41	33.51	39.56	33.47
3	38.77	53.40	75.75	83.90	72.35	12.92	17.80	25.25	27.97	24.12
4	44.87	55.63	79.23	92.16	74.12	11.22	13.91	19.81	23.04	18.53
5 or more	42.12	53.70	84.25	102.26	72.93	7.98	10.34	16.05	19.69	13.97

Other Fuels

	Household					Per Capita				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	17.12	29.63	57.72	80.54	44.83	17.12	29.63	57.72	80.54	44.83
2	23.65	55.46	78.85	111.36	61.43	11.83	27.73	39.43	55.68	30.71
3	31.53	54.35	87.02	111.29	65.31	10.51	18.12	29.01	37.10	21.77
4	36.56	72.06	98.01	130.62	72.20	9.14	18.02	24.50	32.66	18.05
5 or more	41.89	79.61	116.85	101.79	68.11	7.89	15.01	21.59	19.32	12.83

Table 7-5: Median utility share expenditure (%), by family size, area and poverty status, 2002.

	Water														
	All					Relatively poor					Absolutely Poor				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	1.09	0.88	0.76	0.70	0.81	2.00	2.10	2.53	1.61	1.90	2.07	2.53	3.07	1.86	2.23
2	1.03	0.76	0.77	0.59	0.72	1.63	1.64	2.23	1.44	1.66	1.87	1.95	2.37	1.13	1.90
3	0.92	0.71	0.66	0.57	0.65	1.47	1.25	1.55	1.27	1.39	1.63	2.01	2.40	1.63	1.89
4	0.78	0.76	0.67	0.58	0.68	1.65	1.31	1.33	0.95	1.31	1.65	1.65	1.62	1.31	1.61
5 or more	0.89	0.80	0.75	0.70	0.77	1.60	1.21	1.28	1.52	1.32	1.81	1.17	1.02	1.18	1.32
	Electricity														
	All					Relatively poor					Absolutely Poor				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	2.75	1.92	1.61	1.36	1.68	4.24	3.73	3.45	2.88	3.59	4.69	5.59	4.24	3.04	4.24
2	2.44	1.73	1.55	1.28	1.55	3.80	3.06	2.79	2.70	3.08	4.39	4.11	2.98	2.85	3.65
3	2.23	1.59	1.41	1.30	1.49	3.86	3.41	2.83	2.58	3.30	5.29	4.56	3.27	2.88	3.98
4	1.96	1.65	1.47	1.40	1.56	3.57	3.01	2.44	2.49	2.97	4.72	3.81	2.64	2.21	3.85
5 or more	2.23	1.92	1.75	1.57	1.87	3.51	2.89	2.74	2.84	3.13	3.78	3.13	2.74	3.08	3.39
	Gas														
	All					Relatively poor					Absolutely Poor				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	2.14	2.06	2.99	3.41	2.82	2.89	2.93	5.97	7.14	4.76	2.65	2.71	6.73	7.71	5.60
2	1.94	1.92	3.10	2.88	2.55	2.21	2.99	5.18	5.99	3.84	1.93	3.37	6.14	4.57	5.07
3	1.62	1.85	2.55	2.54	2.27	2.52	2.77	3.83	5.14	3.65	3.36	2.56	3.15	3.65	3.37
4	1.62	1.75	2.21	2.49	2.13	2.54	2.66	3.63	4.40	3.06	2.79	2.68	2.55	4.36	2.94
5 or more	1.54	1.98	2.26	2.50	2.06	2.18	2.88	3.60	5.28	2.79	2.40	2.88	4.54	9.01	3.04
	Other Fuels														
	All					Relatively poor					Absolutely Poor				
# members	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy	Warm	Tepid	Cool	Cold	Italy
1	1.07	1.61	3.54	3.64	1.62	1.80	2.13	4.48	5.37	2.36	1.98	2.87	4.48	4.94	2.87
2	0.92	1.85	2.96	3.64	1.61	1.46	3.34	2.79	4.77	1.97	1.69	3.04	3.38	5.88	3.04
3	0.91	1.46	2.23	2.62	1.39	1.27	2.30	2.30	2.64	1.55	1.56	2.36	2.27	0.72	1.70
4	1.00	1.74	2.78	3.19	1.47	1.22	1.77	2.64	1.93	1.46	1.52	2.28	6.36	4.38	1.66
5 or more	1.19	1.79	2.90	2.22	1.51	1.51	1.64	3.89	3.29	1.56	1.51	1.71	3.02	1.14	1.51

Table 7-6: Median utility budget shares by area and type of heating, 2002. W+E: Water and electricity, W+E+H: Water, electricity and heating

			No heating					
			Budget shares (%)					
	# of households	% Relatively poor	Water	Electricity	Gas	Other fuels	W+E	W+E+H
Warm	1,129,122	31.46	1.17	3.01	1.41	0.83	4.17	
Tepid	277,235	33.42	1.17	2.89	1.34	1.32	4.06	
Cool	43,710	28.26	1.20	2.22	1.33	2.35	3.43	
Cold	57,208	20.17	0.70	1.95	2.61	1.42	2.65	
Italy	1,507,275	31.30	1.14	2.91	1.50	0.93	4.05	
			Natural gas heating					
			Budget shares (%)					
	# of households	% Relatively poor	Water	Electricity	Gas	Other fuels	W+E	W+E+H
Warm	1,414,941	14.37	0.91	1.73	1.87	0.89	2.64	4.51
Tepid	3,223,533	11.21	0.73	1.56	2.08	1.59	2.29	4.37
Cool	2,416,730	8.55	0.70	1.43	2.75	2.13	2.13	4.87
Cold	7,966,990	4.29	0.61	1.32	3.07	2.31	1.93	5.00
Italy	15,022,194	7.41	0.67	1.41	2.61	1.99	2.08	4.69
			Electricity and other fuels heating					
			Budget shares (%)					
	# of households	% Relatively poor	Water	Electricity	Gas	Other fuels	W+E	W+E+H
Warm	1,786,139	21.38	0.89	2.47	1.80	1.15	3.37	4.51
Tepid	1,393,941	18.23	0.86	2.16	0.74	1.81	3.02	4.83
Cool	638,629	13.50	0.83	1.89	1.26	3.22	2.72	5.95
Cold	1,908,485	7.72	0.60	1.45	0.76	3.79	2.05	5.84
Italy	5,727,194	15.18	0.78	1.95	0.87	1.79	2.73	4.52

Table 7-7: Percentage of households with affordability problems by utility, area and family size, 1997

		Warm		
	Actual water	Affordability problems		
# members	Share > 3%	Heating	Water	Electricity
1	15.28	23.05	23.57	18.18
2	8.51	10.15	8.39	10.52
3	5.38	5.37	8.09	5.91
4	5.90	5.46	4.31	5.11
5 or more	5.88	3.50	5.59	7.54
Total	8.37	9.91	10.20	9.46
		Tepid		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	8.49	14.37	18.72	14.56
2	7.99	11.14	7.67	6.88
3	2.81	5.00	4.08	5.13
4	5.46	4.85	5.35	6.87
5 or more	6.08	7.31	4.27	10.42
Total	6.22	8.76	8.58	8.41
		Cool		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	5.59	17.72	21.92	15.08
2	3.47	10.09	9.32	10.09
3	2.18	3.85	2.73	3.49
4	1.42	2.54	2.66	4.14
5 or more	2.32	10.15	3.33	15.99
Total	3.11	8.68	8.89	8.56
		Cold		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	2.57	11.42	12.46	11.60
2	2.01	9.87	7.69	6.23
3	1.74	6.50	6.47	7.14
4	1.19	6.58	7.58	9.48
5 or more	2.11	0.61	4.19	16.32
Total	1.93	8.52	8.45	8.75

Table 7-8: Percentage of households with affordability problems by utility, area and family size, 2003

		Warm		
	Actual water	Affordability problems		
# members	Share > 3%	Heating	Water	Electricity
1	13.73	19.65	23.88	12.69
2	10.72	7.70	7.76	6.71
3	5.28	4.78	7.16	4.22
4	7.01	2.79	3.09	1.89
5 or more	5.46	3.66	6.74	5.85
Total	8.90	8.08	9.94	6.24
		Tepid		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	6.73	13.10	21.60	11.09
2	6.41	11.52	11.36	7.27
3	4.66	5.44	5.37	4.85
4	4.92	5.26	7.77	6.35
5 or more	7.13	8.03	6.97	8.79
Total	5.82	9.01	11.65	7.67
		Cool		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	8.82	12.46	20.14	8.70
2	4.94	7.93	9.37	6.66
3	3.34	4.64	4.47	3.31
4	3.29	4.10	5.73	4.69
5 or more	3.55	6.69	6.12	7.80
Total	5.04	7.44	9.89	6.08
		Cold		
	Actual water	Affordability problems		
# members	share > 3%	Heating	Water	Electricity
1	4.08	8.97	12.70	8.37
2	2.85	9.25	8.98	5.02
3	2.70	5.57	7.76	4.66
4	1.71	6.42	9.90	7.86
5 or more	2.88	2.77	11.09	19.68
Total	2.94	7.61	9.96	6.92

Table 7-9: Percentage of households with affordability problems by utility, area and year

		Warm		
Year	Heating	Water	Electricity	At least one
1997	9.91	10.20	9.46	11.22
1998	7.51	9.11	8.57	10.02
1999	8.41	11.71	7.91	11.71
2000	9.22	9.72	7.28	10.70
2001	10.63	11.26	8.11	11.99
2002	8.64	10.57	6.83	10.62
2003	8.08	9.94	6.24	10.00
		Tepid		
Year	Heating	Water	Electricity	At least one
1997	8.76	8.58	8.41	10.43
1998	7.83	8.98	8.72	10.19
1999	10.41	15.57	9.54	15.69
2000	13.05	14.89	11.05	15.81
2001	12.74	14.30	10.78	15.29
2002	9.97	12.73	8.91	13.02
2003	9.01	11.65	7.67	11.84
		Cool		
Year	Heating	Water	Electricity	At least one
1997	8.68	8.89	8.56	10.19
1998	8.71	10.41	9.43	10.99
1999	7.12	11.00	6.90	11.06
2000	9.26	10.89	8.18	11.28
2001	10.11	11.67	8.25	12.09
2002	8.57	11.73	7.75	11.87
2003	7.44	9.89	6.08	10.04
		Cold		
Year	Heating	Water	Electricity	At least one
1997	8.52	8.45	8.75	10.02
1998	7.42	8.11	7.97	9.25
1999	6.04	9.69	5.83	9.87
2000	8.44	10.17	7.81	10.89
2001	9.16	10.09	7.60	11.19
2002	7.69	10.90	7.06	11.31
2003	7.61	9.96	6.92	10.39

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(lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
(lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL) , Venice, August 28-29, 2003
(lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
(lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
(lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003
(lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004
(lxxi) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 2004
(lxxii) This paper was presented at the 10th Coalition Theory Network Workshop held in Paris, France on 28-29 January 2005 and organised by EUREQua.
(lxxiii) This paper was presented at the 2nd Workshop on "Inclusive Wealth and Accounting Prices" held in Trieste, Italy on 13-15 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics
(lxxiv) This paper was presented at the ENGIME Workshop on “Trust and social capital in multicultural cities” Athens, January 19-20, 2004
(lxxv) This paper was presented at the ENGIME Workshop on “Diversity as a source of growth” Rome November 18-19, 2004
(lxxvi) This paper was presented at the 3rd Workshop on Spatial-Dynamic Models of Economics and Ecosystems held in Trieste on 11-13 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics
(lxxvii) This paper was presented at the Workshop on Infectious Diseases: Ecological and Economic Approaches held in Trieste on 13-15 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics.

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