Centre on Regulation in Europe
Improving network industries regulation

Affordability of utilities' services: extent, practice, policy

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About this project

The study within the framework of which this report has been prepared has received the financial support of a number of CERRE members. These are: EDF, E-Control, Microsoft and the Utility Regulator of Northern Ireland (UREGNI). As provided for in the association's by-laws, this report has, however, been prepared in complete academic independence. The contents and opinions expressed in the report reflect only the views of the authors and in no way bind CERRE, any sponsor or group of sponsors or any other member of CERRE (www.cerre.eu).

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Obviously, none of those individuals bear any responsibility for the contents of the report, which, as mentioned above, commits the authors only.

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About the authors

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Executive summary

Affordability of utilities' services is an increasingly important issue on policy agendas. Rising energy costs and prices, the growing importance of telecommunications and broadband communication, and the need to realign water prices with costs, all highlight the salience of utility expenditure for households, and therefore for policy makers. Energy, water, telecoms and transport are vital inputs to household well-being, including participation in society, and affordability problems are increasing in the wake of the Great Recession in some Member States.

This project exploits the unique opportunity offered by CERRE to explore measurement and policy on affordability across utility sectors and across the European Union, combining extensive country- and household-level data with literature reviews. Bringing together a variety of data for the first time, the project analyses the extent of the problem as well as existing policies in different sectors and countries. It also identifies common factors and draws lessons from experience. Finally, as more markets are opened to competition, this project contributes to understanding any potentially damaging effects on vulnerable households.

The report provides an overview of affordability across four utility sectors (energy, water, telecoms and transport) in the European Union. It is based on extensive research which is reported in 13 accompanying research papers (listed in Section 9, and further described in the Introduction and Methodology section). It compares the proportion of total expenditure devoted to utilities across sectors and Member States, explores metrics of affordability problems, simulates policy interventions which might be used to address them and, finally, identifies policies which have been applied along with some assessments of their effectiveness. Case studies on Northern Ireland, France, Austria and the relationship of the Internet to affordability are also included.

Policies on utility affordability need to be understood in the context of the more general support provided to vulnerable and low income households. Such support, which is the responsibility of individual Member States, therefore also varies across the EU, and policies to address affordability in the utility sectors may raise challenges to the development of a Single European Market.

In summary, the author's main findings and recommendations are as follows:

1. Affordability issues vary widely, in type, in extent, between sectors and, particularly relevantly, across Member States;
2. The current variety of policies in the European Union is an appropriate reflection of these differences. This not only respects the sovereignty of Member States over social policies but it also expresses the Member States' ability to address local needs and complements other local policies related to affordability concerns. The report argues for greater localisation in designing and implementing specific interventions. These need to take

account both of local circumstances and needs, and the different responses which arise from householders in different circumstances.

3. As shown by the interest already expressed in this project by policy makers, Member States could, however, benefit from a centralised repository of information and statistics about affordability issues in different sectors and in different Member States, but with no expectation of uniformity of policies nor, necessarily, of metrics for assessing such issues.
4. Commonly used metrics of affordability may lead to the implementation of inappropriate policies, and may record perverse changes in response to some interventions. For example, there may be an incentive to help households who have relatively mild affordability problems to 'cross the boundary' and improve apparent success. The authors instead recommend cost benefit analysis to assess the effectiveness of particular interventions to increase affordability. These analyses can compare the benefits to individual households and wider society against the costs of the intervention concerned.
5. Assessment of potential interventions needs to be based on realistic forecasts of household response, both in the take up of initiatives and in the ongoing response to opportunities for improvement in household circumstances. Continued study of households' response to particular interventions will be critical to obtain the knowledge necessary to make realistic forecasts.
6. Local knowledge is crucial in assessing the potential behavioural issues referred to in point 5 above, identifying specific local needs, addressing potential barriers to adoption, and integrating utility-based assistance with the more general social support available to households. Such local knowledge may be delivered through Local Authorities, Non-Governmental Organisations (NGOs) or other agencies as is most appropriate.

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1. Introduction and methodology

Affordability is increasingly important across utilities and Member States of the European Union. Increasing energy costs, the growing importance of telecommunications and broadband communication and the need to realign water prices with costs, all raise the salience of utility expenditure for households, and therefore policy makers. This project exploits the unique opportunity offered by CERRE to explore measurement and policy across sectors and across Member States. The objective is not to identify a single best practice, but rather to share and learn from the experience in different sectors and Member States, to avoid both pitfalls and 'reinventing the wheel'. Indeed the varying circumstances of Member States, and the different issues in each utility, mean that a variety of approaches and policies is likely to remain appropriate. Moreover, policies on utility affordability need to be understood in the context of the more general support provided to vulnerable and low income households, which also varies across Member States.

Energy, water, telecoms and transport are vital inputs to household well-being, including participation in society, and affordability problems are increasing in the wake of the Great Recession in some Member States. This report summarises the proportion of total expenditure devoted to these sectors by households, and explores some commonly used affordability metrics. It further explores how these might be affected by different policies, before reviewing policies which have been applied, and their success. The paper is based on a number of detailed research papers (listed in Section 9) which contain the detailed information, methodology and references.

Affordability policies within Europe reflect a number of tensions. At the legislative level, there is tension between the EU drive to develop single markets (including the encouragement of competition) and the jurisdiction of Member States over social policy. Within the energy market, the 'trilemma' of ensuring increasing security of supply, sustainability and affordability results in many statements which make reference to affordability but do not elaborate on the trade-offs with these other objectives. For water, moves to cost-reflective prices pose challenges because of a history of uncharged services[1] or subsidised tariffs. The increasing opportunities of new communication technologies pose challenges both for the definition of a basic service, and for avoiding increasing inequality through a 'digital divide'. In transport, the general subsidisation of public transport raises issues of whether such subsidies may be regressive.[2]

The design of any policy to tackle affordability requires assessment of two 'errors' – those of inclusion (helping those for whom help is not intended) and errors of exclusion (not helping those

[1] While direct charges for water may not have been levied in the past, consumers will still have been paying for water services, albeit indirectly, such as via general taxation.
[2] Urban rail systems may be supported by funds from general taxation but may be disproportionately used by relatively wealthy commuters.

for whom it is intended). While the focus in this report is on the effect of policies rather than their financing, the question of who bears the cost affects both their direct effect (particularly if the funding mechanism is distributionally regressive, which may exacerbate the very problem it seeks to address) and their political acceptability. These issues are reflected in the experience and discussion of affordability concerns.

The political sensitivity of energy and water charges is explained by the rapidly increasing expenditure shares of these two commodities as a household's total expenditure (income) falls, so that price increases can cause particularly severe detriment to low income households. The transport expenditure share follows a very different pattern from the other sectors, first increasing, and then gently decreasing. This reflects the fact that, unlike the other sectors, affordability issues in transport are felt most acutely by the 'working poor'.

The relative expenditure shares devoted to each utility vary between household groups and Member States. Across households as a whole in the EU15 in 2010, the average expenditure share of transport is approximately double that spent on energy. However, in those household groups which one might consider economically disadvantaged, a higher proportion of total expenditure is devoted to energy than transport. Indeed, reflecting the generally lower level of economic development in the new Member States, the relationship between energy and transport expenditure shares is reversed, with the energy expenditure share being approximately double that for transport. Among the EU 15, we found that countries which had suffered from particularly harsh austerity measures had seen worsening affordability problems, but that these were less severe than in some new Member States.

In exploring measures which might alleviate affordability problems we found that reducing expenditure on a product/service was more 'effective' in improving the picture painted by affordability metrics than a corresponding increase in income, though it is likely that households achieve greater welfare gains when they receive income transfers and can choose how these are spent. A review of policies to address affordability issues shows that effectiveness depends crucially on targeting households in most need and on realistic assumptions about consumers' responses. Use of high level affordability metrics as either targets or assessment tools could lead to perverse incentives and misleading conclusions. For example, policy makers might be tempted to improve the apparent success of a policy by focusing on those who are just below a threshold, rather than those in greatest need; and relative metrics (for example twice the median expenditure of the population as a whole) can be even worse after an intervention, despite the intervention delivering real benefits to households. A Low Income – High Consumption (LIHC) criterion generally identifies fewer households as having affordability problems, with clear implications for comparisons across countries and sectors, and for political debates.

In assessing both affordability issues and digital exclusion we found a considerable 'optimism' bias, where policies were assessed beforehand in terms of maximum engineering potential rather than

taking into account the likely behavioural responses of households. As a result, many projects underachieved relative to expectations. Similar issues relate to the potential benefits of the smart metering programme currently being delivered across Europe. There is also a danger that policies to roll out improved technology may exacerbate, rather than alleviate, inequalities, unless specific steps are taken to ensure access and usage by groups at risk of exclusion.

This report summarises the results from an extensive research programme that has utilised a range of different methodologies and data sources. Four main methodologies have been used: (i) reviewing the existing academic literature and relevant policy documents, (ii) producing extensive descriptive statistics using pan-European datasets, (iii) simulating the impact of particular policy interventions on metrics of affordability in certain countries, and (iv) conducting interviews with experts in the countries for which case studies have been written. Combining these different methodologies allows us to provide the most comprehensive survey of affordability issues in the utilities for the EU yet obtained. Along with quantifying utilities' affordability, policymakers' responses across the EU are identified and additional in-depth lessons are drawn for a series of specific Member States. Significantly, not only do we review existing knowledge regarding utilities' affordability, our statistical analysis in (ii) and (iii) substantially increases the body of knowledge on this topic.

The project began with a review of the metrics used to assess affordability across the utility sectors and the existing cross-country evidence on utility affordability. This work is reported in Research Paper 1. The three main types of affordability metrics identified in Research Paper 1, namely (a) fixed threshold metrics, (b) relative measures linked to averages and (c) Low Income – High Consumption metrics are later applied in the detailed national statistics and simulations reported in Research Papers 4-8.

Research Paper 1 also highlights the benefits of Internet access and use in a range of arenas. The benefits of the Internet inevitably raise questions regarding digital exclusion and how this new type of exclusion can be tackled. Research Paper 13 reports evaluations of a range of policies to tackle the 'digital divide'. The aim of Research Paper 13 is to draw out lessons regarding 'what works' from existing literature. Research Paper 13 contrasts policies used to tackle digital exclusion with those designed to address fuel poverty. Most of the literature on fuel poverty alleviation policies involves the evaluation of energy efficiency schemes. The review of these evaluations highlights why private households may not invest in energy efficiency measures, the importance of effective targeting and emphasises that actual households may behave differently to the manner assumed by engineering models.

The most important contribution of the current research project is the extensive mapping of utility affordability issues across the EU. The core of this contribution is provided in Research Papers 2 and 11. These research papers are based on three sources of data: (i) expenditure shares devoted to different utility sectors collated from national household expenditure surveys by Eurostat; (ii) the

percentage of Gross National Income (GNI) per capita necessary to purchase specified fixed line, mobile and broadband packages provided by the International Telecommunications Union (ITU); and (iii) subjective indicators of affordability difficulties from the European Union Statistics on Income and Living Conditions (EU-SILC). These data provide a rich picture enabling comparisons across countries, through time, across sectors and across different household groups. The different household groups considered include low income households, households with a retired household member, single parent households and unemployed households. Research Paper 11 re-cuts the data reported in Research Paper 2 into charts for individual household groups where the difference between the selected household group and the average position of the population as a whole is plotted. This explicitly highlights the distributional aspects of the affordability story and how the relative position of particular household groups has changed through time.

While Research Papers 2 and 11 represent a very comprehensive mapping of utility affordability across the EU, it is important to recognise certain methodological limitations. These limitations are discussed in full in Research Papers 2 and 4. In particular, the most recent expenditure share data available from Eurostat is for 2010, so a full picture of the present affordability situation is unavailable. Also, throughout Research Papers 2 and 4-12 we emphasise the actual proportion of expenditure devoted to each of the utilities considered. The results in these research papers may therefore differ from official affordability metrics based on the proportion of income spent on utilities or on the expenditure required to achieve a predetermined 'optimal/representative' level of consumption.[3]

Research Papers 2 and 11 separate the data for the EU15 and new Member States into separate sections due to the substantial differences in affordability positions between these two sets of countries. To gain a sense of the variety of affordability situations across Member States, six countries are analysed in more detail: Austria, France, the United Kingdom, the Republic of Ireland, Greece and Bulgaria. The first four of these countries reflect the interests of three of our sponsors: E-Control (the Austrian energy regulator), the Utility Regulator Northern Ireland (Northern Ireland is a constituent part of the UK) and EDF Energy. Greece and Bulgaria have been included as interesting outliers for comparison. Greece has experienced the greatest economic deterioration since 2007 of any EU country and Bulgaria consistently has the severest affordability challenges across the entire EU.

The case studies of Austria, France, Northern Ireland and Digital Inclusion in the current report also reflect the interests of the project's four main sponsors, with Digital Inclusion being of particular interest to Microsoft. The case studies for Austria, France and Northern Ireland are where the knowledge obtained through expert interviews has been utilised. Additionally, and more widely,

[3] The ITU data represents an example of this latter approach of considering the affordability of a specified package of services.

throughout the main report and research papers many valuable insights from the projects' sponsors have been incorporated into the analysis and discussion of results.

Returning to a pan-EU perspective, Research Paper 3 reviews the literature on the policies used to tackle affordability concerns in the different utility sectors. It summarises the types of policies that have been implemented, often utilising existing findings from European organisations which have surveyed their members. A key finding of Research Paper 3 is the large number of disparate organisations that deliver affordability policies. This disparate array of actors makes it very difficult to obtain a truly exhaustive list of affordability policies in place across the EU.

The most advanced analysis performed in the research project is reported in Research Papers 4-8. While Research Papers 2 and 11 report high-level averages for particular household groups, Research Papers 4-8 are the result of far more intensive research utilising data from thousands of individual households. Data on individual households enables a far greater range of descriptive statistics to be produced and the impact of particular policy interventions on the affordability metrics identified in Research Paper 1 to be simulated. However, this detailed data was only available for a minority of countries.[4] The countries studied in Research Papers 4-8 are the United Kingdom, Republic of Ireland, France and Estonia. Additionally, analysis was also possible for Northern Ireland as it is a subset of the data for the United Kingdom.

The detailed methodology for these national studies is discussed in Research Paper 4, with additional detail in each of the country specific research papers. Comparisons between countries in Research Papers 4-8 should be treated with caution as the data is from different years and the surveys use different methodologies. In comparison to the collated Eurostat data, in Research Papers 4-8 the percentages of different types of households who experience affordability difficulties, according to the different types of affordability metrics discussed in Research Paper 1, have been estimated. It is also possible to estimate the percentage of households experiencing affordability difficulties in multiple sectors. This innovative analysis regarding affordability difficulties in multiple sectors is reported in Research Paper 10.

The core of Research Papers 4-8 are the policy simulations. These simulations aim to assess the impact on the headline rate of affordability difficulties across the entire population (generally measured using fixed threshold metrics) of targeting a particular policy intervention, e.g. reducing annual energy expenditure by €50, at a particular type of household, e.g. single parent households. To aid with this analysis we have developed an 'effectiveness' metric. However, we suggest caution in interpreting the results of these simulations as they really emphasise how certain interventions can alter the image given by particular affordability metrics, rather than the underlying reality of the benefits that particular policies deliver to individual households.

[4] Our attention had to be restricted to countries where data was publically available at low cost, where the data could be provided in a timely fashion and documentation was available in English (or the necessary translation skills were available within the Centre for Competition Policy).

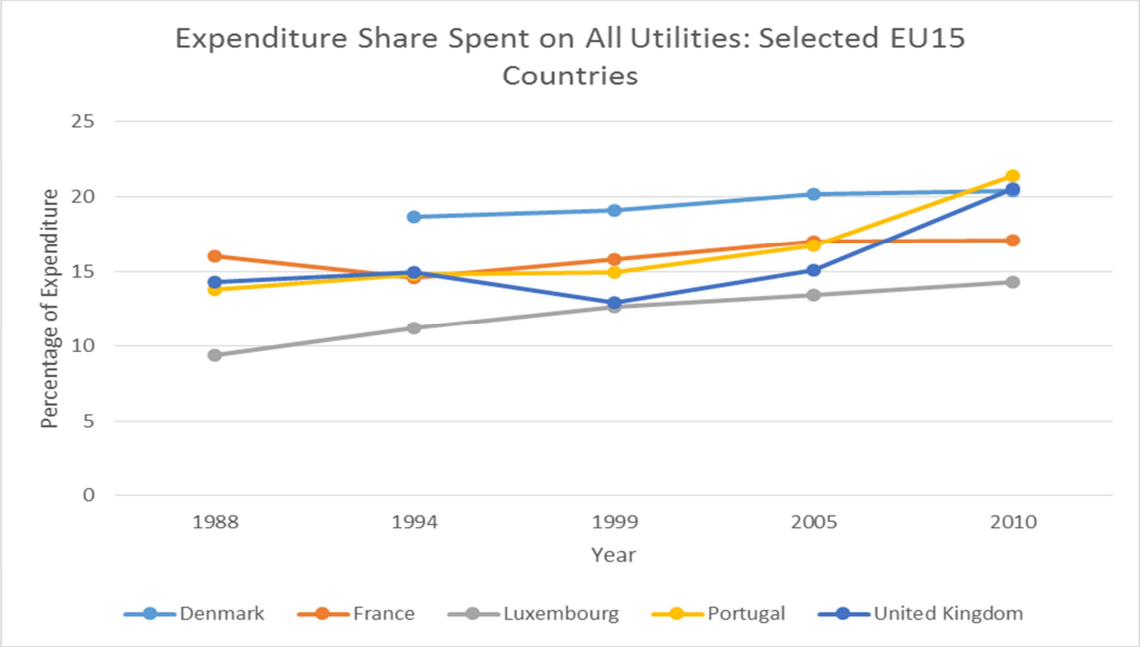
Finally, Research Papers 9 and 12 are, compared to the other research papers, more exploratory in nature. They are intended to use the data available from Eurostat to its maximum possible extent, rather than to represent the ideal methodological approaches to the questions being asked. Research Paper 9 tackles the question of whether correlations exist between the expenditure shares devoted to utilities (objective measures) and households' perceptions of affordability difficulties (subjective measures) in the EU-SILC data. Research Paper 9 has to rely on the comparison of averages at the national level, whereas ideally the analysis should be performed at the level of individual households. However, as far as we are aware, no survey data is available that provides both objective and subjective affordability metrics for the same individual households.

Research Paper 12 extends one of the key pieces of analysis using individual household data in Research Papers 4-8, namely exploring the relationship between the expenditure shares devoted to particular utilities and the total expenditure (income) of households. The relationships reported for these variables in the countries in Research Papers 4-8 follow similar patterns, but the question remains as to whether Research Papers 4-8 are 'special cases' or illustrate more universal trends. Since individual household data is not available for the entire EU, Research Paper 12 charts data points representing the average expenditure share devoted to a particular utility in an EU Member State against the average total household expenditure in the same EU Member State.

2. Comparison of affordability across the EU

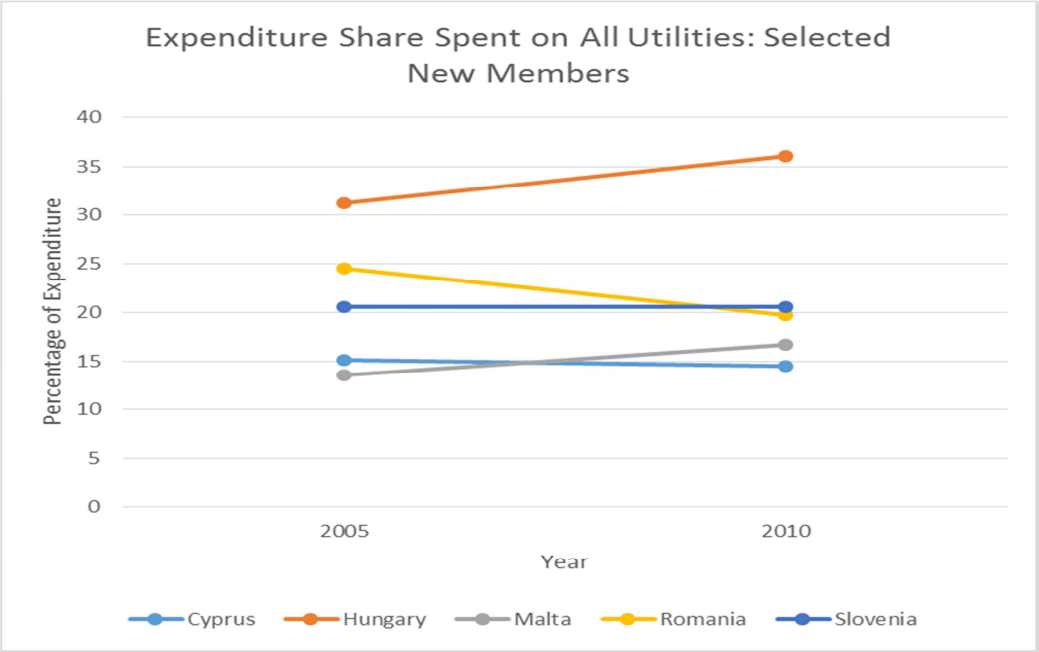
Expenditure shares and other affordability indicators were compared across EU Member States by combining data from Eurostat and the International Telecommunications Union (ITU); a summary is provided here, and Research Paper 2 explains the sources and methodology used. Two main types of data can be utilised to assess affordability difficulties across the EU: (i) average expenditure shares based on data collated by Eurostat from national household budget surveys, and (ii) 'subjective' indicators (reflecting individuals' perceptions of their situation) from the EU Statistics on Income and Living Conditions (EU-SILC). We start with an overview of all four sectors, though this does not imply that any particular sector has affordability issues which require intervention. The varying extent of affordability issues across Member States is illustrated by Charts 1 and 2, with the proportion of total expenditure spent on utilities varying from just under 15% (Luxembourg in 2010) to over 35% (Hungary in 2010).

Chart 1: Expenditure Share Spent on All Utilities: Selected EU15 Countries



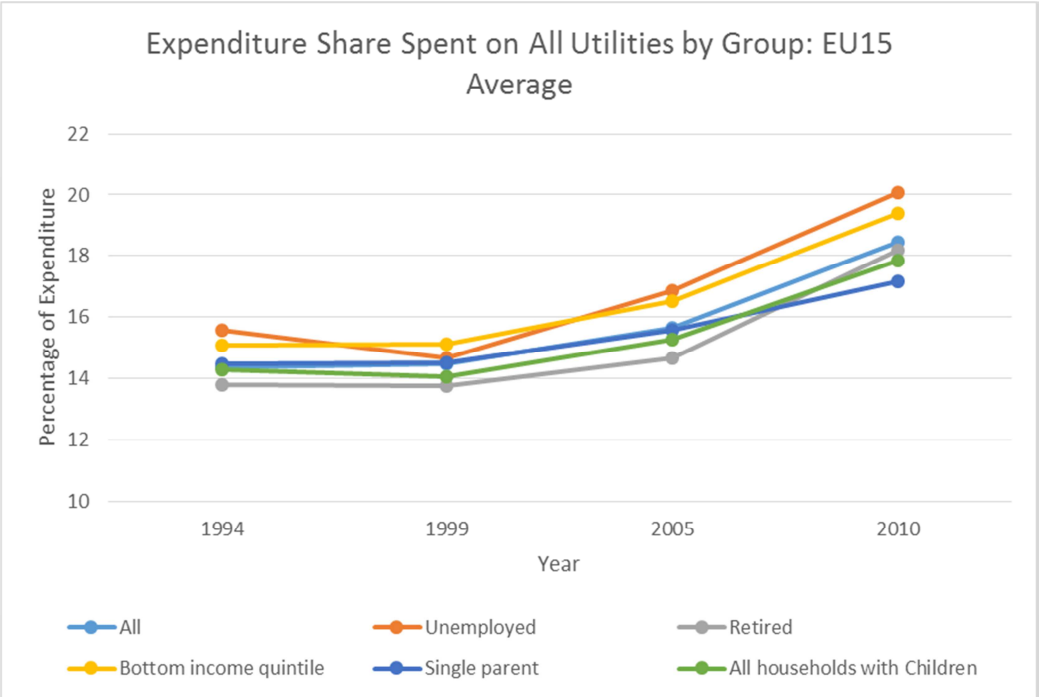
Source: Eurostat collated national household budget survey data

Chart 2: Expenditure Share Spent on All Utilities: Selected New Members



Source: Eurostat collated national household budget survey data

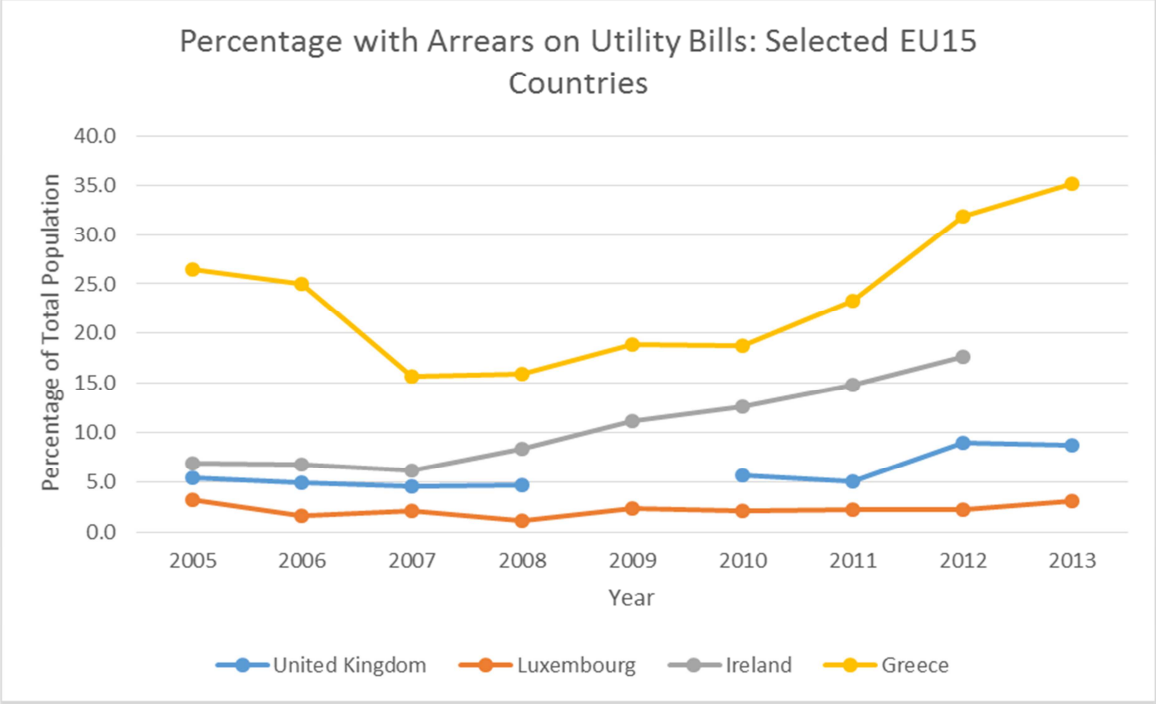
Chart 3: Expenditure Share Spent on All Utilities by Group: EU15 Average



Source: Eurostat collated national household budget survey data

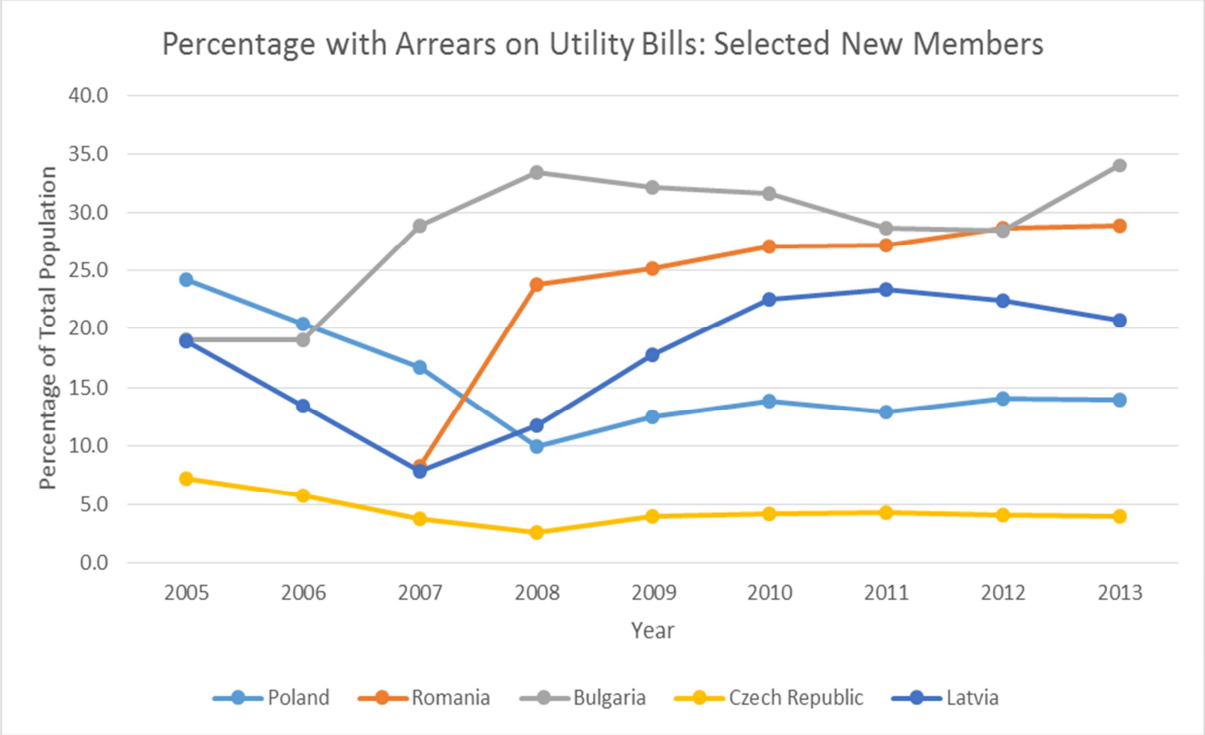
Chart 3 shows that the proportion of expenditure spent on utilities increased by three to four percentage points between 1994 and 2010 for all household groups. The increasing affordability pressures surrounding utilities are also reflected by an increase in the percentage of individuals reporting arrears on utility bills, although, Charts 4 and 5 show considerable variation between old and new Member States. However, in both sets of Member States there are individual states reporting high and low levels of arrears. In 2013, fewer than 5% of people in Luxembourg and the Czech Republic reported arrears, compared to over a third in Greece and Bulgaria. Within Bulgaria, over half of households with an income below 60% of the median had arrears on their utility bills.

Chart 4: Percentage with Arrears on Utility Bills: Selected EU15 Countries



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

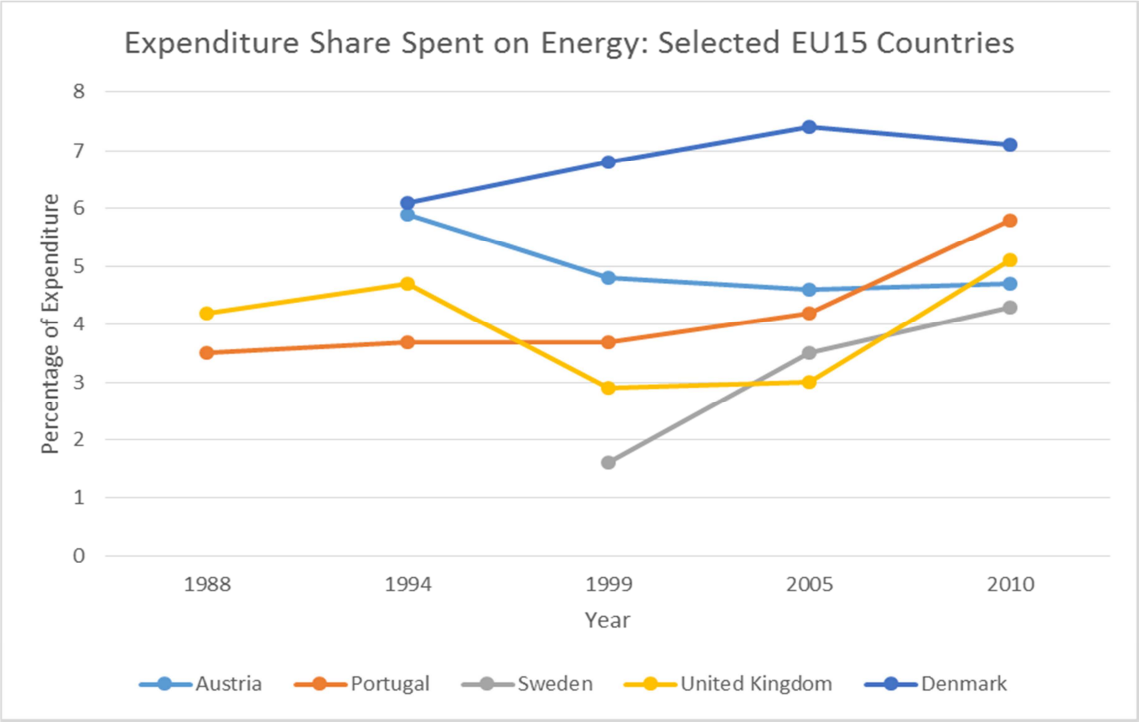
Chart 5: Percentage with Arrears on Utility Bills: Selected New Members



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

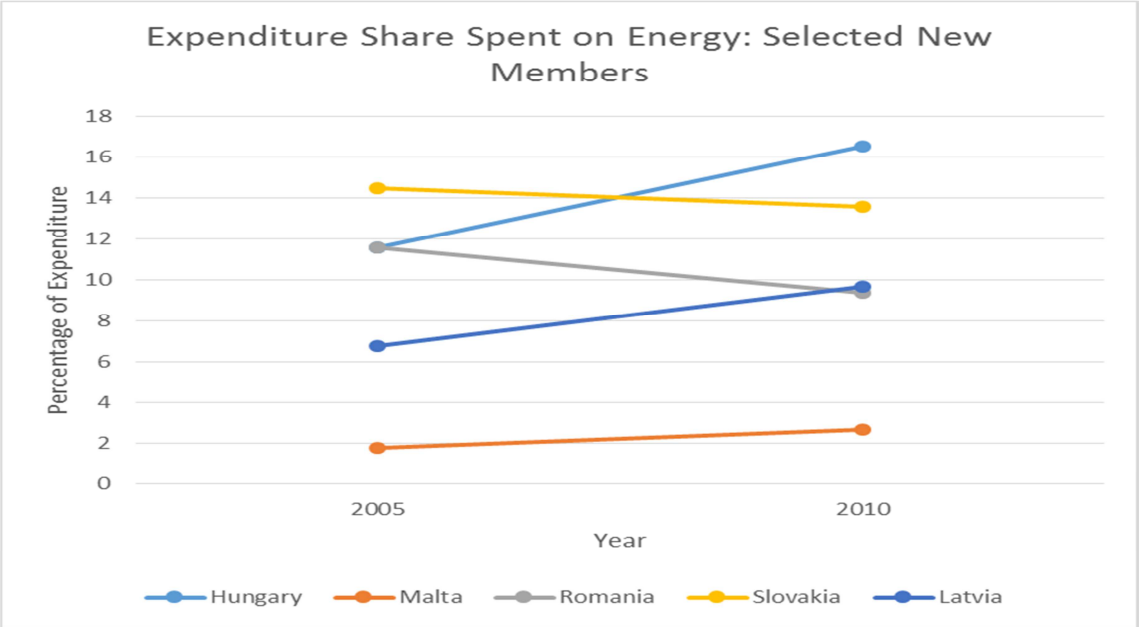
Looking specifically at the expenditure shares devoted to energy, Charts 6 and 7 show substantial variation in 2010, from just over 4% in Sweden to over 16% in Hungary. With such different experiences it is unsurprising that definitions of affordability and the suggested solutions differ across Member States.

Chart 6: Expenditure Share Spent on Energy: Selected EU15 Countries



Source: Eurostat collated national household budget survey data

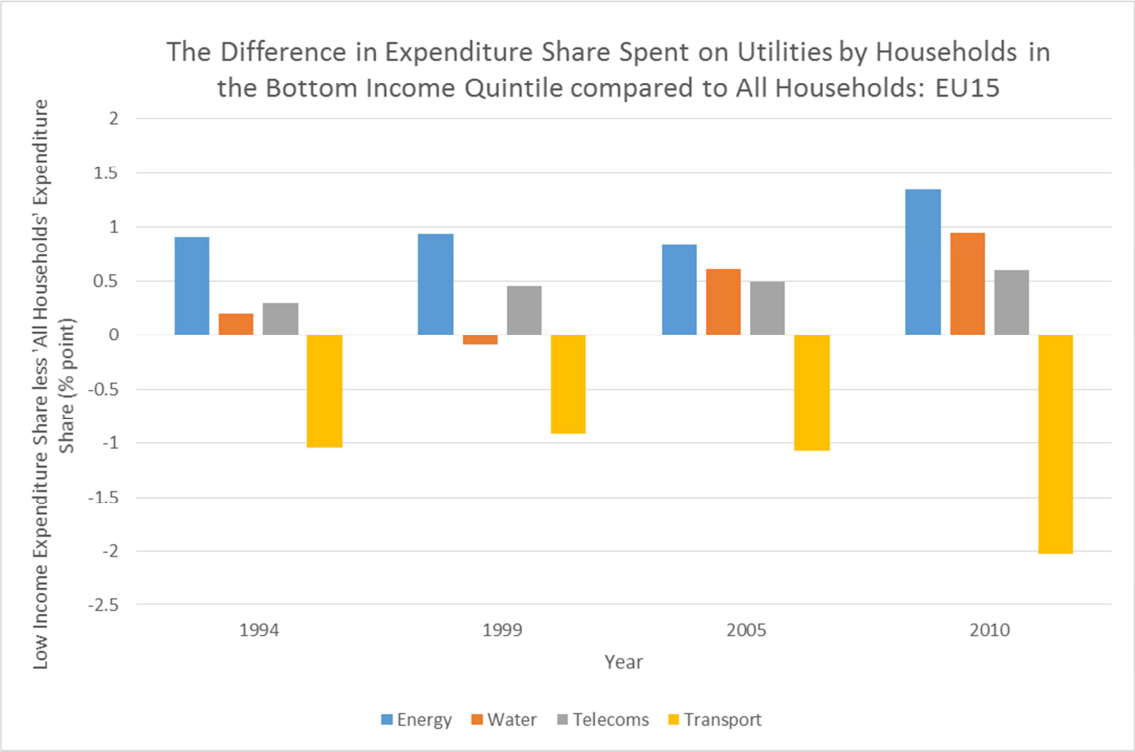
Chart 7: Expenditure Share Spent on Energy: Selected New Members



Source: Eurostat collated national household budget survey data

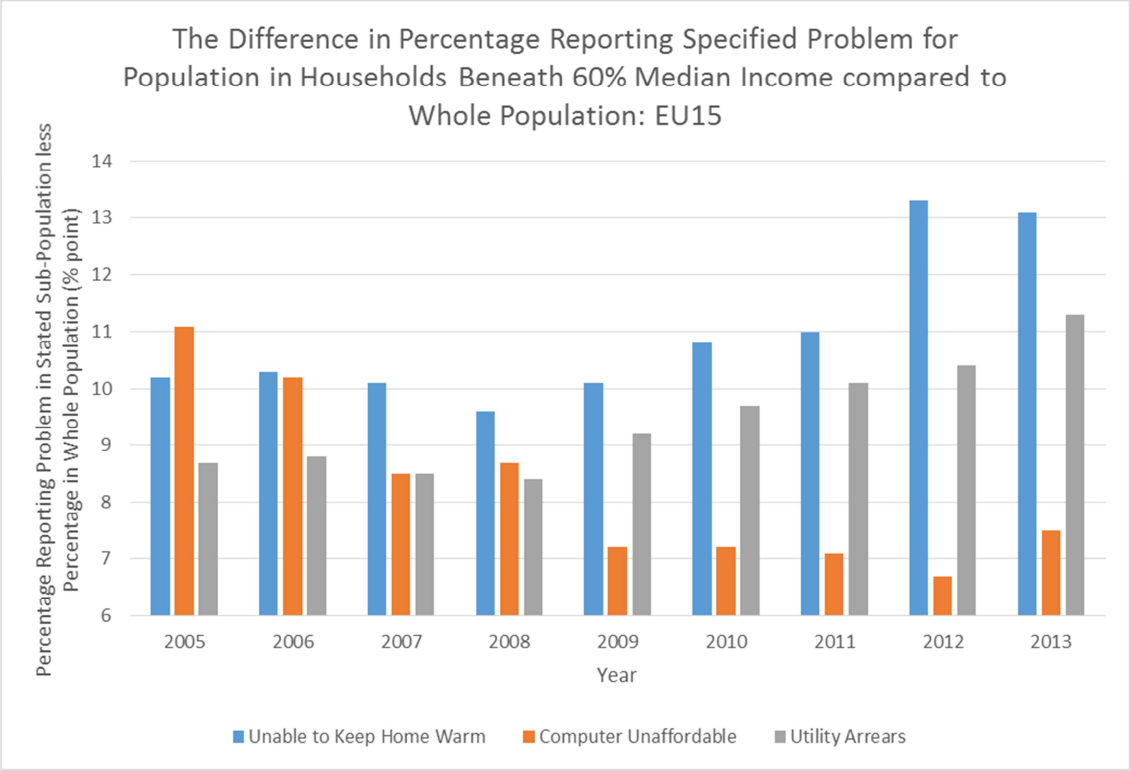
These national averages hide considerable differences in the proportion of total expenditure spent on particular utilities by different household groups; those who may be considered vulnerable tend to devote higher expenditure shares to the utilities. For example, across the EU, households with the lowest 20% of incomes spend a higher average proportion of their expenditure on each utility (except in the transport sector). Chart 8 also shows that the differences from the general population increased after 2005. Low income households also reported considerably higher 'subjective' measures of difficulty, in other words reporting that they were unable to keep their homes warm, afford a computer and had utility arrears. Chart 9 confirms that the gap in the inability to keep warm and in utility arrears, between those on low incomes and the general population, continued to increase after 2010.

Chart 8: The Difference in Expenditure Share Spent on Utilities by Households in the Bottom Income Quintile compared to All Households: EU15



Source: Eurostat collated national household budget survey data

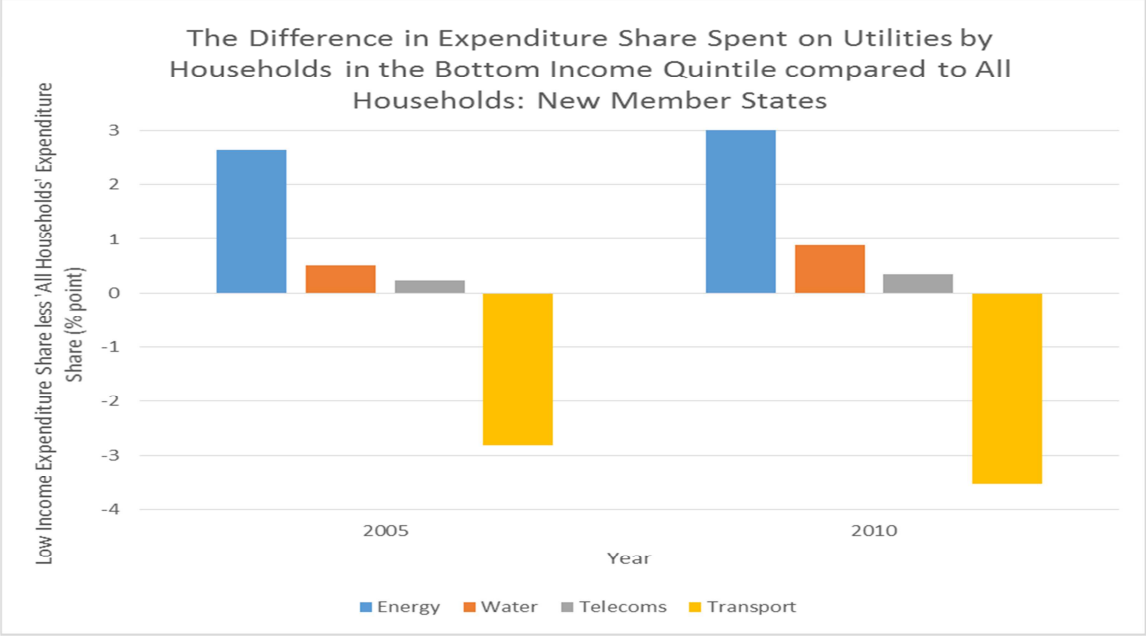
Chart 9: The Difference in Percentage Reporting Specified Problem for Population in Households Beneath 60% Median Income compared to Whole Population: EU15



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

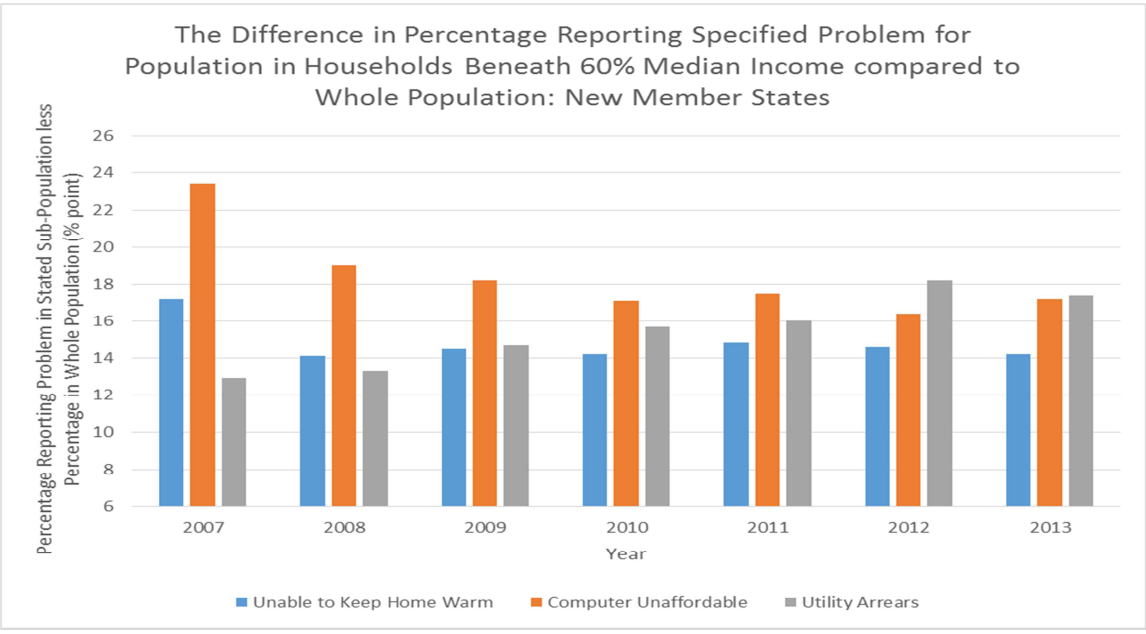
Charts 10 and 11 show that within new Member States, the differences between those on low incomes, and the general population, are even wider than in the EU15. This is particularly notable given that the general population of new Member States report higher average rates of affordability difficulties than the general population in the EU15.

Chart 10: The Difference in Expenditure Share Spent on Utilities by Households in the Bottom Income Quintile compared to All Households: New Member States



Source: Eurostat collated national household budget survey data

Chart 11: The Difference in Percentage Reporting Specified Problem for Population in Households Beneath 60% Median Income compared to Whole Population: New Member States



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

These comparisons (and Research Papers 2 and 11 on which they are based) show that specific sub-populations often have affordability difficulties that are systematically different from those of the general population. However the main variations in affordability through time seem to relate more to changes in specific sectors, rather than to specific sub-populations.

2.1 Correlations between objective and subjective measures of utility affordability

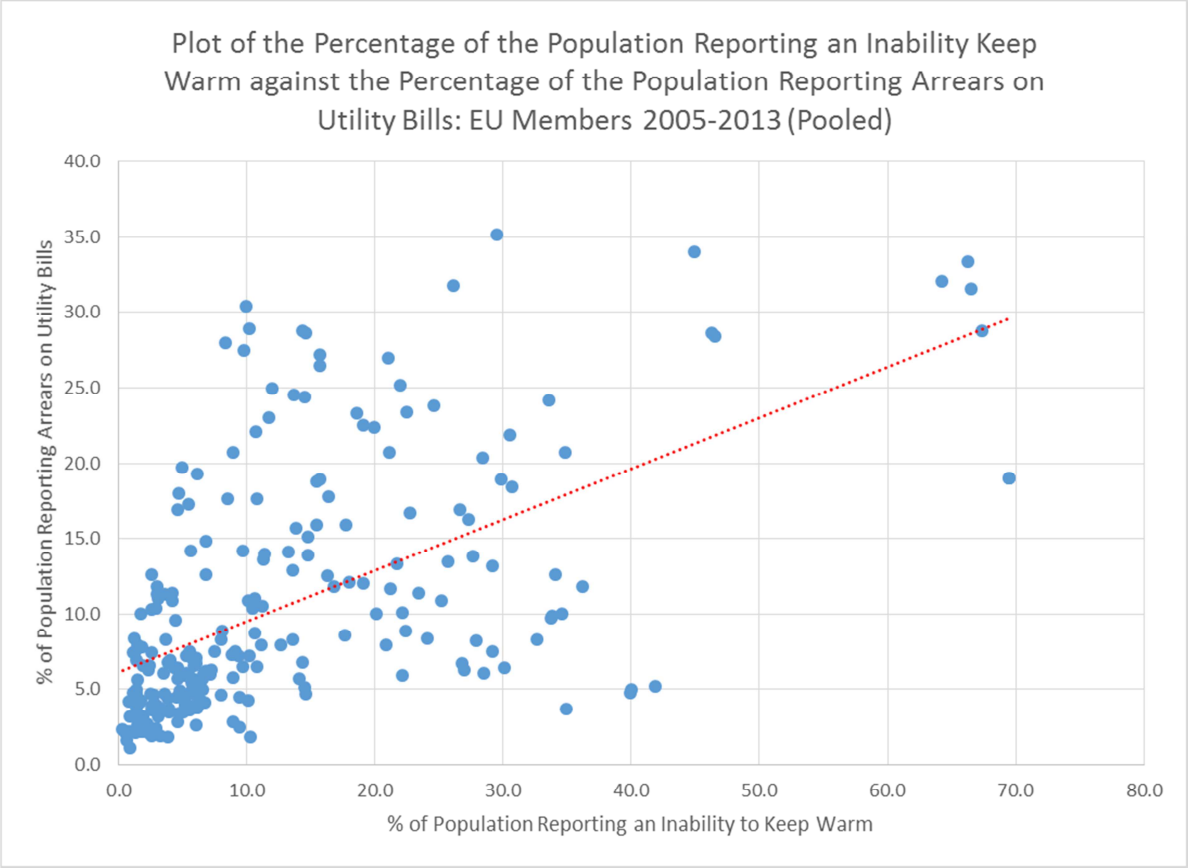
In Research Paper 9, we compare the average expenditure shares devoted to energy, water and telecoms in different countries with the three subjective indicators introduced above: an inability to keep homes warm, an inability to afford a computer and reporting arrears on utility bills. This is important as the data on the three subjective metrics is collected on an annual basis by the EU-SILC and is therefore more timely than the expenditure share data. Divergent pictures between objective and subjective metrics could raise concerns about relying solely on the EU-SILC metrics for policy decisions.

To identify whether objective and subjective measures of utility affordability give the same picture, one would ideally use data from individual households. Significantly we could not identify any pan-European datasets containing both utility expenditure shares and EU-SILC's subjective measures at the individual household level. This is a notable omission in the data on utility affordability issues in the EU. As a result, in Charts 12-14 we can only investigate the correlation between objective and subjective measures using averages for the whole population at Member State level. In Charts 12-14, multiple years and both new Member States and the EU15 are pooled, with each blue dot representing a country-year pair. In each of the charts the objective and subjective indicators appear to be related, though one cannot say that one indicator necessarily causes the other.

Charts 12 and 13 plot the relationship between three potential measures of energy affordability difficulties, the first 'objective' and the second two 'subjective', namely the share of expenditure on energy; the percentage of the population reporting an inability to keep warm; and the percent reporting arrears on utility bills. The correlation between the first two of these indicators is not statistically significant (chart not included) indicating that measuring the prevalence of fuel poverty across the EU by expenditure shares and the reported inability to keep warm will provide different perspectives on the issue. However there are positive and statistically significant relationships between the proportion reporting arrears on utility bills and both the expenditure share spent on energy and the proportion reporting an inability to keep warm[5].

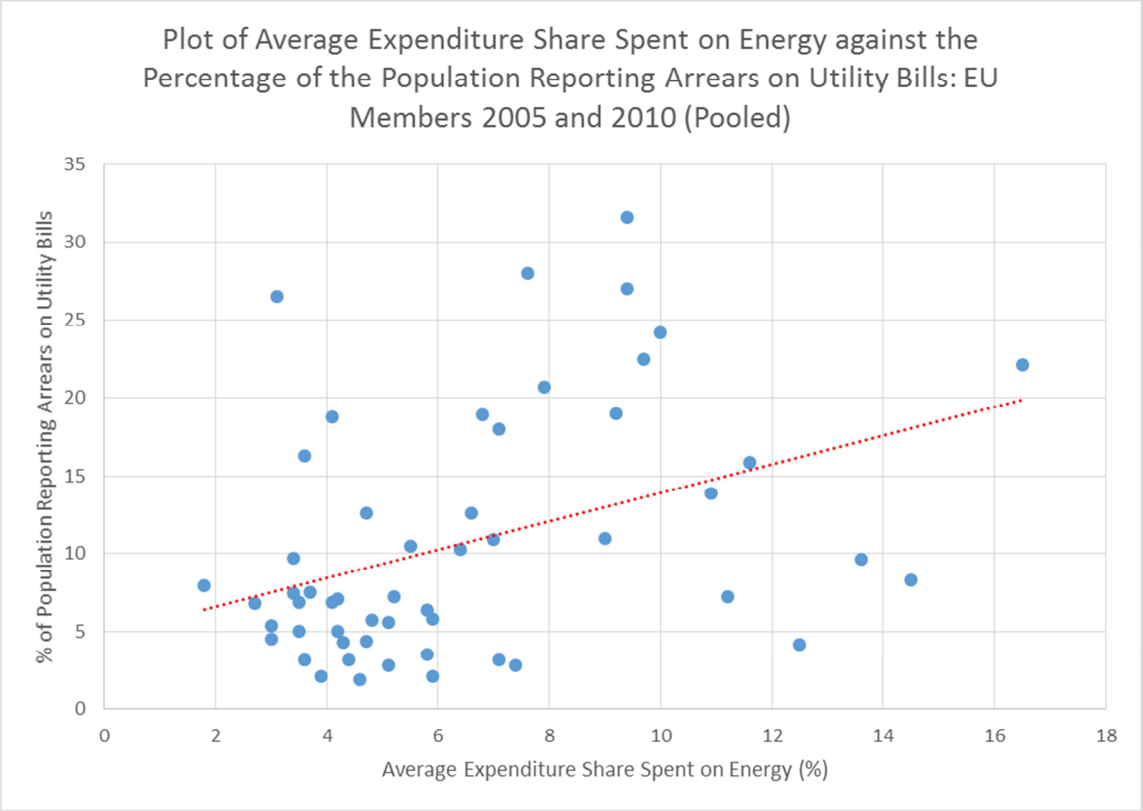
[5] These correlations are 0.39 and 0.57 respectively, both statistically significant at 1%. Charts 12 and 13 show that individual country-year pairs can still show considerable variation in the relative values of the two charted indicators, despite the statistically significant correlation.

Chart 12: Plot of the Percentage of the Population Reporting an Inability Keep Warm against the Percentage of the Population Reporting Arrears on Utility Bills: EU Members 2005-2013 (Pooled)



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

Chart 13: Plot of Average Expenditure Share Spent on Energy against the Percentage of the Population Reporting Arrears on Utility Bills: EU Members 2005 and 2010 (Pooled)



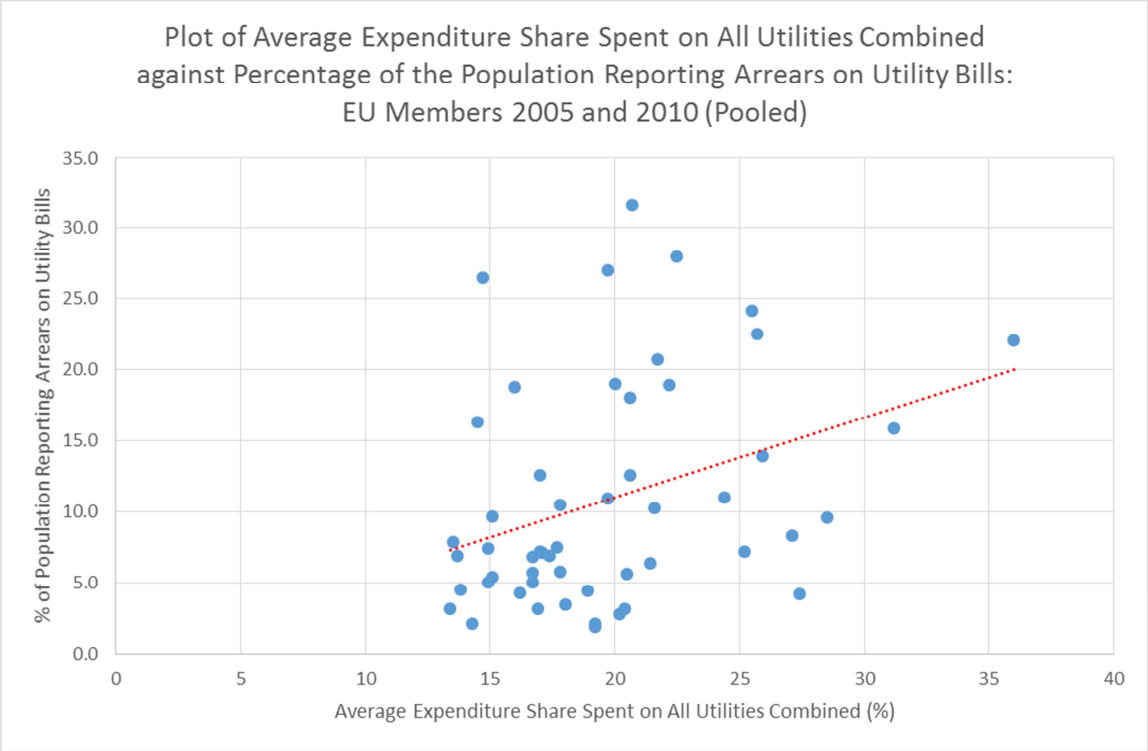
Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC) and collated national household budget survey data

However no statistically significant correlation was found between the proportion reporting arrears on utility bills and expenditure share on ***water***. This may be because the expenditure share households devote to water is much lower than that for energy, or because there are greater social protections in the water sector, so expenditure on water is a weaker driver of households being pushed into financial difficulties and arrears.

There is a statistically significant positive correlation[6] between the average expenditure share devoted to telecoms services and the percentage of the population reporting that having a computer in the household is unaffordable (chart not included), though this relationship is difficult to interpret.

[6] The correlation coefficient is 0.61 which is significant at the 1% level

Chart 14: Plot Average Expenditure Share Spent on All Utilities Combined against Percentage of the Population Reporting Arrears on Utility Bills: EU Members 2005 and 2010 (Pooled)



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC) and collated national household budget survey data

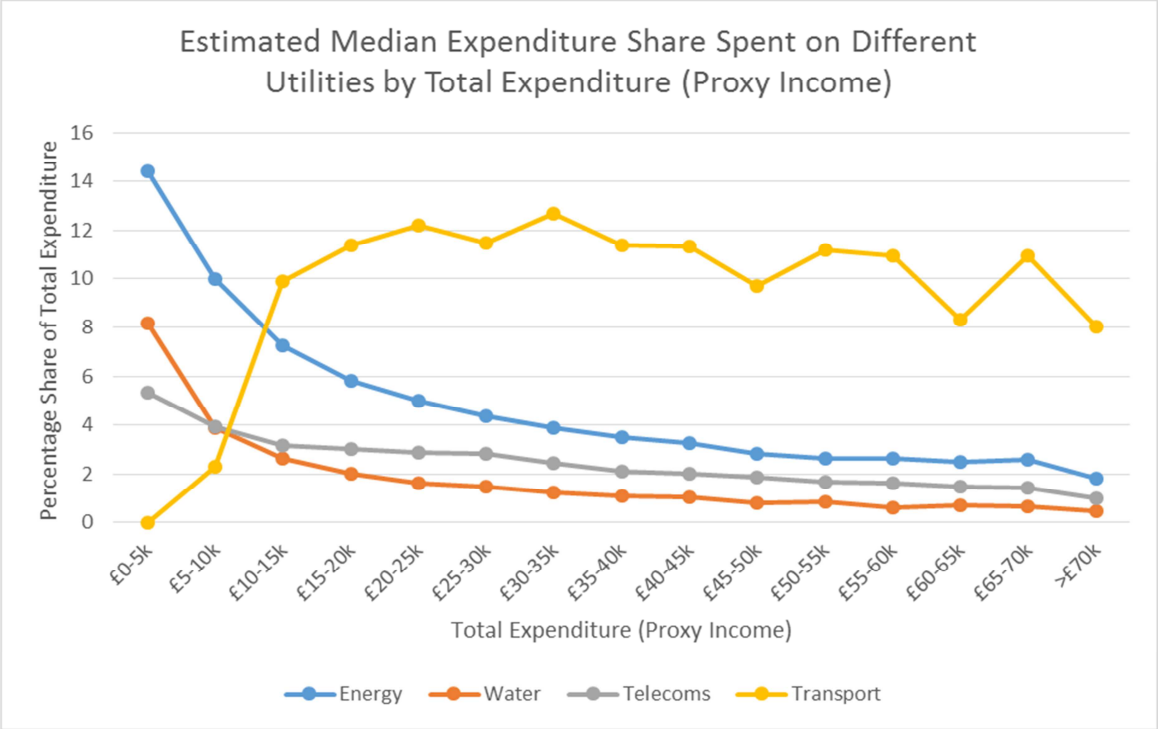
Lastly, Chart 14 plots the combined expenditure share spent on all utilities against the percentage of the population reporting arrears related to their utility bills. These two indicators have a statistically significant positive correlation[7] which is probably driven by the correlation between energy expenditure shares and reported utility arrears.

[7] The correlation coefficient is 0.35 which is significant at the 5% level

2.2 Expenditure shares on utilities as a proportion of income

The greater prominence of affordability issues in the water and energy sectors is driven by the relationship between the expenditure shares of these utilities and the total expenditure (which we use to represent income) of households. As an example, Chart 15 shows considerable differences in the relationship between expenditure shares and total expenditure across the utility sectors in the UK[8].

Chart 15: Estimated Median Expenditure Share Spent on Different Utilities by Total Expenditure (Proxy Income)



Source: UK Living Costs and Food Survey, 2012

In Chart 15 the rapidly increasing expenditure shares on water and energy as a household's total expenditure falls, reflect their roles as necessities and show how price increases can cause particularly severe detriment to low income households. For example, households in the UK with total expenditure less than £5,000 spend on average over 14% of their total expenditure on energy, while households with total expenditure of £25-30,000 spend only 4-5% of this on energy. The

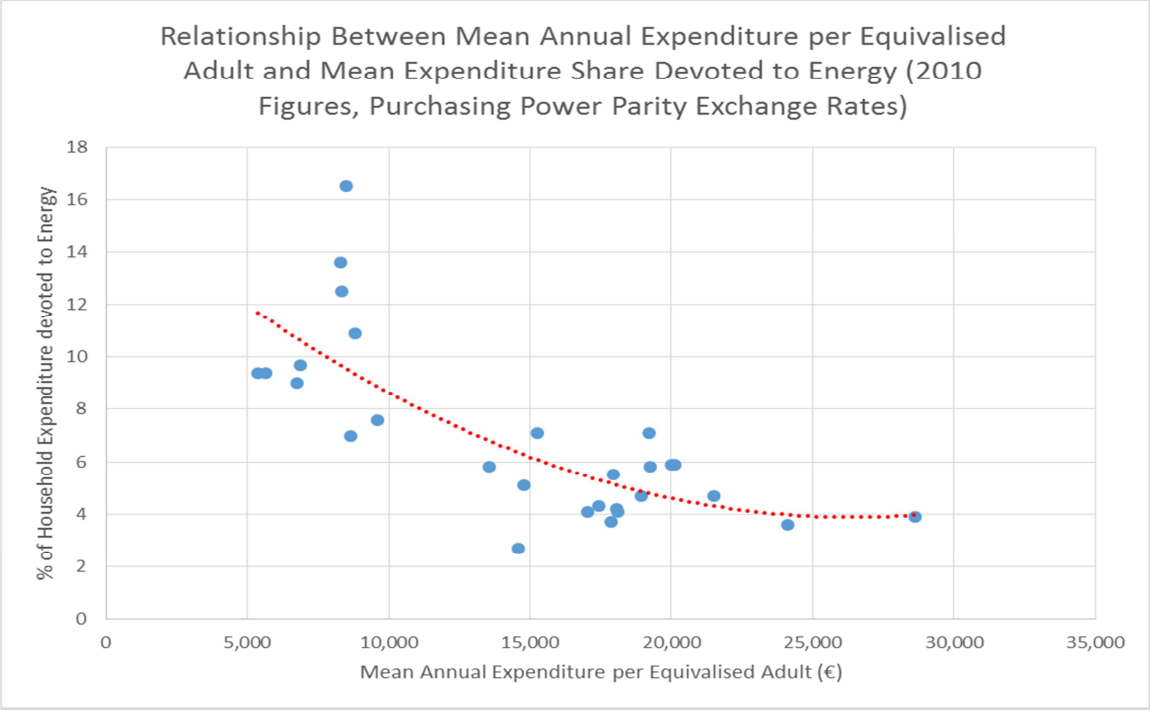
[8] National surveys show that these differences are broadly replicated in Northern Ireland, the Republic of Ireland and France.

proportion of total expenditure on telecoms also declines as a household's total expenditure increases, though at a less dramatic rate than for water or energy, suggesting that poorer households in the UK are more able to economise on telecoms expenditure.

Transport follows a very different pattern from the other sectors. The expenditure share devoted to transport increases sharply at very low income levels, up to the total expenditure category £10-15,000. There is then a gentle decrease in the transport expenditure share as total household expenditure rises above £20-25,000. This pattern probably results from the association of basic transport costs with journeys to and from work. Households with very low total expenditure may include those who are not in work due to old age, unemployment, disability or other reasons, so that issues of transport affordability are likely to be most pressing among the 'working poor'. If 'discretionary' travel for leisure purposes could be excluded from the data, the decline in the transport expenditure share as total household expenditure increases might be somewhat steeper.

Since the data for Chart 15 comes from a national survey, it was not possible to check that the same relationships held in all EU Member States. Nevertheless, Research Paper 12 shows that these relationships hold broadly at the country level (i.e. comparing average expenditure shares with average equivalised household expenditure for different countries). Chart 16, where each dot represents a Member State, shows the statistically significant relationship for the energy sector.

Chart 16: Relationship Between Mean Annual Expenditure per Equivalised Adult and Mean Expenditure Share Devoted to Energy (2010 Figures, Purchasing Power Parity Exchange Rates)



Source: Eurostat collated national household budget survey data

3. Measuring affordability, national expenditure surveys and simulation methodology

The debate on measuring affordability contains a number of core themes, as well as differences in emphasis between the utilities being studied. The literature demonstrates that while the descriptive definition of affordability/poverty may be clear, there is little consensus regarding the precise quantifiable metrics to evaluate affordability.

Each sector presents specific challenges. For energy, identifying 'ideal' consumption can be problematic, with fears of self-rationing and self-disconnection. For water affordability, much of the literature emphasises the availability of water in less developed countries (LDCs), with a focus on establishing the minimum quantity a household requires for healthy living. In telecoms, the main measurement complication is to account for the rapid improvement in the quality and range of services available. There are also issues related to the one-off costs of connection as well as the affordability of ongoing running costs, i.e. of access to and usage of the service. Assessing transport affordability is complicated by the fact that it is generally jointly determined with housing choices. By living on the periphery of a city an individual may trade-off high transport costs to their place of work against lower housing costs. Transport also includes a major non-monetary cost to consider, namely the opportunity cost of time spent travelling, and combines both essential and non-essential (leisure-related) elements.

We identify three general types of affordability metric: (i) a fixed threshold of expenditure as a proportion of income, (ii) a relative threshold linked to median expenditure, and (iii) a residual income approach where income after utility expenditure must not fall below a general poverty line. Another key choice is whether to record actual observed expenditure or the cost of a standardised/ideal bundle of services; where possible the literature prefers the latter. In response to these factors, a wide range of quantified affordability metrics across and within sectors have been suggested by academics and international organisations. However, it is rarer for governments to implement policies based on particular quantified affordability metrics.

Fuller references to the various affordability definitions are provided in the appendix at the end of this report and in Research Paper 1.

The EU requires each Member State to define energy poverty (though only a minority have so far done so). A common measure of energy/fuel poverty is that energy expenditure exceeds 10% of household income, but higher thresholds and definitions involving multiples of the median expenditure share have also been proposed, in particular to measure more extreme degrees of fuel poverty. One definition requires the target expenditure to be no more than that of the average

expenditure of the lowest three income deciles (or other reference group)[9]. Similar patterns have been applied to the water sector, though with lower expenditure share thresholds of between 2 and 5%. In telecoms, the cost of the ITU's basic bundle is often used as the foundation for defining affordability, but usually in relation to national rather than household income. For transport, affordability is defined either in terms of the proportion of households spending more than a specified percentage of their income on journeys to work or in terms of the proportion of income spent on transport.

Both the practice and the literature are most advanced in energy in the UK, and the adoption by the UK (and its constituent countries), Ireland, Austria and France of quantified metrics of fuel poverty are the exception rather than the rule. In England the definition of fuel poverty has moved from a fixed threshold (10% of income) to a relative 'Low Income High Cost (LIHC)' metric, although Wales, Scotland and Northern Ireland have retained fixed threshold metrics.

Research Paper 1 shows that existing evidence on the affordability of utilities across Member States is patchy, with researchers having to trade-off the precision of affordability metrics against the availability of data. The most comprehensive dataset for telecoms is provided by the ITU and measures the affordability of a standardised bundle of telecoms services across the world. Comparisons across the EU are also possible regarding energy poverty, but these have generally been made on the basis of subjective or proxy indicators of fuel poverty rather than recorded expenditure. Existing evidence on water affordability in the European context has often been limited to individual country studies, and little has been published comparing the affordability of transport services.

3.1 National expenditure surveys and simulation methodology

Section 4 reports detailed findings for a number of Member States. These findings for the UK, Northern Ireland, the Republic of Ireland, Estonia and France go beyond the data available through Eurostat to utilise data from national household budget surveys. Accessing this detailed data on individual households enables rates of affordability difficulties using different metrics to be estimated, along with the incidence of households with difficulties in multiple utility sectors. We have also simulated the impact of different policy interventions on the main affordability metrics. The data for each country are from different years and each country has its own methodology for its household budget survey, so caution is needed when making comparisons, particularly since we have not subjected any reported comparisons to tests of statistical significance.

Before reporting the results in Section 4, we briefly describe the methodology used for the simulations. A more detailed discussion can be found in Research Paper 4, with additional detail on specific countries in Research Papers 5-8.

[9] Boardman (1991)

The simulations investigate the impact of four possible policy interventions:

- 250 euro increase in income (as proxied by total expenditure)
- 50 euro decrease in expenditure on a particular utility
- 100 euro decrease in expenditure on a particular utility
- 250 euro decrease in expenditure on a particular utility[10]

These figures were chosen as plausible amounts in the context of the size of utility bills, rather than for any policy significance. We identify the effect of an income or expenditure change, rather than discuss the process of achieving it[11], for example whether the expenditure change results from education programmes or improved insulation or monetary transfers. This approach assumes that the expenditure reductions (ii)-(iv) do not reduce the welfare of the household involved i.e. a household is able to achieve the same standard of living but with lower expenditure.[12] One example of such an expenditure reduction is the energy credit certificate proposed to provide assistance in meeting fuel bills in France. The aim of the simulations is to identify the impact which each of the four 'policy outcomes' in (i)-(iv) has on affordability metrics when targeted at different types of households (e.g. households in social housing vs single parent households).

For the UK, simulations have been performed for the following three affordability metrics:

- Fixed expenditure share thresholds (10% in energy, 3% in water, 5% in telecoms and 20% in transport)[13]
- Twice the median expenditure share thresholds
- Low Income – High Consumption (LIHC) Criterion

The simulations provide a clear illustration of the issues arising with each of the affordability metrics (a)-(c) in measuring affordability issues. In particular, the policy interventions (i)-(iv) can have counter-intuitive impacts on affordability metrics (b) and (c). In some instances, because of their relative nature, these metrics were worsened by policy interventions, even though (by definition) the interventions must raise welfare by always making some households better off and none worse off.

To understand how counter-intuitive increases in recorded affordability difficulties can occur consider the following example involving the twice median metric (b). Suppose median expenditure is €100, implying that twice median expenditure is €200. Now consider an intervention that causes expenditure to be reduced by €10 for every household in the population, but leaves the

[10] For the UK and Northern Ireland these amounts have been converted into pounds sterling using market exchange rates.
[11] To do so would require 'heroic' assumptions.
[12] Note the distinction between a monetary transfer that only reduces a household's expenditure and an intervention such as improved insulation that can reduce both consumption and expenditure.
[13] The thresholds for energy and water are mentioned in policies (see table in appendix). The expenditure share thresholds for telecoms and transport are roughly equivalent to twice the median expenditure share in the UK in 2012.

consumption of the commodity being purchased unchanged. This intervention must make all households better off. However, note that after the intervention median expenditure is €90, while twice median expenditure is €180, so the poverty threshold level has fallen by €20 (€200 to €180). Since the expenditure of all households has only fallen by €10, the proportion of households recorded as being above the twice median threshold increases despite all households being better off.

The counter intuitive outcomes of using metrics (b) and (c) indicate that significant caution should be applied before selecting a particular affordability metric as a target or to assess the success of policies through time. A more insightful way of monitoring the effectiveness of poverty interventions would be to estimate directly the total savings achieved for households, although this is not without its own difficulties

Given the counter intuitive outcomes identified above, we focus our discussion of the 'efficacy' of different policy interventions on metric (a), the fixed expenditure thresholds. While this type of affordability measure is not perfect (the thresholds are somewhat arbitrary) the results are more intuitive and easily understood.

The target groups identified for the policy interventions were determined by policy relevance and the availability of information within each household budget survey. The target groups vary by country and are not necessarily optimal for tackling affordability issues.

In the simulations, total expenditure has been used as a proxy for income, and analysis is based on the actual expenditure of households rather than any notional 'ideal' expenditure required to provide a particular living standard. Ongoing (rather than 'capital') expenditure is the focus of each sector's expenditure figures, so we have excluded one-off purchase costs of vehicles; however, no distinction could be made between 'essential' and 'discretionary' travel within transport expenditure. For energy expenditure, all fuels used to provide heat and power to a household's primary and (where relevant) second dwelling are included. In each country, the simulation results are driven by the pattern of expenditure on each sector across different household groups, and the relative size of these groups as a proportion of the total population.

To compare the efficiency of different policy interventions, we report an 'Effectiveness' Metric. For each intervention (i.e. each of the policy outcomes (i)-(iv) targeted at each of the different household groups) this metric divides the percentage point change in the proportion of households in the general population reported as being in affordability difficulties by the percentage of the population in the intervention's target group. The resulting figure is then made comparable by adjusting for the monetary size of the policy intervention.[14] This 'Effectiveness' Metric has the

[14] For example, the percentage point change when a policy is targeted at households containing someone aged 65 or over would be divided by the percentage of households containing someone aged 65 or over. To make all of the interventions

advantage that it controls for the 'size' of the intervention in terms of the number of households targeted and the extent to which they are helped. We put 'effectiveness' in inverted commas as we strongly caution against policymakers using this metric to direct actual policy decisions. The 'effectiveness' being measured relates to the ability of an intervention to move a particular type of affordability metric rather than identifying effectiveness in terms of the real welfare gain delivered to households.

comparable to a €50 energy expenditure reduction the figures for a €100 drop in energy expenditure are divided by 2 and the figures for a €250 drop in energy expenditure or a €250 increase in total expenditure are divided by 5.

4. Country studies

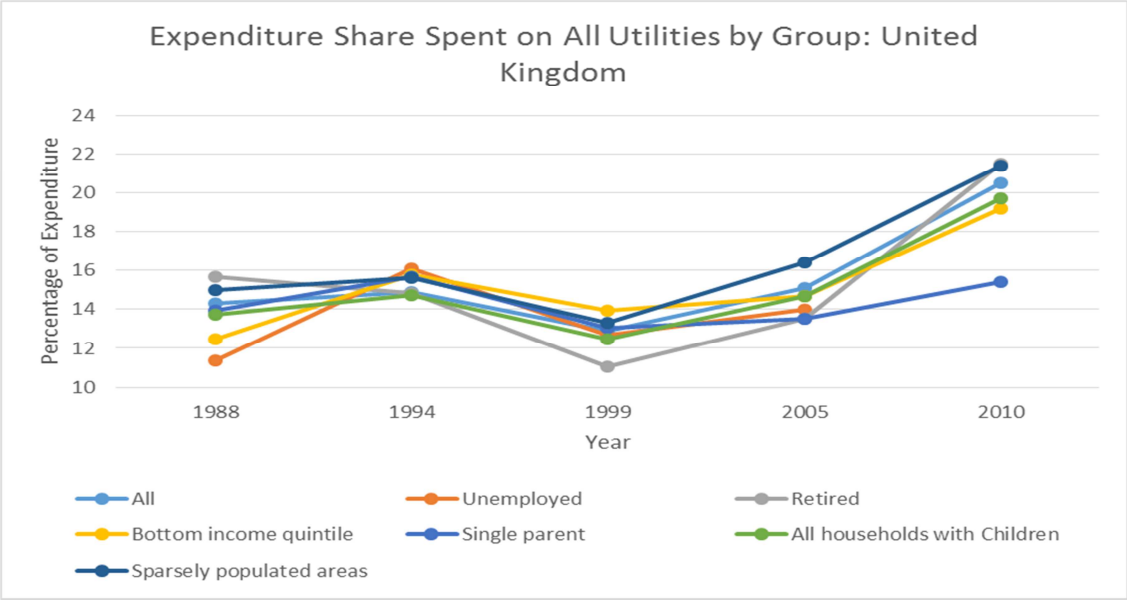
Further detail on individual countries' results from the Eurostat data regarding average expenditure shares and the EU-SILC indicators can be found towards the end of Research Papers 2 and 11. Additional detail from the national household budget surveys, in particular details of the simulations, can be found in Research Papers 4 to 8. Unless otherwise stated, all of the statements in the current section are based on our analysis in Research Papers 2, 4-8 and 11. The specific methodologies used in these research papers means that conclusions drawn may differ from those that can made from 'official' affordability metrics used in each country.

The results for the United Kingdom are reported first and are frequently referred to simply because it was using this Member State's data that we perfected the methodology for the in-depth analysis and simulations.

4.1 The United Kingdom

Chart 17 shows the expenditure share spent on all utilities by different groups in the United Kingdom (the data for the United Kingdom includes Northern Ireland), with expenditure shares for all groups rising between 1988 and 2010.

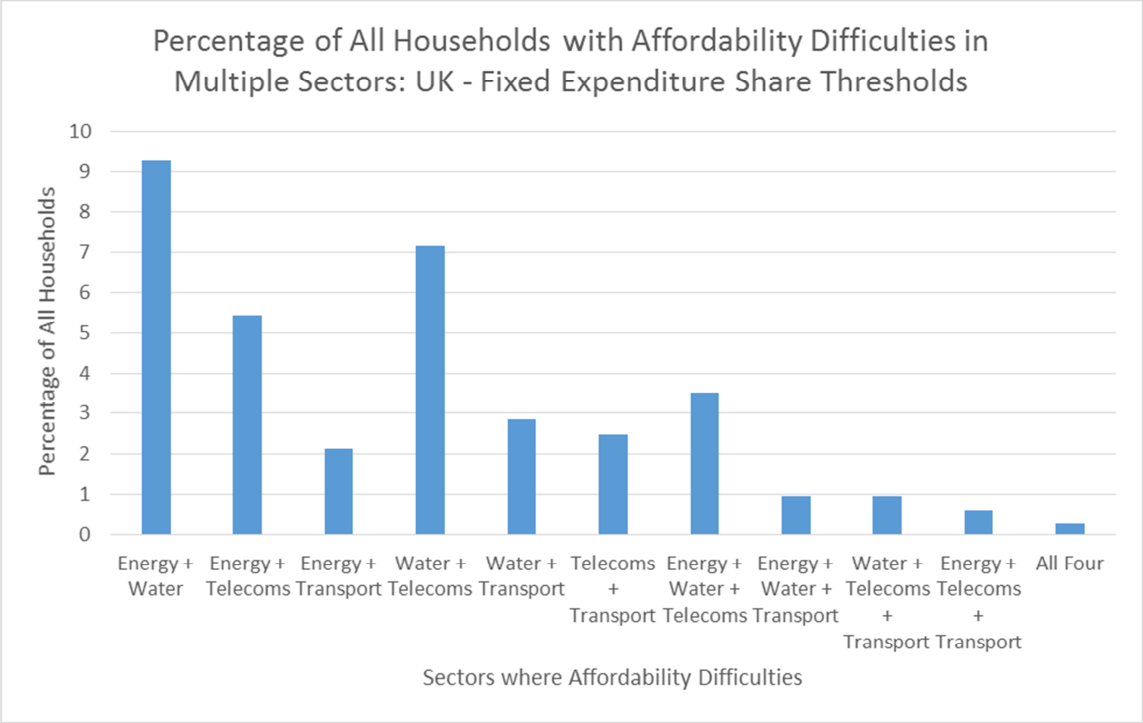
Chart 17: Expenditure Share Spent on All Utilities by Group: United Kingdom



Source: Eurostat collated national household budget survey data

Using data from the Living Costs and Food Survey, Chart 18 shows the percentage of all households in the UK with expenditure difficulties in more than one utility sector, according to the sector-specific expenditure share thresholds. While less than half a percent of households face difficulties across all four sectors, the difficulties for this small group are acute, since they devote at least 38% of their total household expenditure to utilities.

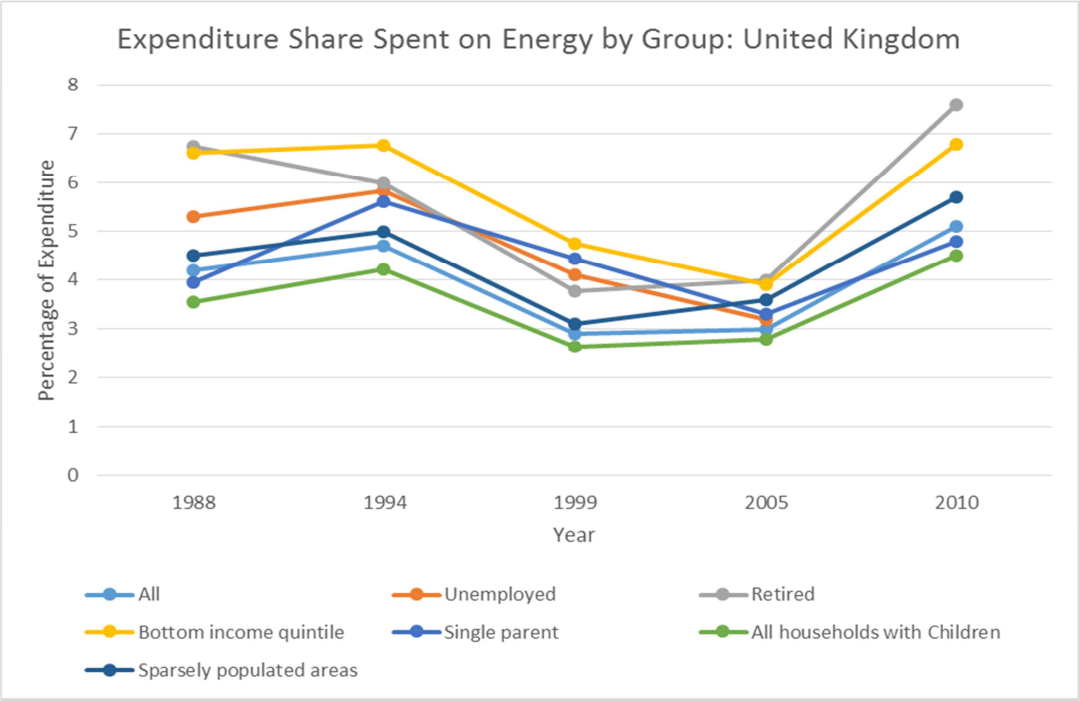
Chart 18: Percentage of All Households with Affordability Difficulties in Multiple Sectors: UK – Fixed Expenditure Share Thresholds



Source: UK Living Costs and Food Survey, 2012

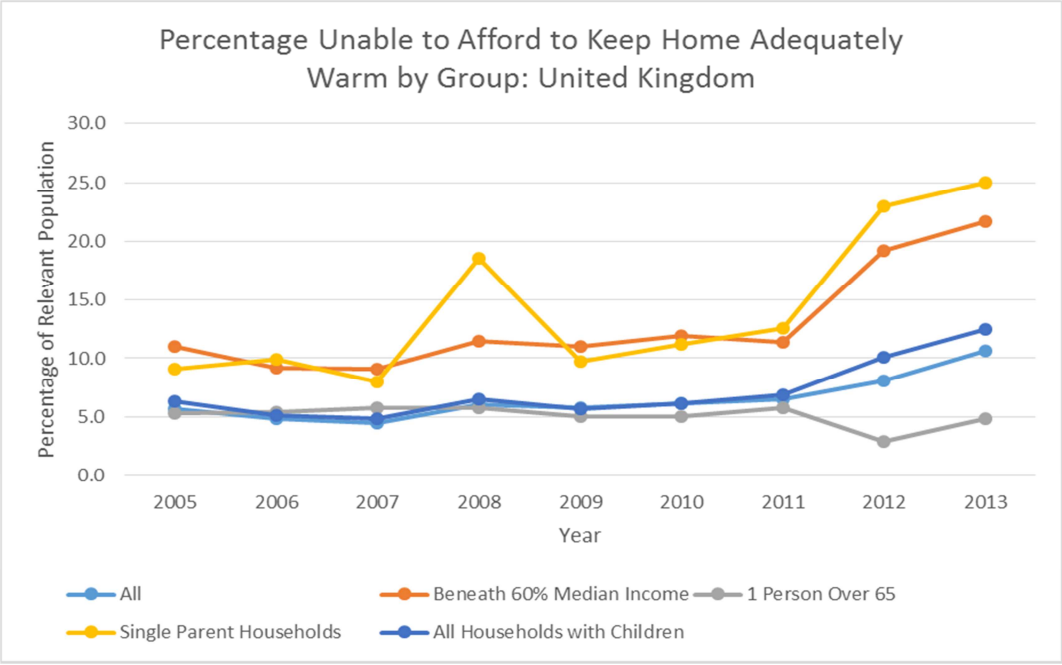
Chart 19 shows how the expenditure share devoted to energy has risen markedly for all groups since 1999. However, the expenditure shares in 2010 are generally at a similar level to those in 1994.

Chart 19: Expenditure Share Spent on Energy by Group: United Kingdom



Source: Eurostat collated national household budget survey data

Chart 20: Percentage Unable to Afford to Keep Home Adequately Warm by Group: United Kingdom



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

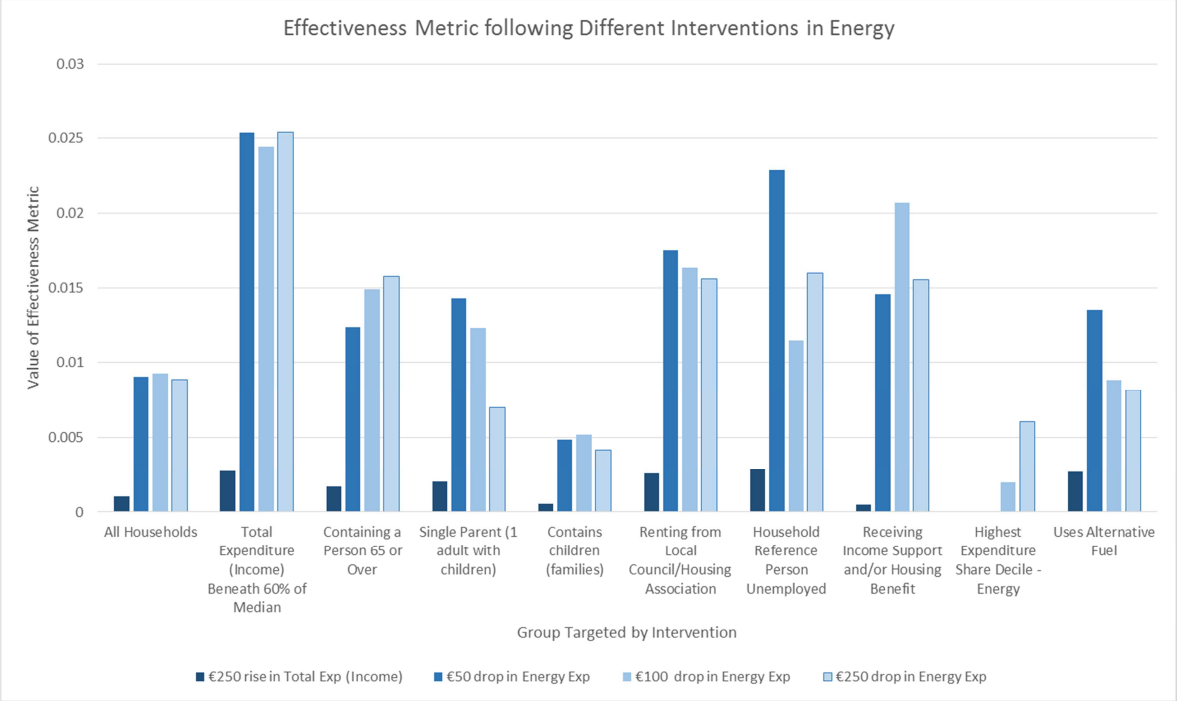
Chart 20 shows how the percentage of individuals unable to keep their homes warm diverged significantly across groups between 2011 and 2012.

We summarise here the main results from the policy simulations for the UK; the full detail and background information are provided in Research Paper 4, with the data coming from the 2012 Living Costs and Food Survey[15]. For the UK, approximately the same percentage of households are identified as being in fuel poverty according to the following two metrics, namely (i) spending over 10% of total expenditure on energy and (ii) spending twice the median share of total expenditure on energy. In general, the LIHC criterion for fuel poverty more than halves the percentage of households identified as fuel poor, compared with the 10% threshold, illustrating the fundamental impact of the choice of metric on the apparent extent of fuel poverty as a problem.

Chart 21 reports the 'effectiveness' metric for policy interventions relating to energy. Perhaps surprisingly, targeting the interventions at the 10% of households with the highest energy expenditure shares has only a limited impact on the proportion of households spending more than 10% of their expenditure on energy. This suggests that many fuel poor households spend considerably more than 10% of their expenditure on energy and highlights the problem of ignoring the depth of fuel poverty when using fixed expenditure share thresholds. Many households are so far from the fuel poverty threshold that even reducing their energy expenditure by €250 does not move them across the 10% threshold, though such a reduction in expenditure will of course benefit the individual households. Metrics involving thresholds provide an obvious incentive to policy makers to target households close to the threshold rather than those in the greatest need, if there is pressure to report large improvements in the metrics.

[15] The simulations for the UK include data from households in Northern Ireland.

Chart 21: Effectiveness Metric following Different Interventions in Energy



Source: UK Living Costs and Food Survey, 2012

While the depth of affordability difficulties can be calculated in relation to all three types of affordability metrics, only the UK's LIHC metric has a fuel poverty 'gap' metric included in its official definition. The depth of fuel poverty in the LIHC 'gap' metric is defined by the reduction in energy expenditure required for a household's energy expenditure to fall to the median level of energy expenditure and hence take the household out of LIHC fuel poverty. Reducing the percentage of households in LIHC fuel poverty does not necessarily reduce the average LIHC poverty gap. This apparent discrepancy occurs because when only certain households in the population are subject to a policy intervention it means that the composition of households which fall beneath the LIHC poverty threshold changes. In the UK the depth of fuel poverty, according to the LIHC gap, is greatest for households using fuels other than gas and electricity, while the average gaps experienced by households containing an elderly individual are among the lowest.

The percentage point drops in the proportion of households classified as being in water affordability difficulties following the policy interventions are greater than the equivalent drops for households facing energy affordability difficulties. This reflects the lower average household spend on water, and consequently the greater impact of a similar absolute reduction in expenditure. The distribution of telecoms expenditure is somewhat more uniform across different household groups than those for either water or energy. Households with children have the lowest rate of telecoms affordability difficulties according to the LIHC criterion. However, the mean and median LIHC gaps

are considerably higher for households containing children than for any other household group: a low income household with children is likely to experience particularly deep affordability difficulties compared with other households.

In contrast to the other three sectors, one of the groups with a higher expenditure share devoted to transport is households with children. Another contrast with other sectors is that according to the 20% threshold (and twice the median expenditure share metrics) the category 'All Households' has the highest rate of affordability difficulties. This reflects the fact that households that are relatively well-off, i.e. not in one of the economically disadvantaged groups identified, devote a higher share of their expenditure to transport. The large absolute size of expenditure on transport makes it difficult for the simulated policy interventions to influence the LIHC criterion. The policy intervention that has the largest impact on the LIHC criterion for transport can reduce the percentage of households recorded as having transport affordability difficulties by only 0.3 percentage points. In contrast, the policy intervention with the biggest impact in each of the other sectors reduces the percentage of households recorded as being in LIHC affordability difficulties by 2 percentage points in energy, 6.3 percentage points in water and 2.25 percentage points in telecoms.

4.2 Republic of Ireland

Households in the Republic of Ireland did not generally pay separately for water and sewerage before 2015, so the water sector is excluded from the results reported here. Compared with the UK, the Republic of Ireland has a younger age structure and a far higher proportion of households reporting expenditure on fuels other than gas and electricity (53.3%) compared with 7.4% in the UK. Estimated median household expenditure in the Republic Ireland in 2009-10 is around a third higher than median household expenditure in the UK in 2012.[16] For all household groups in the Republic of Ireland, except those in social housing and with total expenditure beneath 60% of the median, a higher expenditure share is devoted to transport than to energy. The highest median expenditure shares on energy and telecoms are for those households where total expenditure is below 60% of the median level.

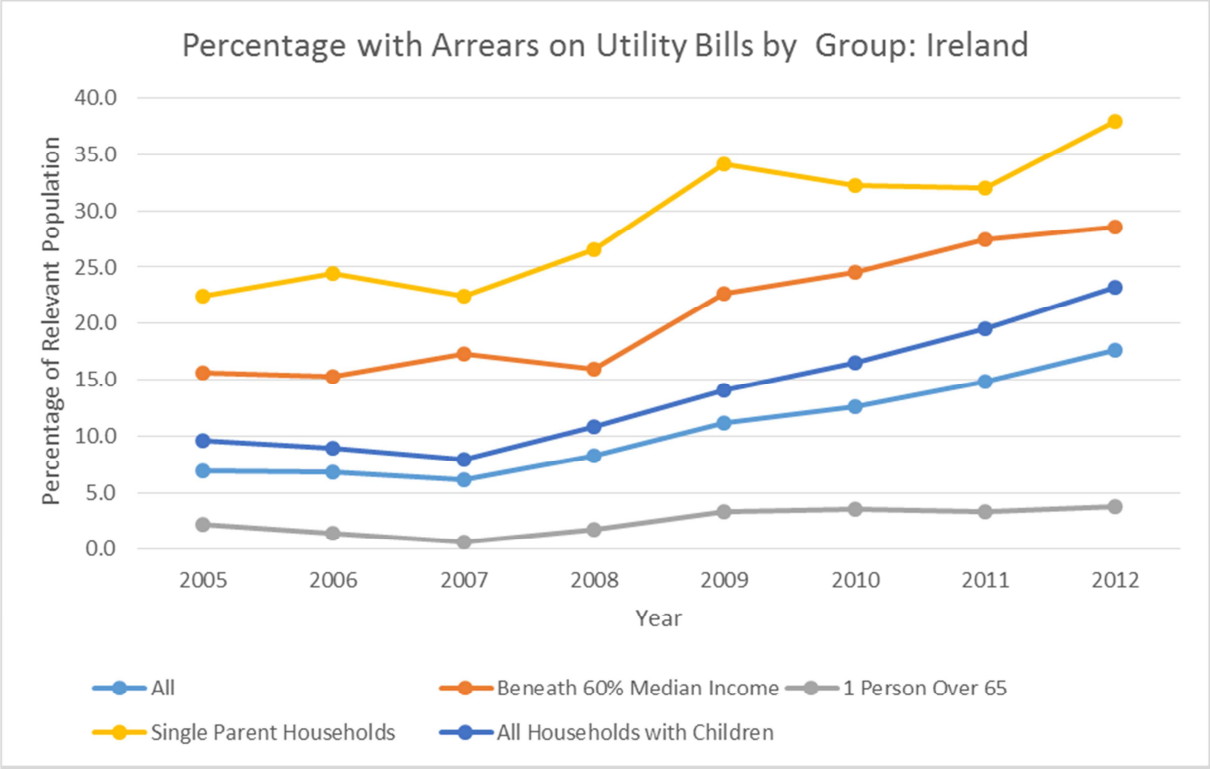
Apart from the difference in charging for water and sewerage, patterns between the expenditure shares devoted to particular utility sectors and the level of total household expenditure (income) are very similar to the UK. Unlike the UK, where the measures are broadly equivalent, in the Republic of Ireland the percentage of households lying above the twice median expenditure share in energy is over 4 percentage points higher than for the 10% energy expenditure share indicator, which was around 4.5 percentage points lower than in the UK in 2012.

[16] This comparison uses the market euro to pound exchange rate on 29 June 2012 of 0.8068 euros to the pound.

Affordability across utility sectors

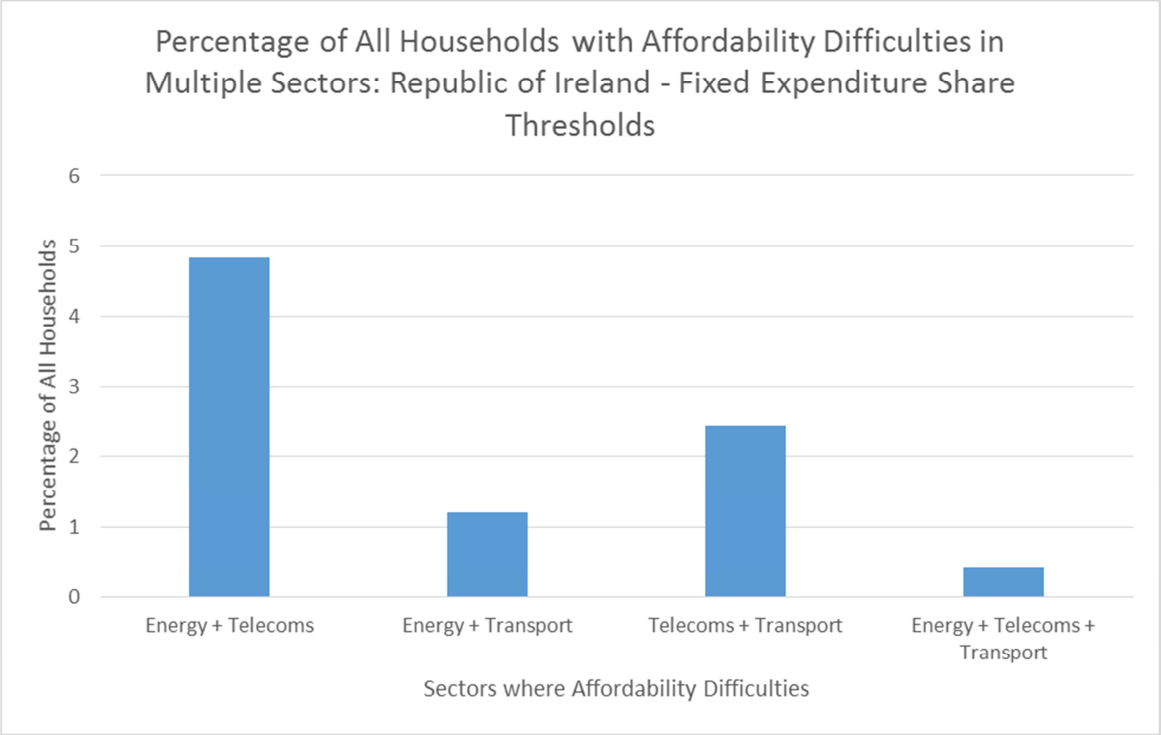
The different charging system for water and sewerage services poses challenges in comparing expenditure with other countries. This may explain the fact that expenditure shares on all utilities in the Republic of Ireland were slightly lower than those in 2010 in the UK, but more individuals report arrears on utility bills (Chart 22). The rates of arrears are higher for all groups in the Republic of Ireland, particularly for those in low income households, where 28% had arrears in 2012 compared with 19% in the UK. Turning to Chart 23 the percentage of households reporting affordability difficulties for both energy and telecoms (according to the fixed threshold metrics) is fairly similar to the UK.

Chart 22: Percentage with Arrears on Utility Bills by Group: Ireland



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

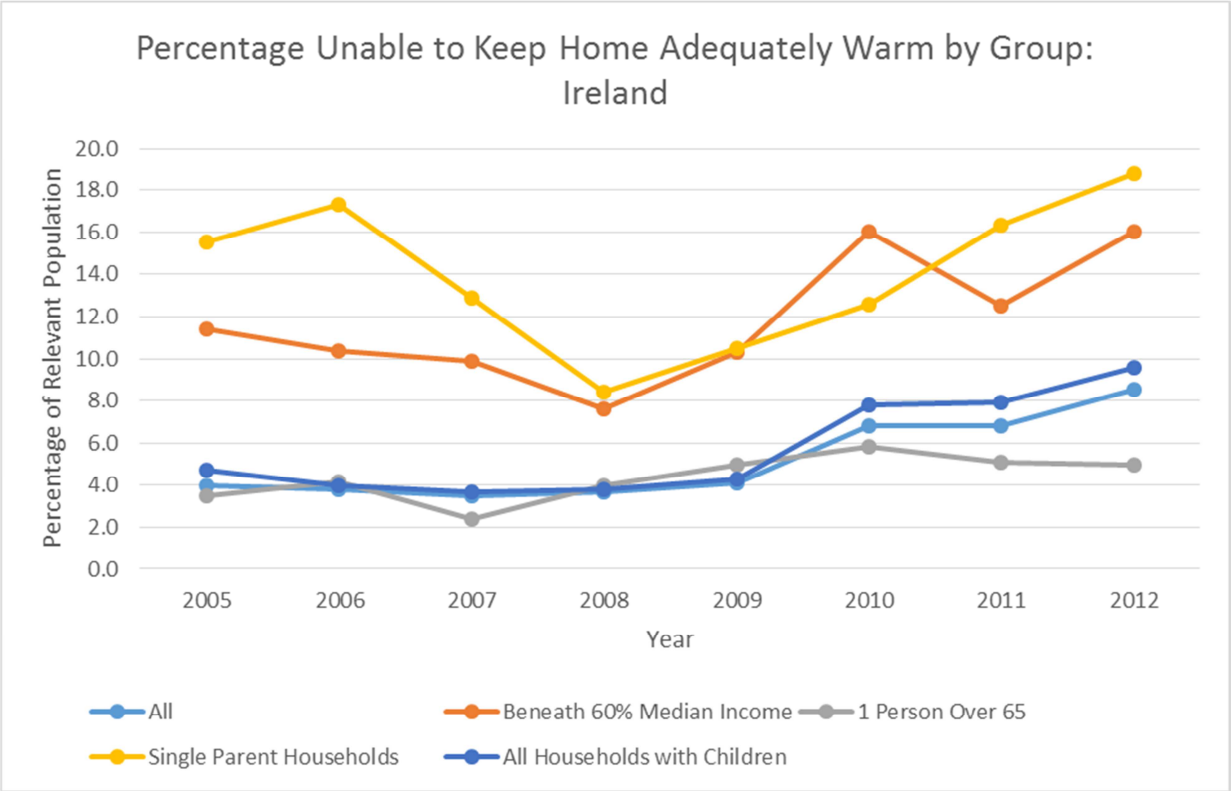
Chart 23: Percentage of All Households with Affordability Difficulties in Multiple Sectors: Republic of Ireland – Fixed Expenditure Share Thresholds



Source: The Irish Household Budget Survey, 2009-10

The impact of the Financial Crisis on Irish citizens' perceptions of the ability to keep warm in their homes is clear in Chart 24, with all groups showing an increase in the reported percentage unable to keep adequately warm after 2008, though the levels in 2012 remain lower than the corresponding figures for the UK. The level of increase in this indicator varies by group, with particularly sharp increases for those in low income and single parent households.

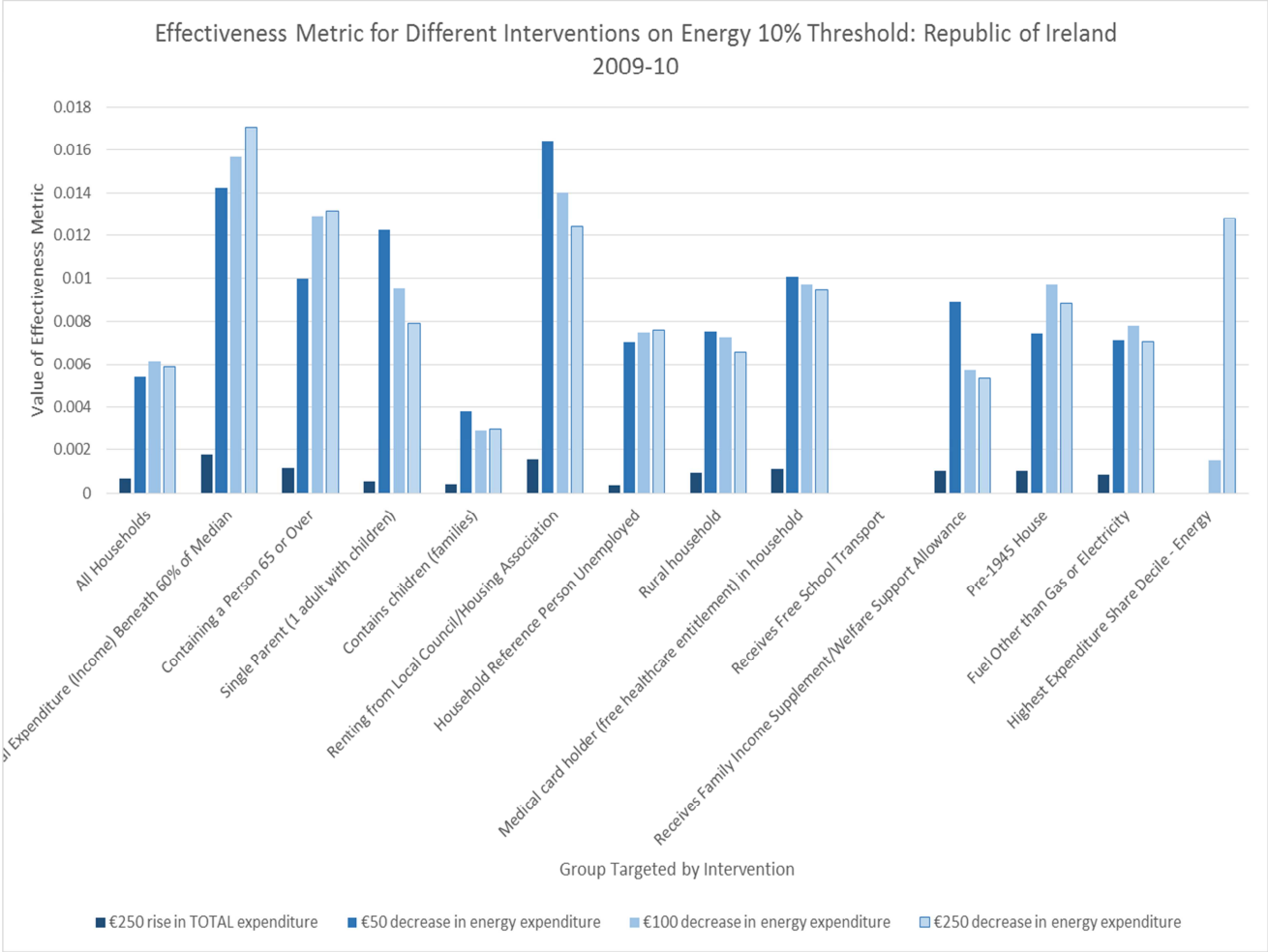
Chart 24: Percentage Unable to Keep Home Adequately Warm by Group: Ireland



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

The simulations we report below are based on the Irish Household Budget Survey 2009-10 and are reported more fully in Research Paper 5. In terms of reducing the percentage of households spending over 10% of their expenditure on energy, targeting those on low incomes and those living in social housing are the most 'effective' (Chart 25), followed by households containing a person aged 65 or over. That a €250 reduction in energy expenditure is needed to reduce meaningfully the recorded affordability difficulties of households in the highest 10% of energy expenditure shares suggests that, within this group, average energy expenditure is well above the 10% expenditure share threshold.

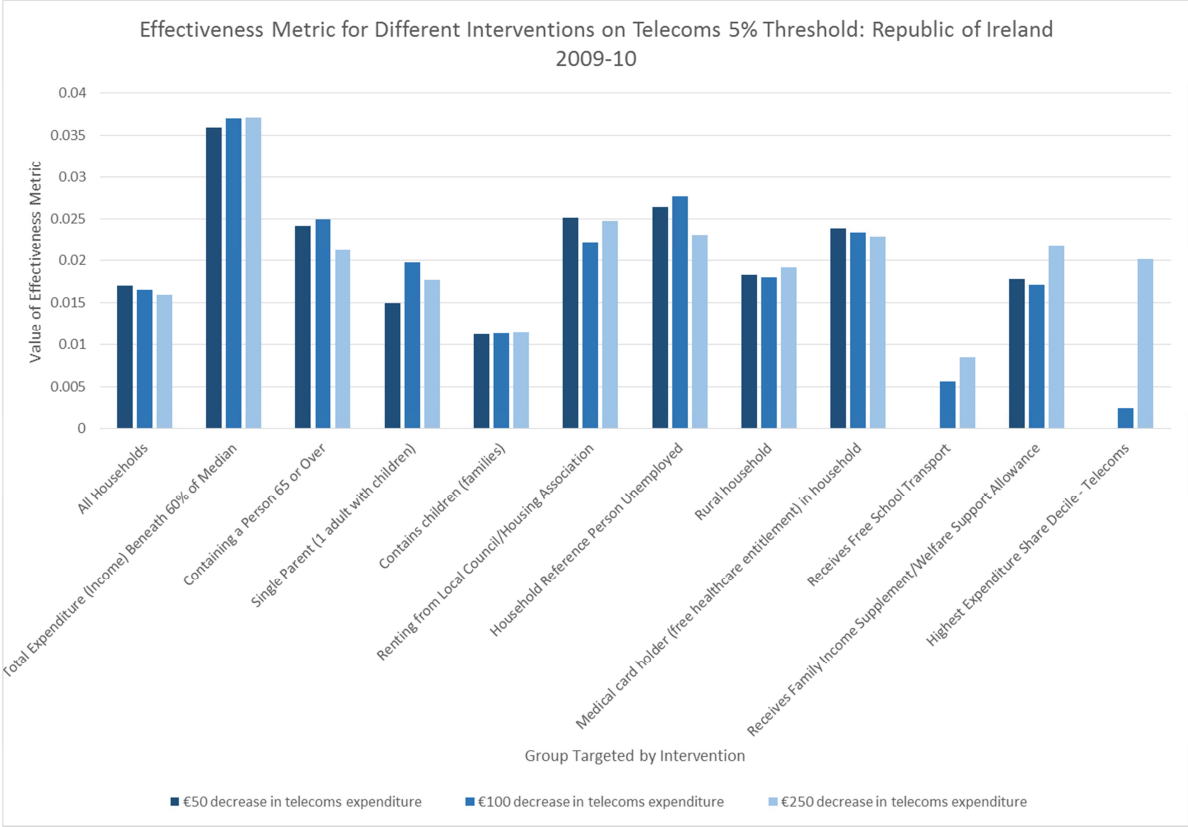
Chart 25: Effectiveness Metric for Different Interventions on Energy 10% Threshold: Republic of Ireland 2009-10



Source: The Irish Household Budget Survey, 2009-10

The percentage of households in the Republic of Ireland devoting more than 5% of their expenditure to telecoms is somewhat higher than in the UK in 2012, at 21% compared to 16%. Given that telecoms affordability difficulties in the Republic of Ireland are closely linked to low income, it is no surprise that the most 'effective' policy interventions are those targeted at households with total expenditure below 60% of the median. A contrast with the UK is that targeting expenditure reductions at the 10% of households with the highest telecoms expenditure shares is much less 'effective' in the Republic of Ireland. This suggests that the absolute level of expenditure on telecoms by this group of households was higher in the Republic of Ireland in 2009-10 than in the UK in 2012. Only an expenditure reduction of €250 has a real impact on the percentage of households above the 5% threshold in the Republic of Ireland (Chart 26).

Chart 26: Effectiveness Metric for Different Interventions on Telecoms 5% Threshold: Republic of Ireland 2009-10



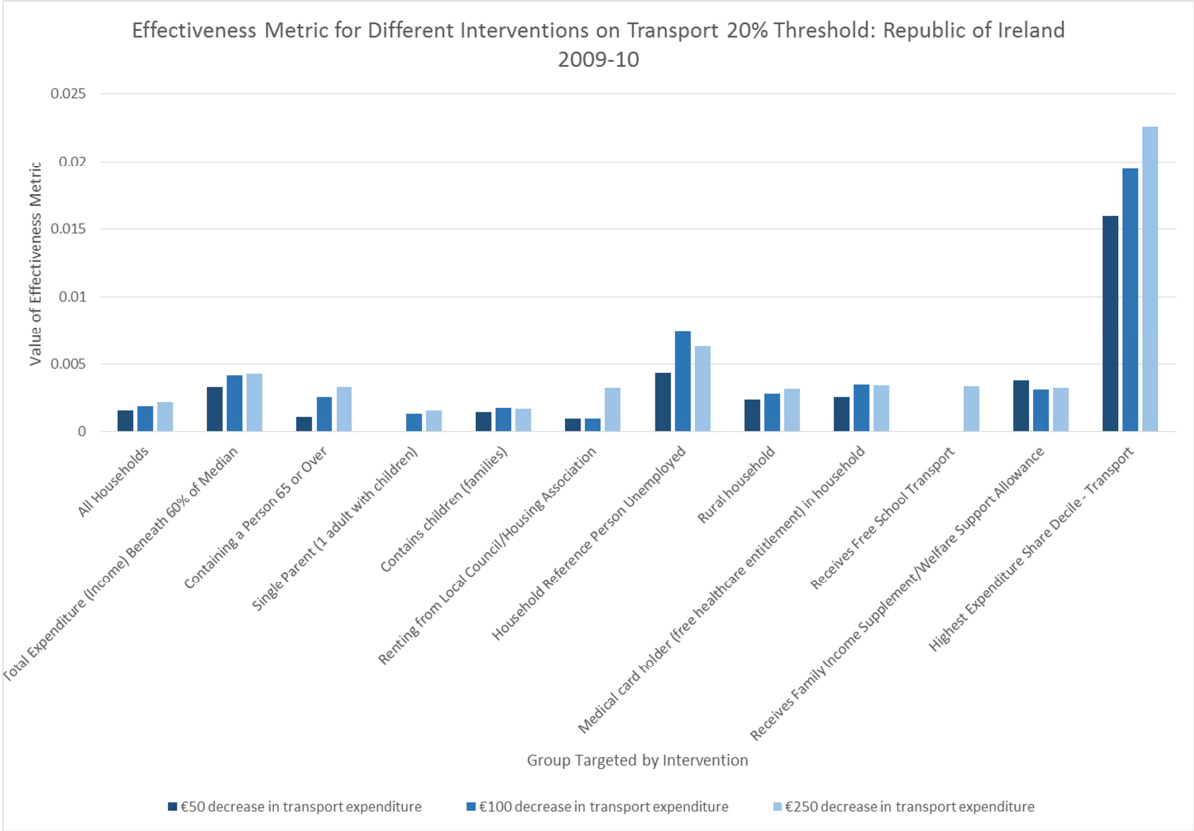
Source: The Irish Household Budget Survey, 2009-10

The percentage of households spending over 20% on transport in the Republic of Ireland is much lower than in the UK (9% compared with 16%). Unsurprisingly, the household group with the highest rate of affordability difficulties according to the 20% threshold in the Republic of Ireland are households in rural areas, who are likely to have a particularly high demand for transport. Another group spending a relatively high proportion of expenditure on transport are households where the breadwinner is unemployed.

Turning to the most 'effective' policy interventions in reducing the percentage of households with a transport expenditure share exceeding 20%, Chart 27 shows a clear difference with the UK. In the Republic of Ireland by far the most 'effective' policy intervention is to target expenditure reductions at the 10% of households with the largest expenditure shares devoted to transport. Targeting an expenditure reduction of €250 at this group results in the percentage of households spending over 20% of their expenditure on transport dropping by over 1 percentage point. In the UK the same policy has little noticeable impact. This suggests that the 10% of households with the highest transport expenditure shares in the UK devote a much higher proportion of their expenditure to

transport than corresponding households in the Republic of Ireland. One explanation may be that there are fewer rail commuters purchasing very expensive season tickets in the Republic of Ireland than in the UK.

Chart 27: Effectiveness Metric for Different Interventions on Transport 20% Threshold: Republic of Ireland 2009-10



Source: The Irish Household Budget Survey, 2009-10

4.3 Northern Ireland

Northern Ireland is, of course, part of the UK, and we focus on the key differences between the picture for the UK as a whole and that for Northern Ireland, with some comparisons with the Republic of Ireland. Because Northern Ireland is a small part of the UK, 'booster' samples for Northern Ireland were taken in the Living Costs and Food Survey until 2009, to ensure sufficient data for meaningful analysis. We use this data from 2009, three years earlier than the latest available for the UK, to take advantage of this 'boosted' sample. This time difference requires some caution when interpreting comparisons with the UK. All monetary differences are reported in nominal terms. In real terms, the differences between Northern Ireland and the UK are likely to be

slightly smaller than reported when Northern Ireland has lower total expenditure, while the differences are likely to be slightly larger than reported when Northern Ireland has higher total expenditure. Moreover, the Northern Ireland sample remains small, so we are more circumspect about the conclusions than for the other in-depth analyses. We should make clear that the UK figures reported above include Northern Ireland, so in this section we report on only a subsection of that larger whole.

Water is not separately charged to households in Northern Ireland, and so is not included in the analysis. Demographically, the Northern Irish sample lies somewhere between the UK's and the Republic of Ireland's populations. Crucially for explaining Northern Ireland's fuel poverty issues, the percentage of households using alternative fuels[17] in the Northern Ireland sample is even higher than that in the Republic of Ireland, being 58% compared with 53%; and the percentage of households in the Northern Ireland sample who were receiving housing benefit or income support in 2009 was three times higher than that in the UK in 2012.

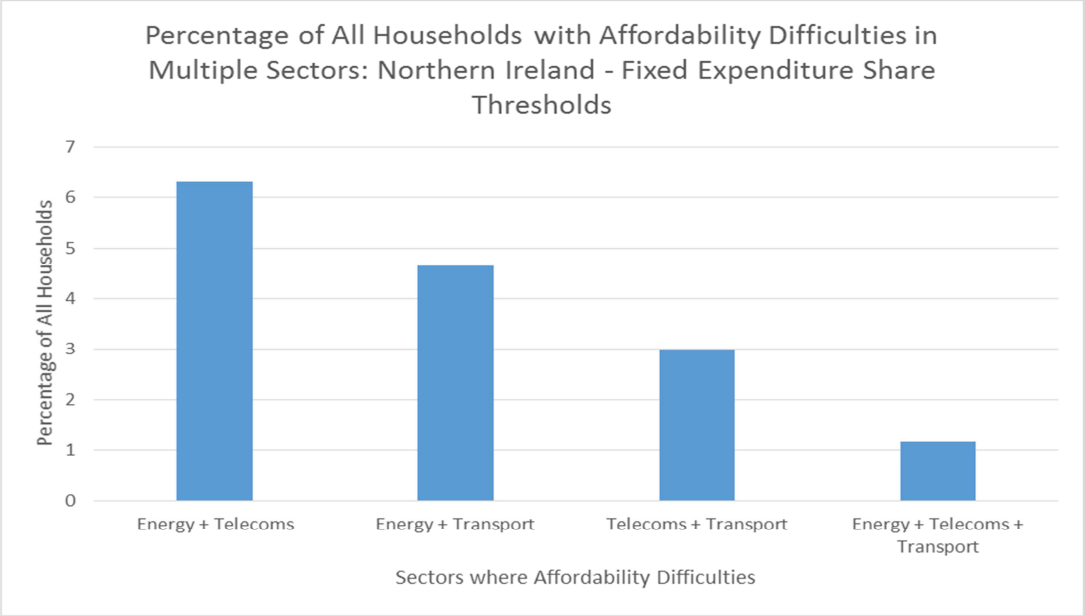
In terms of households' total expenditure (proxy income) in Northern Ireland, while the median household expenditure across all households in 2009 is over £1,000 lower than for the UK in 2012, in some household groups, average total expenditure in the Northern Ireland sample is higher than for the UK in 2012. For example, in the Northern Ireland sample the total expenditure of households where the breadwinner is unemployed is around £6,000[18] higher than in the UK data, and the total expenditure for those receiving benefits is about £2,000 higher.

In broad terms, the expenditure share patterns across sectors and groups shown for the Northern Ireland sample are similar to those found in the UK population. Apart from households where the breadwinner is unemployed or there is a single parent[19], the main difference with the UK is a slightly higher median expenditure share on energy. The median share of expenditure devoted to energy for all households is around 0.5-0.75 percentage points higher in the Northern Ireland data. In particular, the median expenditure share devoted to energy is around 1 percentage point higher in the Northern Ireland data when compared to the UK for households containing someone aged over 65, and is 2 percentage points higher for households receiving income support or housing benefit.

Charts 28 and 29 show that utility affordability difficulties across multiple sectors are slightly more common (but broadly in line) than for UK households as a whole. The exceptions are the combination of energy and transport using the fixed thresholds, which is about double the UK equivalent.

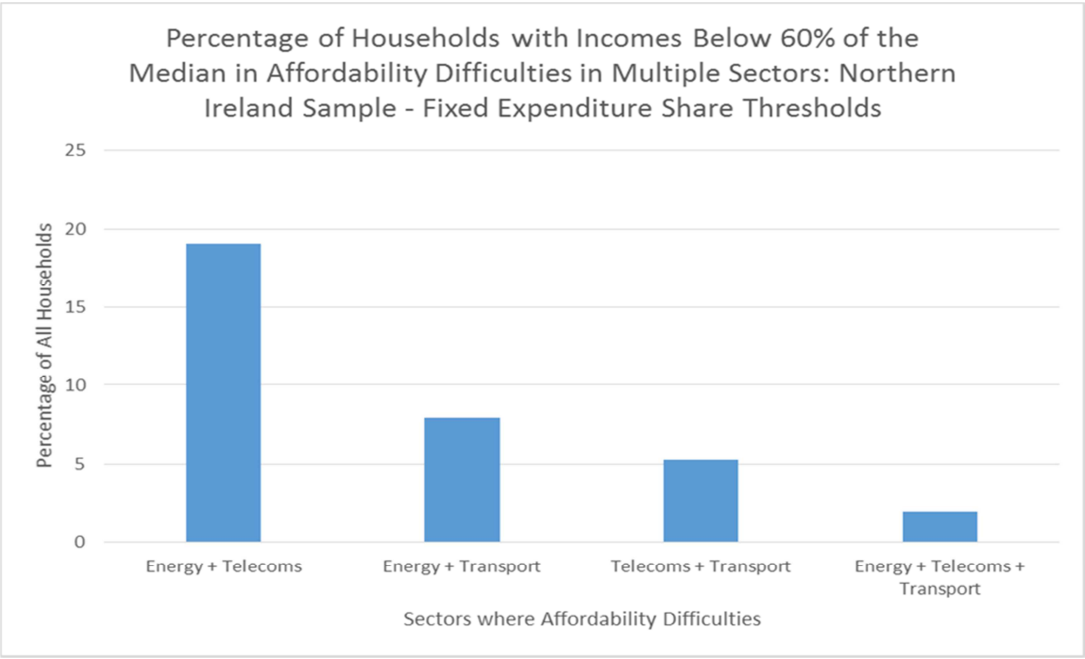
[17] By 'alternative fuels' we mean oil, solid fuels and bottled gas.
[18] This figure may be influenced by the very small size of the unemployed sub-sample within the Northern Ireland sample.
[19] The sizes of the sub-samples for these groups are very small.

Chart 28: Percentage of All Households with Affordability Difficulties in Multiple Sectors: Northern Ireland – Fixed Expenditure Share Thresholds



Source: Living Costs and Food Survey, Northern Ireland sub-sample, 2009

Chart 29: Percentage of Households with Incomes Below 60% of the Median in Affordability Difficulties in Multiple Sectors: Northern Ireland Sample – Fixed Expenditure Share Thresholds



Source: Living Costs and Food Survey, Northern Ireland sub-sample, 2009

For low income households, the rate of reporting affordability difficulties in energy and telecoms, using fixed expenditure share thresholds, is around 2 percentage points higher in Northern Ireland compared with the UK as a whole.

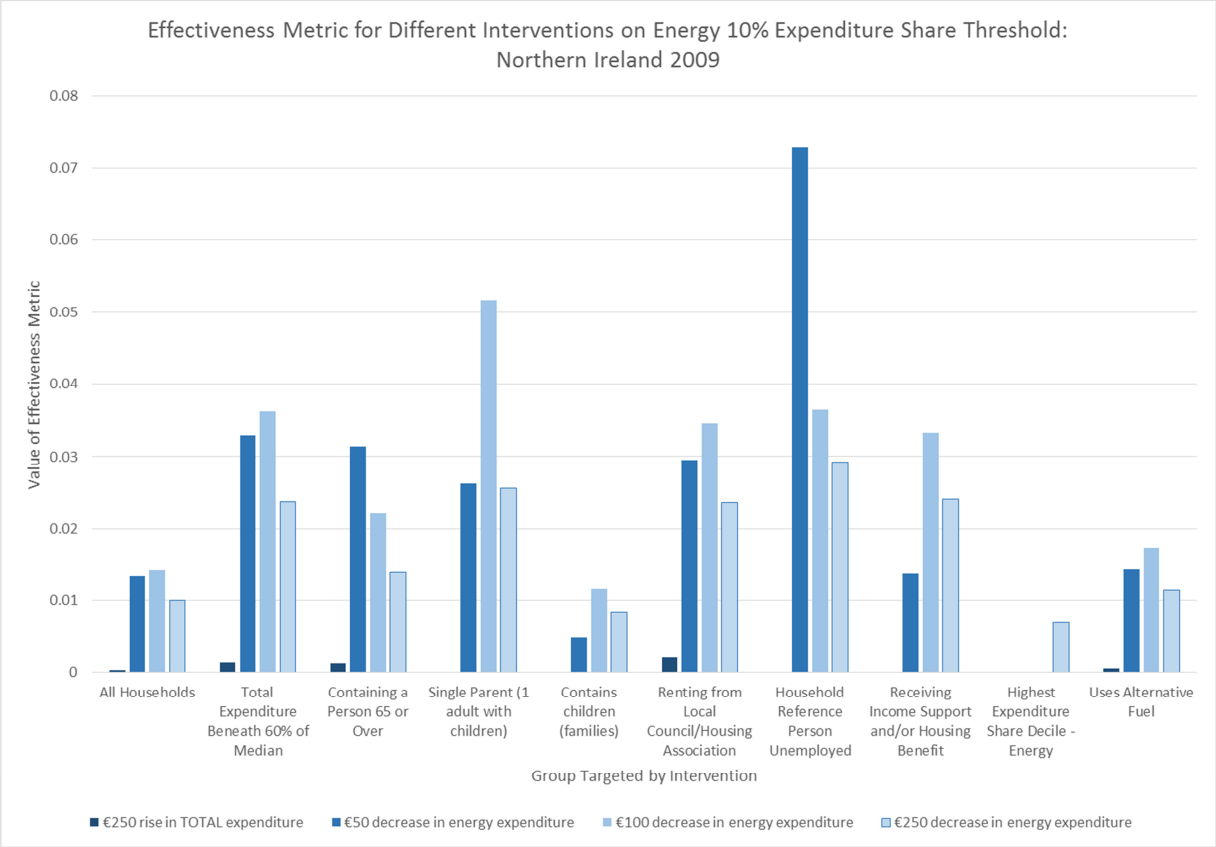
In contrast with the UK data, in the Northern Ireland sample the percentage of households spending twice the median expenditure share on energy is always at least 5 percentage points lower than the percentage of households with an energy expenditure share above 10%. The second major difference from the UK data is that among households using 'alternative' energy sources in the Northern Ireland sample, 30% reported spending over 10% of their expenditure on energy, while for the same (much smaller) group in the UK in 2012 the equivalent figure was 40%. If this difference is real, it may be explained by more heterogeneous characteristics of the group who depend on alternative fuels in Northern Ireland, both in terms of income and location. While alternative fuel use is largely a rural phenomenon in the UK as a whole, it is characteristic of both town and country dwellers in Northern Ireland. Indeed the UK definition of 'alternative', used because in the UK as a whole it is relatively unusual, is a less appropriate term for Northern Ireland where around 68% of homes use home heating oil.

In the Northern Ireland sample the percentage of households with energy expenditure above the 10% expenditure share threshold is 5 percentage points higher than in the UK data for 2012. The percentage of households in the Northern Ireland sample spending over 10% and over 20% of their expenditure on energy is around double that for the Republic of Ireland. This is probably because of the much higher total expenditure (income) levels in the Republic of Ireland. While the Republic of Ireland has a different approach to fuel poverty, here we compare findings from the expenditure surveys using common threshold levels.

The groups which have the highest percentage of households reporting energy expenditure shares over 10% in the Northern Ireland sample coincide with those in the UK. In Northern Ireland there are two groups that have a bigger impact in reducing this affordability indicator compared to the UK, when targeted for policy interventions. These are households receiving housing benefit/income support and those using alternative fuels. These are much larger groups as a proportion of all households than in the rest of the UK.

Turning to the 'effectiveness' metric, the small size of the sub-samples for single parent households and households where the breadwinner is unemployed may reduce the reliability of the results in these two categories. Discounting these two groups, the most 'effective' groups to target to reduce energy affordability difficulties in the Northern Ireland sample are households with total expenditure beneath 60% of the median and those living in social housing. The relatively low effectiveness of targeting households using alternative fuels probably reflects the large size of this group and therefore the wide diversity of households within it.

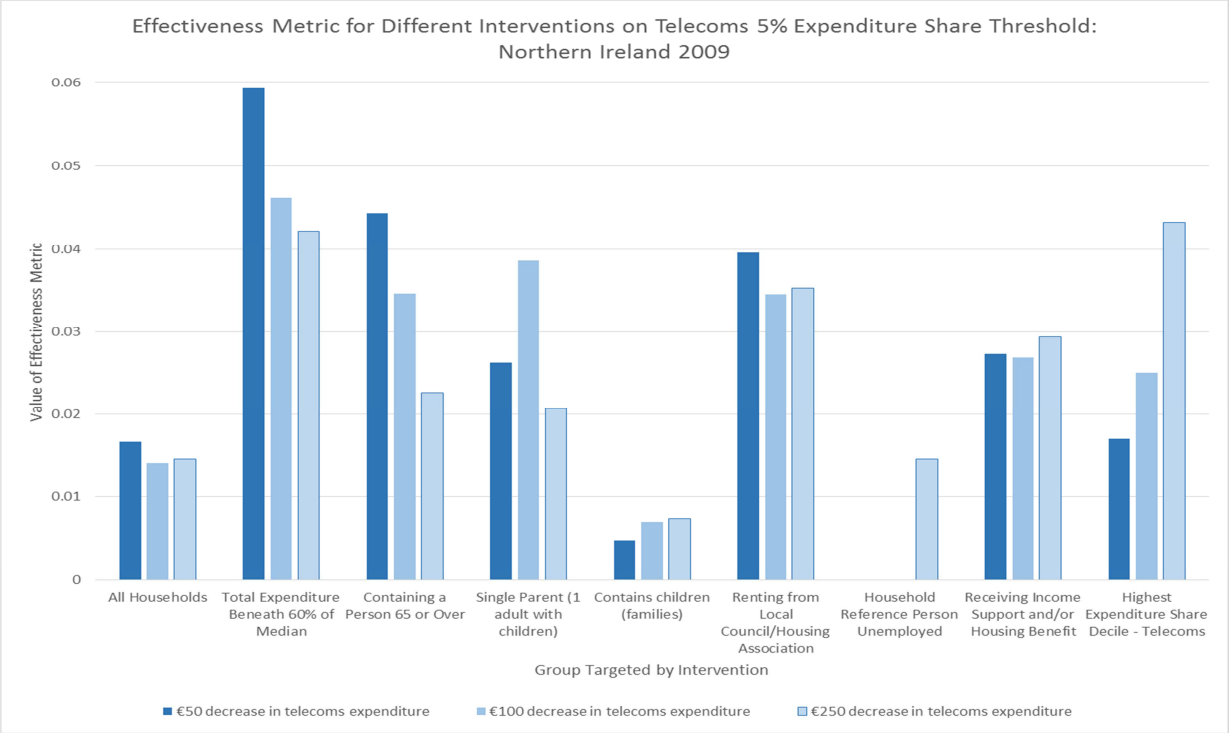
Chart 30: Effectiveness Metric for Different Interventions on Energy 10% Expenditure Share Threshold: Northern Ireland 2009



Source: Living Costs and Food Survey, Northern Ireland sub-sample, 2009

The relative rates of telecoms affordability difficulties across the different household groups in the Northern Ireland sample are similar to that for the UK as whole. The one exception is the rate of telecoms affordability difficulties recorded for single parent households. This is higher in Northern Ireland, although this may be explained by the small sub-sample. As in the UK and Republic of Ireland, the presence of children in a household is associated with the depth of telecoms affordability difficulties being high (conditional on being identified as having telecoms affordability difficulties according to the LIHC criterion).

Chart 31: Effectiveness Metric for Different Interventions on Telecoms 5% Expenditure Share Threshold: Northern Ireland 2009



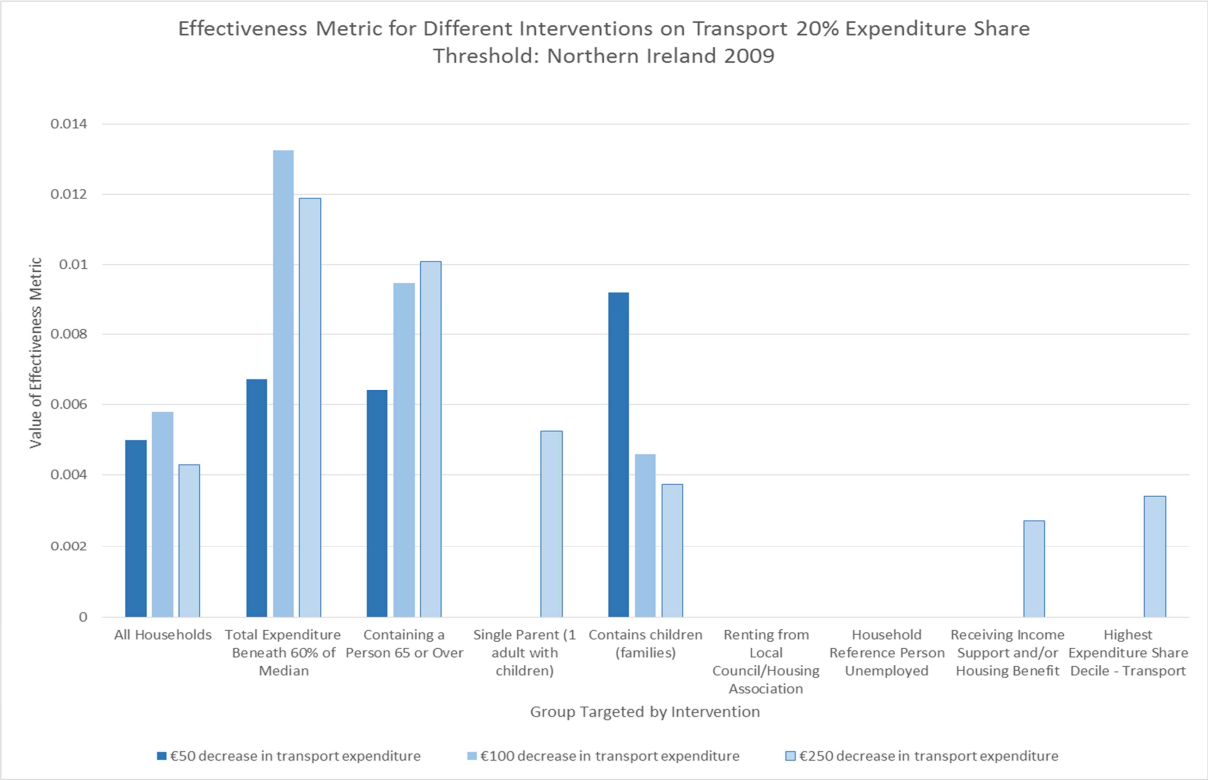
Source: Living Costs and Food Survey, Northern Ireland sub-sample, 2009

Chart 31 shows that the most 'effective' way to reduce the percentage of households spending over 5% of their expenditure on telecoms is to reduce the telecoms expenditure of households with total expenditure below 60% of the median. This is the same policy prescription as in the UK as a whole and the Republic of Ireland. The main difference in Northern Ireland is that targeting households with someone over 65 appears to be relatively more effective (particularly a €50 expenditure reduction), while targeting households with children is even less effective than in the comparator countries.

There is a much higher rate of transport affordability difficulties for households containing someone aged 65 or over in Northern Ireland compared with either the UK as a whole or the Republic of Ireland. In the Northern Ireland sample, households with someone aged 65 or over have the highest rate of affordability difficulties according to all three of the affordability metrics. The rates of affordability difficulties for the population as a whole are broadly in line with the UK. In the transport simulations for the Northern Ireland sample, the clearest result is that the structure of transport expenditure among households with the very highest transport expenditure shares has more in common with the UK than with the Republic of Ireland. In contrast to the Republic of Ireland, expenditure reductions of €50 and €100 have no impact on the percentage of households

spending more than 20% of their total expenditure on transport. The most 'effective' group to target is households with total expenditure below 60% of the median. The main difference between Northern Ireland and the UK as a whole is that targeting households containing someone aged 65 or over is relatively more 'effective' in Northern Ireland.

Chart 32: Effectiveness Metric for Different Interventions on Transport 20% Expenditure Share Threshold: Northern Ireland 2009



Source: Living Costs and Food Survey, Northern Ireland sub-sample, 2009

Case study: Fuel poverty policy in Northern Ireland

Northern Ireland (NI) faces particular poverty challenges: incomes are below those in the rest of the United Kingdom (and have fallen more steeply than in Great Britain (GB)[20] since the Great Recession[21]); the piped gas grid has much lower penetration than in GB, so many households, particularly in rural areas, are dependent on oil heating; but like the rest of the UK, NI has a poor

[20] We use Great Britain to mean the United Kingdom excluding NI
[21] Rowntree foundation, 2014 http://www.jrf.org.uk/publications/monitoring-poverty-and-social-exclusion-northern-ireland-2014

housing stock[22]. The analysis of household expenditure described in this report shows that around 22%[23] of households spend more than the 'traditional ten percent of income' on their energy, around five percentage point higher than for the UK as whole, and double the rates in the Republic of Ireland. Fuel poverty is correspondingly deeper in NI, with more households facing severe fuel poverty (more than 20% of their income on household energy). However affordability of telecoms and transport is roughly comparable, except for particular household groups, indicating particular challenges in energy. Economic and social issues are transferred (devolved) to the Northern Ireland Assembly, and the Executive has taken an innovative approach, particularly with respect to fuel poverty. Here we summarise the background and approach of the Affordable Warmth Programme as an example of a rather different approach in an area of high need.

On the supply side, the main difference between energy supply in Northern Ireland and the rest of the UK is the lack of a mature gas grid, so the fuel heating mix is very different, with many households dependent on oil. This has traditionally had higher costs than gas (around 30% premium until 2014), and is generally delivered either in large tank loads, which requires large payments at each delivery, or in smaller portable loads (e.g. 20 litre drums available from petrol stations) which carry a higher mark-up per unit volume. There seems to be no shortage of potential competitors in this market for smaller supplies, and there are several well used price comparison websites, but there are concerns about safety as well as the high additional cost of heating homes in this way.

One policy approach has been to encourage development of the gas grid, first in The Greater Belfast Area, then in the ten towns, and now a new initiative 'Gas to the West' to extend piped gas to an additional eight towns. But 'converting' to gas requires upfront investment in new boilers which may present a barrier, and current low oil prices make gas a less attractive prospect. There is little competition in the provision of gas for domestic customers, which remains price capped. Residential electricity prices also remain controlled, and there is debate about reconciling this with an open market: the incumbent retains over 70% of the market, though SSE Airtricity has captured almost a quarter of the market, usually by offering a discount against the incumbent's price. All household tariffs consist of a single price per unit of fuel, with no standing charge, so prices should be relatively easy to compare. Electricity prices for all payment methods are slightly higher than the UK average, perhaps because of the small market and the generation fuel mix, and prepayment tariffs are a little lower than standard tariffs, but higher than those paying by direct debit or online.

On the demand side, there is an unusually high proportion of prepayment meters in Northern Ireland: over 40% in electricity and between 64% and 90% (depending on area) in gas. These offer many of the demand side features of smart meters (but they are 'dumb' in that they do not

[22] Though the average efficiency of dwellings is slightly better than in the rest of the UK.
[23] This contrasts with the 42% officially reported rate for 2011 because of different sources and methodology; we cite the rate based on similar methodology elsewhere in the report.

communicate data to the supplier), and are not associated (as sometimes in the rest of the UK) with any social stigma. The roll out programme for smart meters has not yet been determined for NI.

There may also be cultural characteristics in NI which affect the energy market. There are close knit, sometimes isolated, communities, and appreciation of established and trusted relationships and institutions. These favour incumbents and create entry barriers for new suppliers. It may also make householders suspicious of initiatives from 'strangers', and there is a low take up of grants in some areas. At the same time there may be a somewhat cavalier attitude to authority in some areas, which some have suggested accounts for an increasing problem with thefts of energy, particularly for those with keypad prepayment meters which serve almost half the households. However at the official level there is a culture of strong compliance with EU directives, both because of the importance of social benefits and because of the deterrent effect of any fines levied by the EU.

There are a number of NI initiatives that help address fuel poverty, for example the Northern Ireland Sustainable Energy Programme. This is an energy efficiency grant programme operated by the Utility Regulator, which targets 80% of funds to schemes improving the energy efficiency in low-income households. A Warm Homes scheme, launched in the early years of the millennium, has now been replaced by the Affordable Warmth Scheme. Schemes to pay regularly for oil deliveries to spread the expense over time have proved too costly, but there are oil savings stamps to help with lumpy payments, and local joint-buying schemes to use buyer power to seek a better deal; these are most successful where there is a pre-existing community or collaboration, and may struggle to reach households which are isolated geographically or socially. The NI Executive is in the process of developing a new scheme, Energy wise; however details are not yet available.

In 2014 the Department of Social Development launched a geographically based fuel poverty scheme for low income households in private accommodation called Affordable Warmth. It is innovative in being targeted at areas where it is estimated greatest need exists[24], rather than being an open scheme to which eligible households can apply. Local Councils prioritise areas of greatest need and approach households in that area, which may deliver local demonstration effects as well as lower costs of delivery. There have been no formal assessments of the scheme yet, though some stakeholders feel that it has had a slow start.

The scheme takes both a 'whole household' and a 'whole house' approach: eligibility has been simplified to depend on income (less than £20,000) rather than receipt of specific benefits, and so includes a higher proportion of working households than many such arrangements. The scheme comprises improvements to heating systems (including conversion from oil to gas where appropriate), insulation, work on doors and windows as needed. It consists of a global policy initiative (albeit relatively small in the context of NI's population of less than two million) which is

[24] Using an algorithm developed with the University of Ulster. Eligible households in areas which are targeted as lower priority can apply to be included earlier in the programme.

locally targeted and delivered. While the Local Council and Housing Executive will make all the necessary arrangements, householders may choose their own subcontractors (if they have been officially approved) to carry out the work if they prefer. Such flexibility loses some economies of centralised organisation, but is more market oriented and encourages local entrepreneurship.

There are natural barriers to take-up of the scheme, including natural conservatism, particularly with respect to changes to the home. In terms of the criteria suggested in this report, it is clearly targeted, delivered locally and deals with the challenge of up-front expenses to improve energy efficiency. Much of Affordable Warmth's success, and its value as a flagship scheme for other governments who are seeking to address fuel poverty through energy efficiency measures, depends on the accuracy of the targeting algorithm and the success of local agents in recruiting the households who most need help.

4.4 Estonia

This section is based on the publicly available data from Estonia's 2012 Household Budget Survey, though unfortunately the data are very limited compared to the UK or Republic of Ireland. In the Estonian survey, only 14 high-level expenditure categories (broadly matching those used by Eurostat) are available. As a result, simulations for expenditure on energy and water are not possible, and the two categories for which we can carry out simulations 'Communications' and 'Transport' do not match the definitions used for the UK and Irish data. In particular, 'Communications', if it follows Eurostat's classification, includes expenditure on postal services. The main issue with 'Transport' is that we cannot exclude expenditure on the purchase of vehicles.[25] Moreover, compared to the UK and Irish data, three of the groups used for targeting policy interventions (single parent households, unemployed households and households with children) are defined rather differently.

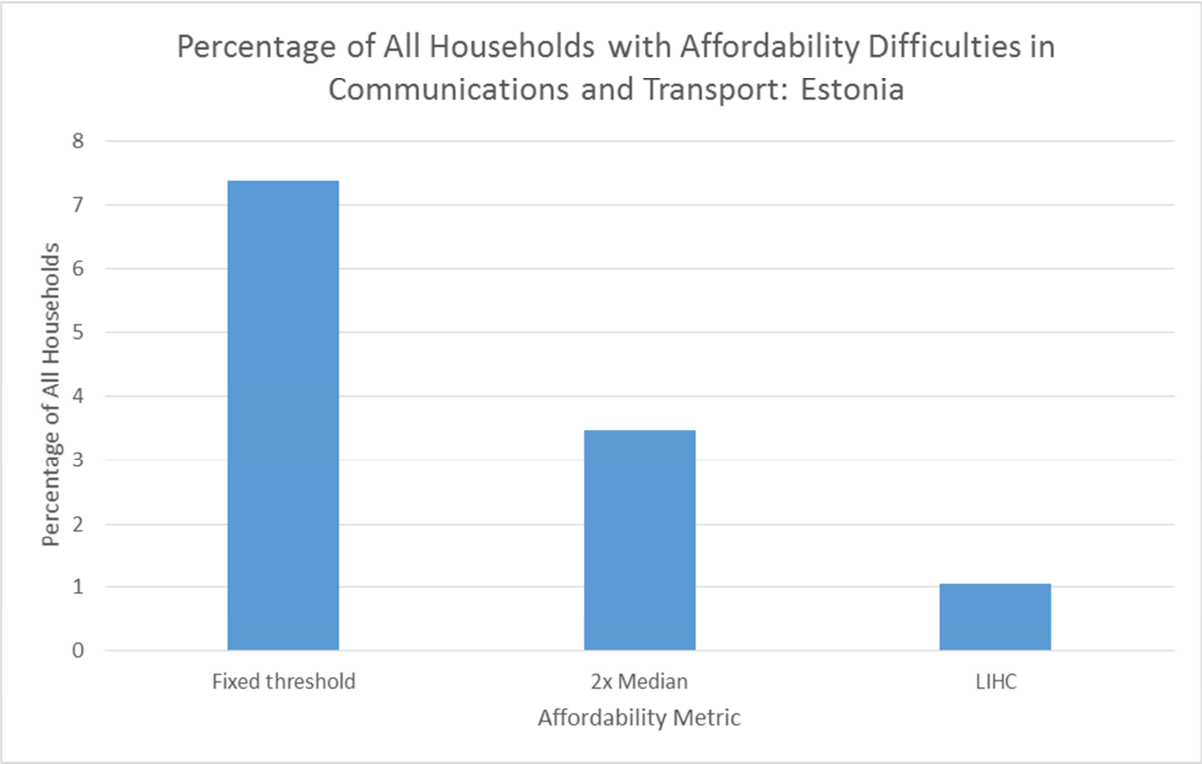
Estonia is more youthful than the UK and the estimated median total household expenditure in Estonia is much lower than in the UK and Republic of Ireland. However, the relative levels of total expenditure across different household groups seem broadly similar to those in the UK and Republic of Ireland. Since the expenditure categories 'Communications' and 'Transport' are different from those in the UK and Republic of Ireland, the conclusions to be drawn from cross-country comparisons are relatively limited. However, it is clear that the median expenditure share across all households devoted to 'Communications' in Estonia is much higher (almost double) the expenditure share devoted to 'Telecoms' in the UK and Republic of Ireland. However, the proportion of expenditure devoted to 'Transport' is much lower in Estonia, even though it apparently includes vehicle purchases.

[25] The documentation available in English is limited so we cannot confirm the precise definition of these two expenditure categories.

Affordability across sectors

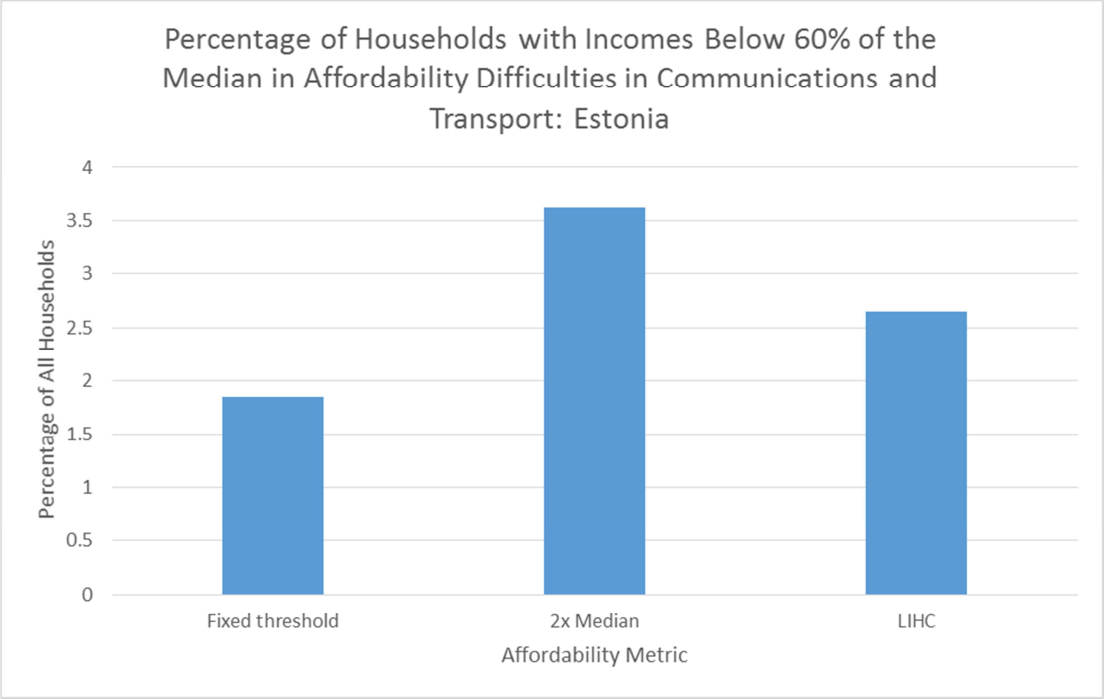
Since Estonia only provides data on the expenditure categories 'Communications' and 'Transport', there is only one combination of affordability difficulties to consider. This is shown in Chart 33 for the population as a whole and in Chart 34 for low income households. As in other countries, Estonians on low incomes devote a lower percentage of their expenditure to transport than those on higher incomes. While in the Estonian population as a whole more than 7% of households have affordability difficulties in both communications and transport, fewer than 2% of low income households have this combination of affordability difficulties according to the fixed threshold metric. A higher percentage of low income households have affordability difficulties in both sectors according to the LIHC criterion.

Chart 33: Percentage of All Households with Affordability Difficulties in Communications and Transport: Estonia



Source: Estonia household budget survey, 2012

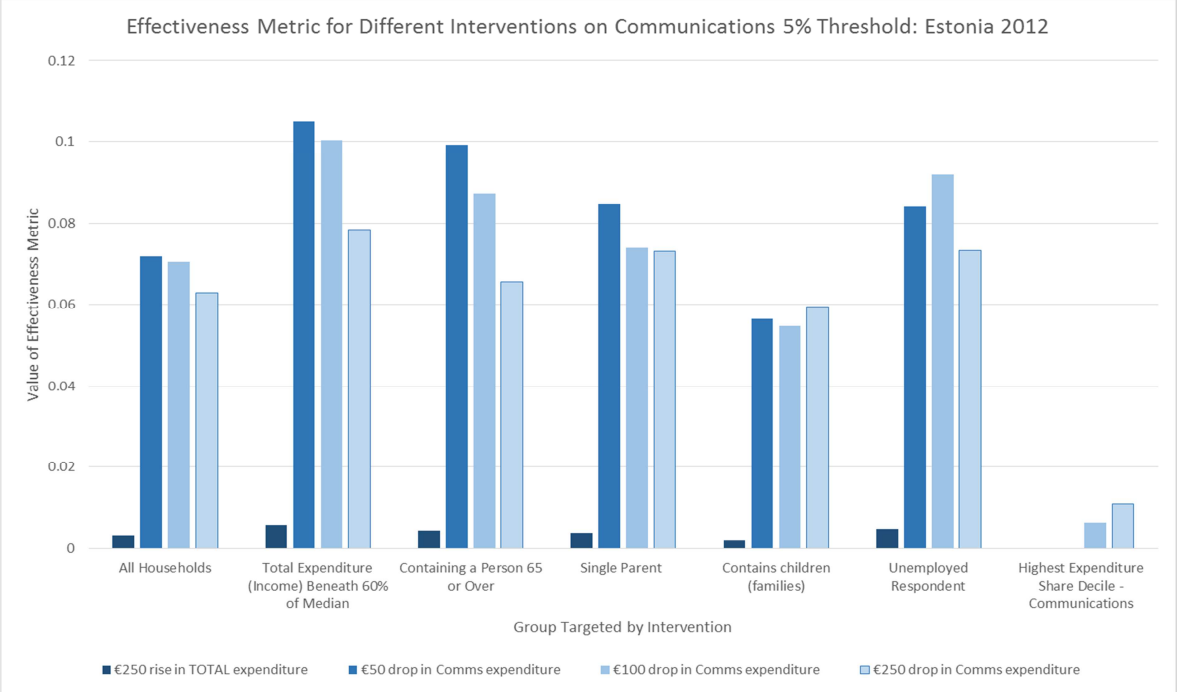
Chart 34: Percentage of Households with Incomes Below 60% of the Median in Affordability Difficulties in Communications and Transport: Estonia



Source: Estonia household budget survey, 2012

The 'effectiveness' metric in Chart 35 shows that in Estonia, as in the UK and Republic of Ireland, the most 'effective' way to alter the percentage spending more than 5% of their expenditure on communications is to target interventions on low income households. However, in contrast to the UK and Republic of Ireland, targeting households containing elderly individuals, single parent households and households where the respondent is unemployed is also relatively effective.

Chart 35: Effectiveness Metric for Different Interventions on Communications 5% Threshold: Estonia 2012



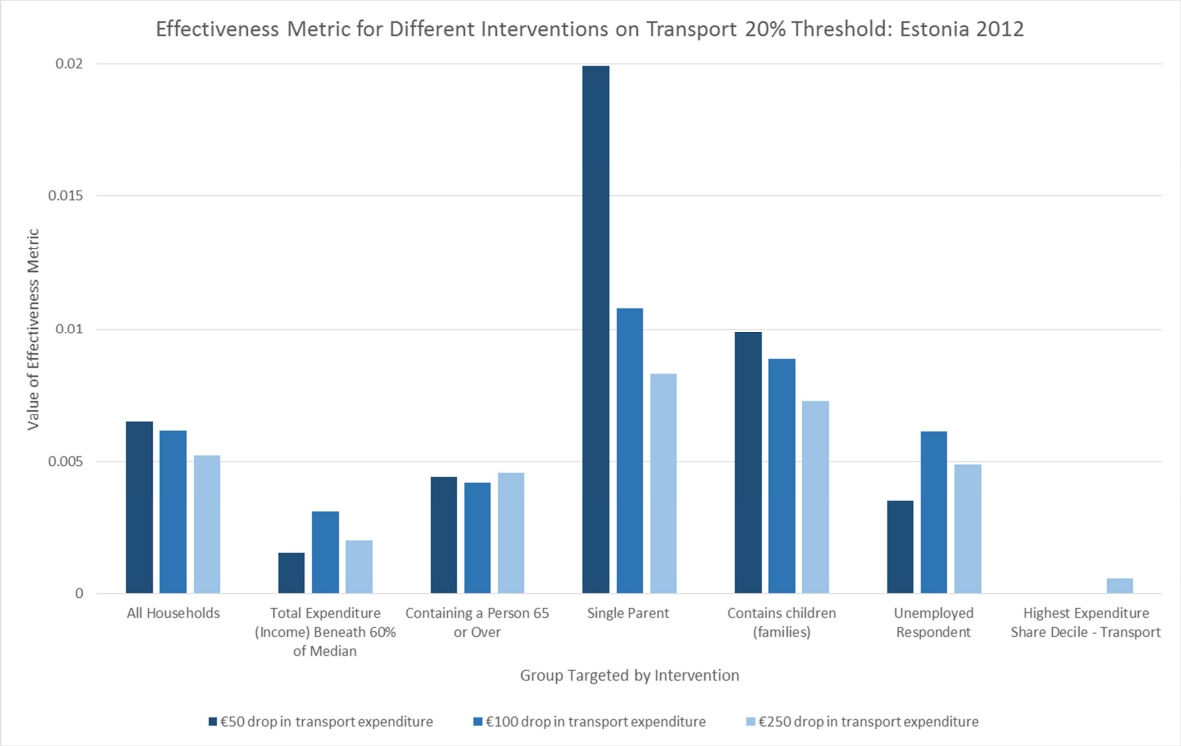
Source: Estonia household budget survey, 2012

Despite the transport expenditure category being broader and total expenditure being lower, the percentage of households devoting 20% or more of their expenditure to transport in Estonia is broadly comparable to that in the UK. When compared to the Republic of Ireland in 2010, the percentage of households with a transport expenditure share exceeding 20% is almost 8 percentage points higher in Estonia in 2012. In addition, in Estonia a far greater proportion of households have expenditure shares devoted to transport which are far in excess of the median. This dramatic skew in the distribution of transport expenditure shares results from many households in the Estonian sample recording a transport expenditure of zero, which we are unsure how to interpret.

Regarding the impact of the policy interventions on the 20% threshold metric, the general pattern is similar to that in the UK. For example, targeting interventions at households in the highest expenditure share decile for transport has essentially no impact on the percentage of households spending more than 20% of their total expenditure on transport. The main difference between Estonia and the UK relates to the impact of the interventions targeted at households with total expenditure below 60% of the median. Targeting this group with a €250 expenditure reduction has much less impact in Estonia, probably reflecting the large number of households reporting zero transport expenditure.

Turning to the 'effectiveness' metric, in Chart 36 it is clear that targeting a €50 expenditure reduction at single parent households is by far the most 'effective' policy to shift the affordability metric. It has an effectiveness rating twice that of the next most effective intervention. The relatively poor performance of the targeting mechanisms evaluated in the simulation is indicated by the fact that the effectiveness of including 'All households', i.e. not targeting any specific household type, is the third most effective targeting option.

Chart 36: Effectiveness Metric for Different Interventions on Transport 20% Threshold: Estonia 2012

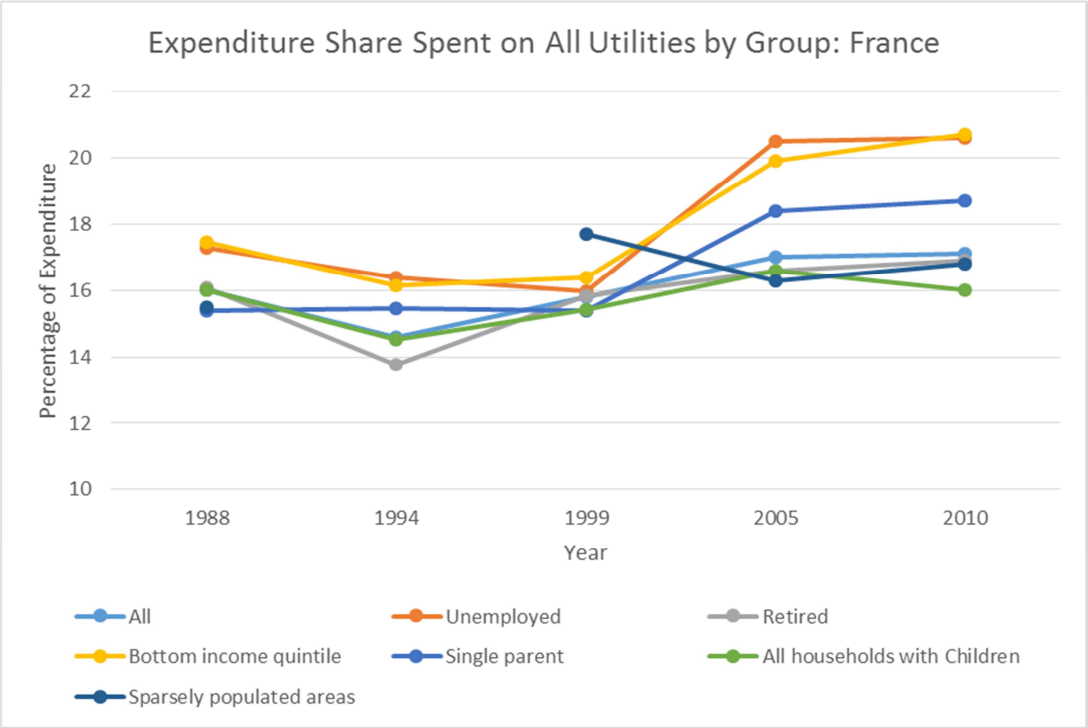


Source: Estonia household budget survey, 2012

4.5 France

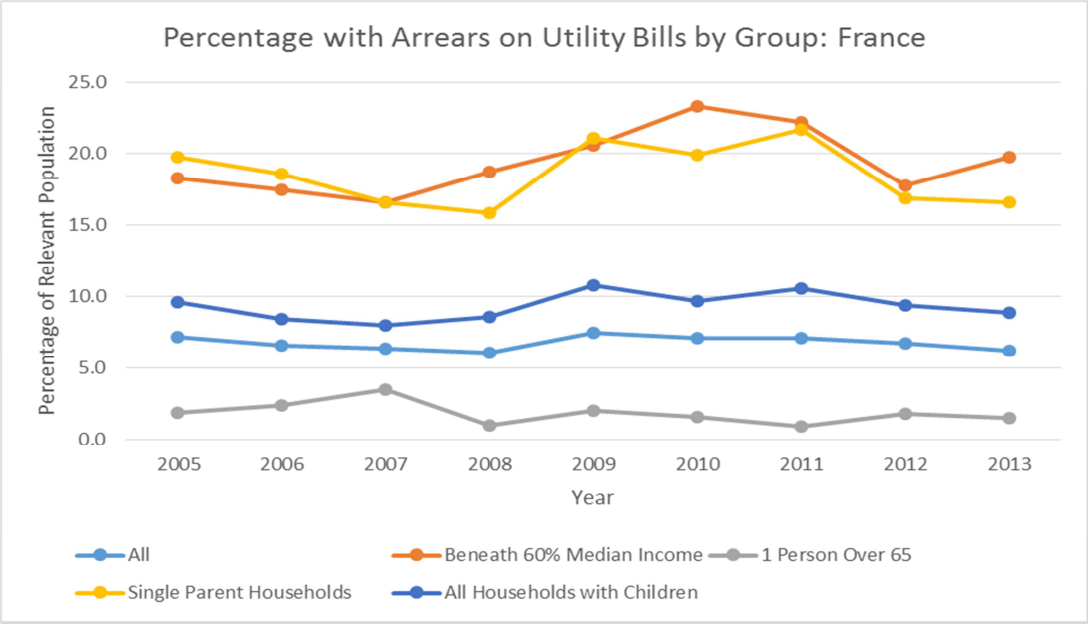
For the population as a whole in 2010, the proportion of total expenditure devoted to utilities in France was slightly lower than that in the UK at 17% instead of just over 20%, although the expenditure share in France had been slightly higher in the period 1988 to 1999 (Chart 37). Expenditure shares devoted to all utilities combined show marked divergence across different groups in France after 1999. This was driven particularly by a disproportionate rise in the expenditure shares devoted to utilities by unemployed households and households with the lowest 20% of incomes. However there was no rise in individuals reporting arrears after 2011 (Chart 38), as in the UK, so that reported arrears were generally lower in France than the UK by 2013.

Chart 37: Expenditure Share Spent on All Utilities by Group: France



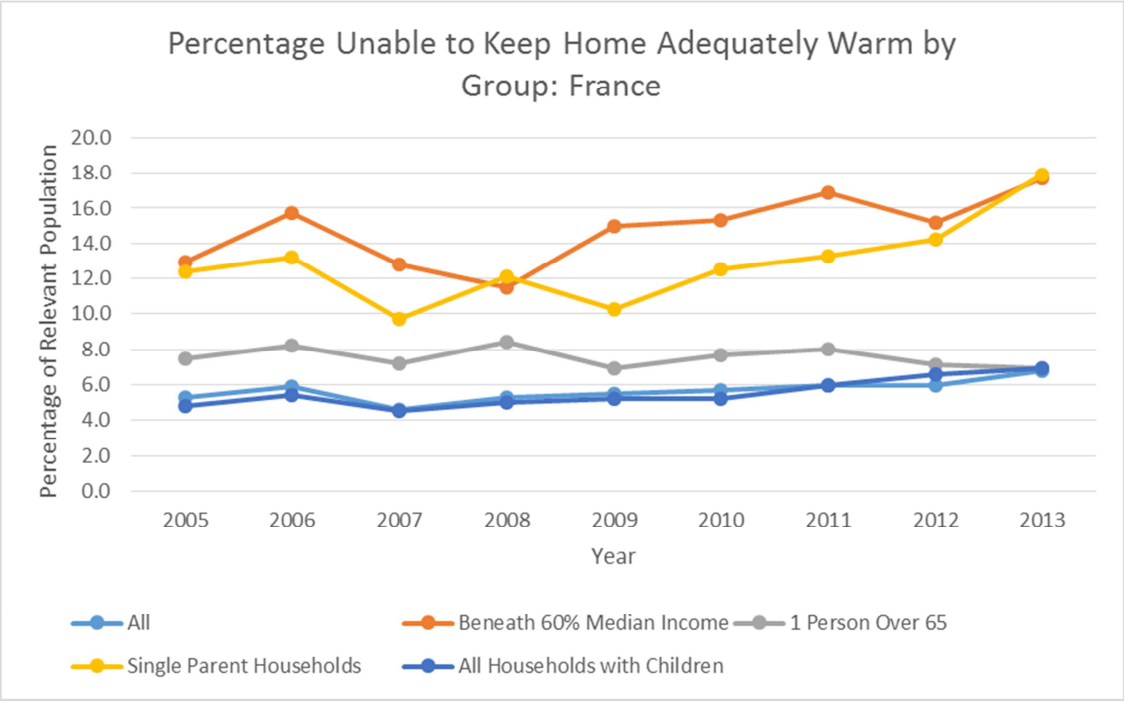
Source: Eurostat collated national household budget survey data

Chart 38: Percentage with Arrears on Utility Bills by Group: France



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

Chart 39: Percentage Unable to Keep Home Adequately Warm by Group: France

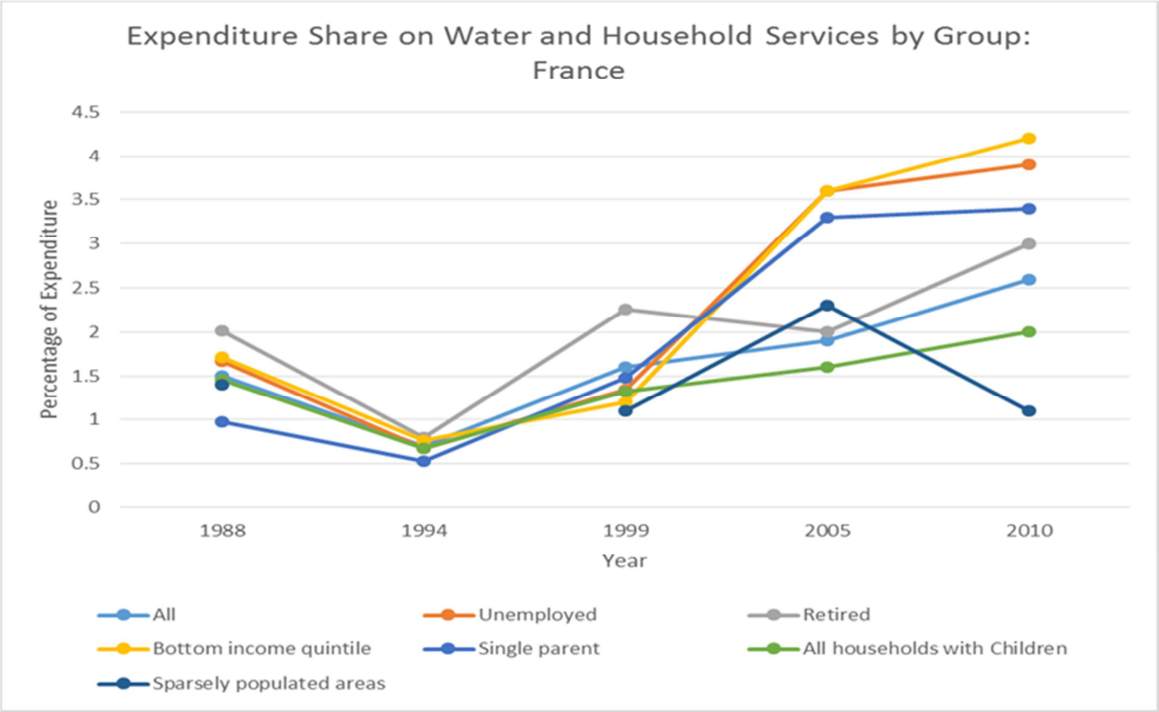


Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

The proportion of single parent households reporting an inability to keep warm (Chart 39) has risen by almost 80% in France since 2009. The proportion of households containing an individual over 65 reporting this form of deprivation has remained constant.

The most striking feature about the expenditure shares devoted to water across household groups in France is the dramatic increase in dispersion between 1994 and 2010. The other clear trend is the upward trajectory of expenditure shares, with the water expenditure share for the population as a whole approximately trebling between 1994 and 2010.

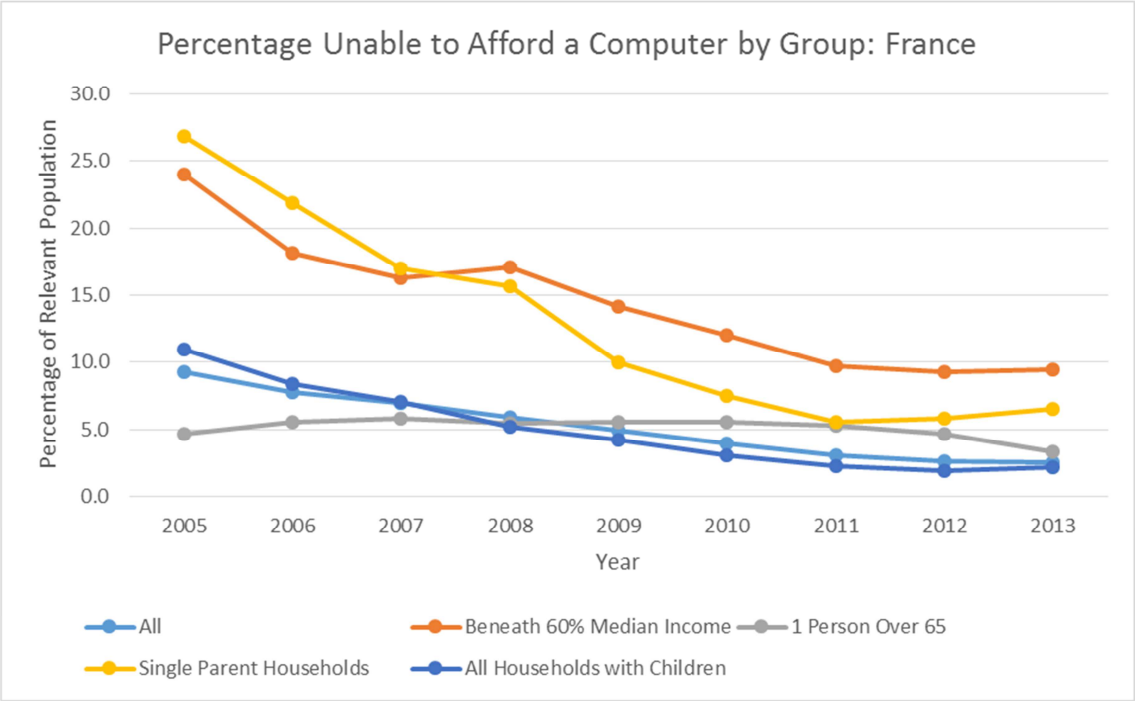
Chart 40: Expenditure Share on Water and Household Services by Group: France



Source: Eurostat collated national household budget survey data

There was also an increase in the dispersion of expenditure shares devoted to telecoms services across groups between 1988 and 2010. However, Chart 41 shows a clear convergence (to a lower level) in the percentage reporting an inability to afford a computer across household types. Between 2005 and 2013, the difference in the proportion reporting an inability to afford a computer between the highest and lowest household groups fell from over 20 percentage points to around 7 percentage points.

Chart 41: Percentage Unable to Afford a Computer by Group: France



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

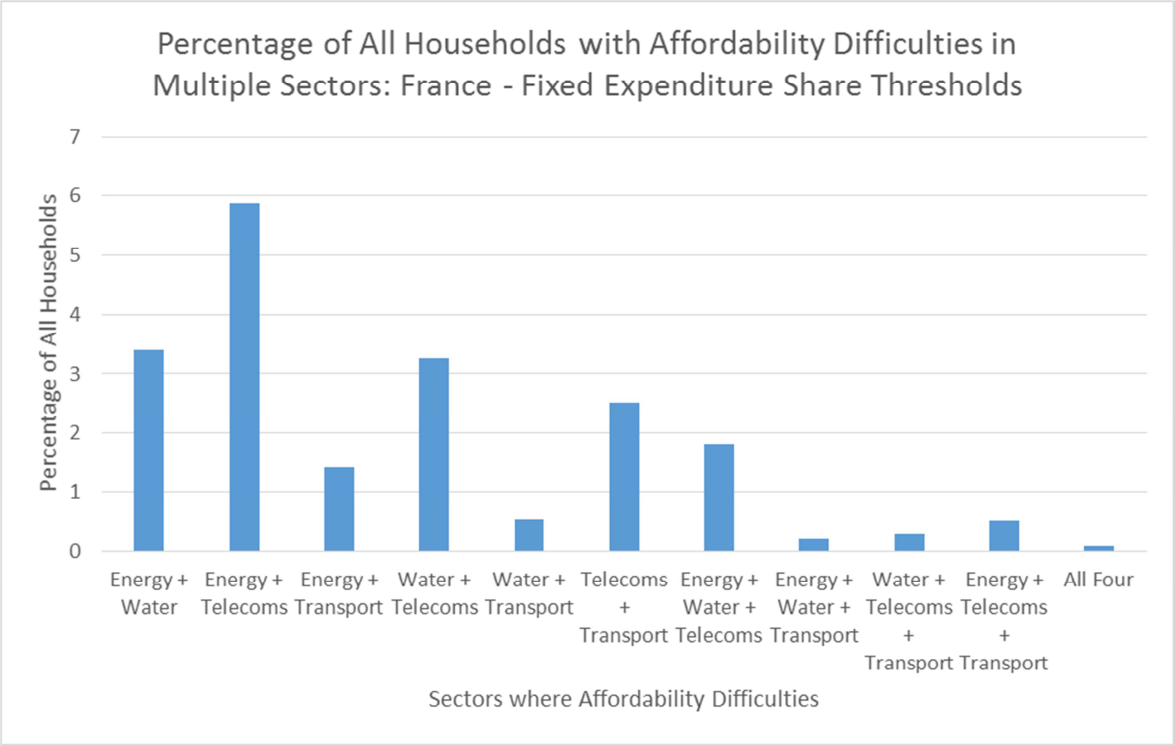
The simulations and analysis reported here are based on data from the French household expenditure survey, 'Budget de Famille', conducted during 2010 and 2011. Given the current policy discussions in France regarding measures to alleviate fuel poverty, we want to emphasise that the figures reported here result from our methodology of comparing actual energy expenditure recorded by households with total household expenditure. Further detail on the results and the methodology used can be found in Research Paper 8.

Looking at all households together, median total expenditure in the Republic of Ireland is approximately 50% higher than it is in France. However, the magnitude of the difference between the two countries is smaller for single parent households and households with an older household member. For these two groups the total expenditure figures for the Republic of Ireland are only around 25% higher than in France. This may indicate relatively more generous financial support mechanisms for these two groups in France than in the Republic of Ireland.

A major difference between France and the UK is the percentage of the population receiving 'housing benefit'. In the UK the figure is no more than 4%, while in France it is over 18%. This suggests that the policies referred to as 'housing benefit' in each of these countries are significantly different. However, the largest difference between all three countries relates to the energy market. In France, the proportion of households reporting using fuels other than electricity and mains gas is just over three times the percentage in the UK, but less than half the percentage of households in

the Republic of Ireland. However, the rates of affordability difficulties for households using 'alternative fuels', according to the 10% threshold, is 15 percentage points higher in France than in the Republic of Ireland, and closer to the UK figure.

Chart 42: Percentage of All Households with Affordability Difficulties in Multiple Sectors: France- Fixed Expenditure Share Thresholds



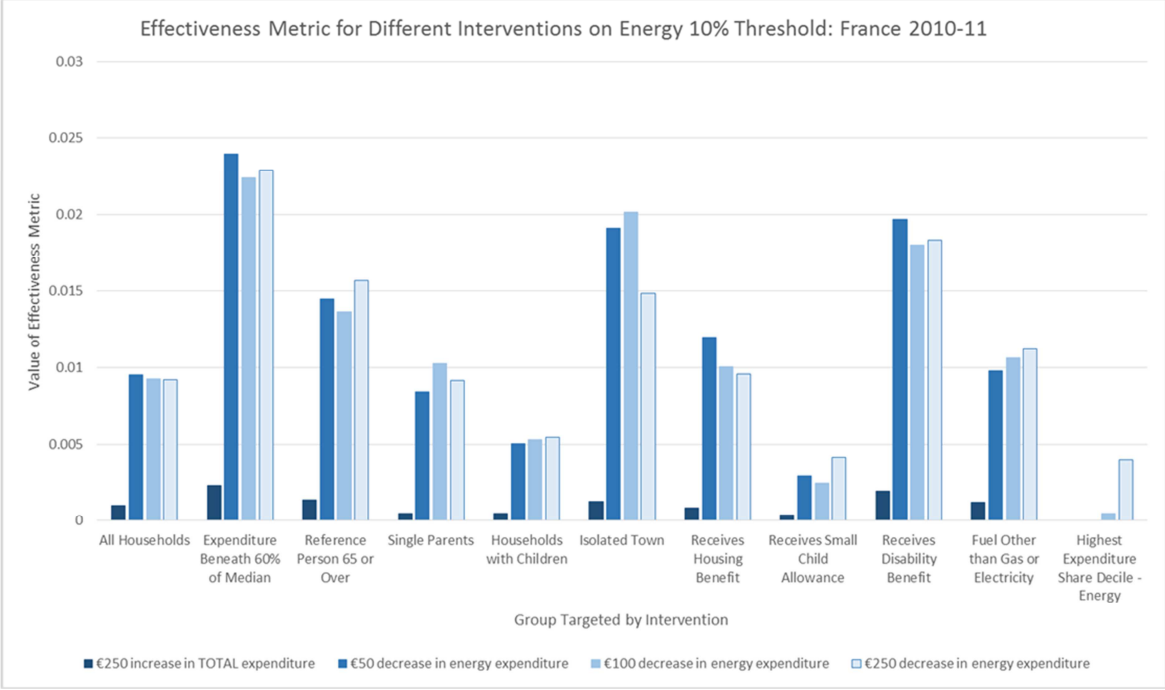
Source: French household expenditure survey 'Budget de Famille', 2010-11

Certain households devote a greater proportion of their expenditure to water in the UK than in France. In France, just over 3% of households are recorded as spending over 3% of their expenditure on water and 10% of their expenditure on energy, whereas in the UK the equivalent figure is around 9% of households (Chart 42). In understanding the results from the French data relating to water, it is important to note that around 30% of respondents provided no information and were recorded as having zero expenditure as their water expenditure is included in 'general' charges paid in relation to the household's dwelling.

The rates of multiple affordability difficulties across the whole population in France are generally low or very low. However, among those households with total expenditure beneath 60% of the median, the rates are much higher. Using the fixed threshold metrics, there are three combinations of affordability difficulties which are experienced by more than 10% of low expenditure (income) households: (i) energy and water, (ii) energy and telecoms, and (iii) water and telecoms.

Turning to the simulations for energy in Chart 43, targeting interventions at households receiving a small child allowance or the 10% of households with the highest energy expenditure shares has virtually no impact on the percentage of the population devoting more than 10% of their expenditure to energy. The most effective groups to target are households with low total expenditure, those containing a person receiving disability benefit and those located in an isolated area. Chart 43 shows that when targeting households in the first two of these groups, the size of the expenditure reduction does not have much impact on the 'effectiveness' of the intervention.

Chart 43: Effectiveness Metric for Different Interventions on Energy 10% Threshold: France 2010-11



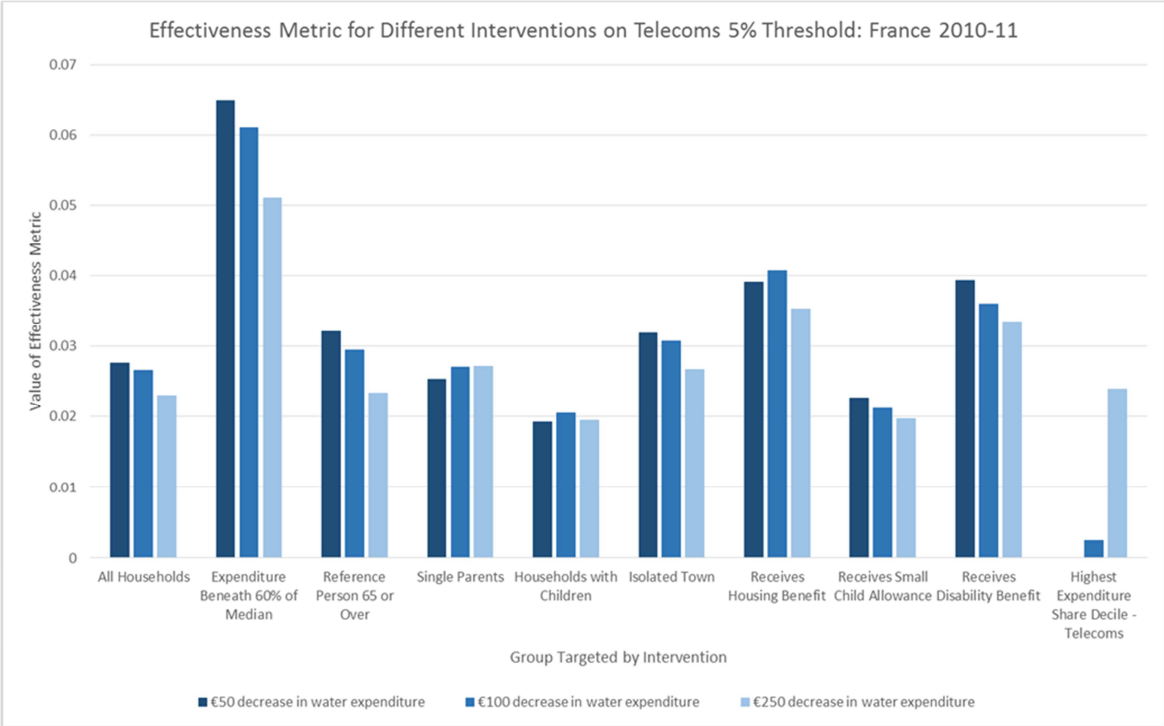
Source: French household expenditure survey 'Budget de Famille', 2010-11

Across all the affordability metrics, French households devote a greater proportion of expenditure to telecoms services than households in the UK or the Republic of Ireland. In particular, almost 24% of French households devote more than 5% of their expenditure to telecoms compared to only 16% of households in the UK. Also, a noticeably greater proportion of single parents in France devote a high expenditure share to telecoms. In France, over 35% of single parent households devote more than 5% of their expenditure to telecoms compared to less than 20% in the Republic Ireland.

Just as in the energy sector, the telecoms simulations in Chart 44 show that targeting expenditure reductions at the 10% of households with the highest expenditure shares has virtually no impact on the rate of affordability difficulties. This indicates that French households with a high telecoms expenditure share have telecoms expenditure which places them considerably above the 5% threshold. Reducing the expenditure of households with low total expenditure (income) is the most

effective intervention, mirroring the results in the UK and Republic of Ireland. Targeting a €250 expenditure reduction at households with total expenditure beneath 60% of the median, reduces the proportion of households spending more than 5% of their expenditure on telecoms by over five percentage points.

Chart 44: Effectiveness Metric for Different Interventions on Telecoms 5% Threshold: France 2010-11



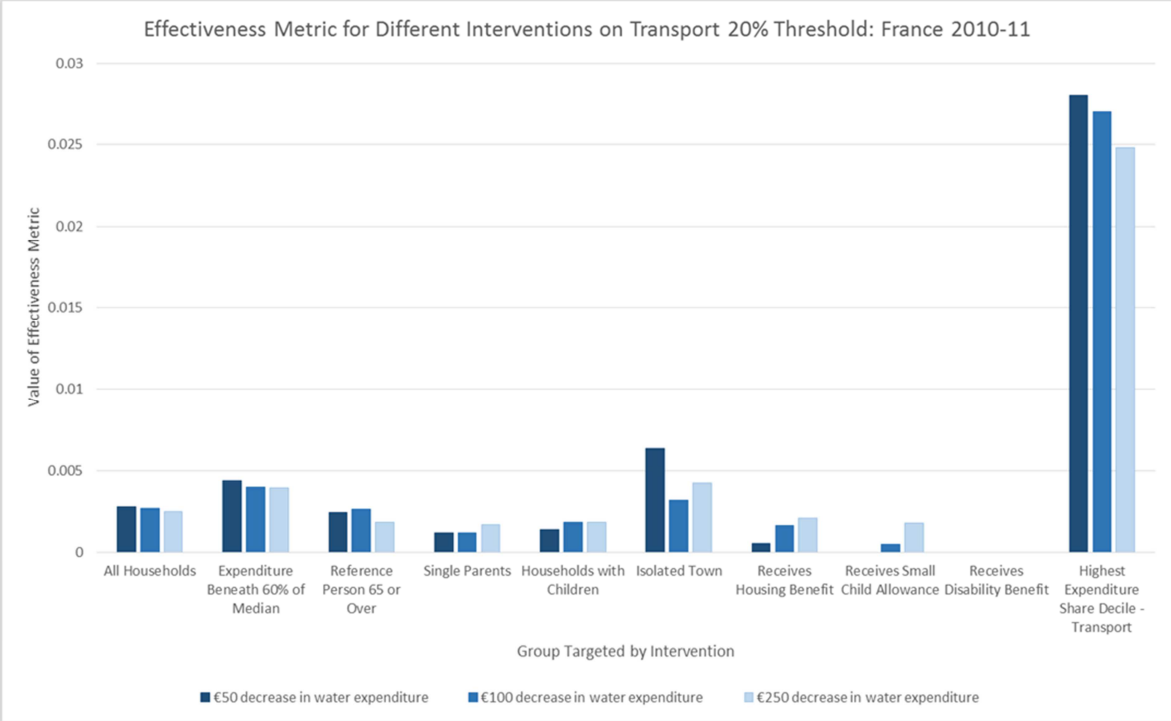
Source: French household expenditure survey 'Budget de Famille', 2010-11

Unsurprisingly, households in 'isolated towns' record the highest rates of transport affordability difficulties according to the 20% expenditure share threshold in the French data. Also, the mean and median LIHC gaps in the transport sector, for households receiving disability benefit, are over €1,000 higher than the household group (households with children) with the next highest gaps. The interesting question is whether disabled individuals face very high transport costs because they require specialist transport services, or whether relatively minor special requirements severely restricts their choice of transport services so that they are forced to use high cost transport services.

The median expenditure shares devoted to transport across household groups in France are generally lower relative to the expenditure shares devoted to the other utilities, than in both the UK and the Republic of Ireland. Also, the median expenditure share devoted to transport by those on low incomes is estimated to be less than a tenth of the median expenditure share devoted to transport for the population of all households.

Chart 45 shows that targeting expenditure reductions at the 10% of households with the highest transport expenditure shares has the greatest impact on the percentage of households reporting a transport expenditure share of over 20%. This is due to the relatively small proportion of households in France with such a high share of expenditure devoted to transport. In this respect France is similar to the Republic of Ireland and very different to the UK.

Chart 45: Effectiveness Metric for Different Interventions on Transport 20% Threshold: France 2010-11



Source: French household expenditure survey 'Budget de Famille', 2010-11

Case Study: Energy Cheques in France

The French government's law on energy transition, agreed in July 2015, included a clause which introduces energy cheques for low income households to replace the social tariffs previously in place. The social tariff had provided a lump sum deducted from electricity and gas bills, while the new energy cheques can be used against oil and other forms of energy, as well as gas and electricity bills, or to provide energy efficiency measures. The energy cheques cover a wider range of energy related expenditure and are in line with the focus of the law on very ambitious targets for reductions in energy use and greenhouse gas emissions. The continuing earmarked nature of the benefit means that it is more similar to a reduction in the bill than an addition to income, which is relevant in interpreting the distributional implications of the policy. This initiative is undertaken in the context of continuing tariff caps in the residential market as a whole (constraints are to be

gradually removed in the non-residential sector) and the French energy regulator's call to raise the level of the tariff cap to allow for full recovery of costs and some headroom for more effective entry into the market.

France is able to closely monitor the level of fuel poverty (defined according to expenditure of 10% or more of income on energy) at a general level. However, data protection rules make it very difficult to do so on a large scale at household level, or to identify the households to whom benefits should be delivered. As a result, eligibility for social tariffs has been based on individual income and tax information, which clearly poses some challenges for identifying households in need. The details of how the energy cheques will be delivered are yet to be determined, and we have focussed our attention on low income and potentially 'disadvantaged' households for simulating the effects of different policies in Research Paper 8. We are not, however, able to determine how many of the results we report relate to households in receipt of the social tariff which, like the energy cheques, involves a lump sum discount from the energy bill.

Despite the social tariff, our analysis of household expenditure shares in Research Paper 2 shows that the lowest income quintile spent a higher proportion of their total expenditure on energy than the average, but slightly less than retired households during the period 1994-2010. Separate analysis in Research Paper 8 shows the proportion of expenditure devoted to energy by the lowest income group was around 16%, falling to 2% for the highest income group in 2010-11. Similarly, Research Paper 2 shows there is a marked difference between the proportion of those in low income (and single parent) households who felt unable to afford adequate heating (18%) and the average across individuals in all households (7%) in 2013. Notably also, only 7% of individuals in retired households felt that they could not afford to heat their homes. The contrast in the rates of reported arrears with utility bills between different household groups is even more striking – 20% of those in low income households reported arrears compared with an overall rate of 6% and only 2% of individuals in retired households. Research Paper 8 shows that rates of fuel poverty amongst households using fuels other than gas and electricity are almost as high as among low income households, emphasising the importance of the wider eligibility criteria which are offered by the energy cheques. The fuel poverty (LIHC) 'gaps' for households with total expenditure below 60% of the median are lower than for many groups, including the population as a whole. This suggests that while many households with low expenditure (income) face energy affordability difficulties, for a lot of households in this group the affordability difficulties are relatively mild, perhaps reflecting the social tariffs.

Given the low level of tariffs overall (relative to costs, from the regulator's evidence) and the existing social tariffs, it is interesting that Research Papers 2, 4, 5 and 8 show that affordability difficulties in France are comparable to those in the UK and higher than those in Ireland (at the time of the surveys). However, Research Paper 8 again shows that fuel poverty is relatively 'shallow' amongst low income households. Reducing expenditure for these households has a high 'effectiveness', since the households are sufficiently close to the 10% expenditure threshold for the

simulated initiatives to move them over the threshold and so no longer be included in the measure. The recorded shallowness of fuel poverty may in part reflect help that is already delivered through existing social tariffs. Therefore, it is difficult to know whether the new energy cheques will deliver additional help as simulated by our calculations. Nevertheless, the simulations give an idea of how help delivered to low income and 'disadvantaged' households might improve the picture given by metrics of fuel poverty.

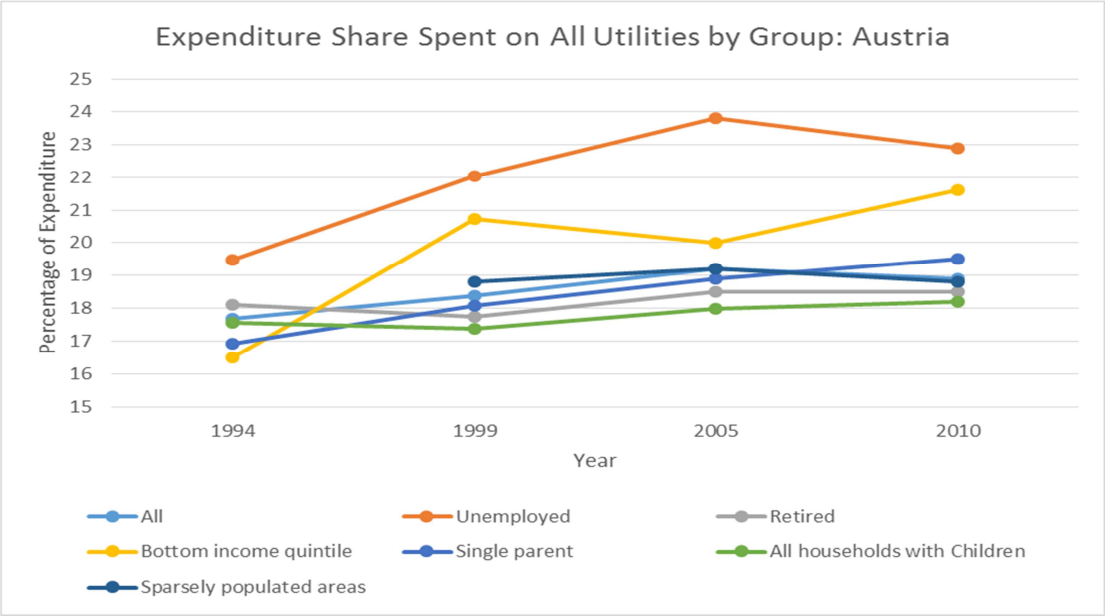
The new system of energy cheques will be introduced against a background of rising general energy tariffs, if the energy regulator's recommendation, to allow tariffs to rise to reflect costs fully, is implemented (Commission de Régulation de l'Énergie, 2014)[26]. One interesting feature will be the development of the competitive market, where France retains regulated tariffs and operates a publicly provided price comparison site to assist those wishing to change suppliers. As we see from other countries with higher residential switching rates, increased consumer activity can introduce a new dynamic in terms of the level and structure of prices. Assistance with affordability issues may become even more salient for households with payment difficulties.

4.6 Austria

From Chart 46 it is clear that the unemployed in Austria devote the largest share of expenditure to utility services and that the gap between this group and the average of all households has increased through time. This is also reflected in the increasing proportion of low income and single parent households who reported arrears on utility bills (Chart 47). However, these levels are lower than corresponding figures for the UK and the Republic of Ireland.

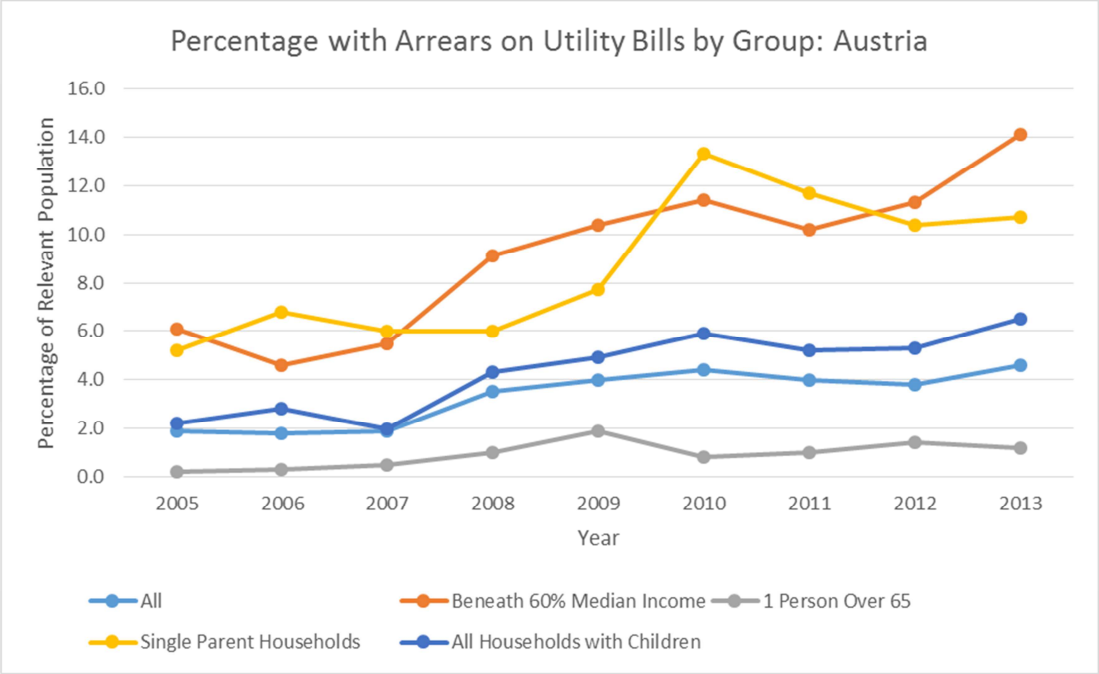
[26] Commission de Régulation de l'Énergie, 2014, Activity report 2013, http://www.cre.fr/en/documents/publications/annual-reports/(annee)/2014 (accessed 4th September 2015)

Chart 46: Expenditure Share Spent on All Utilities by Group: Austria



Source: Eurostat collated national household budget survey data

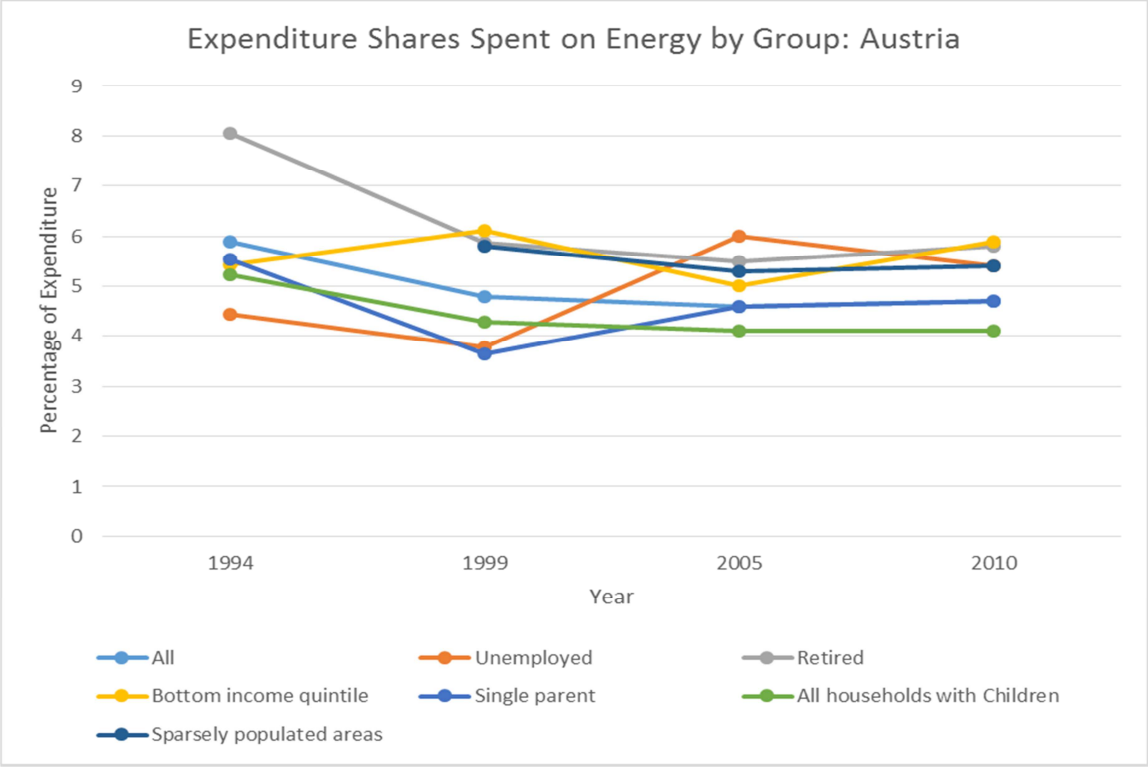
Chart 47: Percentage with Arrears on Utility Bills by Group: Austria



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

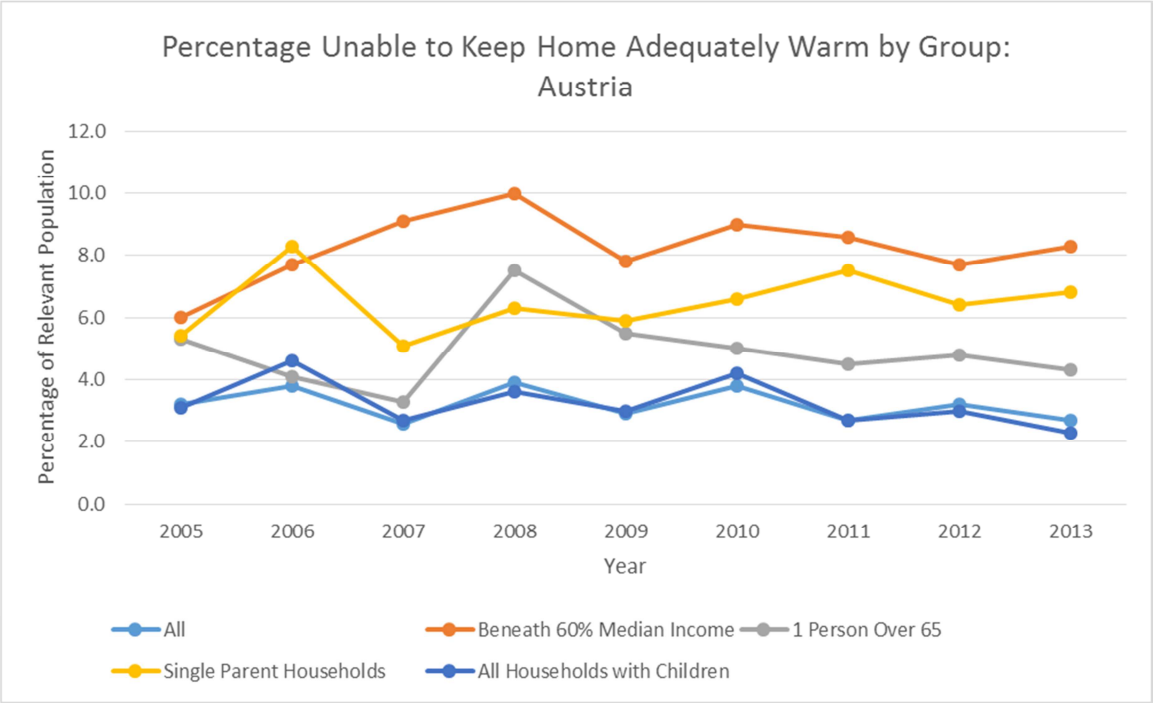
Expenditure shares devoted to energy for retired households in Austria fell between 1994 and 2010. The expenditure share remained broadly constant for other household types (Chart 48), except for the unemployed, where the expenditure share devoted to energy rose by more than 2 percentage points between 1999 and 2005.

Chart 48: Expenditure Shares Spent on Energy by Group: Austria



Source: Eurostat collated national household budget survey data

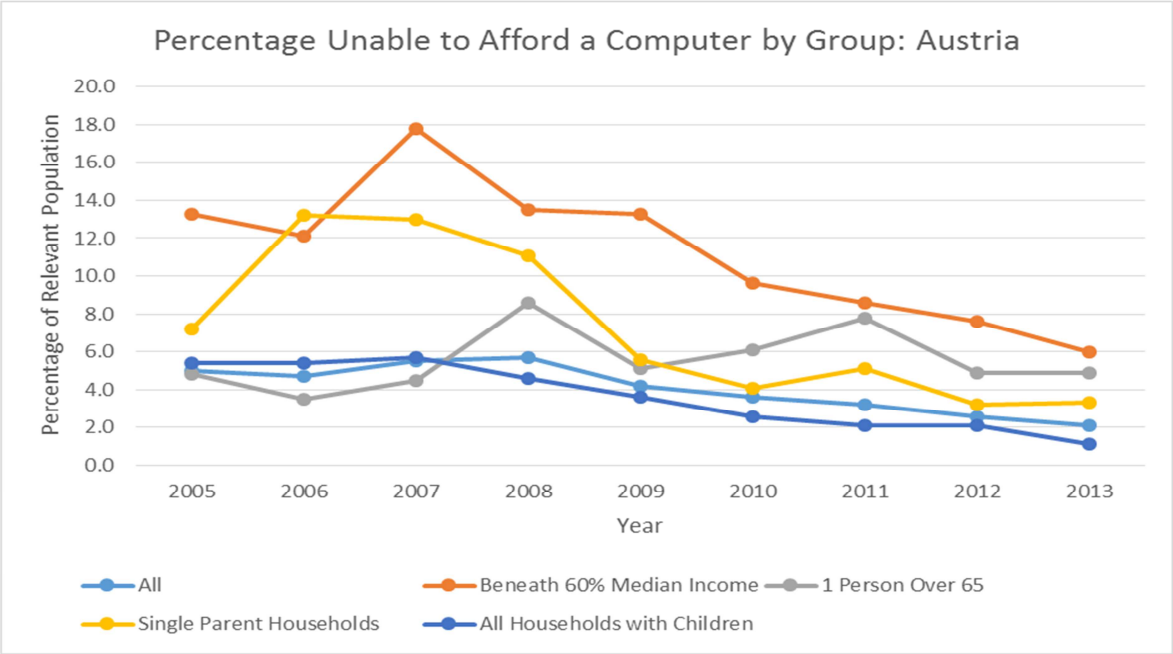
Chart 49: Percentage Unable to Keep Home Adequately Warm by Group: Austria



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

Compared with France, a lower proportion of single parents and those on low incomes report an inability to keep their home adequately warm in Austria (Chart 49). Nevertheless, the gap between the different household types in Austria increased between 2005 and 2013. The expenditure shares spent on telecoms services by different groups in Austria all display an intriguing 'hump' shape, increasing by around 2-2.5 percentage points between 1994 and 1999, before falling by at least 1 percentage point after 2005.

Chart 50: Percentage Unable to Afford a Computer by Group: Austria



Source: Eurostat, EU Statistics on Income and Living Conditions (EU-SILC)

The proportion of households unable to afford a computer has fallen for all groups, apart from households containing at least one person over 65, where the proportion has remained roughly constant (Chart 50).

Unsurprisingly, transport expenditure for those in sparsely populated areas is biased towards operating personal transport equipment (almost certainly cars) rather than transport services, presumably reflecting limits to public transport services. The other interesting feature of the transport expenditure data is that between 2005 and 2010 those in the bottom income quintile show a shift in expenditure away from operating personal transport equipment towards transport services.

Case study: Energy poverty policy in Austria

Austria combines a regulator responsible for defining and identifying fuel poverty, with a clear regulatory view that while energy poverty should be defined as distinct from general poverty, appropriate policies should be part of overall welfare strategies. This approach is reflected in the regulator's definition of energy poverty, which is based on a Low Income High Cost (LIHC) concept: "a household is energy poor if its disposable income is below the at-risk-of-poverty threshold and,

at the same time, it has to cover above-average energy costs"[27]. Disposable income is defined as net of housing costs, and is adjusted for household size. Above-average energy costs are set at 140% or more of median energy costs.

The regulator, E-control, has a legal mandate that includes co-operation with Austrian social partners. It takes an active role in providing both data about the energy market to inform policy, and in providing a single direct contact point for consumers. For example, E-control maintains a well-used price comparison tool (800,000 users from a total of around 6 million gas and electricity accounts). It also operates the Alternative Dispute Resolution mechanism, which is sometimes delegated to suppliers. The regulator has a legal obligation to monitor the gas retail market, though this duty lies with the regional governments for electricity.

Research Paper 2 shows that, amongst the EU15 Member States, Austria's proportion of total expenditure devoted to energy was about average, at just below 5% in 2010, having fallen from 6% in 1994. The expenditure share spent by the retired on energy fell by over 2 percentage points between 1994 and 1999, while that of the unemployed rose by more than 2 percentage points between 1999 and 2005. Research Paper 2 also shows an increasing gap between household groups in their perception of being unable to keep their homes warm. This ranges from 2% of individuals perceiving difficulties in households with children, to 8% of those whose incomes were below 60% of Austria's median income in 2013. This low income group also reported the highest rate of arrears on their utility bills in 2013 (14%), compared with just over 1% of individuals in households which contained a person over 65 (and just over 4% across all consumers). About 4% of households containing a person over 65 reported difficulty in affording to keep their house warm, about double the average across all consumers.

The gap between the expenditure shares spent on energy, perceptions of affordability difficulties in heating homes, and arrears is confirmed in E-Control's own in-depth study of 931 households from the lowest third of the income distribution in 2013. Few of those who carried the financial burden of being in energy poverty were in arrears with their payments. Those in energy poverty were typically female, retired and living in relatively spacious homes, either in rural areas or in social housing. E-Control estimated that households in energy poverty according to the definition above accounted for a relatively small proportion of the Austrian population, around 2.5%. Amongst the households, a fifth kept their homes above the recommended World Health Organisation (WHO) temperatures ("warm enough in winter to wear a T-shirt only"); and there was surprisingly little awareness of energy efficiency possibilities, with only a tenth taking active steps to save energy.

These findings support the general EU policy to approach energy poverty through energy efficiency measures, but also emphasise the behavioural challenges in delivering such a programme. E-

[27] Annex to 'Energy Connections: Engaging the consumer in building stronger systems' (ICER, 2015) http://www.icer-regulators.net/portal/page/portal/ICER_HOME/publications_press/ICER_Reports

Control report that lower levels of education, advanced age and well established habits may all contribute to the current issues. E-control suggests the use of professional energy counselling as one measure to assist energy poor households without reducing their standard of living. Where these households inhabit social housing there is an obvious role for social landlords, if funding permits.

E-Control perceives its own role as co-ordinating and informing others in the area of energy poverty. It conducts an annual expert conference on the subject to stimulate interest amongst other market players "including suppliers, Distribution System Operators (DSOs), NGOs, public administration bodies and academia". Since January 2015, suppliers have been obliged to provide counselling officers to offer advice on energy efficiency, energy prices and related topics. Co-ordination between market participants is a useful step to tackle the relatively low level of energy poverty in Austria. However, an effective programme to combat some of the behavioural issues around householders' reluctance to take energy efficiency measures may require more strongly targeted programmes, along the lines of the Affordable Warmth programme in Northern Ireland.

Case study: Can we reap the benefits of the internet, and ensure they are equitably distributed?

Affordability interacts with access to the Internet in two main ways. The first is in the effect of access on the affordability of other products, including utilities, i.e. the value which Internet access delivers in other markets. The second is in the cost of access, in terms of both money (i.e. expenditure on appropriate equipment and an ongoing connection) and any cognitive or behavioural constraints.

The value of the Internet is generally thought to be increased provision of information at a lower cost, i.e. the reduction of 'search' costs. Robust econometric studies have shown the benefits of Internet access in three key areas, namely political engagement, retail markets, and the labour market[28]. The availability of user reviews on the web provides new channels for understanding the value of products, as well as potential opportunities for providers to manipulate consumers' decisions[29]. The global reach of the Internet also enables the provision of services to niche markets that were previously too small to serve in individual locations[30]. Price comparison websites have provided additional information, but competition between them (or between them and suppliers) may lead to 'too much' investment and higher prices[31]. Moreover, as ever greater quantities of data about purchasing habits are collected, additional opportunities for price discrimination through the Internet grow, which create clear distributional issues between different groups. Since the Internet

[28] For example, see Falck et al (2014), Sengupta and Wiggins (2014) and Kroft and Pope (2014).
[29] Mazylin et al (2014)
[30] Choi and Bell (2011)
[31] Edelman and Wright (2014)

changes (and will change in unpredictable ways) the opportunities and behaviour of both consumers and providers, analysis of its benefits and potential disadvantages needs to be identified at the level of individual markets and transactions. If broadband is to be analysed as a 'quasi utility', like other utilities, its value depends on the use made of it, the services which it enables and the response of providers in the market.

Like any utility, to enjoy the benefits of the Internet requires connection to a network, the appropriate equipment to access the network, and consumer knowledge and inclination to use the services available. Research Paper 2 shows a decrease over time in both the cost of a basic fixed broadband service, expressed as a proportion of national income per capita. It also shows a decrease in the proportion of households reporting an inability to afford a computer in the home. In interpreting these results it is important to note the difficulty in obtaining consistent and relevant measures of affordability through time, precisely because of the rapid advances in technology. The speed of a broadband connection for a heavy user five years ago may be the bare minimum required today, and home PCs may now be less important than access to the Internet via smartphones.

Nevertheless, historical data provide a useful background. Research Paper 2 shows the cost of a specified broadband service as a proportion of national income per capita fell from about 1.5% to 1% between 2008 and 2013 when averaged across the EU28, but remains slightly higher than for comparator countries[32]. The increase in broadband affordability among the new Member States is far greater over the same time period. The percentage of the population unable to afford a computer has fallen among virtually all Member States and within all groups, with the highest rates (unsurprisingly) remaining amongst low income households. By 2013 fewer than 5% of households in the EU15 felt they could not afford a home computer, while the comparable figure for new Member States was about 11%.

As the Internet becomes ever more integral to households and their interaction with markets, concern about the distribution of the benefits which the Internet offers inevitably increases. The benefits which the Internet can deliver to individual households may not be equally available to all, leading to a 'digital divide'. Since restricted access and use of the Internet may be associated with detriment in other areas, such as low income, the question is whether new technology eases or worsens economic and social inequalities?

Moves to e-government raise particular issues, as those who depend most on government support are disproportionately disadvantaged households who are, in turn, more likely to face challenges regarding Internet use. Necessary conditions for participation are the physical availability of adequate broadband, the affordability of ongoing use, the possession of relevant skills and the inclination to utilise a connection. Poor connectivity or equipment can adversely affect the user

[32] The choice of countries to include as 'comparators' inevitably has a significant impact on this conclusion.

experience and reduce the uptake of new opportunities. As the availability of broadband expands, differential usage across groups, and usage for different purposes, comes into focus. Nevertheless those who are not Internet users themselves may have access via friends and family. The provision of the services using representatives for those unable, or unwilling, to use the Internet themselves may become an important aspect of digital policy.

Integrating the use of the Internet into schools' curriculum is one vehicle to motivate use by students[33] in a constructive and safe environment. Evidence from a variety of initiatives providing Internet access in the homes of low income families highlights perceived benefits for children's education, as well as increased engagement by older household members[34]. Assessments of schemes emphasise the importance of understanding the social and cultural background of intended recipients to enable the construction of mechanisms that support ICT usage over the long-term[35]. Highlighting the entertainment value of the Internet can be an effective method to encourage initial use[36].

Can digital technologies help to overcome the general social exclusion of vulnerable groups or is the digital world simply a new domain where people can suffer exclusion? While one initiative found that disabled people felt they were excluded from the Internet's opportunities[37], in other spheres, the anonymity of the Internet has been shown to overcome subtle social disadvantages. For example, one study found the Internet reduced price discrimination against women and non-white car buyers by overcoming disadvantages these groups previously suffered in face-to-face negotiations[38]. However, unless government policies are reviewed before e-government schemes are initiated, the Internet can just as easily perpetuate discrimination. For example, this can be through the use of language which some minorities do not speak[39], or restricting editing rights over official records to the husband of a married couple[40].

Access to the Internet, like other goods and services, is likely to be unequally distributed, along similar lines to the distribution of other resources in a society, unless specific policies help to provide physical access and support social engagement by disadvantaged groups. Well targeted policies can utilise technology to overcome some of these barriers and, in turn, increase the affordability of other utilities, for example by providing better information on prices.

[33] See Ferro et al (2011)
[34] See Jewitt and Parashar (2011) and Yelland and Neal (2013)
[35] See Sinclair and Bramley (2011)
[36] Hseih et al (2008)
[37] Macdonald and Clayton (2013)
[38] Scott Morton et al (2003)
[39] See Polat (2012)
[40] See Foteinou (2010)

5. Review and assessment of policies

5.1 Typology of policies

This section focuses on policies to address affordability difficulties rather than on how such difficulties are measured. Any affordability policies need to be understood in the context of general welfare policies and social support, which may be provided within a Member State to low income households or those deemed to be vulnerable, even though these welfare policies are beyond the scope of this study. The interaction between general and sector specific policies is illustrated in the table below, which summarises the broad policy categories which have been reviewed in the literature.

Table 1: Policy Interventions to Tackle Affordability Issues

Policy Intervention	Sectors	Comments
Efficiency Measures	Energy, Water	Requires upfront investment and may depend on behavioural change; often includes environmental benefits
Social Tariffs	All	Lower prices or flat rate reduction to specified groups
Pre-Payment Meters/ 'Pay-as-you-Go'	Energy, Water, Telecoms	Budgeting and rationing mechanism
Increasing Block Tariffs (IBTs)	Energy, Water (but All in theory)	Lowest price charged for first units of consumption
Low Usage Tariffs	Energy, Water and Telecoms	
Uniform Pricing	All	Across geographic areas or time periods
General Subsidies	All (particularly Transport)	Untargeted
Universal Service Obligations (USOs)	All	Specify minimum standard of service rather than direct subsidy
Lower taxes/tax deductions	All	Lower VAT on service, tax deductions on investments in efficiency; may have regressive distributional effects
Training, Advice and Information Schemes	Energy, Water, ICT/Internet	Impact often unclear
Income Support Measures	All	Non-earmarked income transfers linked to utilities
Utility vouchers	All	Credits for expenditure on specific utility
Benefit deductions	All	Planned and limited deductions to help benefit recipients to manage debt and payments

Source: Author's own work

As with measurement, policies used to address affordability in the energy sector are the most developed, with significant guidelines at both the EU and national levels. As in other areas, EU policies/requirements mainly guide the delivery of policies which are designed and delivered at the

level of individual Member States. For example, European initiatives such as the Vulnerable Consumers Working Group (focused on energy) provide guidance and co-ordination.

The three Member States reporting the broadest range of policies/activities to support vulnerable consumers and the energy poor are Belgium, France and the UK[41]. The three most common types of policies used to tackle vulnerability/affordability are: social tariffs, incentives for energy efficiency improvements and information/educational tools to support engagement with the energy market by vulnerable consumers. However, the Council for Energy Regulator's (CEER) 2014 report shows considerable variation in policies used to address energy affordability. This lack of consensus may reflect differing local conditions, including the general poverty policies which may be in force in different Member States. The use of energy efficiency programmes targeted at particular households or types of buildings plays a major role in several Member States. However, this raises issues of how to fund up-front investment cost, and potential failures in other markets, in particular the market for private[42] rented accommodation and that for loans.

Consumer behaviour plays a crucial part in delivering any policy, and is increasingly recognised as an important element of market behaviour. In terms of affordability programmes, particularly those which are not universal, the uptake of any programme is a key behavioural issue. More specifically in energy affordability programmes, recipients' behaviour may affect the approach to measuring policy effectiveness, if consumers react to improved affordability (however delivered) by increased consumption, effectively taking the benefit from a policy as increased comfort rather than increased disposable income (equivalent to the rebound effect in conservation programmes). The usefulness of new technologies such as smart meters to improve affordability also depends on consumers' responsiveness to the additional information being provided.

In the water sector, the requirement that prices reflect the true economic costs of abstraction, distribution and treatment was a key element of the EU's Water Framework Directive, though derogations were available to ensure basic services could be provided at an affordable price.[43] Since moves to full cost pricing generally led to price increases, it is unsurprising that water metering and tariff rebalancing have frequently met considerable resistance from users, as is being observed with the introduction of water charges in the Republic of Ireland. The framing of water affordability issues is often closely related to the concept of access to water as a right, however difficult this is to define. Increasing block tariffs and prohibitions on disconnection are the most common policy interventions to improve affordability of water and sewerage services.

[41] Evidence from DGEner's Vulnerable Consumer Working Group
[42] Unlike accommodation provided by private landlords, delivering affordability policies may actually be enabled by social housing schemes.
[43] See paragraphs under 'Getting the prices right' at: http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

In telecoms, much of the affordability debate is concerned with Universal Service Obligations, and how a basic but satisfactory service should be defined as technology evolves[44]. An earlier CERRE study[45] provides information on some USO provisions.

5.2 Effectiveness of policies tackling fuel poverty and digital exclusion

This section reviews evidence on the effectiveness of policies tackling fuel poverty and digital exclusion. A major finding from both is that household and individual response is critical in determining the effectiveness of these programmes. One challenge in assessing the effectiveness of energy affordability policies is that energy programmes often involve multiple objectives, including the reduction of carbon emissions, so that the monetary benefits obtained by individual households are not always identified. Policies to increase digital inclusion generally emphasise social outcomes more than economic consequences, and many assessments rely on small scale and qualitative studies. We exclude water and transport policies because the papers identified which study water focus narrowly on increasing block tariffs, while the transport papers often focus on policies beyond CERRE's remit, such as urban planning.

5.2.1 Tackling fuel poverty

Energy efficiency investments

Most papers which explicitly evaluate policies to tackle energy affordability are based on improvements to the energy efficiency of the housing stock. This is the favoured policy both of the EC and the CEER. Investments that appear beneficial for society nevertheless often have a low take up by individual households for a variety of reasons. Some benefits are social rather than realised by an individual householder, and householders may not adequately consider health benefits; rates of interest paid for loans by householders are often higher than those assumed for government assessments; for those in rented accommodation, the investor (landlord) does not realise the benefits, which accrue to the tenant if energy efficiency improvements are not reflected in higher rents, so incentives are misaligned; householders may not stay in a home sufficiently long to want to invest; and, lastly, future energy prices, and therefore the gains from investing, are uncertain (Clinch and Healy, 2000).

Policies to encourage energy efficiency have often been designed explicitly to tackle some of the obstacles identified above. For example, the British government introduced the Green Deal Finance

[44] Accessibility of telecoms services by individuals with certain disabilities is not considered here since this is not primarily an issue of affordability.
[45] Public Service Obligations and Competition Final Report Michael Harker, Antje Kreutzmann and Catherine Waddams, CERRE report http://www.cerre.eu/sites/cerre/files/130318_CERRE_PSOCompetition_Final_0.pdf

scheme (Guertler, 2012), although this scheme has recently been cancelled because of low take-up. Due to the variety of issues highlighted by Clinch and Healy (2000), only the cumulative impact of a range of policies may be sufficient to make energy efficiency investments attractive to householders (Amstalden et al., 2007).

Putting aside direct financial incentives, a range of regulatory interventions has attempted to encourage energy efficiency, but with mixed results. Compulsory energy ratings for new build housing in Germany were judged less useful in understanding energy consumption than more direct information such as energy bills (Amecke, 2012). German requirements to incorporate major energy efficiency upgrades when refurbishing properties are criticised, as the high cost may deter renovations altogether. In addition, it rules out more modest energy efficiency improvements that might offer better financial returns (Galvin, 2012). This also shows the potential limit of environmental policies in addressing affordability issues. The importance of context to regulations is illustrated by the relative success in reducing energy consumption of additional building regulations in Denmark because of the absence of individual meters, and so financial incentives, to encourage energy efficiency in individual apartments (Leth-Petersen and Togeby, 2001).

Nevertheless, Howden-Chapman et al (2012) confirm that large falls in energy consumption are possible with the right home improvements, though they do not establish the financial viability of the interventions they consider. The limits of engineering models in estimating financial savings have been shown by Fowlie et al (2015), who compared predicted positive returns on energy efficiency investments by Michigan households against realised returns, which were negative. Hong et al (2009) note that in the UK, temperatures in homes do not match those of engineering models, complicating measurement of the true welfare effects of policy interventions. Critchley et al (2007) found that lower temperatures often reflected the preferences of occupants, calling into question the use of 'optimal' temperatures in definitions of energy poverty. Lloyd et al (2008) find similar results from a small scale study of social housing in New Zealand, where there was considerable 'under heating' of homes, in comparison to WHO recommendations. The limited evidence of reduced expenditure resulting from energy efficiency improvements is also highlighted by Gilbertson et al (2006) in a small scale evaluation of England's 'Warm Front' Scheme.

Furthermore, difficulties exist in attracting participants to take part in schemes, even those with no up-front costs. While Fowlie et al (2015) found aggressive outreach programmes and personal assistance increased participation dramatically, this was only to 6%, and the authors estimate that the cost of obtaining the participation of a single additional household was $1,000. Armstrong et al (2006) explain the low take-up of free central heating for tenants aged 70 or over in social housing in London, by a combination of poor targeting and the attitudes of those being approached. When individuals refuse assistance, policymakers need to distinguish genuine preferences from poor information, and to do so requires local resources capable of engaging effectively with householders.

The need for effective targeting is shown by Guertler and Jansz (2012) who found that only around a third of the funding dedicated to tackle fuel poverty in the UK actually reaches households which are fuel poor. Nearly two thirds of the funds in 2013 were allocated to the Winter Fuel Payments scheme, which is based solely on age. Evaluating the Warm Homes scheme in Northern Ireland, Walker et al (2013) highlight the need for reliable information on the quality of the housing stock in particular areas, as well as on the socio-economic position of householders, to enable effective targeting. In the UK there is a lack of suitable pre-existing data to directly identify households experiencing fuel poverty so statistical models that prioritise specific geographical areas for policy interventions need development (Walker et al, 2014).

Policies beyond energy efficiency investments

Smart meters can potentially improve consumer welfare through real-time (or peak-related) pricing and an improved user interface which could increase awareness of energy consumption. While real-time pricing may be beneficial in theory, evidence both from randomised field experiments in Chicago (Allcott, 2011) and demand modelling in France (Leautier, 2012) suggest small savings, which are insufficient to offset the investment costs of the meters. In terms of increased awareness of consumption, Gans et al (2013) argue that introducing meters allowing real-time tracking of energy usage in Northern Ireland led to a 10-13% reduction in energy usage.

Another tariff variation relates to the allocation of consumer related costs. Considering tariff variations when liberalisation in the UK energy market was still relatively new, Bennett et al (2002) note that removing a fixed charge benefitted low consumption consumers in absolute terms, but that fuel poor households have high consumption relative to their income. This confirms the findings above that fuel poverty is most effectively addressed by specific efforts to directly target fuel poor households, rather than through a surrogate measure.

5.2.2 Digital exclusion policies

To provide citizens with access to IT and the Internet, three types of policy are available: (i) improve telecoms infrastructure; (ii) provide IT equipment through public facilities; and (iii) provide IT equipment for the homes of the disadvantaged. Policies relating to (i) may be a precondition for technologies to be available, but in advanced economies may have a limited role in closing digital divides outside geographically remote regions (Townsend, 2013). Helsper (2011) notes that wider availability of a technology may increase the divisions in connections and usage according to socio-economic characteristics: large expenditure on infrastructure is unlikely to result in a uniform increase in usage by all social groups.

Yates et al (2010) find that increased competition and devoting greater financial resources to ICT increases the penetration of broadband at the national level. However, Gulati and Yates (2012) find that having a national broadband plan is not associated with broadband diffusion. Importantly for

the majority of countries in the EU, Belloc et al (2012) find that beyond a certain stage of development in the broadband market, only policies which increase demand among users affect the number of broadband subscriptions.

Turning to ICT provision in public facilities, Mariscal et al (2011) highlight some concerns with a programme in Mexico that involved 7,200 Digital Community Centres to provide access to computers, software, the Internet and, in theory, training. The distribution of users did not overcome socio-economic divides, with those at the lowest socioeconomic levels reporting low attendance, and a majority of the users already owning a computer in their home. Polat (2012) discusses the Fatih Project in Turkey to provide schools with a comprehensive package of IT equipment and students with tablet computers. While the programme was extensive, Polat questions its value when other basic educational resources are poor and the tablets only enable Internet connections within schools.

A far more costly approach, although one which addresses the full range of digital exclusion issues and engages individuals beyond students, is the provision of computers and internet services to individual disadvantaged households. Jewitt and Parashar (2011) find consistently positive results from a UK government programme providing home computers and the Internet to low income households with children. Recipients report that not only did the children's' education benefit, but that parents became more confident using IT and more inclined to use the Internet. Analogous positive results are recorded for similar schemes run in Australia (Yelland and Neal, 2013; Broadbent and Papadopoulos, 2013).

Sinclair and Bramley (2011) note that increasing the *use* of ICT by those from disadvantaged backgrounds requires not only equipment and skills, but also appropriate wider cultural and social capital in the relevant environments. Individuals need to be motivated to engage with ICT, and Ferro et al (2011) suggest that policymakers can use levers to increase the incentive for individuals to engage with ICT, for example through the structure of school work. In contrast, Hseih et al (2008) note that emphasising the Internet's entertainment potential can be particularly effective in encouraging engagement.

Digital technologies themselves may help to overcome the general social exclusion of vulnerable groups. However Macdonald and Clayton (2013) found that in a UK city the disabled faced particular difficulties, so that ICT presented an additional sphere of society from which they might suffer exclusion. However those who were disabled did not view their disability as the main barrier to the use of IT. Rather, general poverty limited ownership of IT equipment, ICT knowledge was limited and ICT facilities were inaccessible. Indeed, digital technologies may perpetuate existing non-economic forms of social exclusion. For example, Polat (2012) notes that in Turkey government websites are provided solely in Turkish, providing a significant barrier to other ethnic groups obtaining government information from digital sources. Also, Foteinou (2010) considers the gender

divide in Greece, where the official tax website permitted only husbands of married couples to enter information, continuing the gender divide of tax law into the digital domain.

6. Conclusions and recommendations

Our main conclusion is **that affordability issues vary widely across European Member States, even within the same sector**, as our analysis of the Eurostat data shows. Overall levels of affordability difficulties differ substantially, both between new Member States and the EU15, and within each of these groups. For example, the share of household expenditure devoted to all utilities in 2010 varied from under 15% in Luxembourg to over 35% in Hungary. Similarly, the proportion reporting arrears on their utility bills was more than ten times as high in Bulgaria and Greece as it was in Luxembourg (35% compared with 3%).[46] A common target would make little sense in the context of such variations, and might imply a cross subsidy between Member States. Such a policy would violate the responsibility and sovereignty of each Member State for social issues, of which affordability is clearly an example.

Our second recommendation is that **policies should also vary between sectors because of the very different nature of the products and affordability issues in each sector**. We have taken a holistic approach across utilities, and have identified through the in-depth country studies (Research Papers 4-8) how far households are likely to be subject to difficulties across a number of utilities. While households on low income (less than 60% of the median income level) are, relatively speaking, more likely to face difficulties in at least one of the four sectors we have examined, the nature of those difficulties, and the appropriate response, varies across utilities. As our analysis of household expenditure share data shows, the issue in each sector depends on the relationship between expenditure share and income[47]. A particularly marked increase in the share of expenditure devoted to energy for low income households drives the focus on fuel poverty and the development of policies to address this issue. While water shows a similar (although less marked) expenditure share-income pattern, many Member States do not currently charge all households the full economic cost of water and sewerage services. The recommendations of the European Union to introduce cost reflective water prices may have a significant effect on low income households in those jurisdictions which do not currently charge directly for services in this sector and where there are currently cross subsidies.

The affordability of utilities needs to be understood in the context of more general issues of low income and social exclusion, and the policies which are in place or are being developed to address these. A standard result from economic theory is that an income transfer should improve the welfare of a recipient more than a cash equivalent reduction in the expenditure devoted to a particular item of consumption (in our case, the utilities). The logic behind this result is that individual households are best placed to determine which commodities are most valuable to them.

[46] See Research Paper 2 for more detail on these comparisons.
[47] See Chart 15. Equivalent charts for countries other than the UK are available in Research Papers 5-8.

For example, a low income household may choose increased expenditure on food over additional heat. Nevertheless, political constraints on the ability to redistribute income between households may lead to the pursuit of 'second best' alternatives, in other words, pressures to mitigate the expenditure of households in particular sectors. Our analysis of household expenditure surveys confirms the important role which social policies are likely to already play in leading to different affordability issues for different groups across Member States. Our expenditure share analysis reflects the spending behaviour of households who are already subject to different social support mechanisms in different Member States.

Perhaps it is Member State sovereignty over social policy which leads to surprisingly little centralised information on such issues, and our third recommendation is that **there should be more information shared between Member States.** It seems that more centralised information could be made available to those who wish to learn from the experience of others, through individual Member States' reports on specific projects. We believe that sharing information, both about which households may face affordability problems, and especially the experience of implementing policies, can only be beneficial. However, more general systems of social support vary widely between Member States, and there should be no expectation of uniformity or convergence of policy across Member States. Therefore, learning is likely to be most effective between Member States which share similar social support systems and whose households face similar levels of affordability problems.

Our fourth conclusion is that the **when measuring the success of interventions to alleviate affordability issues, tracking commonly used metrics such as the percentage of households spending twice the median amount on a particular utility, can be misleading.** When assessing interventions that aim to reduce expenditure on a particular utility it is best to use a measure of benefits compared with costs, where both, but especially benefits, reflect the consequences for the individual householders helped and society as a whole. While policy makers naturally want a simple measure of the effectiveness of any policy, the usual metrics which assess affordability are fraught with difficulties, and may give rise to unintended consequences and apparently perverse results. In particular, threshold objectives encourage help to be targeted at those identified as having mild affordability difficulties, so that they can be taken out of the 'in difficulty' category, rather than households who may have more serious difficulties and who will remain on the 'wrong' side of the boundary, even after substantial help. Research Papers 4-8 describe simulations of possible policy interventions that illustrate these difficulties clearly. Of course, when we suggest the use of cost benefit analysis we focus on understanding the most efficient mechanism to deliver a given expenditure reduction to households. We are not suggesting that the importance attached to distributional concerns, which often lies behind debates about affordability, should be subject to cost benefit analysis.

Fifthly, we recommend that **any ex-ante forecasts, and any ex-post assessment, of interventions are based on realistic assumptions regarding behavioural responses**. Many policies in the past

have been implemented based on engineering estimates of the best that is achievable if householders were to take full advantage of the potential for changed consumption, particularly with regard to energy efficiency investments and broadband use. However, our review of experience highlights the gap between potential and realised outcomes, as consumer response is more complex than either engineering or rational economic models often predict, for example through the influence of social factors on the use of broadband and the rebound effect in energy conservation. We urge policy makers to explore the likely responses of householders before implementing policies, a process which may be particularly valuable when designing strategies to address the digital divide and assessing the potential for smart meters to reduce energy expenditure.

Such behavioural considerations can be split into two components: (i) whether householders will invest (effort and/or money) in particular capital measures which improve their situation, for example insulation to improve energy affordability; and (ii) ongoing behaviour, after such 'fixed investment' is made, for example turning down a heating system rather than heating a house to a higher temperature than recommended. All of these complexities need to be considered when assessing the likely benefits of a particular intervention.

The **importance of local knowledge in designing and implementing policy, our sixth conclusion, relates to the previous recommendation**. While sharing knowledge should bring benefits, the particular circumstances, both social and economic, of householders and their likely response to initiatives will vary between and within Member States. As an example, in Northern Ireland there was some resistance to insulation improvement schemes because they included the removal of traditional fireplaces which were seen as a focal point of the household, particularly by older consumers. Similarly, local knowledge is likely to play an important part in understanding the behavioural factors that increase take up of measures and ensure the desired response. Where such local implementation can be integrated with other social assistance tools, a more holistic solution may be found to help households in difficulty, for example combining energy efficiency investments with eligibility checks for the receipt of general social benefit payments from government.

7. References

Allcott, H. (2011), 'Rethinking real-time electricity pricing', Resource and Energy Economics, 33(4), pp. 820-842

Amecke, H. (2012), 'The impact of energy performance certificates: A survey of German home owners', Energy Policy, 46 (July), pp. 4-14

Amstalden, R. W., M. Kost, C. Nathani and D. M. Imboden (2007), 'Economic potential of energy-efficient retrofitting in the Swiss residential building sector: the effects of policy instruments and energy price expectations', Energy Policy, 35(3), pp. 1819-1829

Armstrong, D., R. Winder and R. Wallis (2006), 'Impediments to policy implementation: the offer of free installation of central heating to an elderly community has limited uptake', Public Health, 120(2), pp. 161-166

Armstrong-Wright, A. and S. Thiriez (1987), 'Bus Services: Reducing Costs, Raising Standards', The World Bank, Washington DC

Belloc, F., A. Nicita and M. A. Rossi (2012), 'Whither policy design for broadband penetration? Evidence from 30 OECD countries', Telecommunications Policy, 36(5), pp. 382-398

Bennett, M., D. Cooke and C. Waddams Price (2002), 'Left out in the cold? New energy tariffs, low-income households and the fuel poor', Fiscal Studies, 23(2), pp. 167-194

Boardman, B. (1991), 'Fuel poverty – from cold homes to affordable warmth', Belhaven Press, London, Great Britain, Chapter 3, pp. 46

Broadbent, R., and Papadopoulos, T. (2013), 'Bridging the digital divide–An Australian story', Behaviour and Information Technology, 32(1), pp. 4-13

Choi, J. and D.R. Bell (2011), 'Preference Minorities and the Internet', Journal of Marketing Research, 48(4), pp. 670-682

Clinch, J. P., and J. D. Healy (2000), 'Domestic energy efficiency in Ireland: correcting market failure', Energy Policy, 28(1), pp. 1-8

Critchley, R., J. Gilbertson, M. Grimsley, G. Green and Warm Front Study Group (2007), 'Living in cold homes after heating improvements: evidence from Warm-Front, England's Home Energy Efficiency Scheme', Applied Energy, 84(2), pp. 147-158

Department of Transport (1996), 'White Paper on National Transport Policy', Pretoria, South Africa

Dubois, U. (2012), 'From targeting to implementation: The role of identification of fuel poor households', Energy Policy, 49, pp. 107-115

E-Control (2014), 'Energy Poverty in Austria – Definitions and Indicators', Vienna, Austria

Edelman, B. and J. Wright (2014), 'Price Restrictions in Multi-sided Platforms: Practices and Responses', Competition Policy International, 10(2), pp. 889-101

Environmental Protection Agency (2006), 'Small Drinking Water Systems Variances – Revision of Existing National-Level Affordability Methodology and Methodology to Identify Variance Technologies that are Protective of Public Health', Federal Register, 71(41), March 2, 10,671-10,685

European Commission (2010), 'An Energy Policy for Consumers', Commission Staff Working Paper SEC(2010) 1407 final, Brussels, Belgium

European Commission Communications Committee (2014), 'Broadband access in the EU: situation at 1 July 2013', DG CNECT/F4 COCOM 14-03, Brussels, Belgium

Falck, O., R. Gold and S. Heblich (2014), 'E-lections: Voting Behaviour and the Internet', American Economic Review, 104(7), pp. 2238-2265

Fankhauser, S. and S. Tepic (2007), 'Can poor consumers pay for energy and water? Affordability analysis for transition countries', Energy Policy, 25, pp. 1038-1049

Ferro, E., N. C. Helbig and J. R. Gil-Garcia (2011), 'The role of IT literacy in defining digital divide policy needs', Government Information Quarterly, 28(1), pp. 3-10

Foteinou, G. (2010), 'E-exclusion and the Gender Digital Divide', ACM SIGCAS Computers and Society, 40(3), pp. 50-61

Fowlie, M., M. Greenstone and C. Wolfram (2015), 'Costs of Residential Energy Efficiency Investments are Twice their Benefits: Implications for Policy', Research Summary, Energy Policy Institute at the University of Chicago

Galvin, R. (2012), 'German Federal policy on thermal renovation of existing homes: a policy evaluation', Sustainable Cities and Society, 4, pp. 58-66

Gans, W., A. Alberini and A. Longo (2013), 'Smart meter devices and the effect of feedback on residential electricity consumption: Evidence from a natural experiment in Northern Ireland', Energy Economics, 36, pp. 729-743

Gilbertson, J., M. Stevens, B. Stiell, and N. Thorogood (2006), 'Home is where the hearth is: Grant recipients' views of England's Home Energy Efficiency Scheme (Warm Front)', Social Science & Medicine, 63(4), pp. 946-956

Gomez-Lobo, A. (2001), 'Making Water Affordable: Output-based Consumption Subsidies in Chile', Chapter 2 in Brook, P.J. and S.M. Smith (eds.), 'Contracting for Public Services: Output-based Aid and Its Applications', The World Bank, Washington D.C., pp. 23-29

Gomide, A., S. Leite and J. Rebelo (2004), 'Public Transport and Urban Poverty: A Synthetic Index of Adequate Service', The World Bank Urban Transport Program in Brazil, The World Bank, Washington DC

Guertler, P. (2012), 'Can the Green Deal be fair too? Exploring new possibilities for alleviating fuel poverty', Energy Policy, 49, pp. 91-97

Guertler, P., and A. Jansz (2012), 'The Impact on the Fuel Poor of the Reduction of Fuel Poverty Budgets in England', Report for Energy Bill Revolution and Association for the Conservation of Energy, November 2012

Gulati, G. J., and D. J. Yates (2012), 'Different paths to universal access: The impact of policy and regulation on broadband diffusion in the developed and developing worlds', Telecommunications Policy, 36(9), pp. 749-761

Helsper, E. (2011), 'The emergence of a digital underclass: digital policies in the UK and evidence for inclusion', media policy brief 3, London School of Economics, July 2011

Hong, S. H., J. Gilbertson, T. Oreszczyn, G. Green, I. Ridley and Warm Front Study Group (2009), 'A field study of thermal comfort in low-income dwellings in England before and after energy efficient refurbishment', Building and Environment, 44(6), pp. 1228-1236

Howden-Chapman, P., H. Viggers, R. Chapman, K. O'Sullivan, L. T. Barnard and B. Lloyd (2012), 'Tackling cold housing and fuel poverty in New Zealand: a review of policies, research, and health impacts', Energy Policy, 49(October), pp. 134-142

Hsieh, J. P. A., A. Rai and M. Keil (2008), 'Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged', MIS Quarterly, 32(1), pp. 97-126

Hutton, G. (2012), 'Monitoring "Affordability" of water and sanitation services after 2015: Review of global indicator options', A paper submitted to the United Nations Office of the High Commission for Human Rights

International Telecommunications Union (ITU) (2012), 'Measuring the Information Society, 2012', Geneva, Switzerland

Isherwood, B.C. and R.M. Hancock (1979), 'Household Expenditure on Fuel: Distributional Aspects, Economic Advisor's Office, DHSS, London, United Kingdom

Jewitt, C., and U. Parashar (2011), 'Technology and learning at home: findings from the evaluation of the Home Access Programme pilot', Journal of Computer Assisted Learning, 27(4), pp. 303-313

Kroft, K. and D.G. Pope, 'Does Online Search Crowd Out Traditional Search and Improve Matching Efficiency? Evidence from Craigslist', Journal of Labor Economics, 32(2), pp. 259-303

Léautier, T. O. (2012), 'Is Mandating 'Smart Meters' Smart?', Working Paper

Leth-Petersen, S., and M. Togeby (2001), 'Demand for space heating in apartment blocks: measuring effects of policy measures aiming at reducing energy consumption', Energy Economics, 23(4), pp. 387-403

Liddell, C., C. Morris, S.J.P. McKenzie and G. Rae (2011), 'Defining Fuel Poverty in Northern Ireland: A preliminary review', University of Ulster, Coleraine, Northern Ireland

Liddell, C., C. Morris, S.J.P. McKenzie and G. Rae (2012), 'Measuring and monitoring fuel poverty in the UK: National and regional perspectives', Energy Policy, 49 (October), pp. 27-32

Lloyd, C. R., M. F. Callau, T. Bishop and I. J. Smith (2008), 'The efficacy of an energy efficient upgrade program in New Zealand', Energy and Buildings, 40(7), pp. 1228-1239

Macdonald S.J. and J. Clayton (2013), 'Back to the future, disability and the digital divide', Disability & Society, 28(5), pp. 702-718

Mariscal, J., J. R. Gil-Garcia and A. Aldama-Nalda (2011), 'Policies on access to information technologies: The case of e-Mexico', Information Technologies and International Development, 7(2), pp1-16

Mazylin, D., Y. Dover and J. Chevalier (2014), 'Promotional Reviews: An Empirical Investigation of Online Review Manipulation', American Economic Review, 104(8), pp. 2421-2455

Polat, R. K. (2012), 'Digital exclusion in Turkey: A policy perspective', Government Information Quarterly, 29(4), pp. 589-596

Scott Morton, F., F. Zettelmeyer and J. Silva-Rosso (2003), 'Consumer Information and Discrimination: Does the Internet Affect the Pricing of New Cars to Women and Minorities?', Quantitative Marketing and Economics, 1, pp. 65-92

Sengupta, A. and S.N. Wiggins (2014), 'Airline Pricing, Price Dispersion, and Ticket Characteristics On and Off the Internet', American Economic Journal: Economic Policy, 6(1), pp. 272-307

Sinclair, S., and G. Bramley (2011), 'Beyond virtual inclusion–communications inclusion and digital divisions', Social Policy and Society, 10(01), pp. 1-11

Townsend, L., A. Sathiaseelan, G. Fairhurst and C. Wallace (2013), 'Enhanced broadband access as a solution to the social and economic problems of the rural digital divide', Local Economy, 28(6), pp. 580-595

Walker, A. (2009), 'The Independent Review of Charging for Household Water and Sewerage Services – Final Report', Department for Environment, Food and Rural Affairs, London, United Kingdom

Walker, R., C. Liddell, P. McKenzie, and C. Morris (2013), 'Evaluating fuel poverty policy in Northern Ireland using a geographic approach', Energy Policy, 63, pp. 765-774

Walker, R., P. McKenzie, C. Liddell and C. Morris (2014), 'Estimating fuel poverty at household level: An integrated approach', Energy and Buildings, 80, pp. 469-479

Yates, D. J., Gulati, G. J., and Weiss, J. W. (2010), 'Towards Universal Broadband: Understanding The Impact Of Policy Initiatives On Broadband Diffusion And Affordability', European Conference on Information Systems (ECIS) Proceedings, Paper 69

Yelland, N., and G. Neal (2013), 'Aligning digital and social inclusion: A study of disadvantaged students and computer access', Education and Information Technologies, 18(2), pp. 133-149

8. Appendix: summary of affordability metrics

The table on the next page provides details of all the quantifiable affordability metrics identified in the literature. The most developed discussion of measuring affordability difficulties is in the energy sector, where the most common metrics relate either to expenditure levels (sometimes restricted to low income groups) or to expenditure shares relative to some marker level (often median). Thus a statement of 'High fuel expenditure' that takes no account of income level is not an affordability metric in itself. Instead a common measure of fuel poverty is spending more than ten percent of income on household energy needs. Of course there are nuances around precise definitions of income and household needs, and whether the metric reflects actual expenditure, or the theoretical expenditure required to reach a particular level of comfort. The advantage of the latter is it is not affected by householders 'self-rationing' energy consumption. While spending more than 10% of expenditure on energy is generally considered to constitute fuel poverty or energy precariousness, figures of 15% and 20% have been used to identify more severe fuel poverty. As an alternative to these absolute proportional thresholds using specified percentages, some definitions relate the share of expenditure to a population average, and a common definition defines households in fuel poverty as those who spend more than twice the median expenditure share on energy.

More recently there has been more focus on combining both low income and high expenditure when identifying fuel poverty, so a household may be classified as fuel poor if it has an income below the at-risk-of-poverty threshold while also having above-average energy costs. A specific form of this criterion identifies fuel poor households in England as those for whom household fuel expenditure exceeds the national median and 'disposable' income (after deducting fuel expenditure from equivalised income after housing costs) is below the official poverty line.

Concepts of water affordability largely follow the energy definitions, but with lower threshold proportions, reflecting the lower costs of water and sewerage. Thresholds range from 2% to 5% of household income. Sometimes the definition is restricted to low income households, but no definitions relative to median expenditure were identified. In telecoms and broadband, affordability concepts are related to the price of achieving a particular level or bundle of services. The concepts are usually defined nationally and relative to national income, rather than for individual households as in energy and water. Transport affordability has an intermediate focus between households in the aggregate and individual households. For example, Armstrong-Wright and Thiriez (1987) refer to transport services being affordable if no more than a tenth of households spend more than 15% on journeys to work, while South Africa considers services affordable if commuters spend no more than 10% of their disposable income on transport.

Author, Organisation or Country	Title of Metric	Description
	Energy	
Isherwood and Hancock (1979)	High fuel expenditure	> twice the median expenditure on fuel, light and power
Boardman (1991): Alternative 1	Fuel poverty	> twice the national average expenditure on fuel services (as % of total expenditure)
Boardman (1991): Alternative 2	Fuel poverty	> average expenditure on fuel by bottom 30% of income distribution
United Kingdom (1998)	Fuel poverty	>10% of income spent for heating (adequate[48] for health and comfort)
Proposed revision to Directive 2002/91/EC	Energy poverty	>10% of income spent heating home to standard identified by World Health Organisation (WHO)
Scotland (2002)[49]	(i) Fuel poverty; (ii) Severe fuel poverty; (iii) Extreme fuel poverty	(i) 10-15% of income spent on heat, power and light; (ii) 15-20% of income spent on heat, power and light; (iii) >20% of income spent on heat, power and light
Fankhauser and Tepic (2007)	Problematic affordability	>20% of household expenditures spent on electricity and heating costs
France (2010)[50]	Energy precariousness	>10% of income spent on actual energy expenses

[48] Liddell et al (2011) cite the UK's 2001 Fuel Poverty strategy as defining adequate heating according to the following standard: "21°C in the living room and 18°C in the other occupied rooms – the temperatures recommended by the World Health Organisation".
[49] Quoted in Liddell et al (2012).
[50] Dubois (2012) states this is a 'practical' definition that complements the 2010 law on energy precariousness. This definition does not appear in the text of the law itself.

European Commission (2010)	Considerable expenditure share	> twice the national average of energy expenditure to income ratio
Liddell et al (2011)	Lay definition of fuel poverty for Northern Ireland	>15% of income spent to achieve a minimum standard of heating and electricity
Liddell et al (2012)	(i) Fuel poverty; (ii) Severe fuel poverty; (iii) Extreme fuel poverty	(i) 2-3 times median expenditure on heat, power and light; (ii) 3-4 times median expenditure on heat, power and light; (iii) >4 times median expenditure on heat, power and light
Republic of Ireland	Fuel poverty	>10% of income spent on heating
United Kingdom (Current)	Fuel Poverty: Low Income High Cost (LIHC) measure	(i) Fuel expenditure exceeding national median; and (ii) after deducting fuel expenditure from equivalised income after housing costs the remaining income is below the official poverty line (60% of median equivalised household income after housing costs)
United Kingdom (Current)	Fuel Poverty Gap	Required fuel costs for a fuel poor household less median required fuel costs (average and aggregate poverty gap figures reported)
Austria[51]	Energy Poverty	"…income is below the at-risk-of-poverty threshold and, at the same time, it (the household) has to cover above-average energy costs"

[51] See E-Control (2014).

Telecommunications		
Broadband Commission for Digital Development (2011)[52]	Affordable entry-level broadband	Cost of fixed broadband service used in ITU's ICT Price Basket <5% of average GNI per capita
International Telecommunications Union (2012)	ICT Price Basket (IPB)	Cost of standardised bundle of fixed telephony, mobile telephony and fixed broadband services from largest supplier as % of average GNI per capita
EC Communications Committee (2014)	Broadband affordability	Median cost of 12-30Mbps Internet connection as % of gross disposable income per capita
Water		
Chile[53]	Threshold for water subsidies	>5% of monthly income spent on water and sewerage services among low-income households
World Bank (2002)[54]	"received wisdom" (Herrington, 2003)	3-5% of total household income/expenditure on water
Asian Development Bank (2003)[55]	N/A	5% of total household income/expenditure on water
United Kingdom[55]	Hardship measure (Herrington, 2003)	Households in lowest income decile spending >3% of total household income/expenditure on water
United States, EPA (2006)	Affordability threshold for small investments	Post-investment cost of water must be less than 2.5% of median household income
Fankhauser and Tepic (2007)	Problematic affordability	Water & waste water >5% of household expenditures
Walker (2009)	N/A	Individuals in lowest 3 income deciles spending >3% of disposable income (before housing) on water bills

[52] Discussed in ITU (2012).
[53] Described by Gomez-Lobo (2001).
[54] Reported in Table 1 of Fankhauser and Tepic (2007).

Lithuania[55]	Unaffordability threshold	Expenditure on water and sanitation >2% of individual household's disposable income
Northern Ireland[56]	Unaffordability threshold	Expenditure on water and sanitation >3% of individual household's disposable income
France[56]	Unaffordability threshold	Expenditure on water and sanitation >3% of individual household's disposable income
United States[56]	Unaffordability threshold	Expenditure on water >2% of median household's disposable income
Portugal[56]	Unaffordability threshold	Water (for 120 litres per capita per day) and wastewater bill should not >2% of income
Transport		
Armstrong-Wright and Thiriez (1987)	'Fair' transport outlay threshold	No more than 10% of households should spend >15% of household income on journeys to work
South Africa, Department of Transport (1996)	Affordability aim	Commuters spend "less than about 10% of disposable income on transport"
Belo Horizonte, Brazil[56]	threshold for travel pass	Employer pays for travel to work in excess of 6% of worker's gross income

[55] Quoted in Hutton (2012).
[56] Described by Gomide et al (2004)

9. Supporting research papers

1. Literature Review – Affordability Metrics
2. Affordability in the EU: Discussion of Eurostat and ITU Data
3. Literature Review – Policies Used to Tackle Affordability in Different EU Member States
4. Simulations of Policies to Alleviate Utility Affordability Issues in the UK: Evidence from the Living Costs and Food Survey 2012
5. Simulations of Policies to Alleviate Utility Affordability Issues in the Republic of Ireland: Evidence from the Irish Household Budget Survey 2009-10
6. Simulations of Policies to Alleviate Utility Affordability Issues in Northern Ireland: Evidence from the Living Costs and Food Survey 2009
7. Simulations of Policies to Alleviate Utility Affordability Issues in Estonia: Evidence from the Household Budget Survey 2012
8. Simulations of Policies to Alleviate Utility Affordability Issues in France: Evidence from the 'Budget de Famille' Survey 2010-11
9. The Relationship between Objective and Subjective Measures of Utility Affordability in the EU
10. Estimates of the Percentages of Households with Affordability Difficulties in Multiple Sectors
11. The Affordability of Utilities: Differences between Specific Household Types and the General Population
12. Relationship between Average Expenditure and the Expenditure Share Devoted to Particular Utilities
13. Literature Review – Evidence on the Effectiveness of Policies Tackling Fuel Poverty and Digital Exclusion