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Energy affordability and the benefits system in Italy

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HIGHLIGHTS

- The paper provides a discussion of alternative measure of energy affordability.
- We examine the emergence of fuel poverty in Italy from 1998 to 2011.
- We assess the appropriateness of the Italian energy benefits eligibility criteria.
- A simulation shows that the energy benefits have little impact on fuel poverty.

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ABSTRACT

In this paper, we discuss a number of ways to define and measure the affordability of energy consumption, and we examine the emergence of energy poverty in Italy in the period from 1998 to 2011. The paper examines the eligibility criteria for claiming the benefits available to support energy consumption for vulnerable families and it identifies the potential beneficiaries. The study assesses the appropriateness of the eligibility criteria by comparing the population targeted by the policy with the population actually facing affordability problems. A simulation exercise, using the hypothetical scenario most likely to result in energy benefits being made available, shows that, regardless of the affordability index adopted, the provision of state energy benefits has little impact on fuel poverty.

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1. Introduction

It is well-known that escalating energy prices have led to real and growing affordability problems for many utility customers even in advanced countries. These problems are likely to have been exacerbated by the recent financial crisis. There is also growing anxiety about the potential effect of policies aimed at countering climate change on the price consumers pay for energy and thus for most essential products.

As highlighted in a recent report of the EU Citizens' Energy Forum (Vulnerable Consumer Working Group, 2013), many EU governments have implemented different measures – ranging from specific government support to pay energy bills (i.e. social tariffs, benefits, discounts, delayed payments) to broader social security measures (i.e. general income and housing support) – in order to help low income households and other socially vulnerable groups. Consequently, the beneficiaries and the results of these measures may vary considerably from country to country.[3] However, the relevant information needed to assess these interventions is rarely made available, making it difficult to investigate their effectiveness.

There is a lively debate about the concept of affordability and the statistical indices used to assess fuel poverty, different approaches can produce quite different pictures of the situation as documented in the Hills Report (Hills, 2012).[4] Affordability criteria should be sensitive to changes in supply side variables (i.e. energy prices,

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[3] In Belgium 8.5% of all residential customers have benefited from social tariffs in gas and electricity in 2012; in Italy, beneficiaries included about 600,000 households; in France 1083,000 and 313,000 consumers benefited from social tariffs for electricity and gas, respectively (see Vulnerable Consumer Working Group, 2013). On the energy poverty policies in the EU see also Bouzarovski et al. (2012).

[4] On this point and as applied to the Italian experience see Miniaci et al. (2008a,b).

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technology, conditions of service) and, at the same time, they must take into consideration consumer needs and preferences. This seems to be particularly complex, given the heterogeneity of household living conditions and composition.

This study aims to provide some evidence about the Italian experience. On the basis of our discussion on the *pros* and *cons* of the different affordability criteria, we look at the dynamics of the affordability issue in the Italian electricity and gas markets for the period 1998 to 2011 using the annual Surveys on Family Budgets (SFB). Gas and electricity are the main sources of home energy in Italy, where basically all households consume electricity and the share of households using natural gas for heating and/or cooking rose from 63.5% in 1998 to 76.5% in 2011. As expected, the results depend to a large extent on which measures are used. However, by any measure, electricity and gas unaffordability in Italy seems to be on the increase since 2007, accompanied by a remarkable reduction in household spending capacity.

The study then looks at the electricity and gas benefits scheme introduced in 2008 and designed to support low income households in Italy. We first investigate the extent to which the existing rules accurately identify the households with the greatest energy affordability problems, and we assess whether the policy would have been effective in reducing energy affordability problems if all eligible households had received the benefit.

Our analysis, based on data from the 2011 EU Survey on Income and Living Conditions (EU-SILC), highlights that the eligibility rules have several limitations: about 12.5% of the households in absolute poverty do not meet the criteria. Only 43% of the households at risk of poverty and no more than 59% of those with affordability problems qualify for the benefits. The value of the benefits in 2011 was on average €68 for electricity and €92 for gas, corresponding respectively to 0.9% and 1.6% of the net income of the eligible households. If all those entitled had taken up the benefit, the total cost of the scheme would have been €409.9 million, equivalent to 0.026% of the GDP. The amount of benefit available from the scheme and its failure to target households in need accurately means that even in the most favourable scenario the scheme has no significant impact on the affordability of gas and electricity, no matter what type of indicator is used to depict the phenomenon.

2. Methods

According to the Warm Homes and Energy Conservation Act (UK Government, 2000), a person is said to be in fuel poverty "*if he is a member of a household living on a lower income in home which cannot be kept warm at a reasonable cost*". This definition points to the different causes of fuel poverty i.e. low income, efficient home equipment, high energy consumption. Demographic circumstances, the nature of housing tenure and the heating system all matter in fuel poverty (Boardman, 1991, 2010). The complex interactions of these elements and their detrimental effects on the quality of life, social attainment and health, have been also investigated referring to the wider issue of "energy poverty" and evaluated through – at least – three main different approaches: (i) the technical evaluation of home efficiency; (ii) the households' perception of their energy needs; (iii) the economic analysis of energy affordability (Bouzarovski, 2013). In the present paper we adopt the latter approach and we present typical measures of affordability which are based on the incidence of energy spending on total expenditure or income. We then describe the relative new indicators which are based on the notion of residual income.

2.1. Affordability indices based on energy spending as a budget share

The notion of affordable energy consumption is based on the idea that it is undesirable that the expenditure on these basic goods exceeds a critical threshold: beyond this limit, households presumably struggle in covering the costs and consequently ad hoc policies would be recommended.[5] The general idea is that energy consumption is part of an essential basket of goods which every household should be able to afford in order to have a "normal" standard of living in terms of heating conditions and use of household appliances. In practice, once policy makers have determined the level of the critical threshold, a household is considered to have an affordability issue for energy consumption if it exceeds that limit and it can then be said exhibit what the UK has labelled "fuel poverty" (DEFRA, 2001, 2007). Accordingly, such households should be considered as part of the target population for which the benefits scheme was designed.

Within the class of indices based on budget shares, we distinguish different alternatives. In the UK, the level to consider is the expenditure needed to keep adequately warm the house, irrespectively of actual energy consumption. This approach allows one to identify those households that over-consume energy without needing to, as well as those that under-consume energy but that would need to consume more to live in an adequately heated home. The disadvantage of this approach is that it is particularly data demanding, as it requires an accurate estimate of households' energy needs given the characteristics of their accommodations. These data are available for representative samples of the population in the UK, and they are at the basis of the old and new fuel poverty measurements (see Hills, 2012). When such data are unavailable, as in continental Europe, the actual level of energy expenditure is used to assess the affordability of energy consumption, which some authors refer to as "expenditure fuel poverty" (e.g. Bennett et al., 2002) or "economic energy insecurity" (e.g. Hernández, 2013).

In this context, a headcount index (*HI*) is the percentage of consumers whose actual energy expenditure exceeds a given fraction of their income. In most studies, this critical threshold has been fixed between 5% and 10%.[6] This approach does not incorporate any information about a desirable amount of consumption, either for utilities or other goods. For instance, a policy based on such a criterion does not address, and may potentially exclude from the set of eligible households, impoverished consumers who do not have access to the service either because of limited supply or because of high fixed costs.

Formally, define x_h the total expenditure for household h, and x_h^u its observed expenditure in utilities: a household has problems of affordability of its energy consumption if the ratio $r_h = x_h^u/x_h$ is larger than a given threshold, r^u. Considering any population, the extent of the affordability problem is measured by the headcount index *HI*, that is the fraction of households for whom $r_h \geq r^u$.

In our view, such a concept of affordability cannot provide useful information on either the extent of the problem, or its depth. As for the former issue, it excludes from the definition of fuel poverty those households in absolute poverty that decide – because of economic constraints – to spend very little in utilities. Moreover, this approach can label as "fuel poor" some relatively well-off households that are characterised by high energy consumption.

2.2. Affordability indices based on residual income

A different way of measuring affordability stems from the observation that energy is not the only item essential for a decent life, and that spending on energy can become problematic where it leaves a household insufficient income to consume other goods or

[5] Some studies in economic literature have highlighted the idea that policy makers should consider essential levels of energy consumption – and more generally of public utility services – as a merit good and consequently address policies to support lower consumption (Hancock, 1993; Sandmo, 1983; Besley, 1998).

[6] See also Fankhauser and Tepic (2007), Chaplin and Freeman (1999), Hancock (1993), Sefton (2002), Sefton and Chesshire (2005), Waddams Price et al. (2012).

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services. The indices presented in Section 2.1 completely neglect this point.

The notion of "residual income" was first used to study problems of affordability in the field of housing economics (Thalmann, 2003). Adapting this approach to energy consumption, we can say that there is a problem with energy affordability if the household does not have sufficient financial resources to fund a minimum level of consumption of other goods after paying bills for gas and electricity.

Note that this approach focuses on financial difficulties incurred as a result of the consumption of public utilities (Stone, 1993). Moreover, it allows one to identify at least three types of households with affordability issues for which different types of interventions are suitable:

(i) Households unable to access the minimum amount of essential commodities and utilities: in this case, the problem of energy affordability can be alleviated by income support mechanisms which are not conditional on the actual level of consumption;
(ii) Households with limited income that over-consume: in this case, an appropriately targeted action should address the reason why this happens (preferences, technological constraints, inefficient equipment, etc.);
(iii) Households whose consumption is below the minimum standard due to monetary or non-monetary constraints (e.g. lack of access to gas or electricity networks): in this case, interventions should first be aimed at removing these constraints.

We consider a household to be "residual income poor" if its residual income, defined as the difference between the total observed expenditure and the actual energy expenditure, is not sufficient to purchase the minimum bundle of non-energy goods and services which are considered necessary for a decent standard of living (x^{cp}). Whenever the actual expenditure for energy is lower than the minimum standard expenditure for energy (x^{up}) the household is instead classified as "under-consumers". The extent of the affordability problem is then measured by the fraction of residual income poor households in the population (H_u^{RI}), the fraction of under-consumers (H_c^{RI})and, by combining the two deprivation conditions, the fraction of residual income poor and/or under-consumers (H^{RI}).

`The above indices do not consider the difference between the minimum consumption level and household's income and therefore give no guidance on the level of subsidy needed. This information is instead conveyed by the average gap between the minimum standards and the actual expenditures of the residual income poor (GI_u^{RI})and the under-consumers (GI_c^{RI}).

With respect to the budget share approach, the residual income framework has the advantage of distinguishing between the different causes of fuel poverty (income poverty, over-consumption or under-consumption) and of assessing (through the poverty gap indices) the monetary transfer needed to support the households in need. Both aspects are crucial in the design of effective policies aimed at alleviating the problem of fuel poverty.

The suggested residual income approach to affordability measurement can be compared with the "*after fuel costs poverty*" measure discussed by Hills (2011). A household is defined to be "after fuel costs poor" if its disposable income after actual housing and fuel needs falls below the 60% of the median value of the same quantity for the entire population. We deviate from this definition in at least three directions: (i) we consider actual energy expenditure; (ii) we set the income threshold based on the absolute poverty approach rather than the relative one, as in the Minimum Income Standards (Hills, 2011); (iii) we consider consumption under the minimum standard as possible source of deprivation.

Hills' Low Income and High Costs (LIHC) indicator classifies households as fuel poor if "they have required fuel costs above the median level; and were they spend that amount, they would be left with a residual income below the official poverty line", where the official poverty line is a relative poverty line (Hills, 2012). Again, we deviate from the LICH indicator for the same reasons itemised in the previous paragraph and because we consider all households with insufficient income as facing an energy affordability problem.

We believe that as we consider the actual energy expenditure rather than fuel needs, spending less than the minimum standard is potentially a major concern because it indicates that the household is consuming less than what is considered necessary for a decent quality of life, where this standard is set in absolute (physical) terms. It may be the case that some of the under-users demand less energy because their accommodation and electric apparels are more efficient than standard ones, but at the same time the under-users include those families that when facing the "to heat or to eat" dilemma (Bhattacharya et al., 2003) choose to drastically reduce their energy expenditure (and at the extreme, to be disconnected). Given the potentially noisy signal provided by the under-users group, we treat the results for this group with caution and provide evidence on the possible causes of under-consumption.

Finally, we do not see any plausible reason to exclude any households in absolute poverty from the set of those facing energy affordability problems. Households in absolute poverty cannot afford the minimum standard of energy and of other goods at the same time. Supporting these families with social tariffs or energy benefits (or improving the efficiency of their accommodation) would help them reach the minimum standard of energy consumption and at the same time it would free resources for other essential goods. In this respect, we consider fuel poverty policies as part of a multi-facet strategy against poverty and material deprivation.

3. Results

We apply the affordability measures outlined in Section 2 to the consumption of electricity and gas in Italy; to this end, we need to follow two preliminary steps:

(i) Define the threshold (r^u) above which the budget share indicates the presence of an affordability problem.
(ii) Set the level of the minimum standard expenditures for electricity and gas (x^{up}) and the other goods (x^{cp}).

3.1. Setting the minimum standards and the budget share thresholds

We set the values for the minimum expenditure of gas and electricity (x^{up}) and for the sum of the other goods (x^{cp}) as equal to those included in the definition of the official Italian poverty line (ISTAT, 2009), and we estimate them for each household sampled by the Italian Central Statistical Institute (ISTAT) for the Survey on Family Budgets from 1998 to 2011.

Table 1 shows the average monetary value of the minimum standards for electricity, gas and other goods in Italy in 2011. For electricity, the value of the reference consumption does not depend on the area of residence and it amounts to about half of the actual median expenditure. The minimum expenditure for gas is defined as the heating and cooking component of the poverty line. It depends on the number of household members by age group, which also defines the standard size of the dwelling, and the use of regional adjustment coefficients account for heterogeneity in both climatic conditions and

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Table 1
Average monetary value of the minimum reference monthly expenditure for utilities and other goods.

No. of household members	Electricity	Gas			
		Warm	Mild	Temperate	Cold
1	12.01	5.33	36.49	36.51	53.36
2	16.34	20.27	47.76	52.12	68.27
3	22.33	27.17	53.79	59.17	75.12
4	25.13	40.94	61.98	68.05	87.79
5 +	27.29	55.90	73.82	82.38	102.72

No. of household members	Other goods (food, housing, etc.)							
	Warm		Mild		Temperate		Cold	
	No gas	With gas	No gas	With gas	No gas	With gas	No gas	With gas
1	563.96	556.05	614.81	634.19	647.80	624.12	739.93	682.33
2	801.03	779.45	870.63	868.71	889.19	858.70	1025.34	953.41
3	1035.76	1006.74	1106.69	1106.82	1139.85	1091.55	1301.22	1220.38
4	1260.45	1222.44	1349.52	1311.79	1331.91	1302.77	1566.30	1471.95
5 +	1456.33	1430.94	1531.08	1501.59	1506.09	1468.43	1774.63	1718.28

Values for 2011, by climatic classification of the area of residence.

construction standards (see Appendix A for further details). The estimated value of the gas reference expenditure is about 80% of the actual median spending except for small households living in warm areas, where it is considerably smaller than the median expenditure. Given such relatively high level of minimum standard expenditures for electricity and gas, we expect under-consumption to be diffused among the households, except in the warm areas.

Not all Italian households use natural gas for heating and/or cooking. The percentage of households using heating oil decreased from 18.6% in 1998 to 5.7% in 2011 in favour of the use of natural gas (rising from 63.5% to 76.5% in the same period). The use of other types of energy for heating has been almost stable during the period under consideration: LPG and other liquid fuels about 8%, wood about 6% and other energy sources (including electricity) about 3%. As a consequence, we differentiate the minimum standard for other goods (x^{cp}) between users and non-users of natural gas. In the latter case the value of x^{cp} includes the minimum expenditure for heating and cooking.

For the definition of the threshold values r^u, we can adopt several alternative approaches:

(i) A "normative" approach, that internalises the implicit value judgements adopted in the construction of the absolute poverty line. In this case the maximum sustainable threshold (r^u) is defined as the ratio between the value of the subsistence level of the household referred to energy (x^{up}) and the value of overall subsistence spending ($x^p = x^{up} + x^{cp}$). This ratio varies with household size, area of residence and relative price, thus acknowledging the role played by economies of scale, climate conditions and prices.

(ii) A "positive" approach, that looks at the balance sheets of households with low purchasing power and defines the maximum sustainable threshold (r^u) as the median value of the share of energy expenditure for the households in a state of relative poverty. This threshold is conditional on household size and geographical area and varies over time due to changes in relative prices and household consumption decisions.

(iii) The standard approach that sets a threshold equal for all types of households is the one which at least apparently yields more interpretable results. Much of the literature sets the threshold at 10% for gas (including heating) and 5% for electricity (e.g. Fankhauser and Tepic, 2007).

Table 2 allows us to appreciate the difference between the alternative approaches showing for the year 2011 the thresholds computed according to the criteria (i) and (ii) described above. For electricity, the thresholds set by criterion (i) are about half of those set according to the second approach, while the differences are narrower in the case of gas. Note that the standard thresholds of 10% for gas and 5% for electricity are much higher than those identified by the criteria (i) and (ii), and therefore their use classifies fewer household as "fuel poor".

3.2. *Affordability indices based on energy spending as a budget share: Different pictures but same dynamics since the 2007 recession*

Table 3 provides an initial insight into the relevance of electricity and gas affordability in Italy, based on the incidence of energy spending on household budgets. For each year, the table shows the average thresholds and the estimates of the headcount index for electricity and gas (referring only to those households actually connected to the natural gas network). The left-hand panel refers to the normative approach (where threshold values are implicit in the poverty line); the central panel shows the results for the positive approach (where threshold values are set with reference to the observed budget share of the low income households); while the right-hand panel considers the threshold of 5% for expenditure on electricity and 10% for gas. Adopting the normative criterion, the percentage of households spending an excessive share of their budget on electricity varies from 33.7% in 1998 to 51.4% in 2010. Using the positive criterion the percentage of households with electricity affordability problems is halved and estimates range between 14.8% in 2007 and 20.1% in 1999. Finally, setting the limit constant at 5%, the percentage remains between 5% (in 2000) and 8.1% (in 2009).

Different criteria deliver remarkably different pictures of the affordability of electricity consumption, both in terms of overall levels and dynamics. Nevertheless, all methods agree in indicating a worsening of the sustainability of electricity bills coinciding with the start of the Great Recession. With regard to gas consumption, the indices computed with the normative and the positive approaches have a similar size, but their time changes differ significantly: the normative headcount index varies from 20.4% in 2001 to 28.9% in 2009, while with the positive criterion it ranges between 24.7% in 2003 and 33.4% in 2000. Moreover, two out of three indicators show consistent evidence in favour of the claim that the affordability of gas consumption has worsened in recent years.

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Table 2
Critical thresholds r^u for the budget share approach.

No. of household members	Thresholds based on components of the absolute poverty line (1)					Thresholds based on budget shares of households in relative poverty (2)				
	Electricity					Electricity				
	Warm	Mild	Temperate	Cold	Total	Warm	Mild	Temperate	Cold	Total
1	0.0209	0.0182	0.0181	0.0161	0.0176	0.0526	0.0412	0.0525	0.0325	0.0403
2	0.0201	0.0179	0.0179	0.0158	0.0173	0.0453	0.0384	0.0365	0.0274	0.0341
3	0.0211	0.0192	0.0193	0.0170	0.0186	0.0424	0.0355	0.0275	0.0291	0.0329
4	0.0196	0.0182	0.0184	0.0159	0.0176	0.0362	0.0344	0.0290	0.0258	0.0307
5+	0.0185	0.0177	0.0185	0.0151	0.0171	0.0390	0.0301	0.0298	0.0232	0.0300
Total	0.0203	0.0183	0.0184	0.0161	0.0177	0.0442	0.0374	0.0379	0.0290	0.0350
No. of household members	Gas				Gas					
	Warm	Mild	Temperate	Cold	Total	Warm	Mild	Temperate	Cold	Total
1	0.0094	0.0511	0.0523	0.0715	0.0594	0.0398	0.0511	0.0718	0.0745	0.0663
2	0.0250	0.0497	0.0552	0.0660	0.0566	0.0278	0.0404	0.0550	0.0610	0.0524
3	0.0258	0.0444	0.0497	0.0571	0.0490	0.0242	0.0475	0.0409	0.0502	0.0448
4	0.0318	0.0435	0.0481	0.0555	0.0473	0.0268	0.0400	0.0388	0.0437	0.0390
5+	0.0370	0.0458	0.0523	0.0560	0.0492	0.0187	0.0297	0.0505	0.0289	0.0305
Total	0.0247	0.0476	0.0519	0.0642	0.0539	0.0285	0.0445	0.0540	0.0596	0.0517

Values for 2011.

Table 3
Affordability measures based on the budget share approach.

	Normative approach				Positive approach				Standard approach	
	Electricity		Gas		Electricity		Gas		Electricity	Gas
	Average threshold	*HI*	Average threshold	*HI*	Average threshold	*HI*	Average threshold	*HI*	5% threshold *HI*	10% threshold *HI*
1998	0.0200	0.3372	0.0523	0.2287	0.0283	0.1987	0.0382	0.3236	0.0588	0.0575
1999	0.0191	0.3726	0.0523	0.2317	0.0286	0.2012	0.0451	0.2824	0.0647	0.0568
2000	0.0198	0.3352	0.0543	0.2186	0.0279	0.1868	0.0363	0.3340	0.0497	0.0578
2001	0.0196	0.3698	0.0542	0.2039	0.0296	0.1894	0.0387	0.3241	0.0526	0.0508
2002	0.0189	0.4066	0.0508	0.2536	0.0306	0.1768	0.0466	0.2714	0.0565	0.0589
2003	0.0187	0.4122	0.0510	0.2503	0.0315	0.1685	0.0493	0.2471	0.0578	0.0515
2004	0.0177	0.4331	0.0502	0.2637	0.0308	0.1668	0.0476	0.2653	0.0548	0.0532
2005	0.0179	0.4458	0.0528	0.2621	0.0319	0.1616	0.0529	0.2498	0.0582	0.0589
2006	0.0194	0.4220	0.0555	0.2607	0.0340	0.1566	0.0515	0.2692	0.0600	0.0688
2007	0.0197	0.4262	0.0543	0.2167	0.0344	0.1481	0.0412	0.3001	0.0542	0.0483
2008	0.0202	0.4706	0.0561	0.2505	0.0370	0.1556	0.0495	0.2639	0.0710	0.0605
2009	0.0196	0.4920	0.0534	0.2894	0.0366	0.1648	0.0520	0.2744	0.0806	0.0735
2010	0.0181	0.5138	0.0519	0.2852	0.0362	0.1559	0.0536	0.2519	0.0716	0.0649
2011	0.0177	0.5042	0.0539	0.2708	0.0350	0.1614	0.0517	0.2645	0.0690	0.0645

Average threshold ratios for normative and positive approaches and headcount indices (*HI*) for electricity and gas. Threshold and HI for gas refer to gas users only.

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3.3. *Affordability indices based on residual income: Residual income poverty increases during the recession, under-spending is price sensitive*

Let us now consider the measures related to the residual income approach shown in Table 4.

In this case we account for the sum of the costs of electricity and gas accurately, taking into consideration whether or not the household uses natural gas. The first column shows the fraction of households classified as being in absolute poverty, that is, those whose expenditure falls below the absolute poverty line. From 2007 to 2011, the percentage of households in absolute poverty has increased by almost 50%, rising from 5.2% to 7.7%. Column (A) shows HI_u^{RI}, the fraction of households defined as residual income poor, i.e. those households whose expenditure, net of electricity and gas bills, is lower than the value of the minimum bundle of other goods nec; essary to guarantee a decent standard of living. We can observe that this fraction fluctuated around 5.5% until 2007, reaching 8.4% in 2011. The fraction HI_c^{RI} of under-users, namely the households whose expenditure on electricity and/or gas is less than the subsistence level as identified by the poverty line, varies over time. In particular, the proportion of under-users has decreased from approximately 30% to 20.6% between 1998 and 2005 and then increased to 24.9% in 2011 (see column (B)).

The high percentage of under-users is a consequence of the relative "generosity" of the minimum reference expenditure for gas, which is almost equal to the observed median expenditure for heating. The combination of residual income poor and under-users, column (C), estimates in about 30% the percentage of households with affordability problems. As expected, the majority of these households are not poor in the absolute sense. Table 4 presents also the percentage of residual income poor and under-users who are not absolutely poor. The first group of households varies between 0.5% and 0.7% until 2007, with a recent increase to more than 0.9%. Overall, at least 85% of the residual

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Table 4
Affordability measures based on the residual income approach.

	Below the absolute poverty line	(A)	(B)	(C)	Above the absolute poverty line		Energy/general CPI	Real GDP_t/GDP_{1998}
		Residual income poor	Under-users	A and/or B	Residual income poor	Under-users		
1998	0.0537	0.0572	0.2897	0.3256	0.0051	0.2668	1.000	1.000
1999	0.0545	0.0596	0.2745	0.3136	0.0065	0.2527	0.952	1.015
2000	0.0517	0.0557	0.3003	0.3328	0.0057	0.2754	1.019	1.052
2001	0.0562	0.0595	0.2929	0.3292	0.0054	0.2677	1.045	1.071
2002	0.0551	0.0607	0.2540	0.2955	0.0073	0.2331	0.976	1.076
2003	0.0504	0.0551	0.2337	0.2717	0.0064	0.2150	0.988	1.075
2004	0.0492	0.0544	0.2157	0.2573	0.0059	0.2021	0.950	1.094
2005	0.0470	0.0523	0.2057	0.2461	0.0066	0.1925	0.990	1.104
2006	0.0487	0.0547	0.2365	0.2760	0.0069	0.2204	1.074	1.129
2007	0.0518	0.0563	0.2523	0.2905	0.0062	0.2325	1.075	1.148
2008	0.0646	0.0707	0.2493	0.3006	0.0086	0.2275	1.143	1.134
2009	0.0667	0.0740	0.2329	0.2886	0.0099	0.2120	1.115	1.072
2010	0.0668	0.0759	0.2244	0.2804	0.0112	0.2024	1.044	1.090
2011	0.0772	0.0841	0.2493	0.3089	0.0090	0.2226	1.080	1.095

Gas and electricity together. Headcount indices for absolute poverty, overall energy poverty (C) and by cause of deprivation (A and B).

income poor households are actually absolutely poor, that is unable to afford the minimum standards of consumption either of energy or of other goods. On the other hand, less than 10% of the under-consumers are also poor in absolute terms.

The last two columns of Table 4 provide useful insight about the main forces driving the dynamics of affordability, that is, changes in relative prices and real income. They show the ratio of the energy products consumer price index (CPI) over the general CPI, and the ratio of the GDP at constant (2005) prices over its 1998 value, both ratios rebased to one in 1998. Relative prices have been almost constant until 2005; since then, energy prices began to increase more than average. Real GDP grew slowly but steadily until 2007, it drastically dropped in 2009 (−5.5%) and it weakly recovered in the last two years. Comparing prices and GDP dynamics with the dynamics of the headcount indices for the residual income poor and the under-users (columns A and B), it is apparent that the surge of the energy prices has driven the rise of both indices between 2005 and 2008. The 2009 drop in real GDP has been so strong that, despite the reduction of energy prices, the number of residual income poor households kept increasing.

The number of under-users instead tracked more closely the energy price dynamics, that is, it decreased in 2009 and 2010 and it increased in 2011. The latter result makes evident that the two components of our affordability indicator have different sensitivity to income and price changes. As the percentage of under-users varies with energy prices, we conjecture that most of the under-users are households who cut their energy consumption under the minimum standards when fuel price increases and increase it when energy becomes more affordable. Households that consume consistently less than the minimum standard because of their energy efficient dwellings should be less sensitive to price variations.

In order to assess to what extent energy under-utilization is actually a signal of affordability problems, we try to identify what induces households to consume less than the minimum standards. For expositional convenience we focus on the under-users who are not absolutely poor in 2011. We estimate them to be 22.26% of the households connected to the natural gas grid (see Table 4). Few of them, about 62,000 out of 5.4 million of under-user households (1.15%), do not have any heating system in their houses: for these households under-consumption is a signal of deprivation, because living in a heated accommodation is a necessary condition for a decent standard of living. About 12% of the under-users (around 648,000 households) heat their houses using heating oil, LPG or other forms of energy. The gas bill of these households does not include the expenditure for heating, and it is likely to be lower than the minimum standard expenditure (which instead includes heating). In this case under-consumption is not a concern, as it is caused by the use of an alternative form of energy.

For the vast majority of the under-users the causes of under-utilization are not so clear. We therefore resort to a multivariate regression analysis to show that, ceteris paribus, richer, larger and older families are significantly less likely to spend less than the minimum standard for energy, that living in a small house and/or in a multi-unit building rather than in a single unit/detached house increases the probability of under-consumption by about 10 percentage points, and that the incidence of under-consumption in the coldest area is 28 percentage points higher than in the warmest area. Moreover, additional evidence from the EU-SILC shows that the fractions of households reporting arrears on utility bills or claiming difficulties to keep their home warm are the same among the under-users and all the other households. All together, these results suggest that in many cases under-utilization may not be considered a major indicator of affordability problems. Unfortunately, we are not able to disentangle between two alternative explanations, that is, that under-utilization is due to the fact that the household's actual accommodation is smaller and/or more insulated than the one considered to set the minimum reference expenditure, or that the standard dwelling is adequate but the associate reference expenditure is badly overestimated for the coldest areas of the country.

So far, we have only looked at headcount indices, which simply count the number of households "with affordability problems". In the case of the residual income approach, it is particularly informative to study the depth of the phenomenon among these households. Indeed, in this framework the average deviation from minimum standard expenditure is an exact measure of the average money transfer required to ensure that residual income poor households can consume the current amounts of electricity and gas and – at the same time – be able to afford the subsistence basket of other goods; for the under-consumers, it is the index that identifies the transfer that would allow them to consume the minimum amount of electricity and gas, leaving their current spending on other goods unchanged.

The average deviations for the residual income poor and the under-consumers (GI_u^{RI} and GI_c^{RI} respectively) are reported in Table 5. Our estimates show that not only energy is less affordable for more Italian households today than in the past (see Table 4), but also that households are affected by this issue in an increasingly serious way. In fact, for the residual income poor households, the amount which they would need to finance the sufficient consumption of other items

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Table 5
Average monthly gap.

			No gas		With gas	
	(A) Residual income poor	(B) Under-users	(As) Residual income poor	(Bs) Under-users	(Ac) Residual income poor	(Bc) Under-users
1998	128.45	16.99	139.96	4.14	114.31	20.00
1999	122.02	16.59	124.20	3.68	118.94	19.54
2000	128.03	19.41	140.41	4.04	117.74	21.99
2001	126.88	18.93	138.48	4.09	116.84	20.93
2002	141.88	18.62	151.48	4.14	134.80	20.07
2003	144.52	19.01	153.11	4.03	137.84	20.65
2004	141.01	18.83	147.78	3.71	136.03	19.91
2005	148.87	21.40	163.58	3.88	136.88	22.27
2006	145.21	22.80	150.60	4.46	141.07	24.07
2007	156.49	23.29	169.51	4.74	149.06	24.03
2008	182.03	25.67	192.31	4.26	175.71	26.62
2009	188.26	24.24	213.28	4.45	173.14	25.20
2010	187.27	22.37	201.79	4.81	180.12	23.23
2011	200.36	25.48	209.06	4.51	195.08	26.51

Average monthly gap from the minimum standards for the residual income poor and the under-consumers. Euro, current prices.

has increased from €128 per month in 1998 to €200 per month in 2011 (+56%)—compared to an inflation of 36.6% in the same period. For the under-users, however, the distance from the threshold has remained unchanged in real terms.

4. Discussion

The Italian policy regarding benefits payable for electricity and gas consumption was set forth by Law 266 of 23 December 2005, and then implemented through two decrees in 2007 (electricity bonus) and 2008 (gas bonus). The declared aim of the policy was to support:

(i) households living in poverty—or on its margins;
(ii) large households;
(iii) in case of electricity, households which include a disabled, or a critically ill person.

The program is funded through specific components in transmission or distribution prices, paid by all consumers.

The income eligibility criteria for electricity and gas benefits are the same[7]; and the spending ability of the family is tested by using a synthetic indicator called ISEE (the acronym for "Indicatore di Situazione Economica Equivalente", that is, the Equivalent Economic Conditions Indicator). The indicator combines information about income, real and financial assets, and the composition of the household. To be eligible, the household's equivalent income indicator must not exceed €7500 unless the family includes more than three dependents, in which case the threshold is increased to €20,000.

Given that the benefits are paid in the form of lump sum discounts on electricity and gas bills, a necessary eligibility condition is that the household is a domestic customer in its primary residence. In the case of electricity, some limits to the installed power must be met (3 kW for up to four household members, 4.5 kW if more), unless the household includes a person who needs essential electro-medical appliances. In the case of gas, customers having a condominium contract (usually due to the presence of centralised heating) receive their benefit with a bank transfer.

[7] For detailed information about the benefit design, see ⟨http://www.autorita.energia.it/it/bonus_sociale.htm⟩.

All domestic customers meeting the above criteria can apply for the benefits by filing a form with the municipality where they reside. As the eligibility criteria are independent of actual consumption levels, the ubiquity of the power grid guarantees that all Italian households meeting the above requisites are potential beneficiaries of the electricity bonus. The availability of the gas benefit instead is affected by the limited penetration of the gas distribution grid which does not serve many mountainous areas and the entire Sardinia region.

The electricity bonus depends on the number of components and it is independent of actual consumption, with the exception of the presence of electro-medical appliances, where it is calculated on the ground of the electricity usage intensity. For gas, the discount is proportional to the family size and depends on the classification of the municipality according to its typical winter temperature and the declared use (hot water and cooking and/or heating, see Appendix B).

4.1. Assessing the appropriateness of the eligibility criteria

All the affordability indicators discussed in previous sections refer to actual and/or standard expenditure in order to identify households in need. The eligibility criteria used to determine electricity and gas benefits in Italy are instead independent of actual household consumption. In order to assess to what extent the eligibility criteria are able to identify those households facing affordability problems, we have made use of the 2011 EU-SILC data to classify the households according to different energy poverty criteria which we then compare with their eligibility status.

The 2011 EU-SILC survey allows us to compute the equivalent income indicator (ISEE) for every family participating in the survey, but the data do not reliably identify the households which might be beneficiaries of the electricity benefits for health reasons; therefore, we have focused exclusively on the households eligible for electricity benefits for economic hardship, which are the vast majority of recipients (see online supplementary documentation for details). Some approximation is necessary for gas as well. In fact, with the EU-SILC data we can determine whether the household uses gas for cooking and/or heating, but the EU-SILC questionnaire does not distinguish between natural gas and other kinds of gas, thereby leading to an overestimate of the pool of eligible customers. Moreover, we cannot observe the cost of gas included in general condominium expenses (see online supplementary documentation for details).

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Table 6
Average income, fraction of income poor, eligible households, and households with affordability problems.

	Adult equivalent income	Poor	At risk of poverty	With affordability problems									
						Budget share approach						Residual income approach	
				Benefit eligible		Electricity			Gas			Electricity & Gas	
				Electricity	Gas	Normative	Positive	5%	Normative	Positive	10%	Residual income poor	Under-users
Total	**33,576.1**	**0.0533**	**0.1947**	**0.1146**	**0.0919**	**0.3827**	**0.0933**	**0.0611**	**0.1756**	**0.0585**	**0.0262**	**0.0557**	**0.2673**
Household types													
No children													
Single	37,495.7	0.0513	0.2394	0.1084	0.0819	0.4156	0.0679	0.0737	0.2760	0.0357	0.0425	0.0537	0.2733
2 Adults, less than 65 yrs	39,354.8	0.0462	0.1250	0.0732	0.0594	0.3344	0.0805	0.0480	0.1381	0.0438	0.0213	0.0466	0.2749
2 Adults, at least 65 yrs	33,910.8	0.0078	0.1373	0.0980	0.0805	0.3492	0.0676	0.0349	0.1314	0.0202	0.0149	0.0084	0.2615
Others	35,962.0	0.0196	0.1084	0.0654	0.0486	0.2612	0.0649	0.0268	0.0811	0.0355	0.0085	0.0203	0.2397
With children													
Single parent	22,145.6	0.2058	0.3440	0.3340	0.2682	0.5704	0.2504	0.1843	0.3054	0.2105	0.0911	0.2189	0.3033
2 Adults, 1 child	30,102.1	0.0638	0.1728	0.1195	0.1021	0.3302	0.1202	0.0628	0.1711	0.0716	0.0224	0.0689	0.2640
2 Adults, 2 children	26,139.6	0.0832	0.2336	0.1383	0.1167	0.4408	0.1304	0.0720	0.1357	0.1168	0.0160	0.0857	0.2578
2 Adults, 3 or more children	22,206.8	0.1475	0.3676	0.2875	0.2194	0.5635	0.2247	0.0953	0.1770	0.1735	0.0251	0.1564	0.3149
Others	26,371.4	0.0692	0.2475	0.1377	0.1208	0.4671	0.1234	0.0530	0.0867	0.0860	0.0147	0.0699	0.2821
Region													
North	37,629.8	0.0340	0.1153	0.0597	0.0529	0.3229	0.0471	0.0307	0.0966	0.0304	0.0306	0.0341	0.3434
Centre	36,498.4	0.0402	0.1659	0.0850	0.0762	0.3227	0.0584	0.0385	0.0593	0.0419	0.0166	0.0422	0.3605
South and Islands	25,605.0	0.0908	0.3331	0.2163	0.1610	0.5107	0.1850	0.1212	0.4058	0.1219	0.0255	0.0968	0.0938
Degree of urbanisation													
Densely populated area	36,187.17	0.0558	0.1807	0.1083	0.0892	0.3397	0.0867	0.0581	0.1400	0.0563	0.0188	0.0568	0.3252
Intermediate area	32,350.9	0.0484	0.1913	0.1035	0.0862	0.4162	0.0961	0.0606	0.1818	0.0554	0.0299	0.0515	0.2193
Thinly populated area	29,455.6	0.0585	0.2410	0.1586	0.1135	0.4178	0.1043	0.0704	0.2688	0.0737	0.0392	0.0629	0.2264
Tenure status													
Outright owner	36,585.2	0.0243	0.1740	0.0605	0.0466	0.3425	0.0688	0.0432	0.1627	0.0307	0.0205	0.0263	0.2373
Owner paying mortgage	36,805.5	0.0285	0.0844	0.0363	0.0286	0.2988	0.0656	0.0333	0.1001	0.0386	0.0114	0.0291	0.2821
Tenant at market rent	23,351.7	0.1638	0.2717	0.3354	0.2897	0.5585	0.1959	0.1445	0.2556	0.1632	0.0602	0.1652	0.3345
Tenant at reduced rent	24,475.7	0.0918	0.3116	0.2764	0.2251	0.5220	0.1356	0.0834	0.1872	0.0927	0.0364	0.1010	0.3595
Free accommodation	29,955.8	0.0868	0.3007	0.1562	0.1076	0.4221	0.1131	0.0774	0.2482	0.0959	0.0299	0.0919	0.2885
Dwelling type													
Detached house	32,050.6	0.0510	0.2282	0.1166	0.0869	0.4745	0.1224	0.0761	0.2441	0.0580	0.0330	0.0562	0.1601
Semi-detached house	32,844.0	0.0453	0.1876	0.1104	0.0860	0.4061	0.0936	0.0624	0.1874	0.0586	0.0353	0.0483	0.1831
In building <10 units	32,324.4	0.0722	0.2100	0.1380	0.1137	0.3840	0.0992	0.0694	0.1829	0.0793	0.0258	0.0750	0.2593
In building ≥ 10 units	36,844.7	0.0454	0.1551	0.0938	0.0831	0.2806	0.0625	0.0398	0.1007	0.0413	0.0117	0.0445	0.4419
Leaking roof, damp, broken windows etc.	29,472.4	0.0726	0.2511	0.1665	0.1323	0.4862	0.1305	0.0872	0.2363	0.0874	0.0393	0.0768	0.2279
Unable to keep home warm	24,456.0	0.1162	0.3710	0.2626	0.1960	0.5586	0.1797	0.1315	0.3065	0.1242	0.0448	0.1224	0.2033
Arrears on mortgage or rent	18,604.2	0.2551	0.4450	0.4443	0.3924	0.7066	0.2891	0.2287	0.3507	0.2796	0.0989	0.2638	0.2676
Arrears on utility bills	22,608.9	0.1574	0.3811	0.3055	0.2597	0.6082	0.2514	0.1740	0.3175	0.1956	0.0605	0.1657	0.1958
Excessive housing costs	28,785.4	0.0750	0.2544	0.1686	0.1403	0.4814	0.1322	0.0859	0.2173	0.0852	0.0344	0.0785	0.2355
Difficult to face unexpected financial expenses	25,070.8	0.1020	0.3353	0.2248	0.1782	0.5274	0.1599	0.1107	0.2550	0.1142	0.0378	0.1070	0.2555
Difficult to make ends meet	24,607.2	0.1026	0.3361	0.2320	0.1859	0.5414	0.1708	0.1160	0.2698	0.1200	0.0403	0.1078	0.2348

Statistics for gas affordability with the budget share approach refer to gas users only. Adult equivalent income (euro per year): household income net of taxes and contribution to the social security system, including imputed rents, divided by the equivalence scale used for the definition of the absolute poverty line. Poor: households whose adult equivalent income is below the absolute poverty line. At risk of poverty: households whose adult equivalent income is lower than 60% of median adult equivalent income.

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We first provide a new description of the affordability of gas and electricity, the incidence of poverty, and the eligibility status for the energy benefits. Although we maintain the definitions of affordability illustrated in the previous sections, their implementation is slightly different, mainly because we now refer to disposable income rather than to total expenditure.

4.1.1. About 10% of the Italian households are eligible for the energy benefits

The adult equivalent income is estimated at an average of €33,567 in 2011, its distribution is such that 5.3% of the households are in the state of absolute income poverty and 19.5% are at risk of poverty[8] (see Table 6). In this scenario, the electricity benefits provide support to potentially 11.5% of households (about 2.9 million families), while 9.2% of the households (2.3 million) qualify for the gas benefit. Depending on which strategy is adopted to set the critical threshold for the budget shares, the percentage of households in difficulty

[8] The adult equivalent income is defined as household income net of taxes and contribution to the social security system, including imputed rents and social transfers, divided by the Carbonaro's equivalence scale that is used for the definition of the absolute poverty line. The households at risk of poverty are defined by Eurostat as those households whose adult equivalent income is less than 60% of median adult equivalent income.

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ranges from between 6.1% to 38.3% for electricity and between 2.6% and 17.6% for gas. Resorting to the residual income approach, 5.6% of households do not have sufficient resources left after having paid electricity and gas bills, while 26.73% families have energy expenditure below the minimum standards. The statistics vary considerably between different types of families. The incidence of income and fuel poverty is higher among households with children, dramatically higher in the case of single parents.

4.1.2. *Tenants and southern households are more likely be eligible for the benefits*

The percentage of households covered by the means-tested benefits tends to be higher among households with higher poverty rates. It is not therefore surprising that the coverage rate for the Southern regions is more than three times the coverage rate for the richer northern regions, and that the percentage of eligible families in rural regions is higher than the corresponding percentage in more densely populated areas.

The quality of accommodation may play a crucial role in determining energy consumption, and therefore its affordability. Table 6 shows that households who own their homes are less likely to face an affordability problem, to be income poor or to be eligible for the benefits. This is partly due to the fact that homeowners are richer than tenants, but it is also the case that rented houses are typically of lower quality in comparison with owner-occupied houses. In fact, Table 6 highlights that where accommodation is poorly maintained (e.g. leaking roofs, broken windows, dampness or poor insulation), the likelihood of falling into fuel poverty is higher.

4.1.3. *Many households with energy bills arrears are not eligible for the benefits*

Finally, we investigate whether households that declare difficulties in coping with regular mortgage payments, rent and utility bills are classified as poor and are supported by the electricity and gas benefits. Among the households with arrears (for economic reasons) on mortgage or rent payments the percentage of the absolutely poor is above 25% and affordability problems are widespread. To a lesser extent, the incidence of income and fuel poverty is also higher among households with arrears (for economic reasons) on utility bills.

We might expect that households with arrears would be covered by the benefits system, but this is not so. Within this group, the percentage of eligible households is three times the average, but nevertheless more than 70% of families declaring difficulties in paying bills are not eligible for the system. Even taking into account the households who see themselves in financial difficulty, either because they consider their housing costs to be almost unbearable, or because their savings are insufficient to face unexpected expenses of about €800 or because they struggle to make ends meet, there is a wide gap between the number of households who see themselves in need and the number of households potentially eligible for support.

4.1.4. *Many households with energy affordability problems are not eligible for the benefits*

Although perceived financial difficulties may be relevant per se, we prefer to rely on objective indicators. We therefore studied the percentage of eligible households among the income poor families, and also among the families facing energy affordability problems according to the alternative approaches.

The stated aim of the electricity and gas benefits scheme is to support low income households, but the eligibility criteria do not ensure that all the targeted families qualify for the benefits. In particular, Table 7 shows that:

- about 12.5% of the households absolutely poor do not qualify for the benefits, i.e. 170,000 poor families are not eligible for these benefits;
- only 43% of the households at risk of poverty qualify for the benefits, that is, 2.8 million households at risk of poverty are not supported by the policy.

Our estimates also reveal that the eligibility criteria are particularly inadequate in addressing poor households without children and/or not living in the Southern regions.

More than 40% of the households, whose electricity and/or gas bills amount to more than 5% (10%) of their net income, are not entitled to the benefits; the coverage rate is higher (75%) if we refer to households with gas affordability problems according to the positive budget share approach. The percentage of potential beneficiaries of the scheme among residual income poor households is about 87%, while on average only about 10% of under-users are eligible. The fact that the eligibility criteria exclude a significant portion of households in need is due to a combination of factors:

(i) the Equivalent Economic Conditions Indicator (ISEE) used to assess the financial resources of the households refers to a definition of income that differs from that considered by the standard poverty indicators. In fact, the ISEE considers gross household income together with an estimate of the income produced by real estate properties and financial wealth, while the poverty statistics refer to net household income including imputed rents due to primary residence ownership and social transfers;
(ii) the ISEE indicator is based on an equivalence scale that is slightly different from that used for poverty definition. In particular, the equivalence scale used in the ISEE indicator considers the presence of disabled individuals, single parents and couples with children where both partners are employed (see online supplementary documentation), while the equivalence scale used for the poverty indicators considers only the size of the household and the age of its members;
(iii) the threshold value of the ISEE indicator is independent of the region of residence; the components of the absolute poverty line are instead region-specific, which allows it to consider regional variations in prices, housing markets and heating needs;
(iv) the eligibility criteria do not depend on the household's actual energy consumption; the scheme, by its design, is not well suited to deliver benefits to consumers who face difficulties despite an income above the subsistence level.

4.2. *Assessing the potential effectiveness of the electricity and gas benefits scheme in fighting fuel poverty*

Let us now investigate to what extent the electricity and gas benefits schemes actually alleviate the energy affordability problems of low income households. We circumvented the lack of publicly available data on the recipients of the benefits by assuming that all eligible households actually receive the benefits and comparing this outcome with a situation in which no such scheme existed. More specifically, we first make use of the EU-SILC 2011 data to identify eligible households (as in Section 4.1). We then use the eligibility rules to determine the appropriate level of benefits for each family. Finally, we compare the poverty and affordability indicators with and without the benefits. By doing so we are able to estimate the maximum potential effect

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Table 7
Fraction of eligible households among poor households, households at risk of poverty and households with affordability problems.

	Poor	At risk of poverty	Fraction of eligible households for electricity benefits							
			With affordability problems							
			Budget share approach						Residual income approach	
			Electricity			Gas			Electricity and gas	
			Normative	Positive	5%	Normative	Positive	10%	Residual income poor	Under-users
Total	0.8740	0.4320	0.2292	0.4997	0.5894	0.2862	0.7553	0.5389	0.8720	0.1111
Household types										
No children										
Single	0.7744	0.3076	0.1879	0.4753	0.4642	0.2080	0.7563	0.3247	0.7600	0.0970
2 Adults, less than 65 yrs	0.9025	0.4906	0.1851	0.4739	0.6934	0.2775	0.8068	0.7610	0.9179	0.0755
2 Adults, at least 65 yrs	0.8024	0.3169	0.1701	0.3323	0.3998	0.1827	0.6820	0.2029	0.8784	0.0742
Others	0.7866	0.4035	0.1539	0.2851	0.4413	0.2466	0.6830	0.4755	0.8148	0.0497
With children										
Single parent	0.8901	0.7453	0.4726	0.7160	0.7718	0.5575	0.8294	0.8896	0.8874	0.3295
2 Adults, 1 child	0.9581	0.5670	0.2945	0.5324	0.6696	0.3663	0.7863	0.9108	0.9507	0.1423
2 Adults, 2 children	0.9435	0.5423	0.2846	0.6097	0.7583	0.4482	0.7118	0.8283	0.9411	0.1146
2 Adults, 3 or more children	0.9644	0.6340	0.4135	0.6269	0.8637	0.4996	0.7523	0.8492	0.9664	0.3942
Others	0.9046	0.4730	0.2573	0.4674	0.6563	0.5471	0.7711	0.7795	0.8964	0.1464
Region										
North	0.7737	0.3400	0.1404	0.4314	0.4827	0.2212	0.7168	0.3756	0.7866	0.0738
Centre	0.8522	0.3562	0.1863	0.4551	0.5436	0.4020	0.6924	0.4900	0.8113	0.1018
South and Islands	0.9370	0.5038	0.3314	0.5349	0.6393	0.3014	0.7886	0.8675	0.9342	0.3404
Total	0.8747	0.4254	0.2224	0.4992	0.5810	0.2862	0.7553	0.5389	0.8702	0.1018
Household types										
No children										
Single	0.7675	0.3004	0.1838	0.4798	0.4608	0.2080	0.7563	0.3247	0.7461	0.0786
2 Adults, less than 65 yrs	0.8944	0.4731	0.1821	0.4805	0.6612	0.2775	0.8068	0.7610	0.9126	0.0625
2 Adults, at least 65 yrs	0.8411	0.2995	0.1565	0.3127	0.3762	0.1827	0.6820	0.2029	0.9131	0.0674
Others	0.7885	0.3802	0.1384	0.3046	0.4206	0.2466	0.6830	0.4755	0.8259	0.0460
With children										
Single parent	0.8777	0.7176	0.4570	0.7115	0.7465	0.5575	0.8294	0.8896	0.8709	0.3068
2 Adults, 1 child	0.9510	0.5647	0.2927	0.5306	0.6593	0.3663	0.7863	0.9108	0.9422	0.1398
2 Adults, 2 children	0.9377	0.5436	0.2785	0.5978	0.7665	0.4482	0.7118	0.8283	0.9342	0.1106
2 Adults, 3 or more children	0.9554	0.5853	0.3750	0.6068	0.8013	0.4996	0.7523	0.8492	0.9561	0.3759
Others	0.9079	0.4740	0.2571	0.4524	0.6633	0.5471	0.7711	0.7795	0.8980	0.1550
Region										
North	0.7912	0.3466	0.1377	0.4312	0.4729	0.2212	0.7168	0.3756	0.8059	0.0730
Centre	0.8365	0.3645	0.1862	0.4582	0.5445	0.4020	0.6924	0.4900	0.7904	0.0969
South and Islands	0.9426	0.4949	0.3393	0.5426	0.6424	0.3014	0.7886	0.8675	0.9366	0.3267

Poor: households whose adult equivalent income is below the absolute poverty line. At risk of poverty: households whose adult equivalent income is lower than 60% of median adult equivalent income. Statistics for gas affordability and eligibility of gas benefits refer to gas users only. Gas and electricity bonuses have the same eligibility criteria, thus the fraction of gas users eligible for the electricity discount coincides with the fraction of gas users eligible for the gas discount.

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that the policy has in terms of fighting fuel poverty, given the actual features of the households, the distribution of income and energy expenditure.

4.2.1. *The energy benefits are too small with respect to households needs*

The value of the benefits depends on household size and, in the case of gas, on the climatic conditions of the area of residence. In 2011, the benefits for electricity ranged from €56 for a single or two-person household to €124 per year for a family with at least five members (see Appendix B). The gas benefit varied between €70 for a household in the warmest areas of the country with at most four members to €264 for larger households in the coldest regions. According to our estimates, the average amount of the discount, included the related tax advantage, was €75.4 for electricity and €135.2 for gas. Their impact on household budgets is very limited: for the low income households, who are the potential beneficiaries of the policy, the electricity and gas benefits are on average respectively equivalent to 0.9% and to 1.6% of their net income. The resources required to combat residual income poverty, for example, are much larger: in Table 5 we estimate the average deviation from the minimum standard for the residual income poor to be about €2400 in 2011. To include cross-national comparisons, we note that the Winter Fuel Payment scheme in the UK paid £400 to pensioners over 80 in 2011 and that this subsidy could be added to advantages coming from the Warm Home discount scheme and from other measures used in UK fuel poverty policy (Hills, 2012).

4.2.2. *The benefits system does not significantly impact on energy affordability*

Table 8 summarises what would happen if all entitled households took advantage of the scheme. In the first column we present the fraction of households not eligible for the benefits who are in income or fuel poverty according to the different criteria adopted. In this exercise we take advantage of the fact that the eligibility rules are constant across sectors. Therefore, if gas users qualify for the gas bonus, we consider the sum of the two benefits, and we report a unique set of affordability indicators for gas and electricity.

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Table 8
Fraction of poor households, households at risk of poverty and households with affordability problems by eligibility status.

	Not eligible	Eligible		Before −after difference	
		Before payment	After payment	Eligible	Total
Income poverty					
Poor	0.0076	0.4067	0.3979	0.0088	0.0010
At risk of poverty	0.1249	0.7341	0.7208	0.0133	0.0015
Budget share approach for electricity and gas					
Normative	0.2001	0.6449	0.5264	0.1186	0.0136
Positive	0.0177	0.4268	0.3502	0.0765	0.0088
5%+10%	0.0185	0.2204	0.1838	0.0366	0.0042
Residual income approach for electricity and gas					
Residual income poor	0.0080	0.4239	0.4203	0.0035	0.0004

Poor: households whose adult equivalent income is below the absolute poverty line. At risk of poverty: households whose adult equivalent income is lower than 60% of median adult equivalent income. Statistics for gas affordability and eligibility of gas benefits refer to gas users only. Gas and electricity bonuses shares the same eligibility criteria, thus the fraction of gas users eligible for the electricity discount coincides with the fraction of gas users eligible for the gas discount.

The second column similarly shows the same values for the eligible households where they did not take up the benefits.

All our statistics confirm that these families are more vulnerable than households that are not eligible. After the payment of benefits, the situation improves only marginally with respect to income poverty (the third and fourth columns). Among the recipients, absolute poverty decreases by 0.9 percentage points, from 40.7% to 39.8%; this means that only 2.2% (=0.9/40.7%) of the recipients who are absolutely poor would exit from poverty status thanks to the electricity and gas benefits scheme. A similar value for the exit rate is estimated from the "at risk of poverty" status, and the same rate is even lower if we focus on the residual income poor. The small effect that benefits have on recipient welfare together with the fact that the eligibility criteria leave many poor households without support (see Table 7), implies that the overall potential effect of the policy on the poverty indicators is negligible (see last column of Table 8).

Even though the targeting of the scheme does not take into account actual expenditure for electricity and gas, the counter-intuitive result is that the main effect of the benefits scheme is to improve the affordability indicators based on the budget share approach; the bonus works "as if" it were targeting actual high energy expenditures. In fact, comparing the affordability indices for the eligible households before the payment of the bonuses (column 2 of Table 8) with the differences in the headcount ratios (column 4) we see that the percentage of the recipients that may solve their difficulties by taking advantage of the fuel discounts ranges between 16.6% (=0.0366/0.2204%) if we consider the combined threshold of 5% for electricity and 10% for gas, and 18.3% (=0.1186/0.6449%) for the normative approach. The reduction of the headcount indices for the entire population is much smaller due to the limited coverage provided by the eligibility criteria: considering the combined threshold of 5% for electricity and 10% for gas, the payment of the benefits reduces the headcount index to 3.7% (column 4) from 4.2% (not reported in the table).

5. Conclusions and policy implications

Alternative indices of energy consumption affordability may represent the Italian situation in very different ways, both in terms of the number of the households in need and in terms of dynamics over time. Despite this variability, the different measures agree in indicating that energy consumption in Italy has become less affordable since the start of the financial crisis in 2007. Furthermore, all approaches are consistent in indicating that households with children, those claiming difficulties to pay their bills, families living in poorly maintained accommodations, tenants and residents in the Southern regions are particularly vulnerable.

Each measure focuses on different aspects of the affordability problem, but any sensible indicator should combine information on households income and the achievement of a minimum standard of quality of life and it should consider under-spending as a potential cause of deprivation. The actual implementation of these principles has to deal with the nature of the available data and it needs to be complemented by an analysis of the determinants of the affordability problem.

The Italian scheme of energy benefits, unlike schemes for general income support as adopted in the UK's fuel poverty strategy (Hills, 2012) and unlike direct subsidies for investments to increase home efficiency as widely-used in Sweden (Mahapatra et al., 2011), consists of a lump-sum contribution for vulnerable consumers, similar to schemes already adopted in France (Dubois, 2012).

The policy provides a limited benefit to a potentially large number of beneficiaries: in 2011 we estimate that about 11.5% of the Italian households were eligible for the electricity benefits and 9.2% for the gas benefit. The coverage of the benefits varied significantly across types of households and regions. In 2011 the average benefits received were €68 for electricity and €92 for gas, which – unfortunately – represent too small an amount to consistently fight the issue.

The eligibility of a household is determined by a combination of income, wealth, labour force participation and demographic composition, while it is independent of the actual spending on energy, housing conditions and the cost of living experienced by the family. This undermines the ability of the benefits scheme to effectively target households in need. At the same time, some of the funds are paid to families that can hardly be considered vulnerable. Our simulation shows that even in the most favourable scenario, the implementation of the policy leaves the poverty and affordability indices basically unaltered. The amount of information required to the applicants and the procedure to certificate the household taxable income may discourage many potential claimants and further reduce the effectiveness of the intervention.

Our analysis suggests that the effectiveness of the Italian energy benefits scheme could be improved by heavily revising the eligibility criteria. In particular, it is necessary to acknowledge that the cost of living differs widely across the country: the material conditions of households with similar income or wealth levels but living in different areas of the country can be remarkably different. Price heterogeneity is duly taken into account by the poverty and affordability indices, but not by the administrative rule applied to grant access to the benefits. In our opinion, household spending ability should instead be compared to area-specific thresholds whose level should depend on the local cost of living.

The discounts are enjoyed by all low income households who are electricity and/or natural gas consumers. The decision to use a discount instead of a cash transfer excludes from the pool of eligible

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households those families who have been disconnected because of arrears as well as vulnerable consumers who live in areas with no access to the natural gas grid. This result is somewhat paradoxical if the goal of the scheme is to finance the consumption of energy as a "merit good". In this respect, means-tested cash transfers can be a more effective way to support households in need, ensuring a wider coverage rate of the target population, without necessarily increasing current (substantial) administrative costs.

Uncited reference

Waddams Price (2005).

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Appendix A. Setting the minimum standard for energy and other goods/services

In order to implement the residual income approach to affordability measurement, it is necessary to set the minimum reference quantities (q^{up}) for gas and electricity and (q^{cp}) for the other goods and services consumed. To maintain consistency with the definition of absolute income poverty, these quantities should coincide with those determining the absolute poverty line. We thus refer to the components of the Italian absolute poverty line as documented by the ISTAT (2009). The procedure allows us to identify the minimum spending level for electricity, heating and cooking necessary to achieve an acceptable standard of living. The definition of the official poverty line does not make any distinction between households using different fuels for heating and cooking. For the purposes of this paper, we consider the minimum expenditure for gas to coincide with the heating and cooking component of the poverty line, which can be seen as an average of the minimum of such costs regardless of the form of energy. For electricity, ISTAT considers basic needs to include spending on lighting, a television, a washing machine and a fridge; the basic heating costs also include spending for the use of gas for cooking and hot water. Having determined the set of electric appliances, electricity consumption has been estimated by the Authority for Electricity and Gas for different household sizes and priced at the rates in effect in January and October 2005. As for heating expenditure, its value has been inferred using a linear regression model estimated on households living in houses with an independent heating system (therefore excluding households with central heating systems), accounting for the size of the (standard) dwelling, the region of residence and the age of the household members. We use the parameters published by ISTAT in the Survey on Family Budgets (SFB) to compute the minimum household expenditure for electricity and heating at 2005 prices. The current price values are obtained for electricity expenditure using the national price index; for heating we refer to the national aggregate price index which includes electricity, gas and other fuels because ISTAT's regression model does not distinguish between different forms of energy.

In a similar way, we reconstruct the minimum expenditure for the other consumption items (goods and services) that make up the total bundle of the absolute poverty line. Wherever possible we use regional price indices to update 2005 values to current prices.

Unfortunately, the SFB public use data file does not contain detailed information on the date of birth of the household members, nor the size of the urban area of residence. Therefore, it is not possible to perfectly replicate the official poverty line for each household. Nevertheless, a comparison between the statistics we produce and the official poverty indices shows that the deviations are marginal. A further deviation from official estimates occurs when updating the values to the current price levels because we can only use published price indices, while official statistics refer to (unpublished) locally disaggregated price indices.

Appendix B. Electricity and gas benefits amounts

See appendix Table B1.

Table B1
Electricity and gas benefits for low income households, euro per year. Gas benefits include the components for heating and cooking.
Source: www.autorita.energia.it.

Household members	Electricity	A/B (Warmest)	Gas			
			C	D	E	F (Coldest)
1–2	56	70	87	115	144	183
3–4	72					
5+	124	98	127	167	206	264

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.enpol.2014.09.008.

References

Bhattacharya, J., DeLeire, D.C., Haider, S., Currie, J., 2003. Heat or eat? Cold weather shocks and nutrition in poor American families. Am. J. Public Health 93 (7), 1149–1154.
Bennett, B., Cooke, D., Waddams Price, C., 2002. Left out in the cold? New energy tariffs, low-income households and the fuel poor. Fisc. Stud. 23 (2), 167–194.
Besley, T., 1998. A simple model for merit good arguments. J. Public Econ. 35, 371–383.
Boardman, B., 1991. Fuel Poverty: From Cold Homes to Affordable Warmth. Belhaven Press, London.
Boardman, B., 2010. Fixing Fuel Poverty: Challenges and Solutions. Earthscan, London.
Bouzarovski, S., Petrovaa, S., Sarlamanov, R., 2012. Energy poverty policies in the EU: a critical perspective. Energy Policy 49, 76–82.
Bouzarovski, S., 2013. Energy poverty in the European Union: landscapes of vulnerability. Wiley Interdiscip. Rev. Energy Environ 0, 1–14.
Chaplin, R., Freeman, A., 1999. Towards an accurate description of affordability. Urban Stud. 36 (11), 1949–1957.
DEFRA, 2001. The UK Fuel Poverty Strategy, 1st Annual Progress Report 2003, ⟨http://www.dti.gov.uk/energy/consumers/fuel_poverty/index.shtml⟩.
DEFRA, 2007. The UK Fuel Poverty Strategy, 4th Annual Progress Report 2006, ⟨http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file29688.pdf⟩.
Dubois, U., 2012. From targeting to implementation: the role of identification of fuel poor households. Energy Policy 49, 107–115.
Fankhauser, S., Tepic, S., 2007. Can poor consumers pay for energy and water? An affordability analysis for transition countries. Energy Policy 32 (2), 1038–1049.
Hancock, K.E., 1993. 'Can pay? Won't pay?' or economic principles of 'affordability'. Urban Stud. 30 (1), 127–145.
Hernández, D., 2013. Energy insecurity: a framework for understanding energy, the built environment, and health among vulnerable populations in the context of climate change. Am. J. Public Health 103 (4), e32–e34.

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ARTICLE IN PRESS

Hills, J., 2011. Fuel Poverty. The Problem and Its Measurement. Interim Report of the Fuel Poverty Review. CASE Report, 69. The London School of Economics and Political Science, London.
Hills, J., 2012. Getting the Measure of Fuel Poverty. Final Report of the Fuel Poverty Review. CASE Report 72. The London School of Economics and Political Science, London.
ISTAT, 2009. La misura della povertà assoluta. Metodi e norme n. 39. ISTAT, Rome.
Mahapatra, K., Nair, G., Gustavsson, L., 2011. Swedish energy advisers' perceptions regarding and suggestions for fulfilling homeowner expectations. Energy Policy 39/7, 4264–4273.
Miniaci, R., Scarpa, C., Valbonesi, P., 2008a. Measuring the affordability of public utility services in Italy. Giornale degli Economisti ed Annali di Economia, 185–230.
Miniaci, R., Scarpa, C., Valbonesi, P., 2008b. Distributional effects of the price reforms in the Italian utility markets. Fisc. Stud. 29/1, 135–163.
Sandmo, A., 1983. Ex post welfare economics and theory of merit goods. Economica 50, 19–33.
Sefton, T., 2002. Targeting fuel poverty in England: is the government getting warm? Fisc. Stud. 23/3, 369–399.
Sefton, T., Chesshire, J., 2005. Peer Review of the Methodology for Calculating the Number of Households in Fuel Poverty in England. Final Report to DTI and DEFRA, ⟨http://www.berr.gov.uk/files/file16566.pdf⟩.
Stone, M.E., 1993. Shelter Poverty: New Ideas on Housing Affordability. Temple University Press, Philadelphia.
Thalmann, P., 2003. House poor or simply poor? J. Hous. Econ. 12, 219–317.
Vulnerable Consumer Working Group, 2013. Guidance Document on Vulnerable Consumers, ⟨http://ec.europa.eu/energy/gas_electricity/forum_citizen_energy_en.htm⟩.
Waddams Price, C., 2005. Effect of liberalising UK retail energy markets on consumers. Oxford Rev. Econ. Policy 21 (1), 1–17.
Waddams Price, C., Brazier, K., Wang, W., 2012. Objective and subjective measures of fuel poverty. Energy Policy 49, 33–39.

UNCORRECTED PROOF

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