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# *Affordability of utilities' services: extent, practice, policy*

## *Research Paper 4: Simulations of Policies to Alleviate Utility Affordability Issues in the UK: Evidence from the Living Costs and Food Survey 2012*

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## Executive Summary

This research paper provides an in-depth analysis of the utility affordability issues in the UK in 2012. The analysis utilises data for individual households from the Living Costs and Food Survey to estimate the proportion of different groups identified as having affordability difficulties in different sectors according to the high-level affordability metrics identified in Research Paper 1. The current research paper then develops simulations of different policy interventions (varying in monetary size) targeted at different groups of households and reports how these interventions alter the affordability metrics reported for the population as a whole. In sections 1 and 2 the methodology of these simulations is described in detail; the methodology used for the UK simulations is also used for the simulations in Research Papers 5-8. The order of these simulations has no significance, and arises from the practicality of developing the simulation methodology for the Member State where the researchers had greatest knowledge and experience. As part of the simulations an 'effectiveness' metric is developed indicating how effective a particular intervention is in moving the affordability metric being considered.

Key messages from this Research Paper include:

- Fixed threshold, twice median and Low Income High Consumption (LIHC) metrics generally show considerably different pictures of affordability difficulties; in particular, the LIHC criterion consistently shows a lower proportion of the population facing affordability difficulties than other traditionally used metrics.

- There are wide variations in the extent of affordability difficulties across different household groups.

- As 'twice median' and LIHC metrics are 'relative' metrics, the simulations show that they can experience 'perverse' moves after large scale interventions i.e. they may show an increase in the percentage of the population with affordability difficulties despite the interventions making some households better off and no households worse off in monetary terms.

- We caution against using the 'effectiveness' metric as a practical tool to guide policy as it reports the ability of an intervention to move an affordability metric rather than the true welfare gain experienced by households.

- The simulations illustrate the limitations of using high-level affordability metrics to monitor the effectiveness of policy interventions; attempts to directly compare the benefits received by households against the costs of interventions seem preferable.

- The apparent 'effectiveness' of an intervention depends heavily on the distribution of expenditure share of households identified as facing affordability difficulties.

# 1. Introduction

This is the first in a series of five research papers (Research Papers 4-8) reporting the results from simulations of different policy interventions to tackle affordability in the utility sectors of the UK, Republic of Ireland, Northern Ireland, Estonia and France respectively. It is important to note that each research paper is based on a different data source and covering different time periods. The data for all the charts in this research paper come from the UK's Living Costs and Food Survey in 2012. Details of the datasets used in the other in-depth analyses are provided in Research Papers 5-8. Given that the data are from different years and each nation has its own survey methodology, it is most appropriate to consider each country's results as a 'case study' rather than attempting formal statistical comparisons between them.

The analysis in this research paper and Research Papers 5-8 consists of two elements: (i) detailed descriptive statistics for the different affordability metrics discussed in Research Paper 1, and (ii) simulations of potential policy interventions. The expenditure data for individual households enables a far greater range of analysis than that presented in Research Paper 2.

The simulations investigate the impact of four possible policy interventions:

(i)      250 euro increase in income (as proxied by total expenditure)
(ii)     50 euro decrease in expenditure on a particular utility
(iii)    100 euro decrease in expenditure on a particular utility
(iv)     250 euro decrease in expenditure on a particular utility[1]

These figures seem plausible amounts when considered in the context of the size of utility bills, rather than having any other particular significance. Importantly we do not aim to assess particular types of policy intervention e.g. education programmes vs improved insulation vs monetary transfers, but rather the effect of an income or expenditure change, whatever the process of achieving it.[2] This approach assumes that the expenditure reductions (ii)-(iv) do not reduce the welfare of the household involved i.e. they are always beneficial, with a household being able to achieve the same standard of living but with lower expenditure.[3] The aim of our simulations is to focus on the impact on affordability measures of the four 'outcomes' listed above. In essence we are providing an indication of the size of savings required to affect the different affordability metrics discussed in Research Paper 1. The process provides guidance on the effect on the

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[1] For the UK simulations in this research paper these amounts have been converted into pounds sterling at the market exchange rate of 0.8068 euros to the pound which was the exchange rate on 29 June 2012.
[2] To simulate particular types of intervention would either require 'heroic' assumptions or would be reliant on results from very specific studies where the ability to generalise the results might be difficult to assess.
[3] Note the distinction that a monetary transfer will only definitely reduce a household's expenditure where as an intervention such as improved insulation can reduce both consumption and expenditure.

affordability metrics of targeting different types of households (e.g. households in social housing vs single parent households) for a particular intervention.

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

(a) Fixed expenditure share thresholds (10% in energy, 3% in water, 5% in telecoms and 20% in transport)[4]
(b) Twice the median expenditure share thresholds
(c) Low Income – High Consumption (LIHC) Criterion

Our original intention had been to identify the most effective of the policies (i)-(iv) along with the groups to which it would be most desirable to target affordability policies. However the simulations instead provide a stark illustration of the issues with each of the affordability metrics (a)-(c). In particular, the policy interventions (i)-(iv) can have counter-intuitive impacts on the pictures of affordability provided by metrics (b) and (c). Indeed, in some instances, these metrics were worsened by policy interventions we simulate. In other words, despite the policy interventions always making some households better off, and never making any households worse off, the metrics sometimes showed that more households were facing affordability difficulties after the interventions had occurred, because of the relative nature of the metrics.

To avoid these counter intuitive outcomes, we concentrate on the effectiveness of different policy interventions by focusing on metric (a), the fixed expenditure thresholds. While fixed expenditure thresholds are not perfect (the thresholds are somewhat arbitrary and the depth of poverty is ignored) the results can be easily understood and are entirely intuitive.

The counter intuitive outcomes when using metrics (b) and (c) indicate that significant caution is needed in selecting a particular affordability metric as a target to assess the effectiveness of policies through time. A more effective way of monitoring the effectiveness of interventions is likely to be the direct calculation of total savings achieved for households rather than tracking a high-level affordability metric. Indeed, the outcomes (i)-(iv) each deliver real benefits to households and it is these benefits that are surely the most relevant to record, regardless of movements in the metrics (a)-(c). Of course quantifying the benefits from particular policy interventions presents its own challenges in terms of identifying the expenditure on utilities by individual households before and after policy interventions have taken place.

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[4] The thresholds for energy and water have been adopted as they are mentioned in actual policies. The expenditure share thresholds for telecoms and transport are roughly equivalent to twice the median expenditure share in the UK in 2012.

## 2. Methodology

In our simulations we utilise the individual household level expenditure data collected by household budget surveys. The nations included in Research Papers 4-8 reflect the availability of the required data at reasonable cost and the Centre for Competition Policy's linguistic skills to utilise the datasets.

To understand the simulation of a particular policy intervention consider the example of reducing the energy expenditure of single parent households by 100 euros (though as explained above, not reducing their benefits from consumption, so the households' welfare does not decrease). Firstly, we estimate the different affordability metrics for a country prior to the intervention (where possible, sample weights were applied to make the estimates as representative as possible)[5]. The next step is to reduce the energy expenditure of each single parent household in the sample by 100 euros.[6] Since utility expenditure is a component of total expenditure, the values of total expenditure also need to be recalculated. However, this recalculation of total expenditure is only performed for metrics (a) and (b). The structure of the LIHC criterion (metric (c)) means that it is important to treat total expenditure in this metric as a proxy for income and not adjust for the sector specific expenditure reduction.[7] After this process has been completed each of the affordability metrics are recalculated. This process is repeated for each target group in each sector of each country.

The target groups for the policy interventions are determined by policy relevance and the information contained within each household budget survey. The target groups therefore may not be optimal for tackling energy poverty, as they are generally defined by the characteristics of

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[5] One consequence of utilising the weights provided with the household budget surveys is that all observations are included in the analysis including all extreme values. Also, following guidance from the Northern Ireland Statistics and Research Agency weights have not been applied to the Northern Ireland data as no suitable weights were readily available.

[6] If this intervention results in negative expenditure the post-intervention expenditure figure is put to zero. For the UK and Northern Ireland this conversion to zero has not been carried out for the energy sector as in the raw data negative expenditure figures are recorded as legitimate entries. These negative expenditure figures relate to rebates associated with the UK's energy billing system.

[7] In the LIHC criterion the second part of the metric involves calculating the residual income of a household after expenditure for the sector being considered has been removed. In our analysis we proxy total income with total household expenditure for simplicity. If after the 100 euro policy intervention we reduced both total expenditure and energy expenditure by 100 euros it would leave the residual income unchanged from before the intervention (the two 100 euro deductions would cancel). This is why for the LIHC criterion we do not reduce total expenditure by the amount of the policy intervention. For the other two metrics we do deduct the amount of the policy intervention from total expenditure because we want to calculate the expenditure shares before and after an intervention in a very literal way. This calculation is equivalent to an assumption that households do not use the money they saved from reduced utility expenditure on other purchases i.e. a 100% saving rate is assumed. Clearly this is a strong assumption, but any other savings rate would also be an assumption. If total expenditure was not adjusted following a simulated intervention, it would lead to all the post-intervention sector-specific expenditure shares to fall by a small amount.

household members rather than those of the dwelling. To overcome this issue, in all sectors and all countries we include simulations which provide benchmarks to aid interpretation. These benchmarks are:

- Applying the policy to every household in the sample (this indicates the maximum impact of a particular intervention)
- Applying the policy to households with total expenditure (income) below 60% of the median (targeting all the poorest households)
- Applying the policy to households with expenditure *shares* for a particular utility in the highest decile (10%) (targeting the households who spend the greatest proportion on a utility)

While the affordability metrics (a)-(c) are inspired by metrics discussed in Research Paper 1, we do not intend to match them perfectly to 'real world' metrics due to the limited data available and the need to standardise simulation procedures across the nations studied. In particular, all the analysis involves the expenditure on particular utilities as a percentage of total expenditure rather than of total income, reflecting the wider availability (and usually greater reliability) of total expenditure data. This approach also avoids the complexities associated with deciding how to define income. We adopt the measure of total expenditure identified within each of the household budget surveys, which generally includes housing costs.[8] Our analysis is based on the actual expenditure of households rather than any notional 'ideal' expenditure required to provide a particular living standard.

Regarding the definition of expenditure for each sector, where possible we have included all expenditure which is ongoing. For transport we have excluded the one-off purchase costs of vehicles, due to the potentially very large differences across households which such occasional spending would generate.[9] Also we are unable to separate 'essential' travel from 'discretionary' travel within transport expenditure. For energy we include all fuels used to provide heat and power to a household's primary and (where relevant) second dwelling.

To help assess the impact of the different policy interventions we develop an 'effectiveness' metric to control for the proportion of the total population targeted by a particular intervention and the monetary amount involved in the intervention. A full discussion of this 'effectiveness' metric is provided in Section 5. We place 'effectiveness' in inverted commas because the metric assesses the ability of an intervention to move a particular affordability metric, rather than providing an accurate indication of the true welfare gain it would provide.

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[8] In the UK and Northern Ireland the data does not include the imputed value of rent for households that own their dwelling outright. This is likely to mean that the expenditure shares spent on particular utilities are somewhat inflated in the UK and Northern Ireland compared to other countries.
[9] We only exclude these capital expenditures from the 'transport' category rather than from total expenditure.

# 3. Description of population and household groups

Chart 1 shows the variation in size of the household groups considered, which will affect both the cost and the impact on the population metrics of applying each policy. Households below 60% of median total expenditure, households with children and households with a person aged 65 or over each form over 25% of households in the UK; while single parent households, households where the main breadwinner is unemployed and households receiving income support/housing benefit each account for less than 5% of households. Fuel types vary across countries: in comparison to both Northern Ireland and the Republic of Ireland, for the UK as a whole relatively few households, 7.4%, utilise fuel types other than mains gas and electricity. In both Northern Ireland and the Republic of Ireland over 50% of households record expenditure on fuel sources other than mains gas and electricity.

**Chart 1: Estimated Percentage of Households in Each Group: UK 2012**
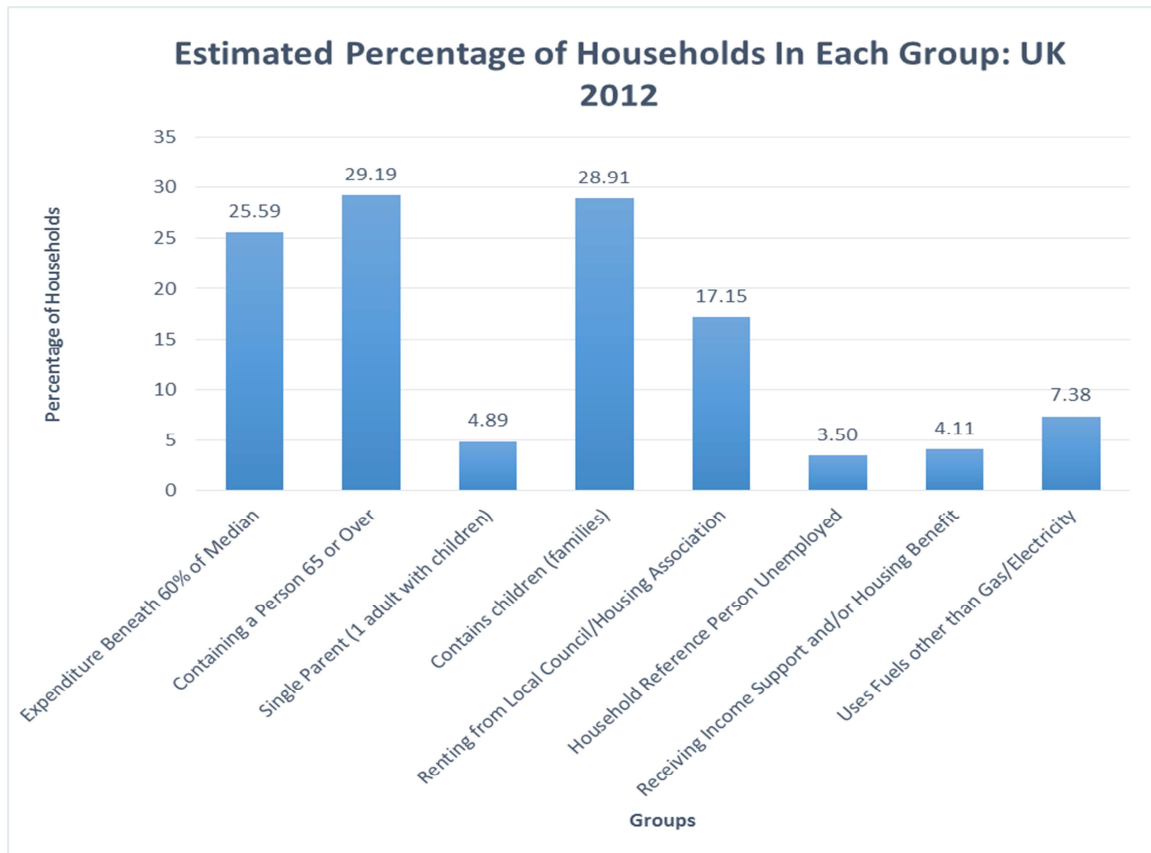


*Source: Living Costs and Food Survey, 2012*

As with all the charts in this research paper, in Chart 1 we report only the central estimate of the percentage of households in each group. As all the figures are estimates for the UK's population of households based on a sample, there is a degree of uncertainty around each estimated figure, and when making comparisons in this research paper and Research Papers 5-8 we have not conducted any tests for the statistical significance of the differences being discussed.

Chart 2 shows considerable variations in total household expenditure across different household groups with the median total expenditure of households containing children being more than three times that of households with total expenditure below 60% of the median. The relatively high expenditure of households containing children probably reflects the fact that these are likely to be relatively youthful households with at least one adult individual in full-time employment.

**Chart 2: Estimated Median Household Expenditure by Group: UK 2012**
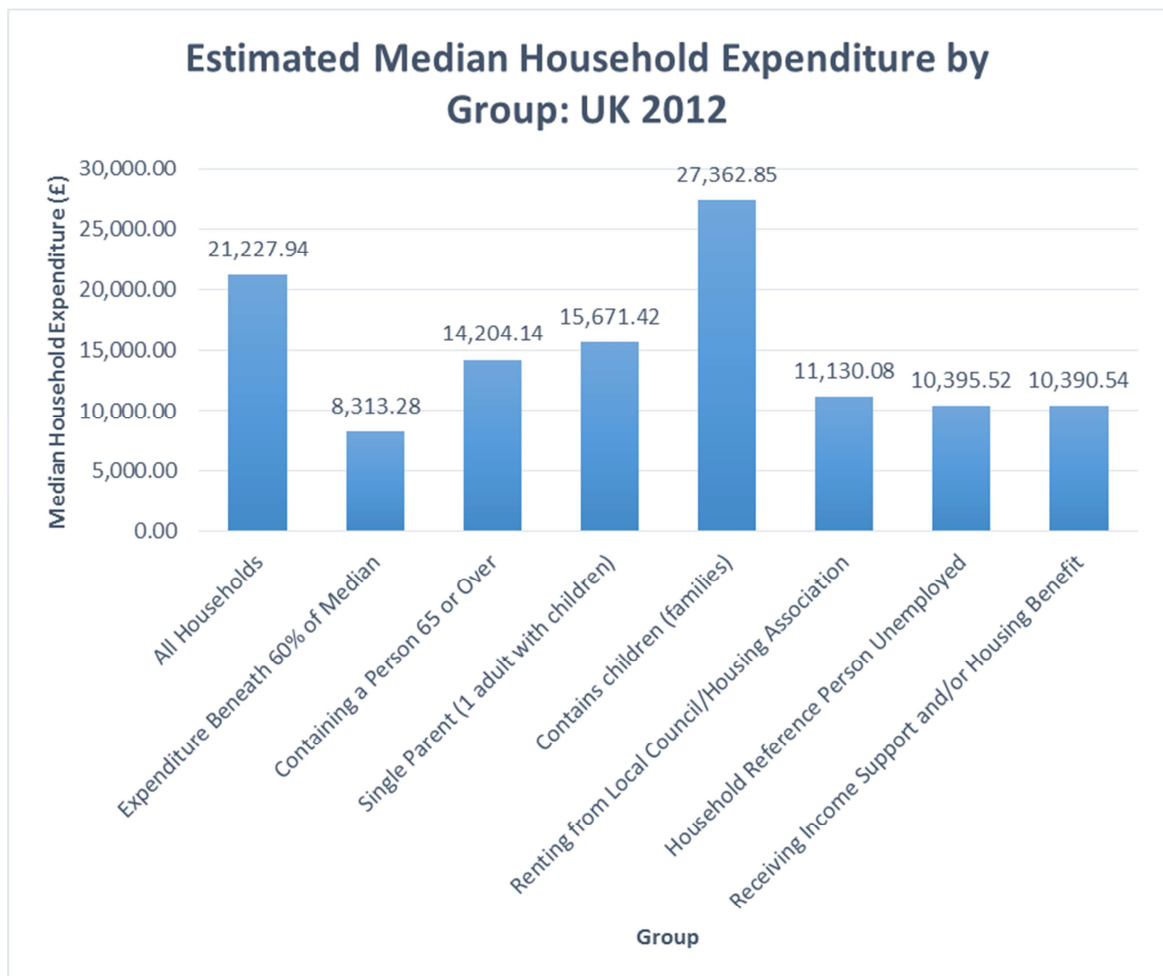


*Source: Living Costs and Food Survey, 2012*

Chart 3 shows that when looking across households as a whole the median expenditure share of transport is approximately double that spent on energy (approximately 10% against 5%). However, in those household groups which one might consider economically disadvantaged (those beneath 60% of median total expenditure, those in social housing, those where the breadwinner is unemployed and those receiving income support/housing benefit) a higher proportion of total expenditure is devoted to energy than transport.

**Chart 3: Estimated Median Expenditure Shares Spent on Different Utilities by Group: UK 2012**
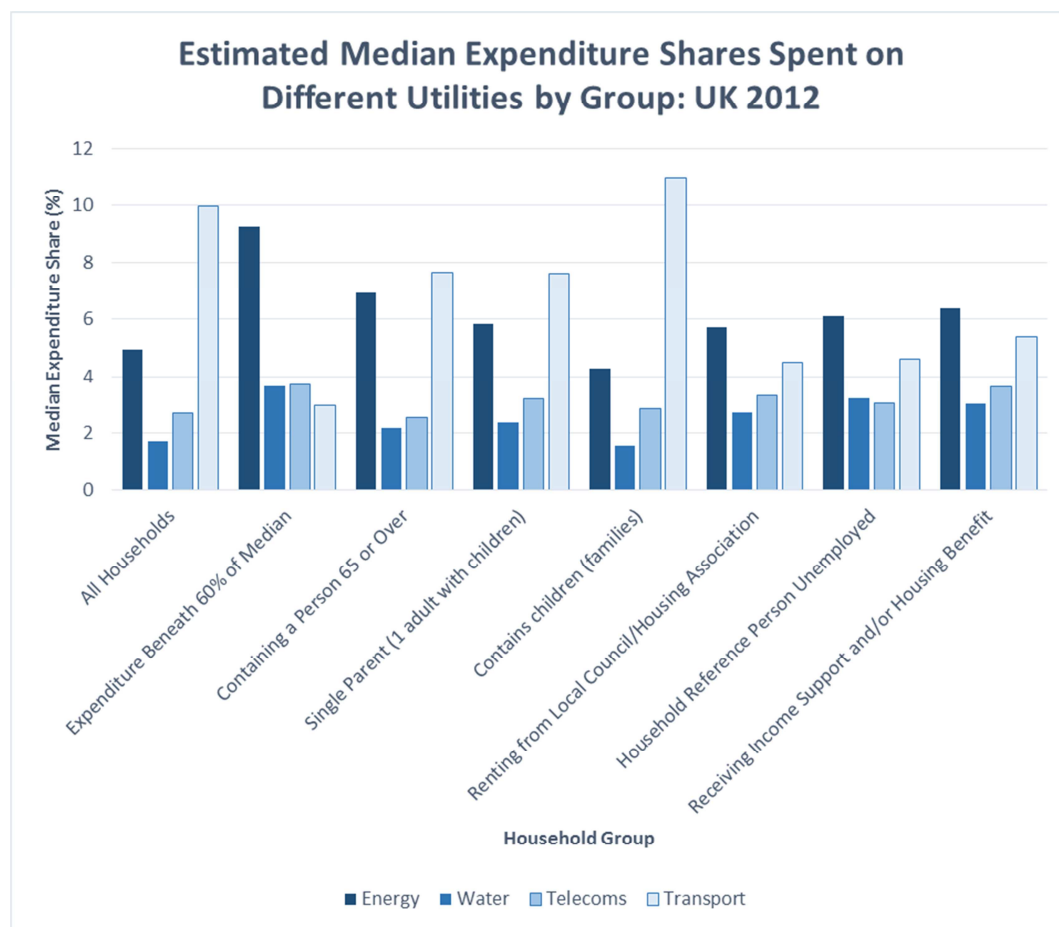


*Source: Living Costs and Food Survey, 2012*

An important underlying determinant of affordability issues is the differing expenditure shares spent on each utility by households with different total expenditure (income) levels. Chart 4 shows considerable variation in the relationship between expenditure shares and total expenditure across the four sectors. In broad terms the pattern shown in chart 4 is replicated in Northern Ireland, the Republic of Ireland and France.

The pattern shown in Chart 4 provides one explanation of why energy and water charges are such politically sensitive topics. The rapidly increasing expenditure shares spent on these two commodities as a household's total expenditure falls indicate that these utilities are necessities, so that price increases in these sectors can cause particularly severe detriment to low income households. For example, households in the UK with total expenditure beneath £5,000 spent over 14% of their total expenditure on energy, while households with total expenditure of £25-30,000 spent only around 4-5% of their total expenditure on energy. The water sector shows a similarly steep decline in expenditure shares with increasing income: households with a total expenditure beneath £5,000 spend over 8% of their total expenditure on water and sewerage charges, compared with only about 1.5% for those households with a total expenditure of £25-30,000. The proportion of total expenditure spent 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 feel more able to economise on telecoms expenditure.

Transport follows a very different pattern to the other sectors. The expenditure share devoted to transport increases sharply 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 different pattern can be explained by the association of key basic transport costs with journeys to and from work. Households with very low total expenditure may include individuals 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.

**Chart 4: Estimated Median Expenditure Share Spent on Different Utilities by Total Expenditure (Proxy Income)**
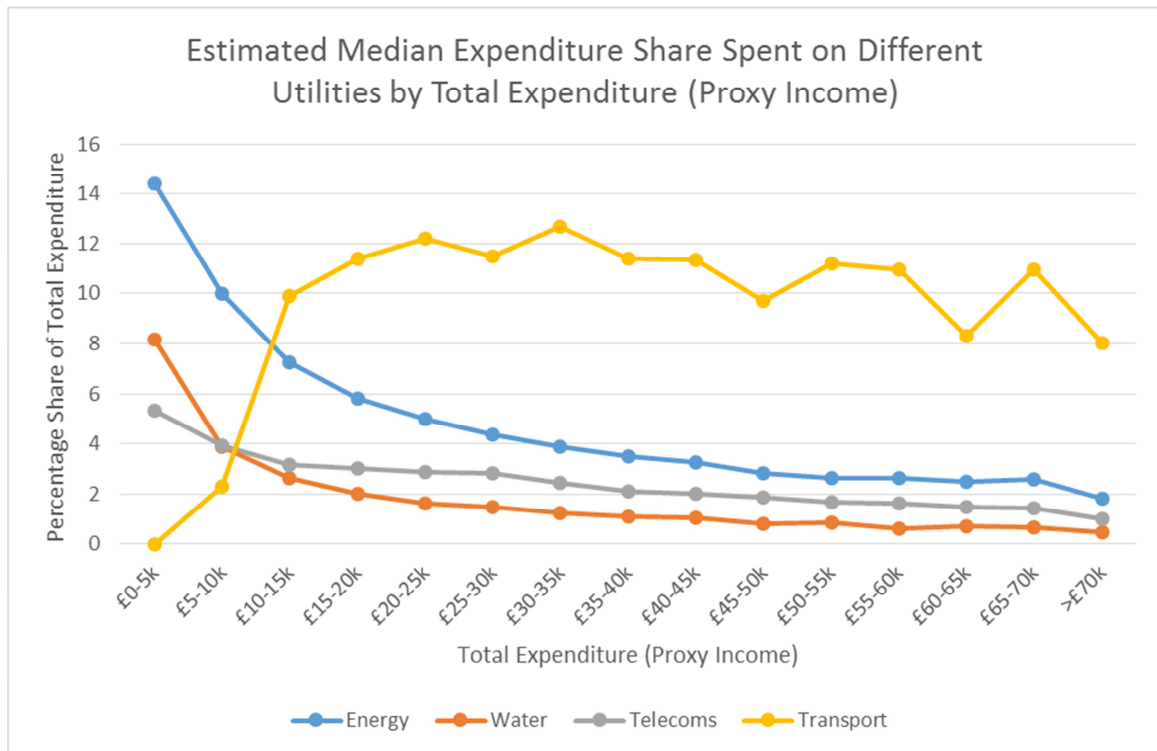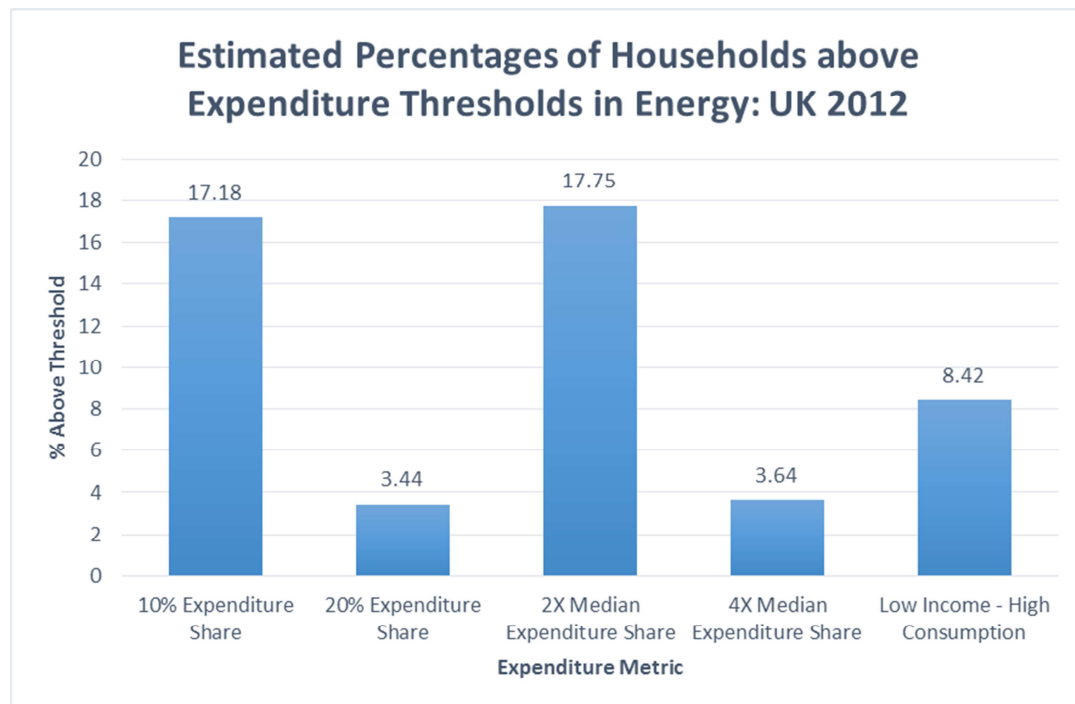


*Source: Living Costs and Food Survey, 2012*

# 4. Energy - Baseline

Chart 5 highlights the broad equivalence in the UK of two of the metrics often used to indicate fuel poverty: (i) spending over 10% of total expenditure on energy and (ii) spending twice the median share of total expenditure on energy.[10] This broad equivalence also links the 20% expenditure share threshold and spending four times the median share on energy. The lower number of households in fuel poverty defined by the LIHC criterion, compared with the 10% threshold, shows why the redefinition by the UK government halved the reported headline rate of fuel poverty. This illustrates the dramatic impact on the apparent extent of affordability problems the choice of a metric can have, despite little change in the underlying reality of the situation.

**Chart 5: Estimated Percentages of Households above Expenditure Thresholds in Energy: UK 2012**



*Source: Living Costs and Food Survey, 2012*

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[10] Due to the complex relationship between household income and total expenditure one cannot automatically assume the same relationship holds if the metrics were based on income rather than total expenditure.

**Chart 6: Estimated Percentages of Households Exceeding Each Criterion in Energy by Group: UK 2012**
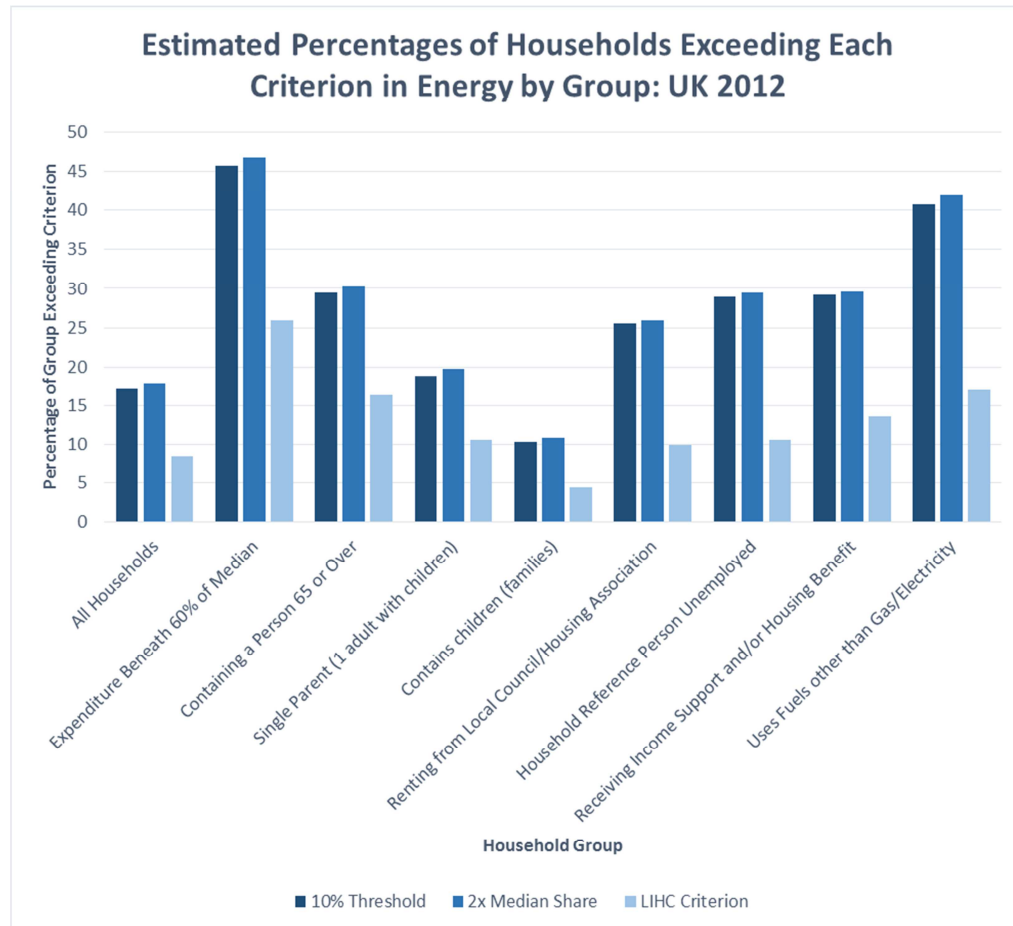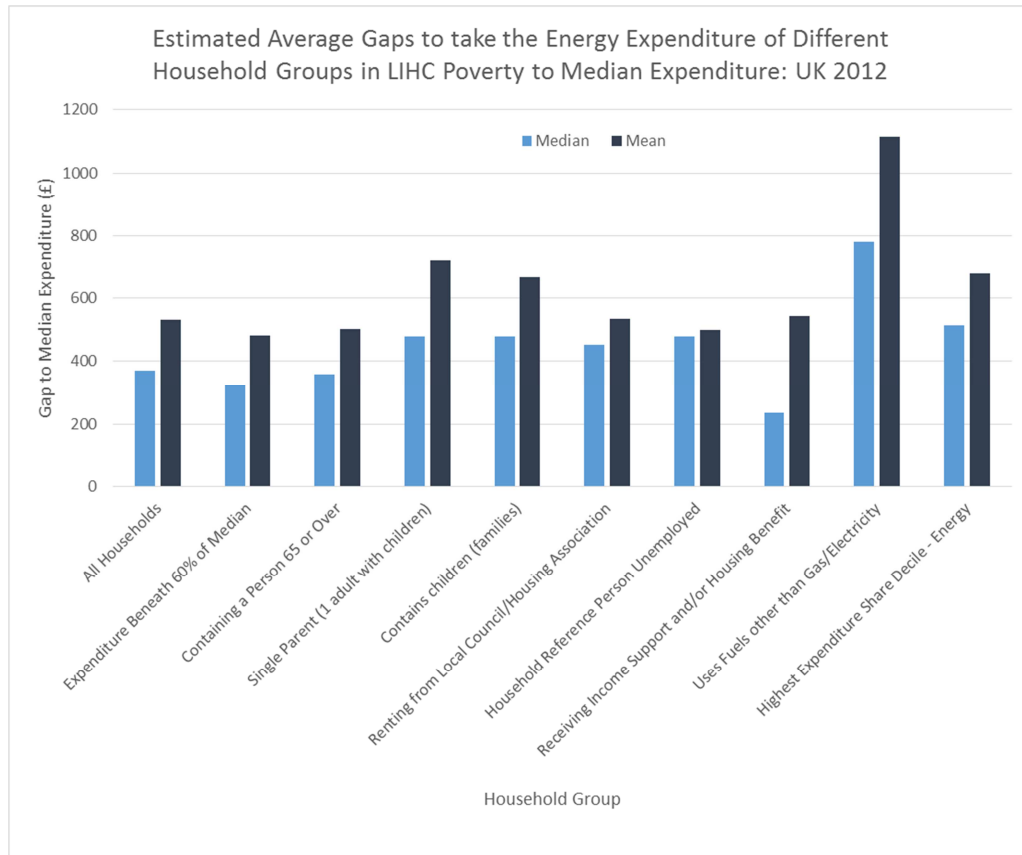


*Source: Living Costs and Food Survey, 2012*

One of the greatest challenges in tackling fuel poverty is to target measures effectively at those households who are in most need of assistance. Chart 6 shows the rates of fuel poverty within different household groups identified from the UK's Living Cost and Food Survey. According to the 10% expenditure share and twice median expenditure share metrics, the groups with the greatest rates of fuel poverty are households with total expenditure beneath 60% of the median and households which use 'alternative' fuels. However, these groups cannot be used as surrogate indicators of fuel poverty, since only a minority (just over 45%) of those with low total expenditure are identified as fuel poor. Only under the LIHC criterion is the rate of fuel poverty higher among 'pensioner' households than those in social housing, households where the breadwinner is

unemployed or households where government benefits are being received[11], though those over retirement age are provided with payments specifically targeted at reducing their energy costs which may influence this result.

**Chart 7: Estimated Average Gaps to take the Energy Expenditure of Different Household Groups in LIHC Poverty to Median Expenditure: UK 2012**



Estimated Average Gaps to take the Energy Expenditure of Different Household Groups in LIHC Poverty to Median Expenditure: UK 2012

*Source:  Living Costs and Food Survey, 2012*

Chart 7 records the average amounts required to take individuals out of fuel poverty according to the LIHC metric i.e. the average amount required to take fuel poor households' energy bills back to the median in the population at large. Households using alternative fuels experience fuel poverty of the greatest depth, while the average gaps experienced by households containing an elderly individual are among the lowest of all the groups.

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[11] Despite this result, policies specifically targeting pensioners could be justified if the 'depth' of their fuel poverty was found to be particularly severe or the consequences of fuel poverty, for example in terms of health outcomes, were more severe than for the other groups mentioned.

# 5. Energy - Simulations

**Chart 8: Percentage of Households with an Expenditure Share on Energy Exceeding 10% following Different Interventions**
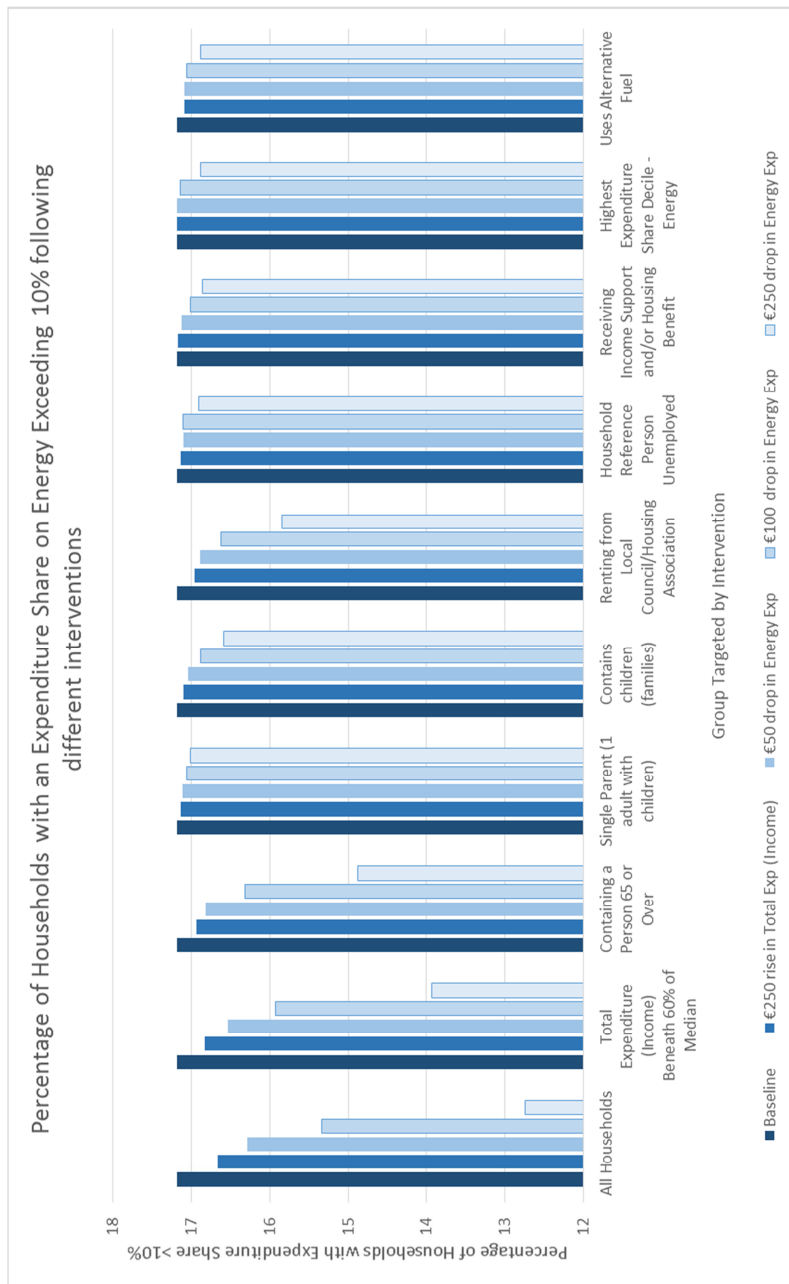


*Source: Living Costs and Food Survey, 2012*

Chart 8 shows the differing effects of targeting each intervention at particular household groups on the estimated proportion of all households in the UK population spending more than 10% of their expenditure on energy, when compared with the baseline of no intervention. The maximum impact of each policy is shown in the first set of bars 'All households', where the relevant intervention is applied to all households in the population. Chart 8 shows that if each household in the UK had their energy expenditure reduced by €250 in 2012 the proportion of households with an energy expenditure share above 10% would be reduced by about 4.5 percentage points. Targeting a €250 reduction in energy expenditure at households with total expenditure beneath 60% of the median or at households containing at least one person aged 65 or over also results in relatively large falls in the proportion of households where energy expenditure exceeds 10% (decreases of just over 3 percentage points and 2 percentage points respectively). This large impact is in part due to 25-30% of all households falling into one of these two groups. Nevertheless targeting households with someone aged 65 or over has a greater impact on reducing the rate of fuel poverty according to the 10% threshold than targeting all households with children (a similarly large group), since a higher proportion of the pensioner group were in fuel poverty and close to the fuel poverty boundary. This illustrates the importance of both the incidence and depth of fuel poverty in determining the effect of policies on affordability metrics.

Chart 8 also shows that a policy which reduces expenditure has a far greater impact on the 10% threshold metric than increasing a household's total expenditure/income. Increasing all households' total expenditure (income) by €250 reduces the proportion of households with energy expenditure above 10% by less than 0.5 percentage points. The relative ineffectiveness of income adjustments is a simple outcome of calculating expenditure shares, where the denominator (total expenditure) is much larger than the numerator (expenditure on energy).[12] However this mathematical relationship and the limited impact on a fuel poverty metric does not imply that putting resources into reducing households' fuel bills is a better policy than raising households' incomes. Generally raising a household's income will raise their welfare by the same, or greater amount, than giving an equivalent monetary amount to subsidise consumption of one particular good: to maximise welfare it is best that an individual consumer can select, according to their own preferences, the relative quantities of all the different goods available to them rather than being restricted to increased consumption of one individual commodity.

Perhaps surprisingly, targeting the interventions at the 10% of households with the highest energy expenditure shares[13] has only a limited impact on the proportion of households spending more than 10% of their expenditure on energy. Even reducing the energy expenditure of those households devoting the greatest proportion of expenditure to energy by €250 reduces the fuel

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[12] Since this piece of logic is universal across the different sectors, the intervention of a €250 increase in total expenditure is not replicated for the simulations in water, telecoms and transport.
[13] This is the group labelled 'Highest Expenditure Share Decile'.

poverty metric in Chart 8 by less than 0.5 percentage points. This highlights the key problem of ignoring the depth of fuel poverty when using a fixed expenditure share threshold to measure fuel poverty. Many households among those with the highest energy expenditure share are such a long way from the fuel poverty threshold that reducing their energy expenditure by €250 does not move them across the threshold. Reporting any form of metrics involving thresholds may encourage policymakers to target households close to the threshold rather than those in the greatest need, if pressure exists to report large movements in the reported metrics.

In the comparisons discussed above there is no control for the differing sizes of the groups being targeted. Although a policy targeting a large group is likely to have a bigger impact on the proportion of households spending more than 10% on energy, the bigger the group the more expensive and complex it will be to implement the policy intervention. Chart 9 controls for this issue by showing an 'Effectiveness Metric' which divides the percentage point change in the proportion of households reporting spending 10% or more on energy that results from a particular intervention 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] For this 'Effectiveness Metric' the crucial figure is the relative value of the metric across different policy interventions; a relatively higher value indicates that a particular policy intervention is more effective in changing the metric. This measure may also be a useful comparator across Member States and sectors.

Chart 9 shows that the most effective way to reduce the percentage of households reporting energy expenditure exceeding 10% of total expenditure is to use policies which reduce the energy expenditure of those households with total expenditure below 60% of the median for the whole population. Other relatively effective policies are reducing energy expenditure by €50 in households where the breadwinner is unemployed and reducing energy expenditure by €100 in households receiving income support or housing benefit. The differing impacts on the 10% fuel poverty metric result from variation in the distribution of energy expenditure across households in each of the mentioned groups, and again reflects the depth of fuel poverty. That a €50 decrease in energy expenditure is particularly effective for households with unemployed breadwinners reflects the fact that many of the households in this group are €0-50 away from the 10% threshold. In contrast, the high effectiveness of a €100 decrease in expenditure for households receiving housing benefit or income support suggests that in this group there are many households which are €50-100 away from the 10% threshold. Chart 9 also demonstrates the ineffectiveness of raising income

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[14] For example, the percentage point change shown in Chart 8 when a policy is targeted at households containing someone aged 65 or over would be divided by 29.19 as this is the percentage of all households falling into this group. To make all of the interventions 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.

by €250 in reducing the proportion of households which spend more than 10% of their expenditure on energy.

**Chart 9: Effectiveness Metric following Different Interventions in Energy**
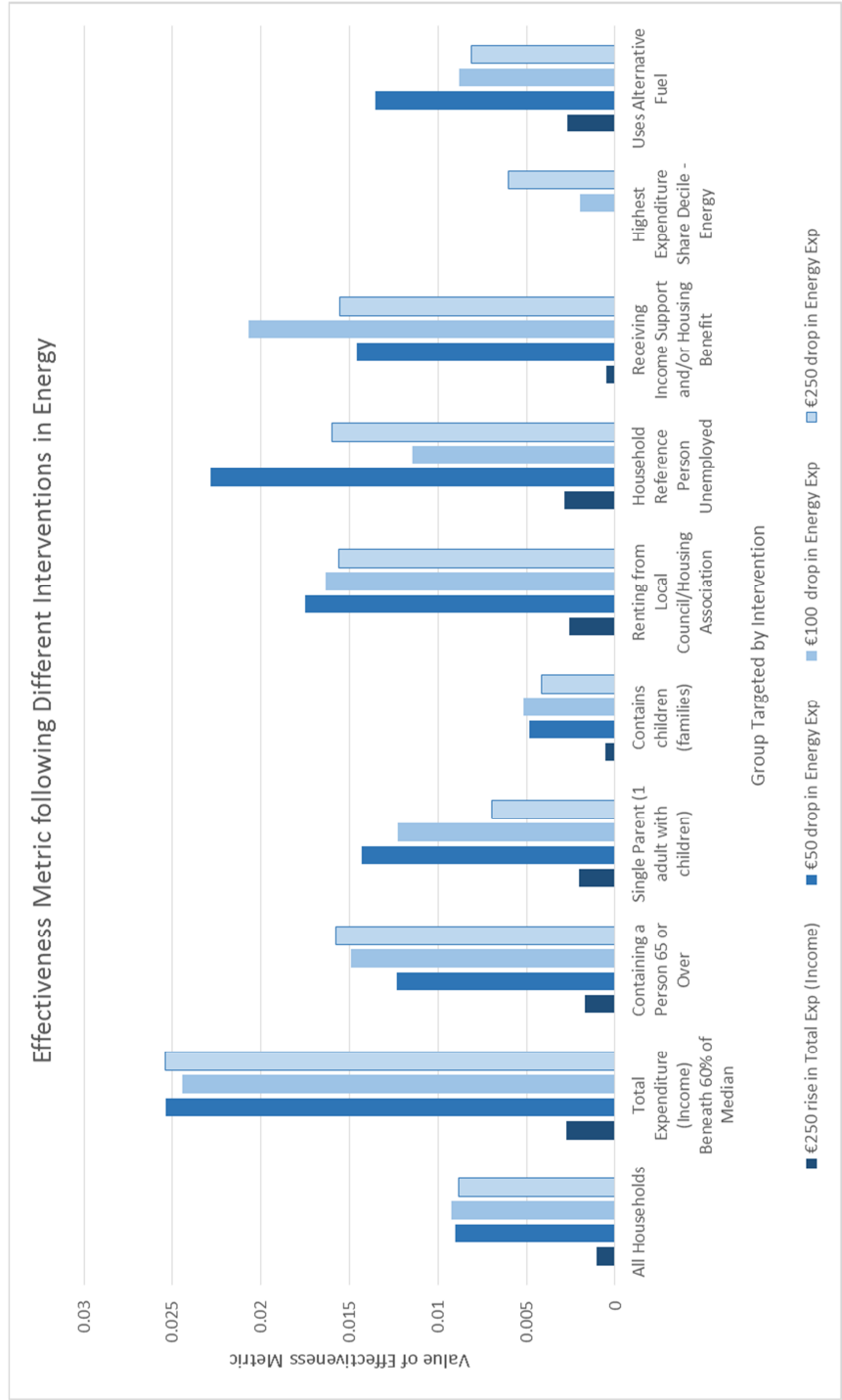


*Source: Living Costs and Food Survey, 2012*

Chart 10 focuses on the second fuel poverty metric: the percentage of households who devote a share of expenditure to energy which is more than twice the median expenditure share. Whereas Charts 8 and 9 simulate how policy interventions affect a fixed threshold, Chart 10 involves a 'relative' metric. As fuel poverty is measured relative to the median, if a particular policy intervention reduces the median expenditure share in the population as a whole it becomes harder to reduce the rate of fuel poverty recorded by this particular metric. In particular, a sufficient condition for a policy intervention to reduce fuel poverty recorded by the twice median metric is for the policy intervention to move households which currently have an expenditure share exceeding twice the median to the region lying between the median expenditure share and twice the median expenditure share.

If a policy intervention reduces the median it actually 'tightens' the affordability metric's boundary, which can *increase* the number of households classed as fuel poor. To illustrate this point, suppose that a policy intervention reduces the energy expenditure of all households so that the median energy expenditure share falls by 0.5 percentage points. A 0.5 percentage point drop in the median expenditure share will automatically lead to twice the median expenditure share falling by a whole percentage point. As a result the fuel poverty metric will have become tighter and more individuals will be classified as fuel poor, although in reality all individuals will have experienced a welfare gain. It is this logic which explains why in Chart 10 reducing energy expenditure in all households by €250 results in the percentage of households spending more than twice the median share on energy rising almost 1.5 percentage points. A similar effect is seen if all households with children are targeted, indicating that in this group there are quite a few households who spend just above the median expenditure share on energy.

In chart 10 the only policy intervention which seems to have any real effect in reducing the rate of fuel poverty recorded by the twice median metric is to reduce the energy expenditure of individuals with total expenditure (income) beneath 60% of the median. Reducing energy expenditure by €250 for all households in this group results in the proportion of households in the whole population spending more than twice the median falling by 1.25 percentage points. Targeting interventions at any of the other household groups shown in chart 10 has little or no impact (the changes are so small they may not be statistically significant).

Chart 11 reports the results of the simulated policy interventions when fuel poverty is measured by the LIHC criterion. The LIHC metric is composed of two requirements:

1. That a household's energy bill is above the median, AND
2. After removing energy costs a household's remaining income is below 60% of the median income of all households[15]

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[15] As our data relates to expenditure 2. is modelled as 60% of total expenditure.

By definition, and regardless of any policy intervention, Requirement 1 must always be satisfied by 50% of all households. The policies which will have most impact on the LIHC fuel poverty metric will target groups with income just above 60% of median income, and with energy bills that are large enough to lift them slightly above the median and take the household to just below the income threshold in Requirement 2.
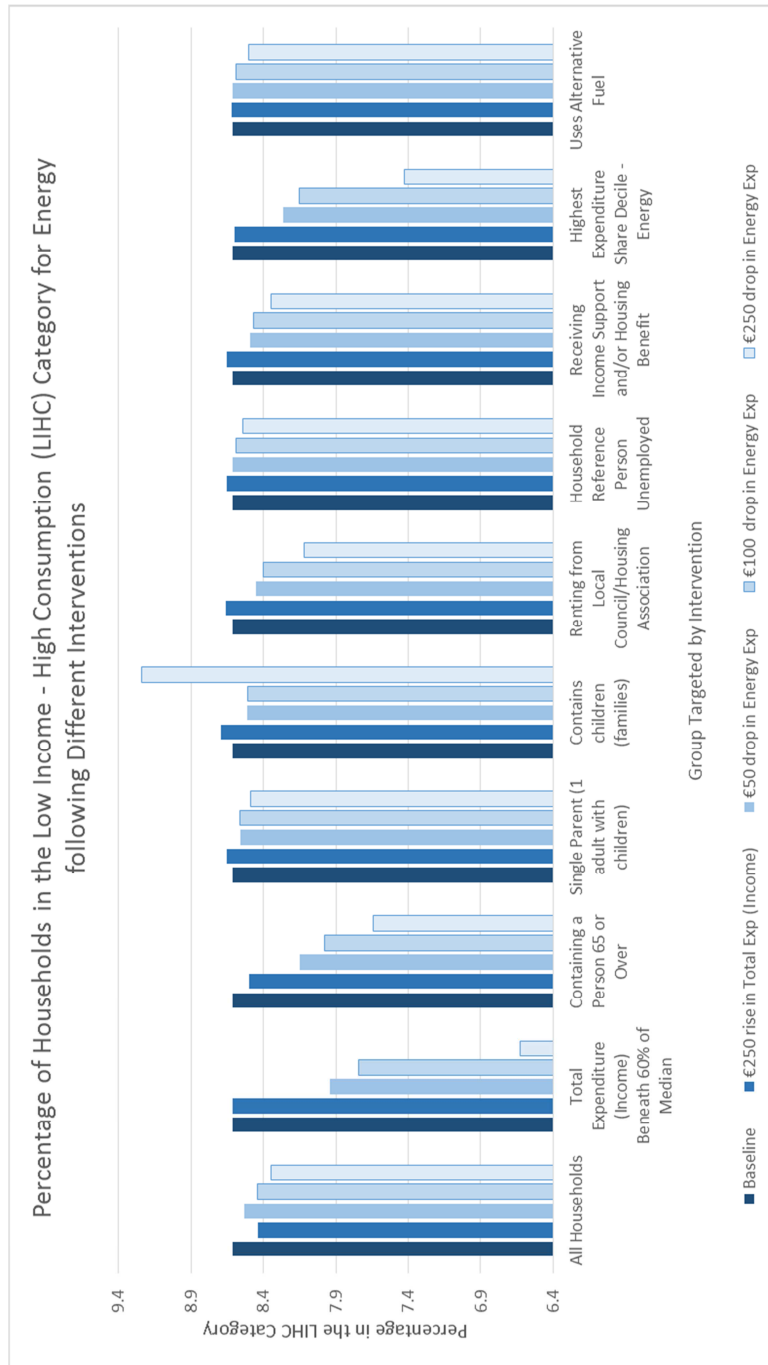
Given the definition of the LIHC criterion it is unsurprising that the policies which result in the largest falls in the LIHC fuel poverty metric are to reduce the energy expenditure of households with total expenditure below 60% of median and those households in the highest 10% of energy expenditure shares.

**Chart 10: Percentage of Households with an Expenditure Share on Energy Exceeding Twice the Median following Different Interventions**
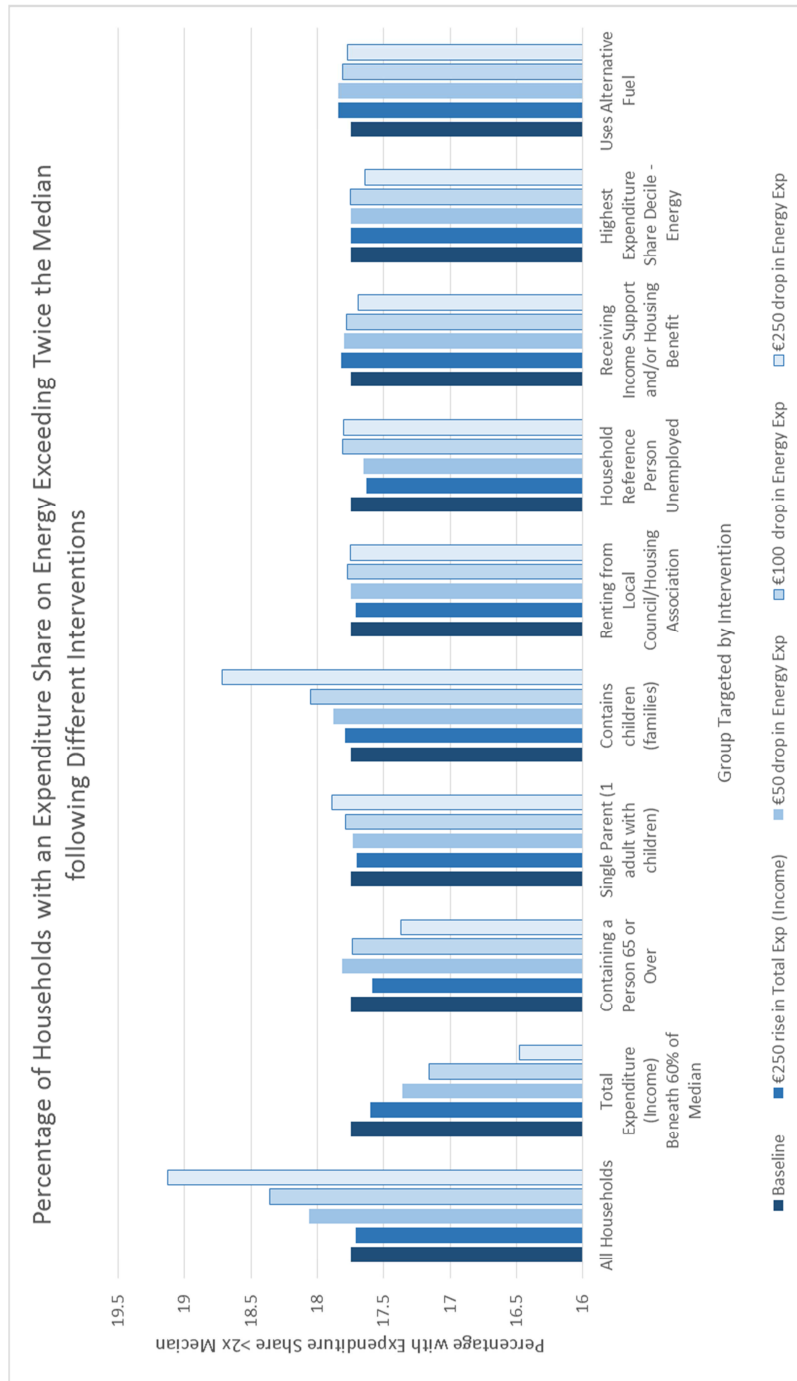


*Source: Living Costs and Food Survey, 2012*

**Chart 11: Percentage of Households in the Low Income – High Consumption (LIHC) Category for Energy following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

The definition of the LIHC criterion used in the UK includes a second metric to consider the depth of fuel poverty which households encounter. The depth or severity of the fuel poverty a household faces is defined by the reduction in energy expenditure required for it to fall to the median level of energy expenditure and hence take the household out of LIHC fuel poverty. Chart 12 reports the median expenditure gaps following different policy interventions and Chart 13 reports the mean expenditure gaps.

Charts 12 and 13 show that reducing the percentage of households in LIHC fuel poverty does not necessarily reduce the average LIHC poverty gap. For example, while reducing energy expenditure by €100 for households with total expenditure less than 60% of the median causes the percentage of households in LIHC fuel poverty to fall, the median poverty gap increases. 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 will change. A priori it is virtually impossible to predict whether the households which remain beneath the LIHC poverty threshold will have a higher or lower poverty gap on average.

Charts 12 and 13 also emphasise the large difference in the mean and median gaps. After all policy interventions the mean poverty gap is over £100 higher than the median gap, suggesting a long-tail of individual observations where energy expenditure is very high relative to the median.

**Chart 12: Median Gap (£) for Households to exit the Low Income- High Consumption (LIHC) Category for Energy following Different Interventions**
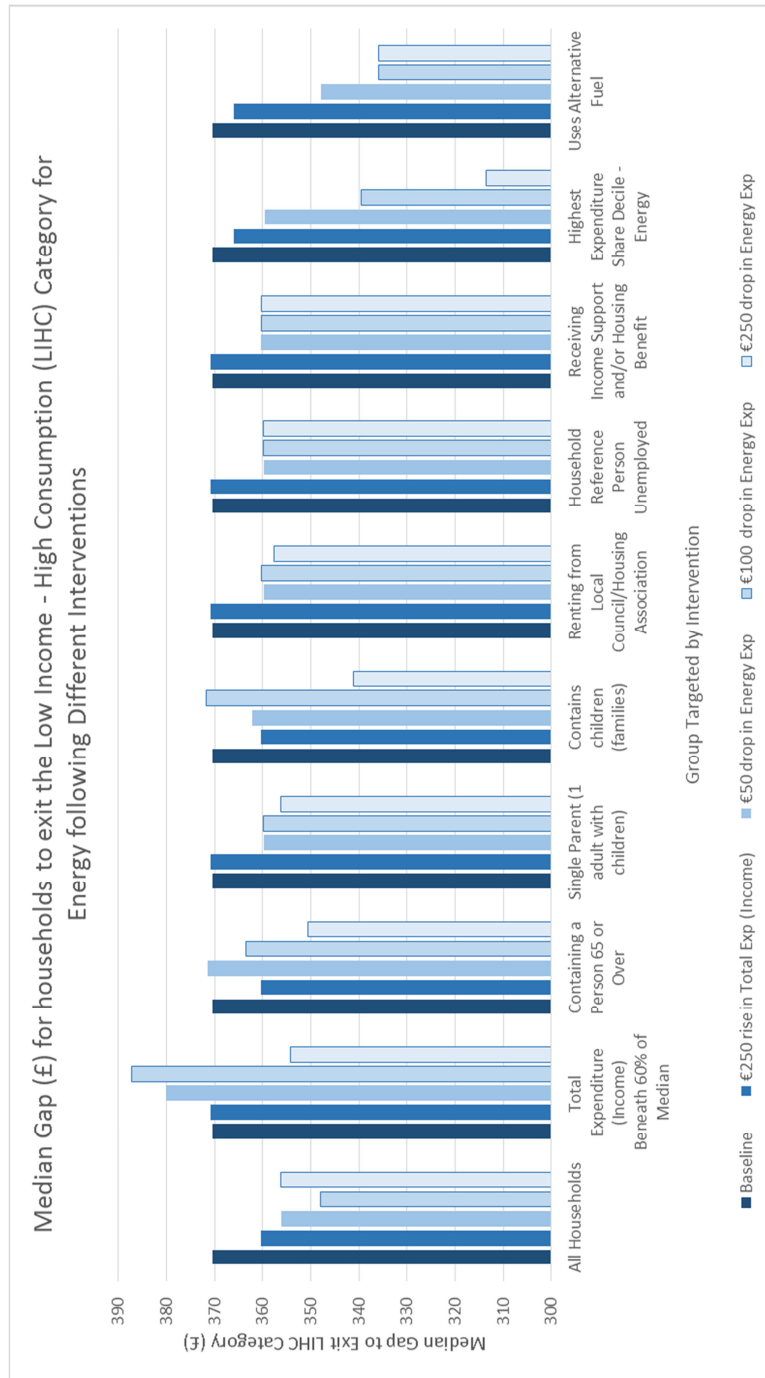


*Source: Living Costs and Food Survey, 2012*

**Chart 13: Mean Gap (£) for Households to exit the Low Income- High Consumption (LIHC) Category for Energy following Different Interventions**
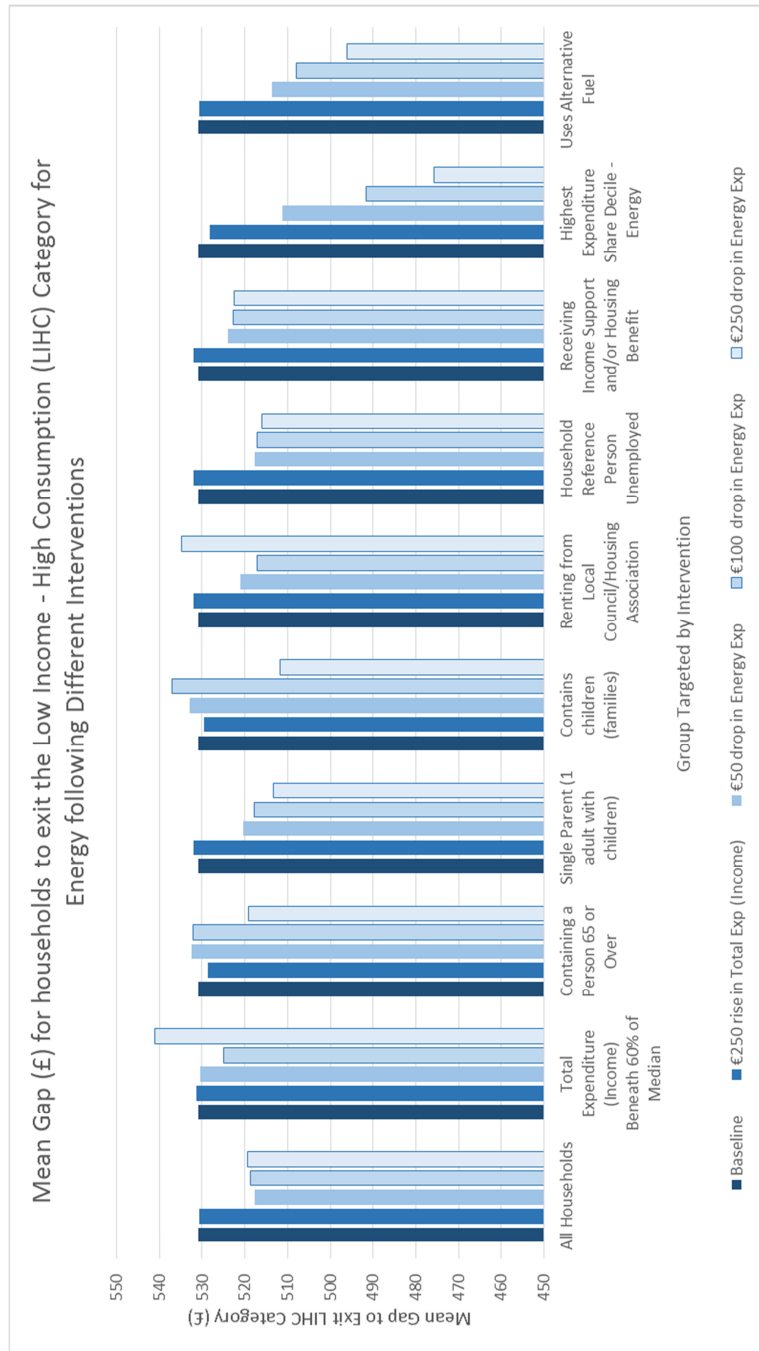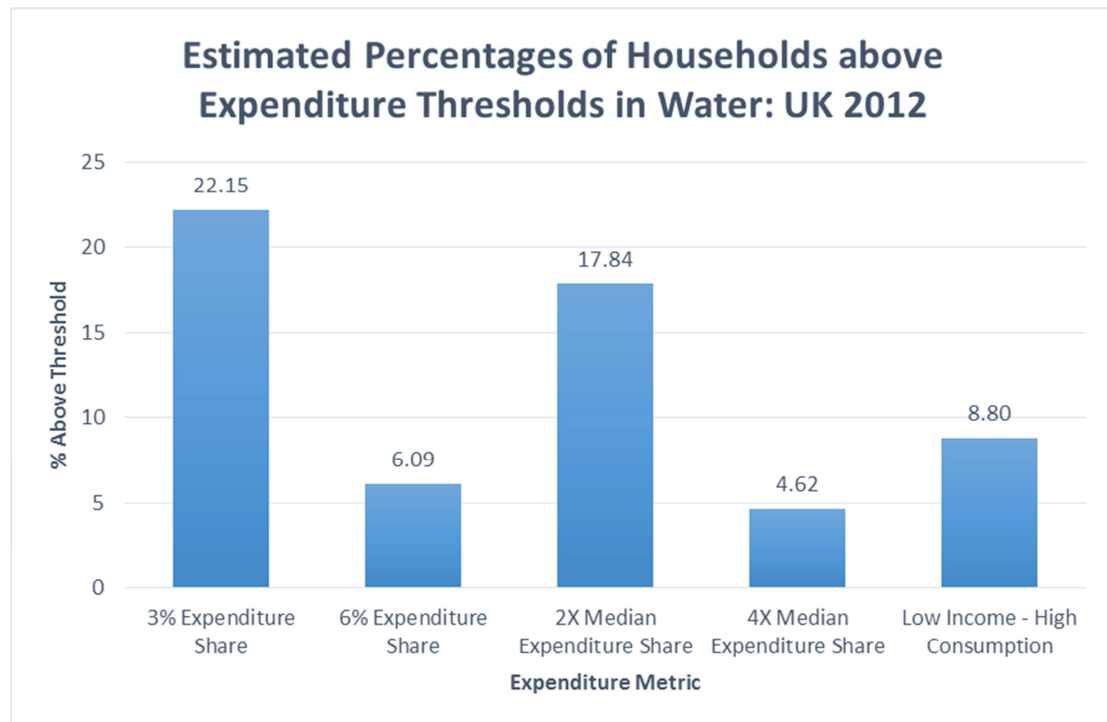


*Source: Living Costs and Food Survey, 2012*

# 6. Water - Baseline

In our analysis of the UK's water sector, water charges have been combined with charges for sewerage. This water expenditure category also includes expenditure on water and sewerage services collected via Council Tax.

As the average expenditure share on water is lower than for energy, the fixed expenditure share thresholds used to indicate affordability difficulties in the water sector are also lower. Rather than using 10% and 20% expenditure thresholds, the fixed expenditure share thresholds we use in the water sector are 3% and 6%. The methods for calculating the twice median expenditure share metric and LIHC criterion are identical to those used for energy expenditure.

**Chart 14: Estimated Percentages of Households above Expenditure Thresholds in Water: UK 2012**



*Source: Living Costs and Food Survey, 2012*

As with energy expenditure, Chart 15 shows that the group with the greatest rate of water affordability issues are those households with total expenditure beneath 60% of the median. This highlights the connection between utility affordability issues and the prevalence of general poverty within a society. Targeting policies to tackle water affordability at those on low incomes seems reasonably sensible since almost 65% of households in this group are spending more than 3% of

their expenditure on water and sewerage bills. The other point to make about Chart 15 is that compared to energy affordability, water affordability issues in the UK in 2012 had more to do with general economic difficulties than the age of household members. In contrast to Chart 6, Chart 15 shows that a greater proportion of households in social housing, where the breadwinner was unemployed or where the household was receiving government benefits, faced water affordability pressures than households containing at least one person aged 65 or over.

**Chart 15: Estimated Percentages of Households Exceeding Each Criterion in Water by Group: UK 2012**
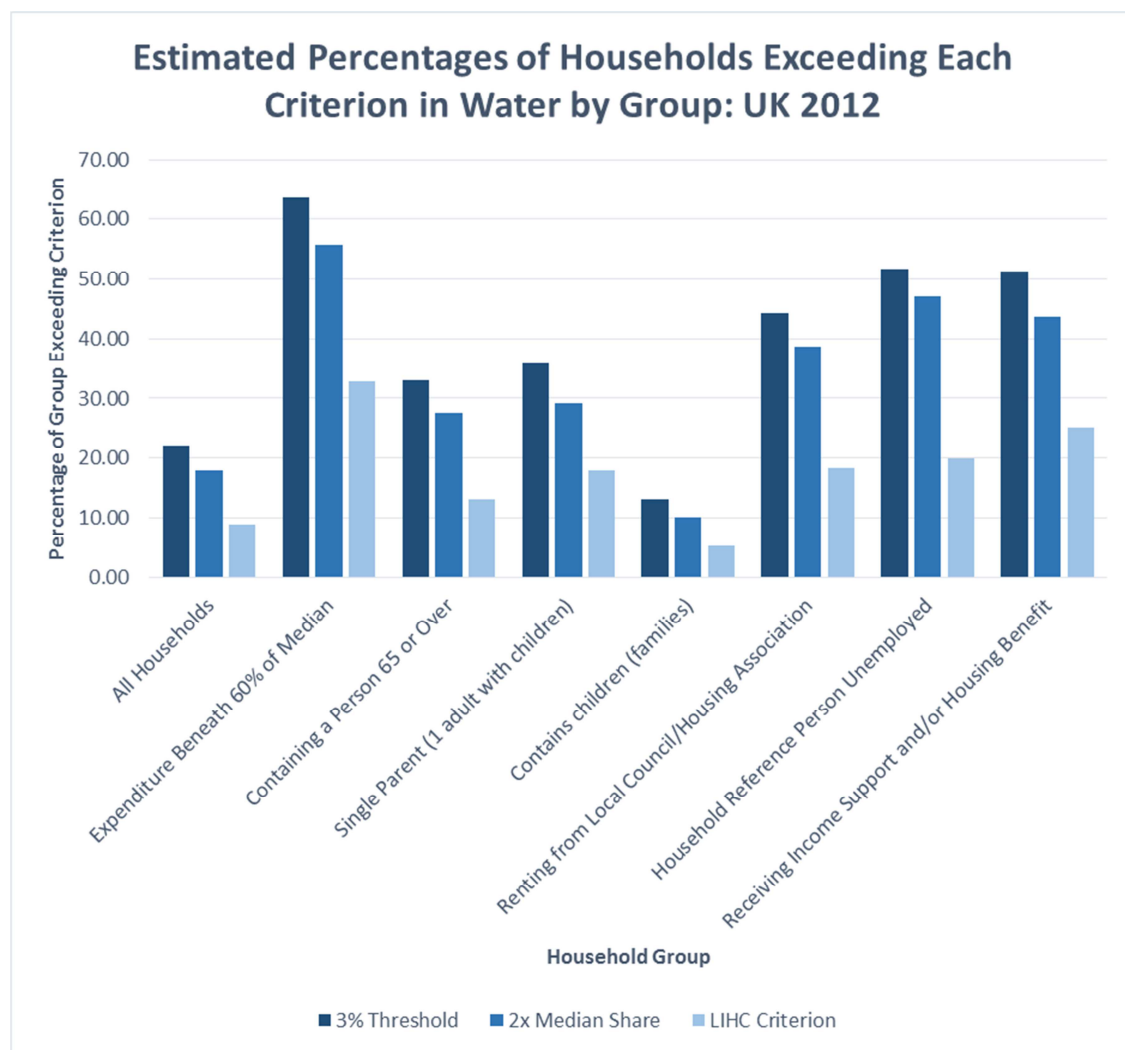


*Source: Living Costs and Food Survey, 2012*

Despite the prevalence of water affordability issues being greater among households in social housing and those receiving government benefits, the depth of affordability difficulties indicated by the mean and median LIHC gaps in Chart 16 are higher among households with at least one person

aged 65 or over. Considering both the mean and median gaps, single parent households appear to be the group experiencing the deepest affordability challenges (conditional on being in LIHC water poverty). Lastly, the LIHC gap for households where the breadwinner is unemployed is notable in that the mean gap is twice the size of the median gap, although the figures for the unemployed involve only a small number of observations.

**Chart 16: Estimated Average Gaps to take the Water Expenditure of Households in LIHC Poverty to Median Expenditure**
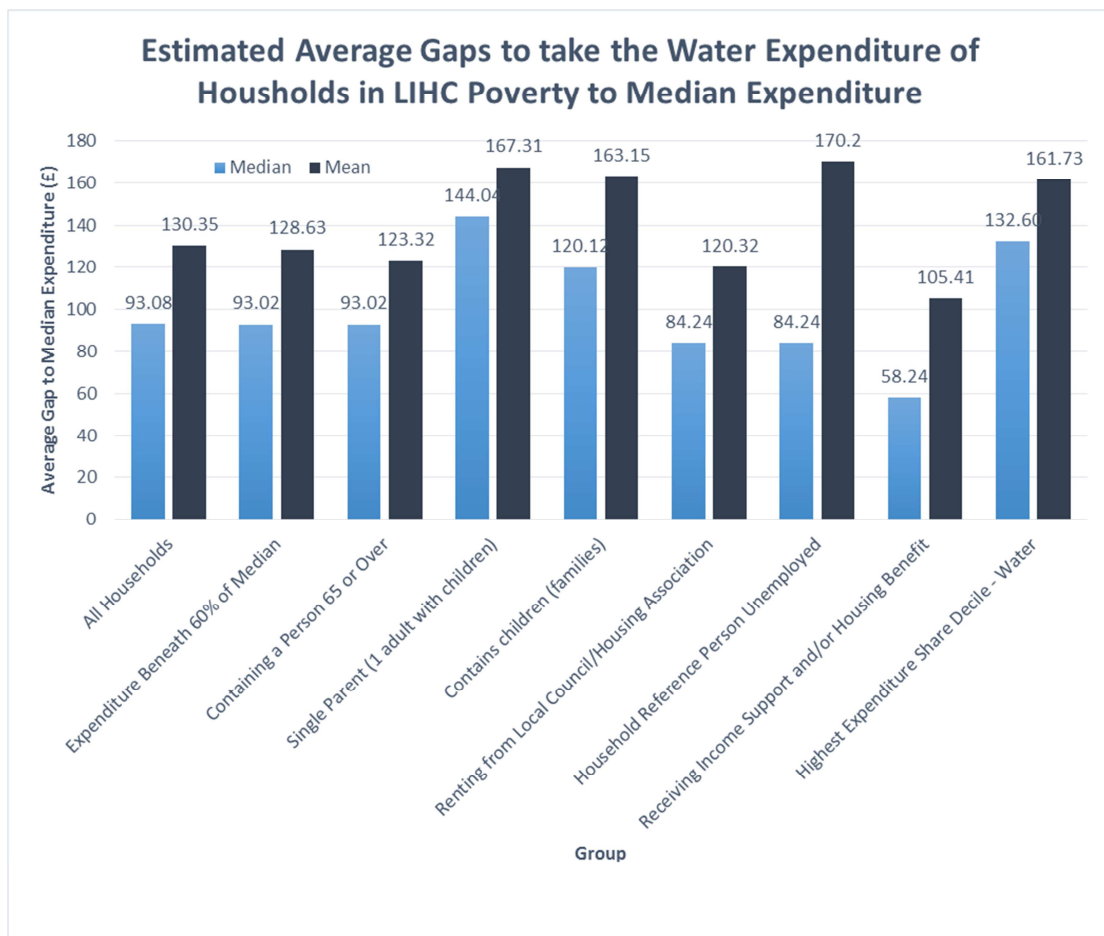


*Source: Living Costs and Food Survey, 2012*

# 7. Water – Simulations

Turning to the policy intervention simulations, Chart 17 provides predictable results: the larger the group targeted the larger the drop in the percentage of households spending more than 3% of their expenditure on water and sewerage. Also, the percentage point drops in households classified as being in water affordability difficulties in Chart 17 are greater than the drops for households facing energy affordability difficulties in Chart 8. For example, reducing water and sewerage expenditure by €250 for all households reduces the estimated percentage of households spending more than 3% of their total expenditure on water by roughly 15 percentage points. The greater impact on the water affordability metric compared to the equivalent energy affordability metric simply reflects the fact that on average households spend substantially less on water than they do on energy. Hence, an identical absolute reduction in expenditure has a greater impact on affordability metrics in water than it does in energy.

The last thing to note in Chart 17 is that when water expenditure is reduced by €50 or €100 for those in the highest expenditure share decile the percentage of households spending more than 3% of their total expenditure on water remains virtually unchanged at around 22%. This indicates that most households with a high expenditure share devoted to water have an expenditure share considerably above the 3% threshold. When the larger expenditure reduction of €250 is applied to this group of households, the percentage of households with a 3% water expenditure share or above drops by a fairly large 3.5 percentage points.

**Chart 17: Percentage of Households with an Expenditure Share on Water Exceeding 3% following Different Interventions**
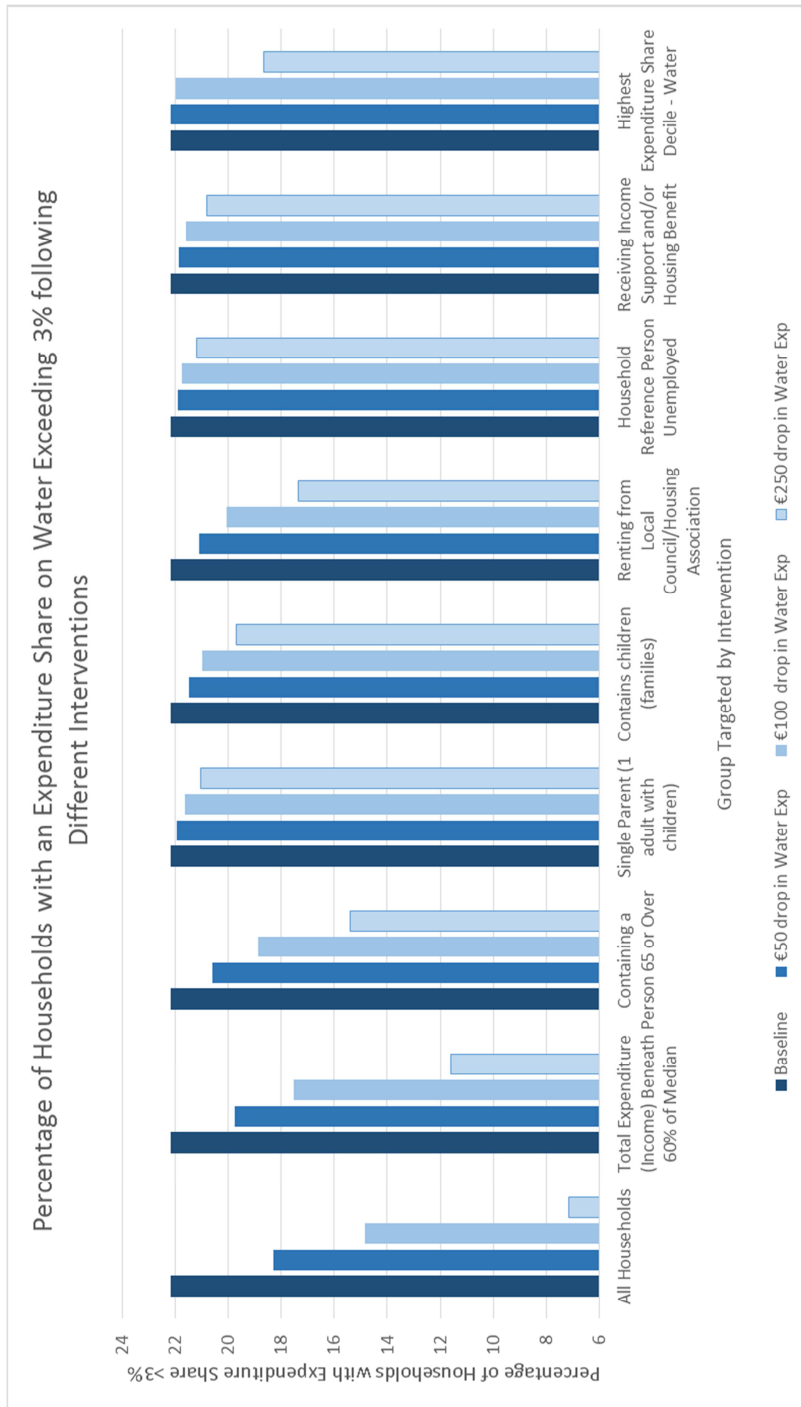


*Source: Living Costs and Food Survey, 2012*

**Chart 18: Effectiveness Metric for Different Interventions to Tackle Water Affordability**
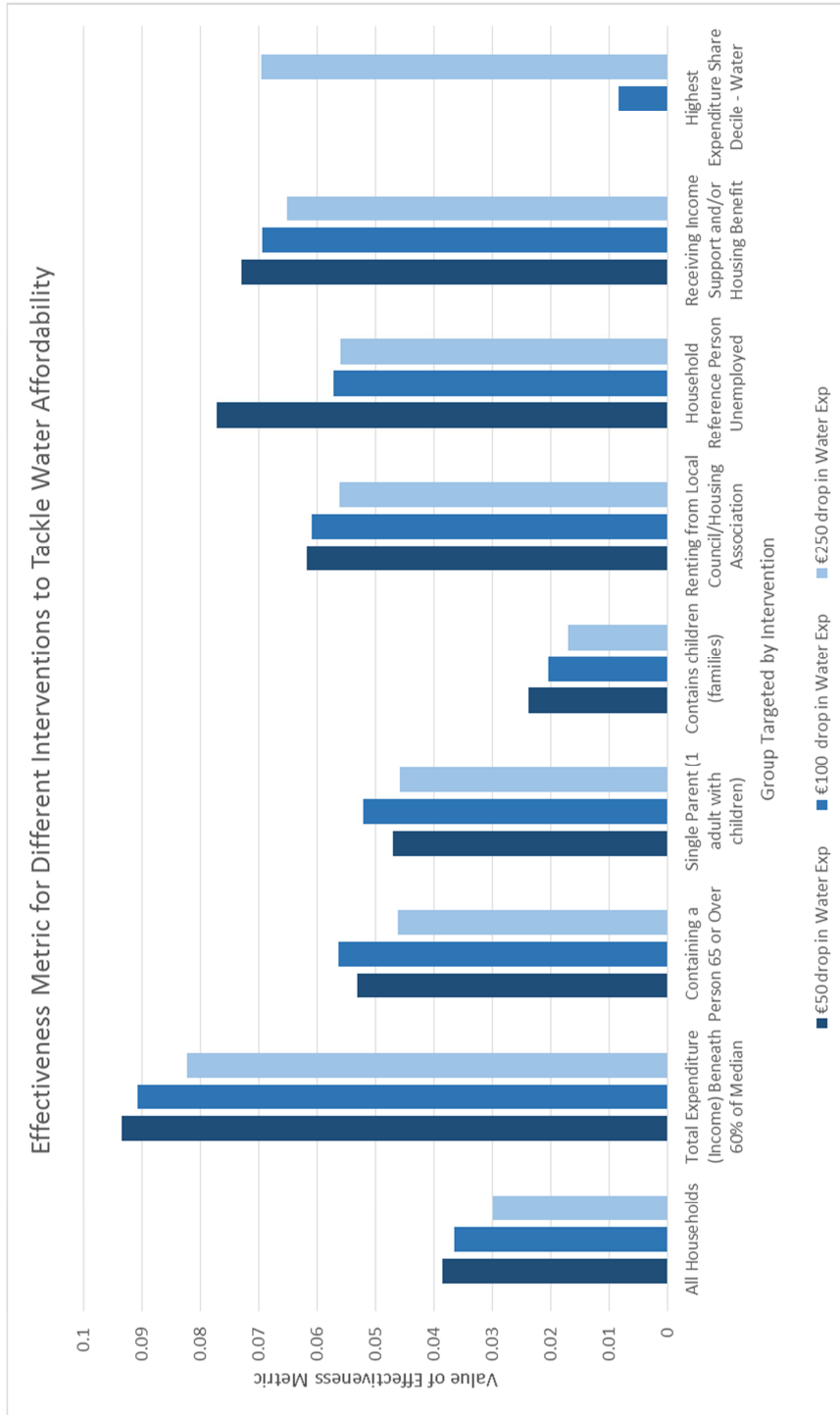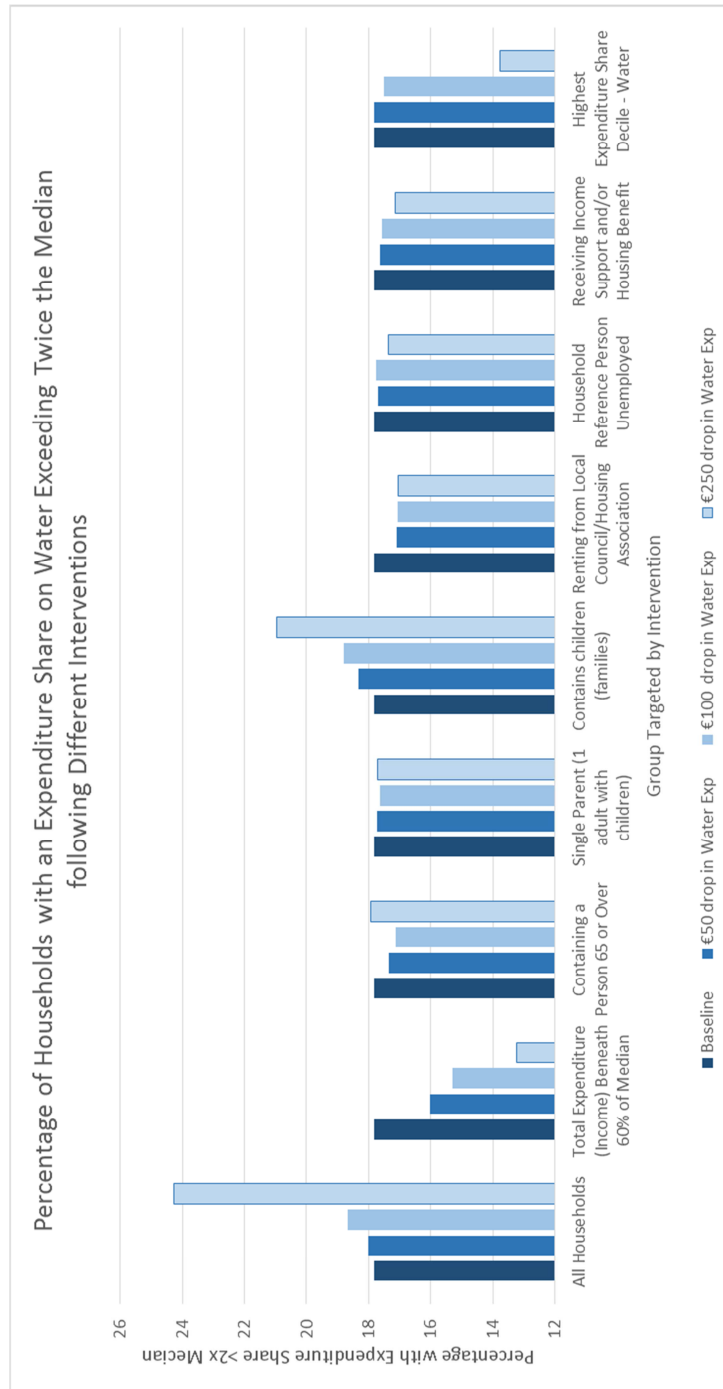


*Source: Living Costs and Food Survey, 2012*

Looking at the effectiveness metric in Chart 18, the significance of many households in the highest water expenditure share decile being a long way from the 3% threshold is clear. While expenditure decreases of €50 and €100 targeted at the highest expenditure share decile are the two most ineffective policy interventions, an expenditure decrease of €250 targeted at the same group is one of the more effective policy interventions.

The most effective group to target for policy interventions to improve water affordability is those households with total expenditure beneath 60% of the median. The question with targeting this policy group is whether policymakers have the information available to identify these low income households in the real world.

One difference for water when compared to energy is that targeting households containing an individual aged 65 or over and targeting single parent households have a broadly similar effectiveness. For energy (Chart 9) targeting expenditure reductions of €100 and €250 at single parents are less effective than targeting the same expenditure reductions at households where one or more individuals are aged 65 or over. More generally, Chart 18 shows that to lower the water affordability metric, it is always more effective to target interventions at households in a disadvantaged economic position (living in social housing, where the breadwinner is unemployed or the household is receiving benefits) than at households with particular demographic characteristics (single parents or people aged over 65).

Moving on to consider the twice median expenditure share metric, Chart 19 immediately highlights how this metric can give a very misleading picture after particular policy interventions. Reducing water expenditure by €250 for all households or for all households with children leads to large increases in the percentages of households with an expenditure share on water exceeding twice the median. Indeed, when an expenditure reduction of €250 is targeted at all households, despite this making all households better off, the percentage of households with a water expenditure share exceeding twice the median rises by 6 percentage points. The only interventions that lead to a reasonably marked reduction in the twice median metric are targeting households with total expenditure beneath 60% of the median and targeting an expenditure reduction of €250 at households with water expenditure shares in the top 10%.

**Chart 19: Percentage of Households with an Expenditure Share on Water Exceeding Twice the Median following Different Interventions**
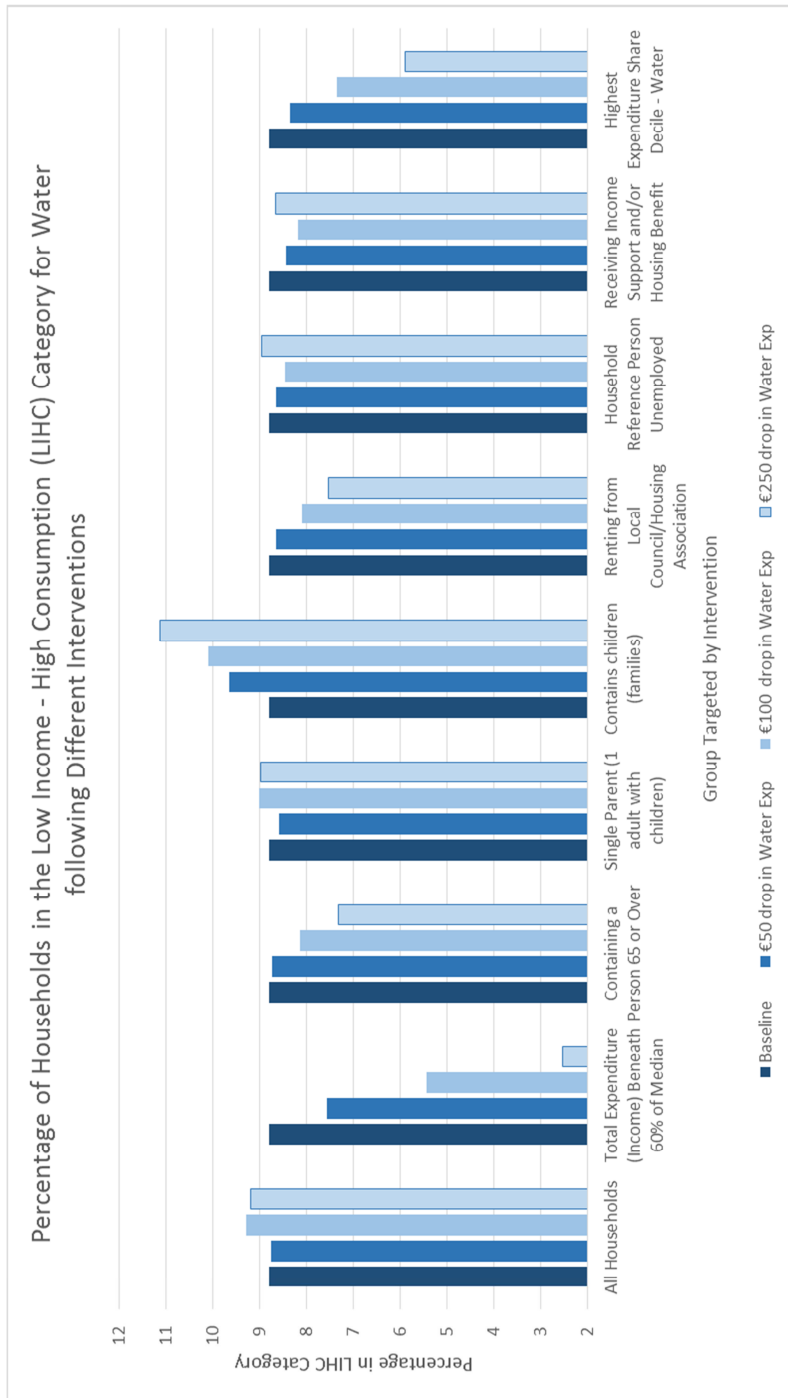


*Source: Living Costs and Food Survey, 2012*

Looking at the LIHC metric in Chart 20 again, targeting expenditure reductions at all households or all households with children leads to the percentage of households being recorded as having water affordability difficulties increasing. Since affordability difficulties identified by the LIHC metric require total expenditure after deducting energy expenditure to be below 60% of median total expenditure, it is unsurprising that the policy which has the largest impact on this metric involves targeting individuals with total expenditure beneath 60% of the median; households in this group are guaranteed to be identified as having affordability difficulties before the policy intervention if their water expenditure is above the median. Reducing the water expenditure of this group by €250 leads to a drop in the percentage of households identified as having water affordability difficulties by just over 6 percentage points. Targeting those households with water expenditure shares in the top 10% is also relatively effective. Reducing the water expenditure of households in this group reduces the percentage of households indicated as having affordability difficulties by almost 3 percentage points.

Turning to the accompanying median and mean LIHC gaps (Charts 21 and 22) the first thing which is apparent is that the median gaps show considerable variation across the size of expenditure reduction-target group combinations. In general, the mean LIHC gaps show less variability across the different policy interventions. The policy intervention with the largest positive impact on the mean LIHC gap is to reduce the water expenditure of households with an expenditure share in the top 10% of households by €250. This intervention results in the mean expenditure gap falling by around £40.

**Chart 20: Percentage of Households in the Low Income – High Consumption (LIHC) Category for Water following Different Interventions**
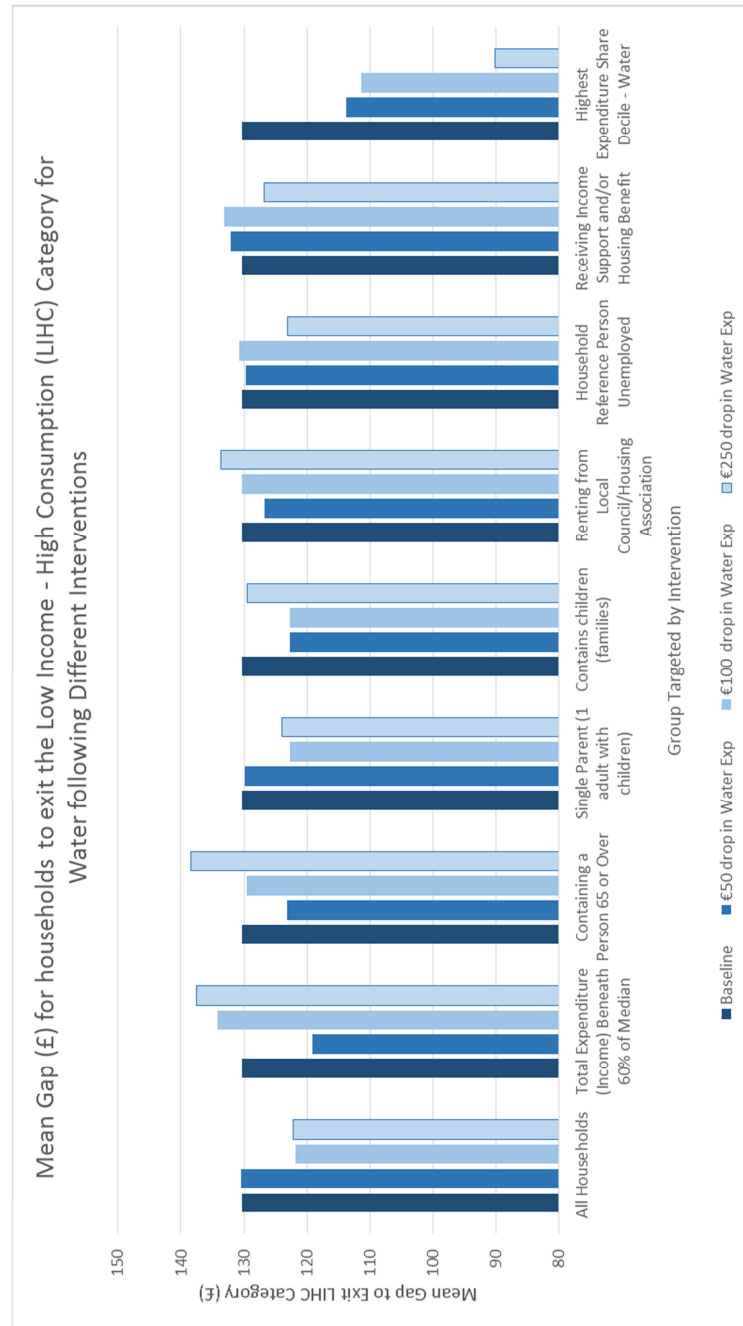
*Source: Living Costs and Food Survey, 2012*

**Chart 21: Median Gap (£) for Households to exit the Low Income – High Consumption (LIHC) Category for Water following Different Interventions**
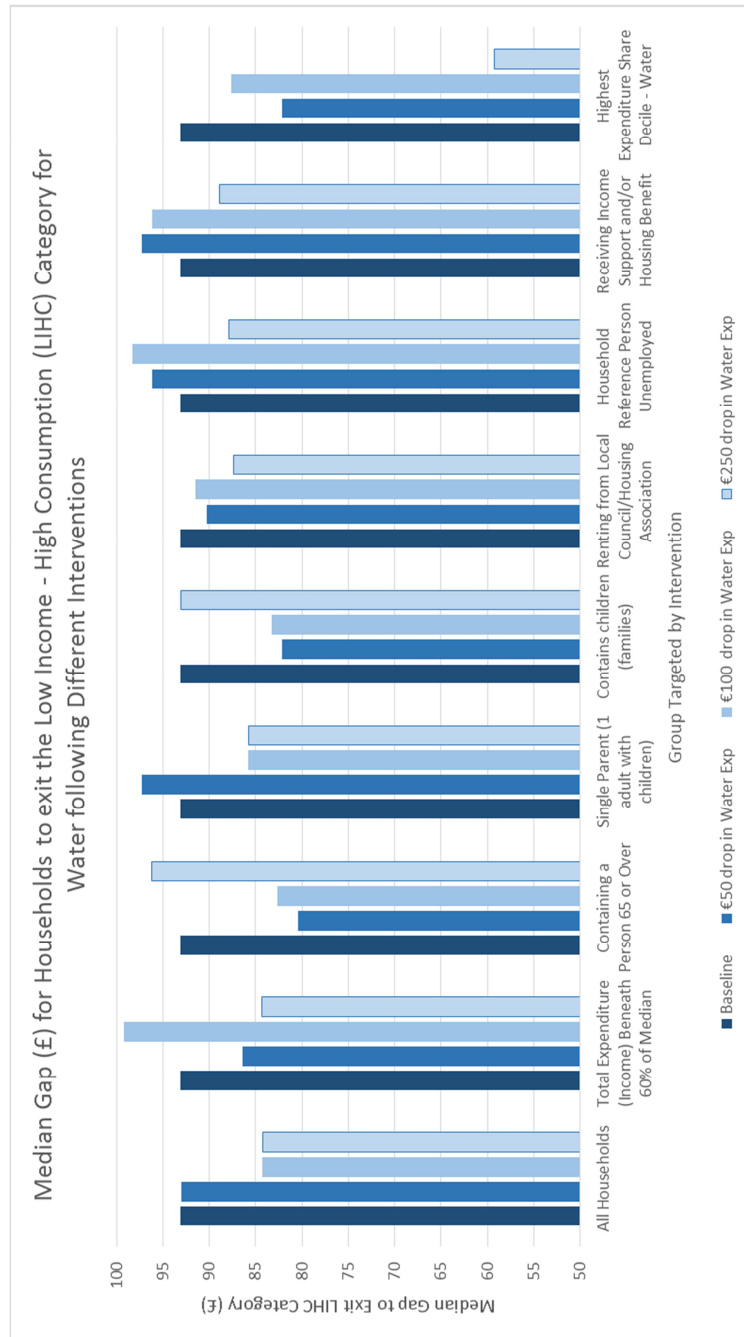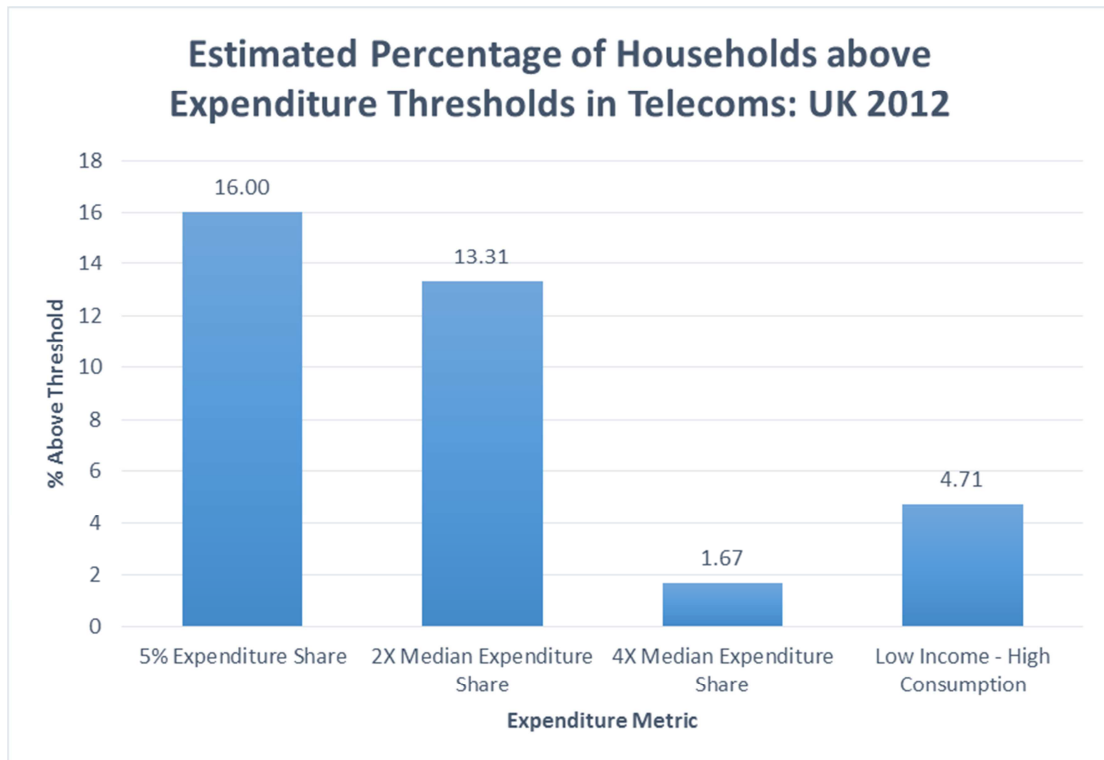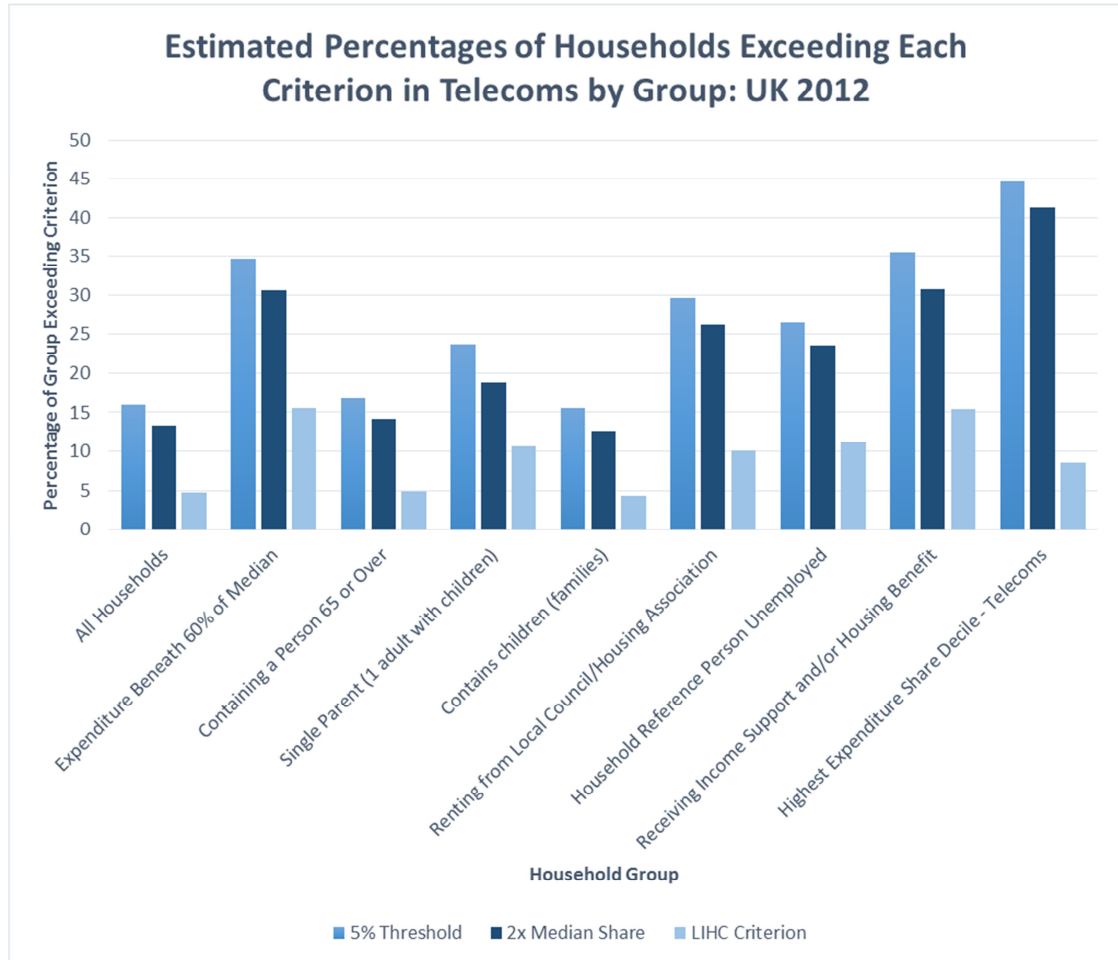


*Source: Living Costs and Food Survey, 2012*

**Chart 22: Mean Gap (£) for Households to exit the Low Income – High Consumption (LIHC) Category for Water following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

# 8. Telecoms - Baseline

Chart 23 shows that the distribution of telecoms expenditure is somewhat less dispersed than the distributions for either water or energy. 13.3% of households spend more than twice the median and 1.7% of households spend more than four times the median on telecoms; the equivalent figures for energy are 17.8% and 3.6% respectively, while in water they are 17.8% and 4.6% respectively.

**Chart 23: Estimated Percentage of Households above Expenditure Thresholds in Telecoms: UK 2012**



*Source:  Living Costs and Food Survey, 2012*

**Chart 24: Estimated Percentages of Households Exceeding Each Criterion in Telecoms by Group: UK 2012**



*Source:  Living Costs and Food Survey, 2012*

The interesting feature of Charts 24 and 25 is the position of households with children when assessed using the LIHC metric. Chart 24 shows that households with children have the lowest rate of affordability difficulties according to the LIHC criterion, however, Chart 25 shows that the mean and median LIHC gaps are considerably higher for households containing children than for any other household group. This suggests that although in general households with children have sufficiently high incomes not to be classified as being in affordability difficulties according to the LIHC criterion, the presence of children in a household is associated with high consumption of telecoms. As a result, when a household with children does have a low income, the household's affordability difficulties will be particularly deep compared to other households.

**Chart 25: Estimated Average Gaps to take the Telecoms Expenditure of Households in LIHC Poverty to Median Expenditure: UK 2012**
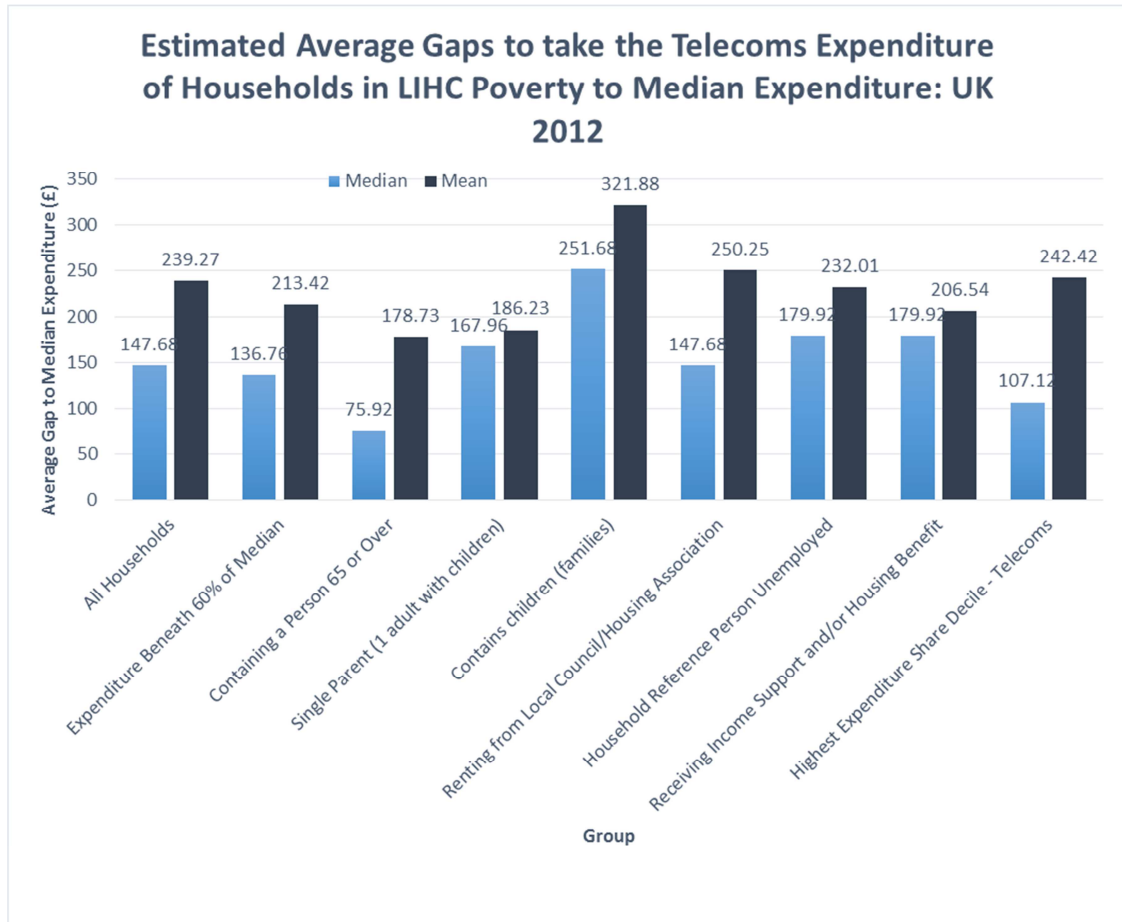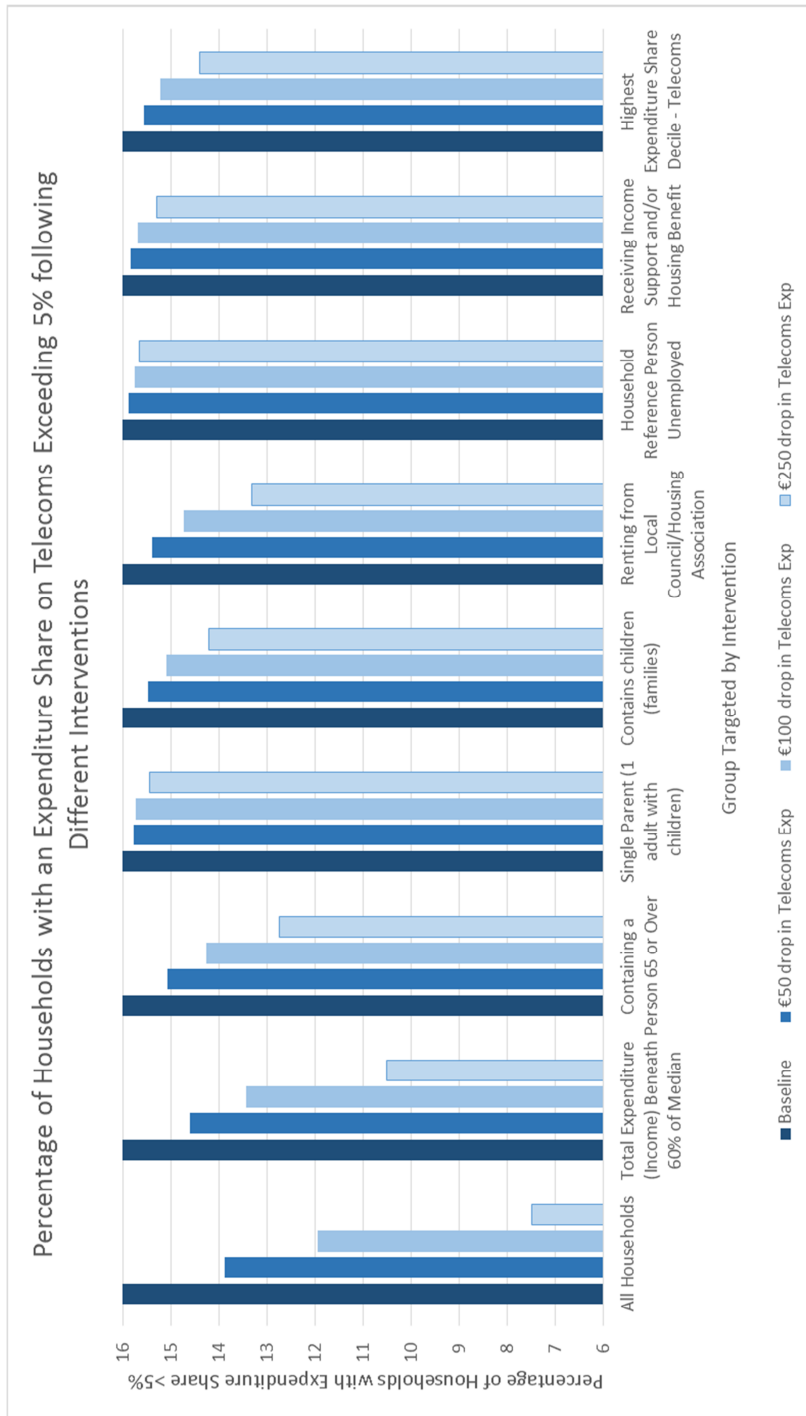


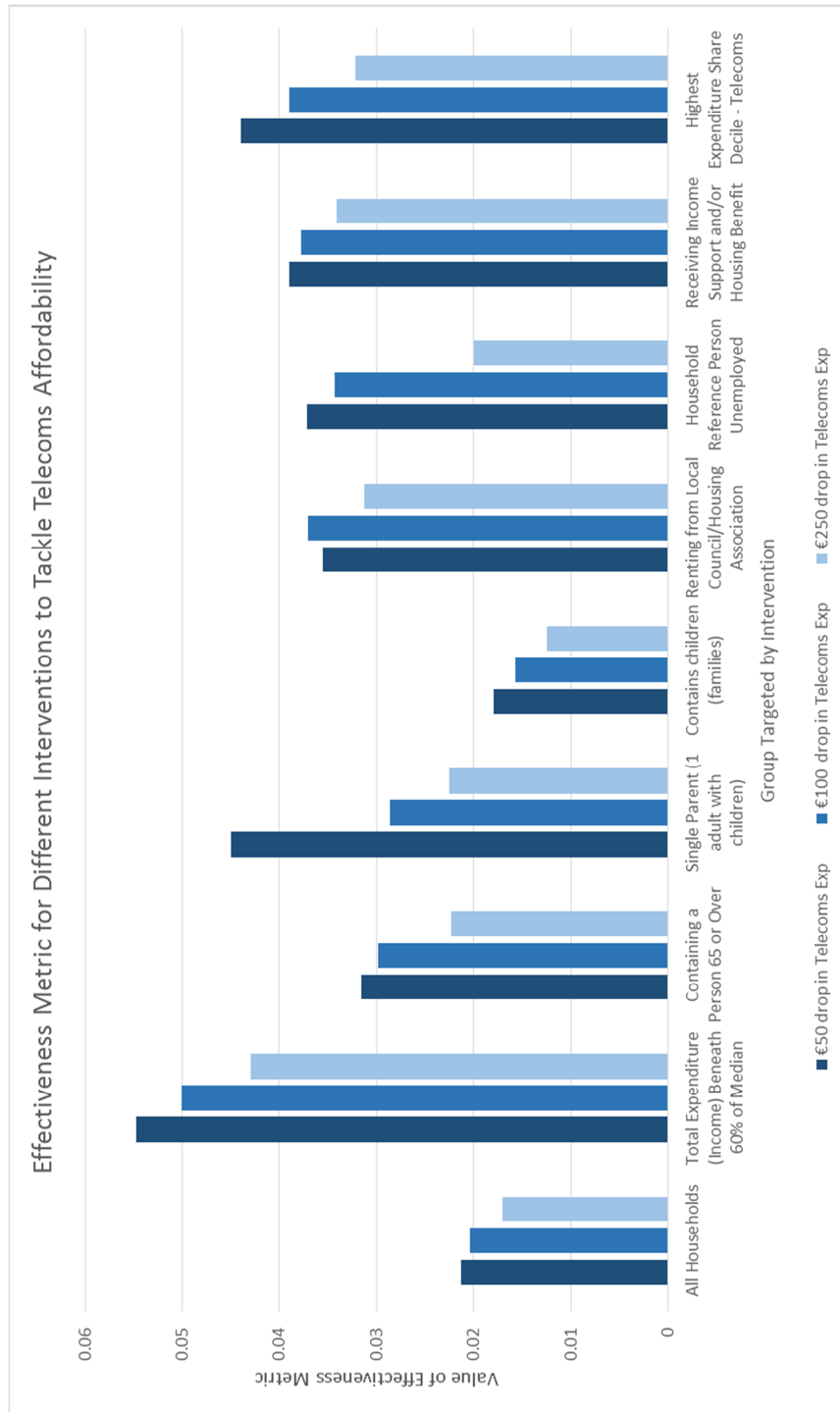*Source: Living Costs and Food Survey, 2012*

# 9. Telecoms – Simulations

Looking at the simulations considering the percentage of households spending more than 5% of expenditure on telecoms, Chart 26 reflects the relatively concentrated nature of the telecoms expenditure distribution. For water in Chart 17, when targeting households in the highest expenditure share decile, only a €250 reduction in expenditure had an impact on the percentage of households identified as having affordability difficulties. In contrast, Chart 26 shows that in telecoms a much smaller expenditure reduction of only €50 is sufficient to start moving households across the expenditure share threshold indicating affordability difficulties.

**Chart 26: Percentage of Households with an Expenditure Share on Telecoms Exceeding 5% following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

**Chart 27: Effectiveness Metric for Different Interventions to Tackle Telecoms Affordability**



*Source: Living Costs and Food Survey, 2012*

Chart 27 shows the effectiveness of the different policy interventions with respect to the threshold of spending 5% of expenditure on telecoms. For all sizes of expenditure reduction it is more effective to target households in social housing or receiving benefits than households where someone is aged 65 or over. This reflects the fact that the average expenditure share devoted to telecoms is higher in the former two groups than in households containing an elderly person. A second feature of Chart 27 is the high effectiveness of targeting a €50 expenditure reduction at single parents. This suggests that there is a high concentration of single parent households that have an expenditure share on telecoms which is very slightly above 5%.

Looking at the impact of interventions on the twice median metric, Chart 28 highlights the great difficulty in altering this metric using the policy interventions studied. Almost all policy interventions leave the percentage of households with an expenditure share on telecoms exceeding twice the median virtually unchanged at around 13%. The only exceptions to this are reducing telecoms expenditure by €250 for large groups (or all) of the population which increases the percentage of households above the twice median threshold by a large extent.

In Chart 29 the results of the simulations for the LIHC criterion in telecoms are reported. As expected the policy intervention with the largest impact is to target individuals with total expenditure below 60% of the median. Reducing the expenditure on telecoms of this group by €250 can approximately halve the percentage of people identified as facing affordability difficulties according to the LIHC criterion. An interesting contrast with the equivalent results for energy and water (Charts 11 and 20) is that for telecoms, reducing the expenditure of those in the highest expenditure share decile has very little impact on the percentage of households identified as having LIHC affordability difficulties.

Chart 29 also shows that targeting individuals in social housing leads to the second largest drop in the percentage of households recorded as having LIHC telecoms affordability difficulties. Only targeting individuals with total expenditure beneath 60% of the median has a bigger impact.

Moving on to consider the mean and median LIHC expenditure gaps, Charts 30 and 31 show that if the telecoms expenditure of those with total expenditure below 60% of the median is reduced by €100 or €250 it increases the size of these gaps. This suggests that the simulated expenditure reductions only take those with relatively shallow telecoms affordability difficulties out of LIHC poverty. The households which are then left in LIHC poverty have very high expenditure leading to the median LIHC gap (Chart 30) increasing by almost 50% when expenditure for these low income households is reduced by €250.

Conversely when expenditure reductions are targeted at households containing children it increases the percentage of households identified by the LIHC criterion as having telecoms affordability difficulties, but reduces the mean LIHC expenditure gap.

**Chart 28: Percentage of Households with an Expenditure Share on Telecoms Exceeding Twice the Median following Different Interventions**
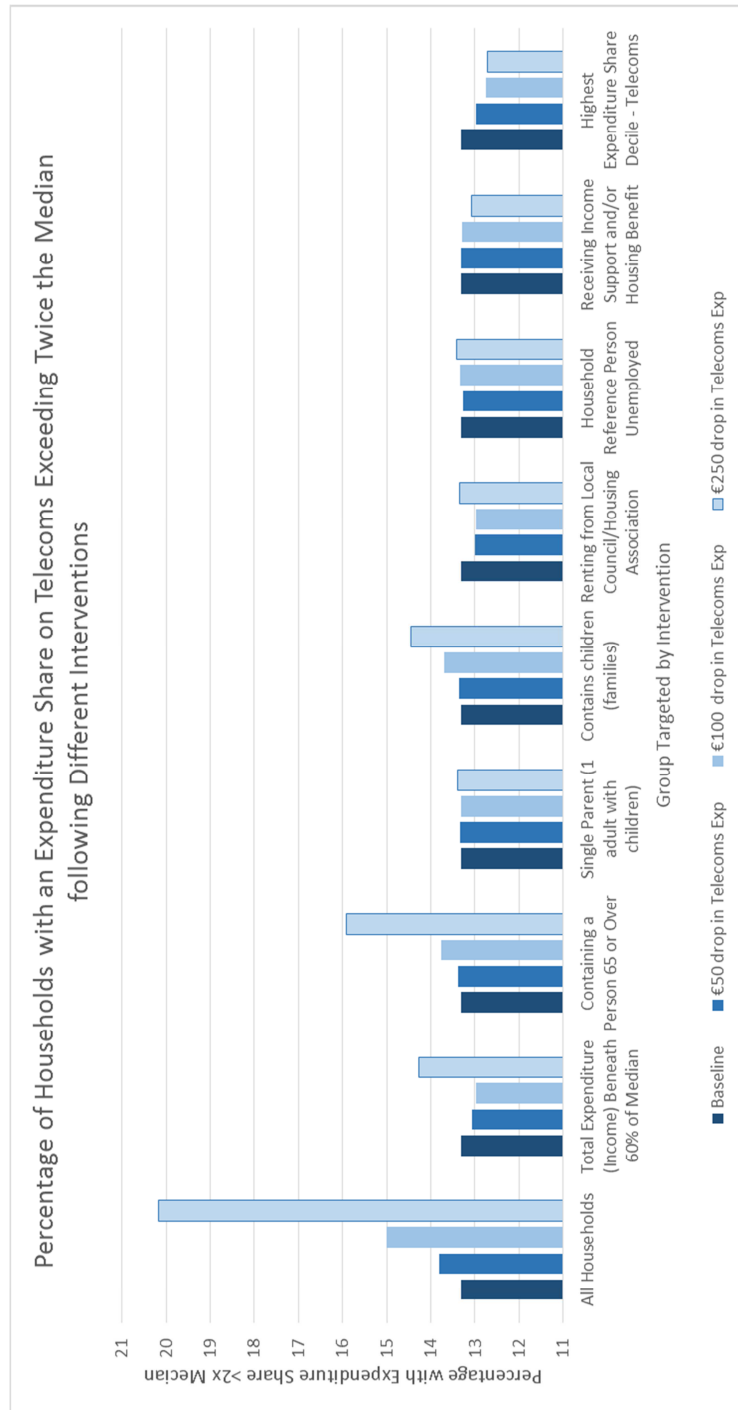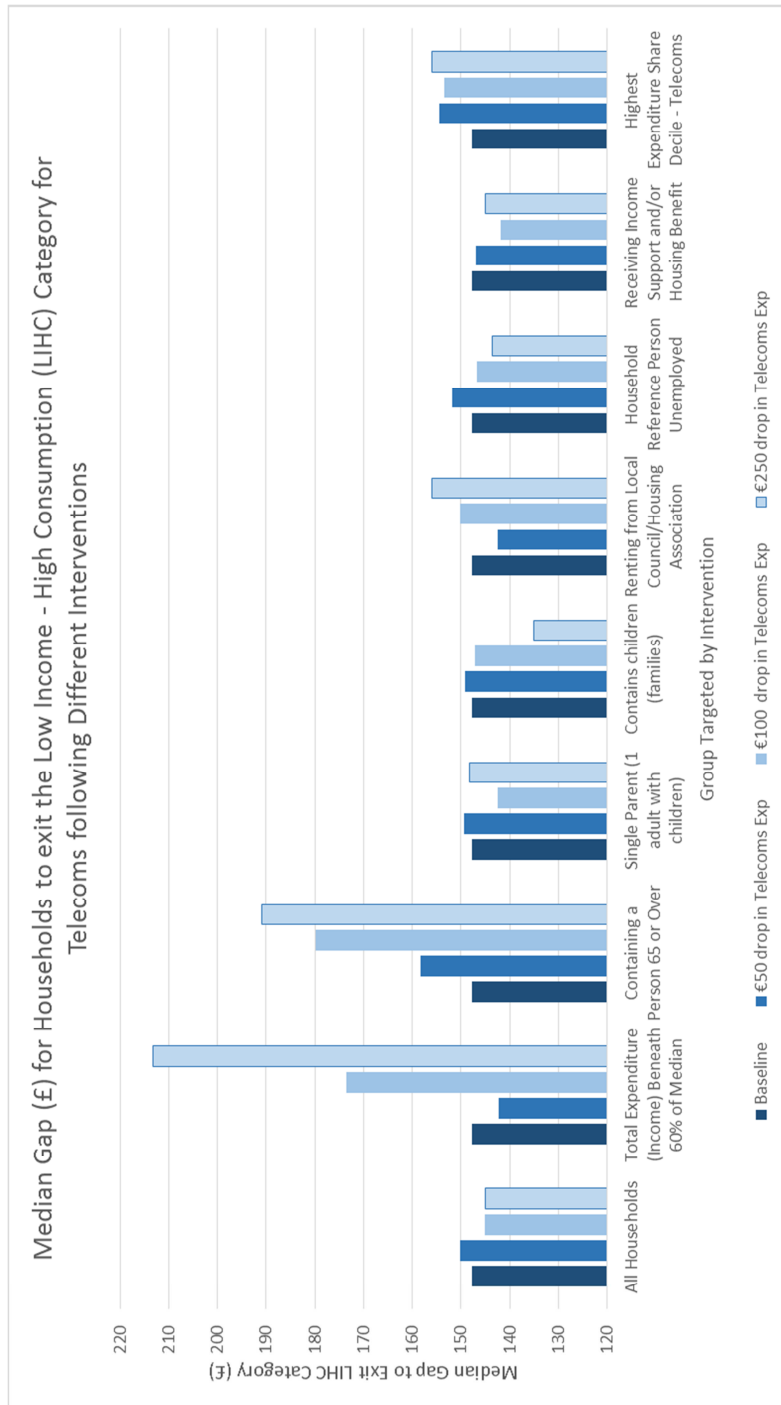


*Source: Living Costs and Food Survey, 2012*

**Chart 29: Percentage of Households in the Low Income – High Consumption (LIHC) Category for Telecoms following Different Interventions**
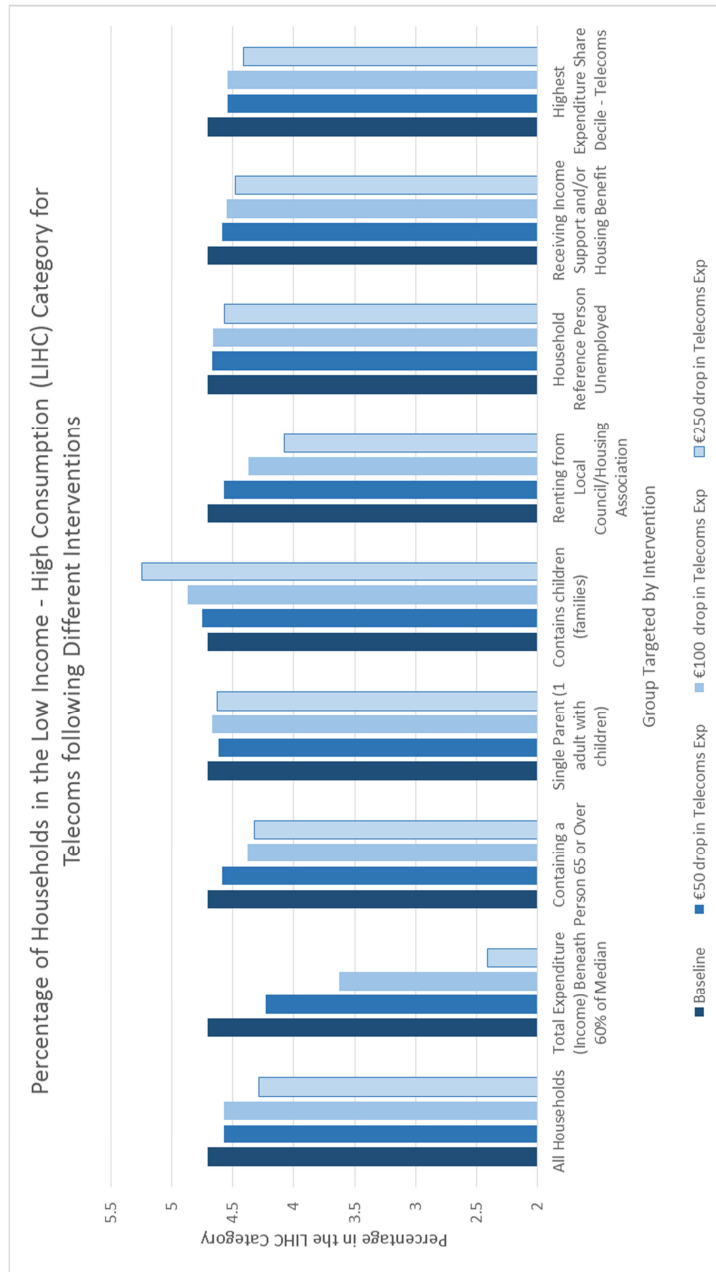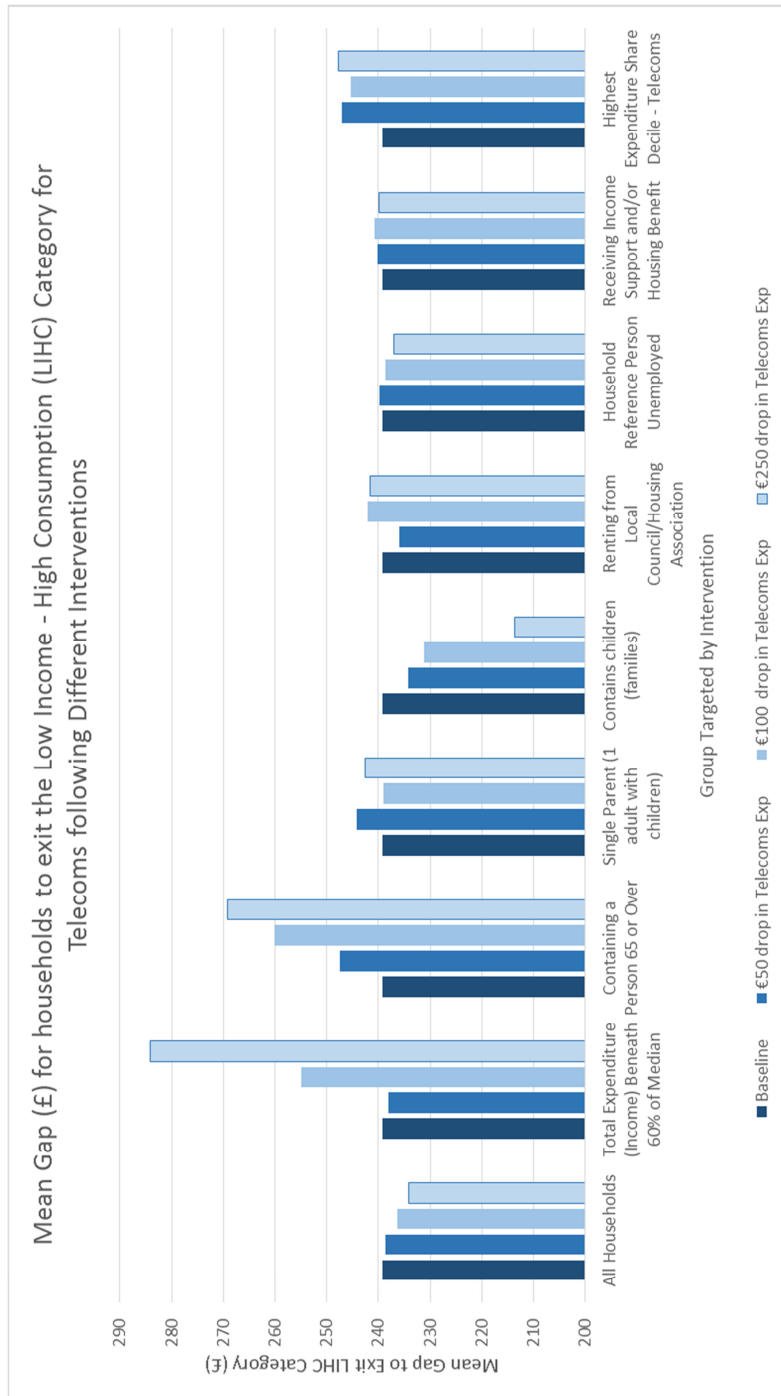


*Source: Living Costs and Food Survey, 2012*

**Chart 30: Median Gap (£) for Households to exit the Low Income – High Consumption Category for Telecoms following Different Interventions**
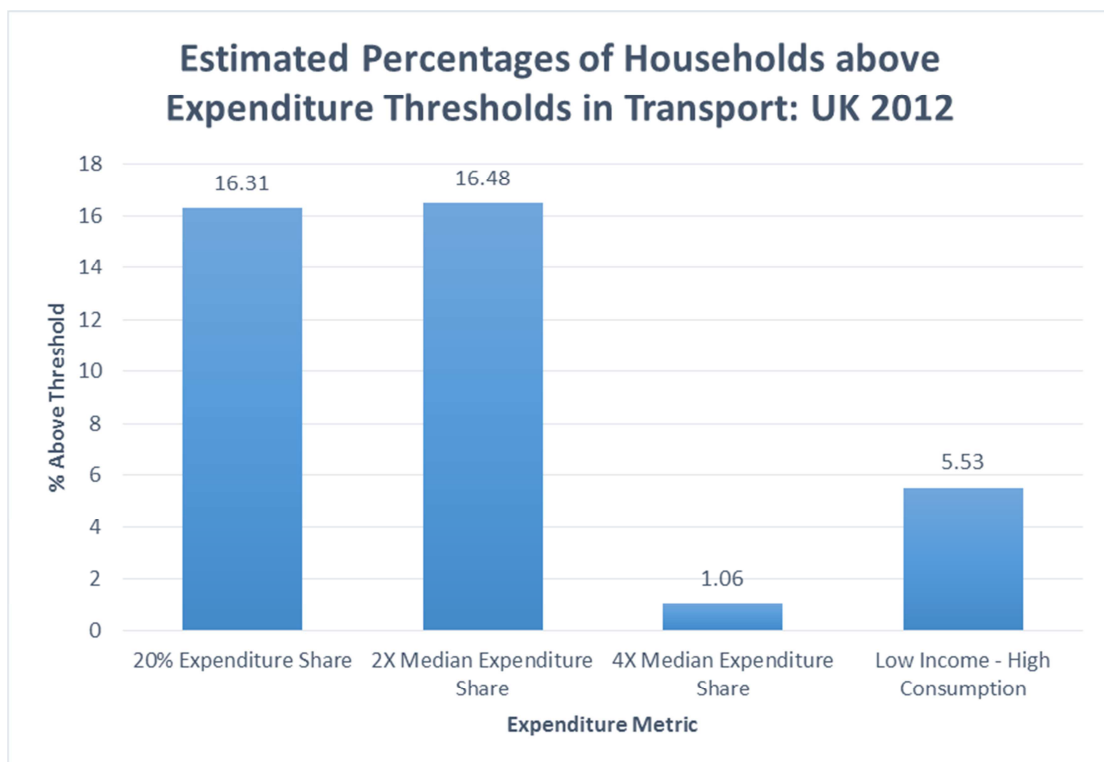


*Source: Living Costs and Food Survey, 2012*

**Chart 31: Mean Gap (£) for Households to exit the Low Income – High Consumption Category for Telecoms following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

# 10.    Transport - Baseline

Chart 32 shows that a 20% expenditure share on transport is closely aligned with the median expenditure share on transport in the UK in 2012.

**Chart 32: Estimated Percentages of Households above Expenditure Thresholds in Transport: UK 2012**
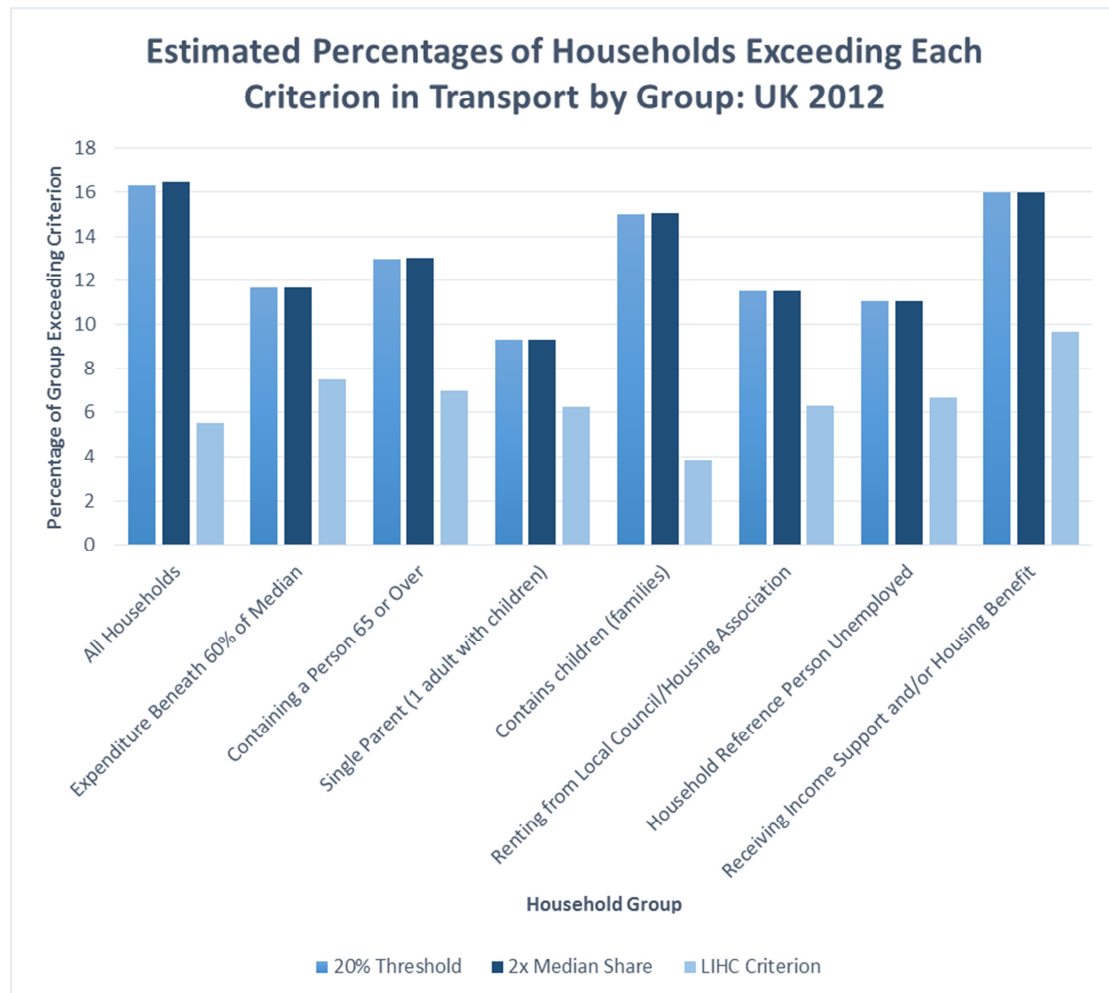


*Source: Living Costs and Food Survey, 2012*

Chart 33 shows that, in contrast to the other three sectors, one of the groups with a higher expenditure share devoted to transport are households with children. However, while this household group devotes a high share of expenditure to transport, the group also has the lowest rate of transport affordability difficulties as identified by the LIHC criterion. The combination of these two facts suggests that while households with children have a high demand for transport (the school run, leisure trips and holiday flights for multiple people), the relatively high incomes of this group mean that this expenditure can, on average, be tolerated without impinging excessively on other forms of consumption.

Another feature of Chart 33 suggesting transport is different to the 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 an economically disadvantaged group, devote a higher share of their expenditure to transport. In turn, this highlights one of the problems with not using the residual income approach of the LIHC criterion: for higher expenditure shares to indicate true affordability difficulties you need to ensure that for the utility you are considering there is a negative relationship between expenditure shares and income/total expenditure. In transport this relationship does not exist, at least at the lowest levels of total expenditure. Firstly, working households with higher incomes than non-working households consume more transport as they must travel to work.

**Chart 33: Estimated Percentages of Households Exceeding Each Criterion in Transport by Group: UK 2012**



*Source: Living Costs and Food Survey, 2012*

While the rate of affordability difficulties for households with children may be low according to the LIHC criterion, Chart 34 shows that those households with children that face affordability difficulties according to the LIHC criterion have particularly deep difficulties. The mean LIHC expenditure gap for households with children is approximately £600 higher than the next highest group (excluding households in the highest expenditure share decile).

**Chart 34: Estimated Average Gaps to take the Transport Expenditure of Households in LIHC Poverty to Median Expenditure**
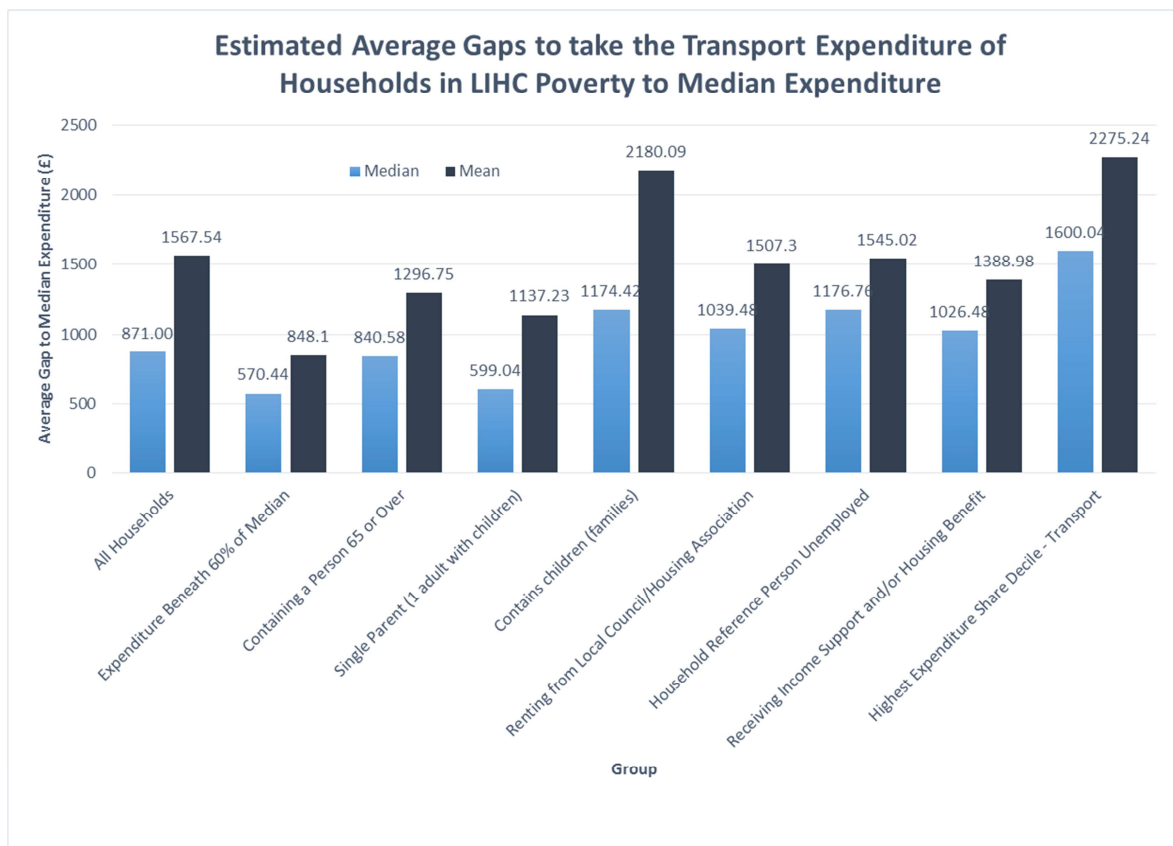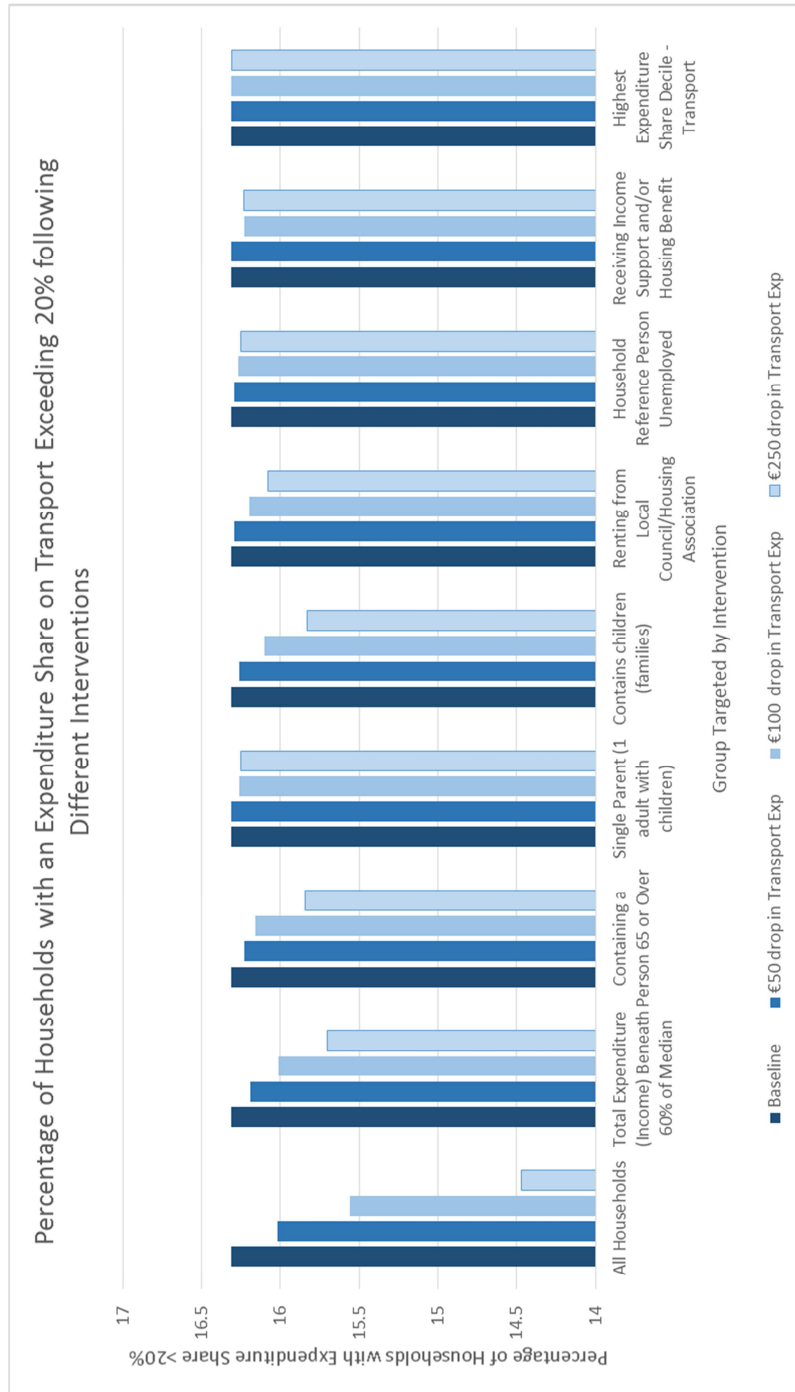


*Source: Living Costs and Food Survey, 2012*

# 11.     Transport – Simulations

Chart 35 shows that it is relatively difficult to reduce the percentage of households spending more than 20% of their expenditure on transport with the policy interventions we are considering. Excluding an expenditure reduction targeted at all households, the most effective policy intervention, a €250 expenditure reduction targeted at those with total expenditure beneath 60% of the median, can only reduce the percentage of households with a high transport expenditure share by around 0.5 percentage points. This apparent lack of impact suggests that many households have expenditure shares considerably higher than the 20% threshold. Indeed a €250 expenditure reduction targeted at households with transport expenditure shares in the top 10% has no impact on the percentage of households with a transport expenditure above 20%. The lesson to take is that for expenditure categories which absorb higher proportions of total expenditure, the policy interventions need to be larger expenditure reductions in absolute terms to have any impact on the affordability metrics.

**Chart 35: Percentage of Households with an Expenditure Share on Transport Exceeding 20% following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

**Chart 36: Effectiveness Metric for Different Interventions to Tackle Transport Affordability**
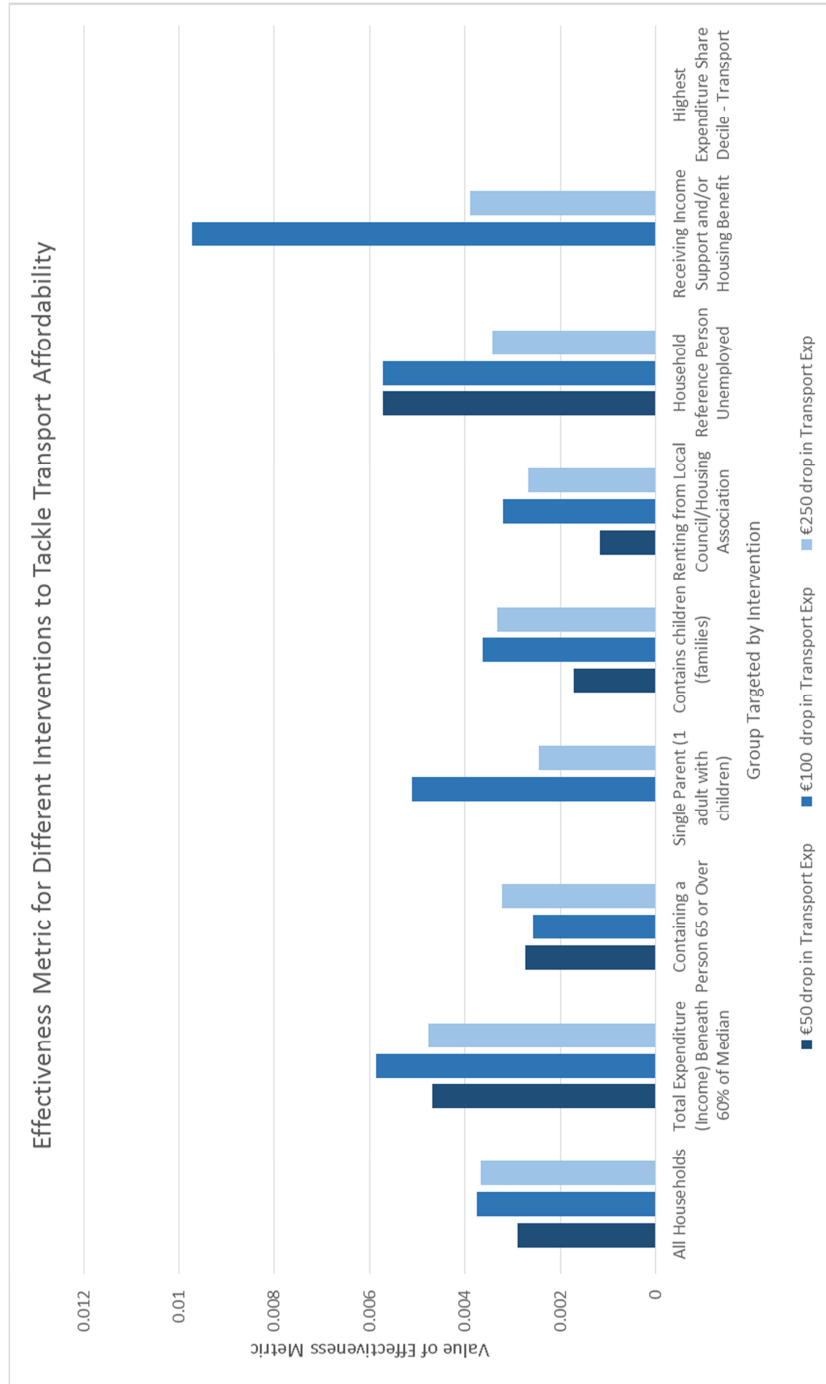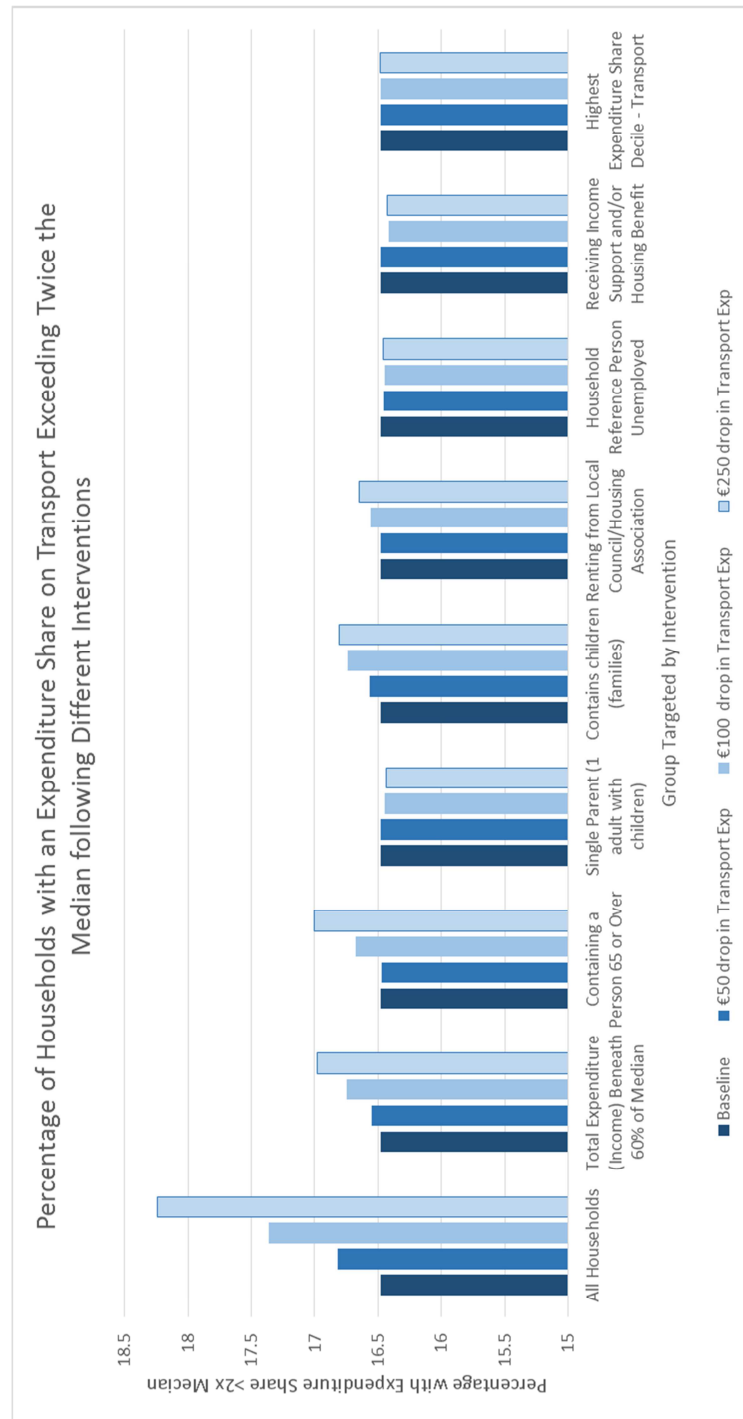


*Source: Living Costs and Food Survey, 2012*

Turning to the effectiveness metric in Chart 36, the policy intervention with by far the greatest effectiveness is to reduce transport expenditure for households receiving state benefits by €100. The two other target groups which are relatively effective are households where the breadwinner is unemployed and households where total expenditure is below 60% of the median.

In terms of the twice median expenditure share metric for transport (Chart 37), it appears that the simulated policy interventions have virtually no positive impact. It seems easier to raise the rate of households with transport affordability difficulties recorded by this metric than to reduce it. Once again this is despite the simulated policy interventions only improving the welfare of householders if applied in the real world.

Again the large size of transport expenditure makes it difficult for the simulated policy interventions to shift the LIHC criterion shown in Chart 38. The most effective policy intervention can reduce the percentage of households experiencing transport affordability difficulties according to the LIHC criterion by only 0.3 percentage points. In contrast, the most effective policy intervention in the other sectors reduces the LIHC metric of affordability difficulties by: 2 percentage points in energy, 6.3 percentage points in water and 2.3 percentage points in telecoms.

Combining the results in Chart 38 with the results in Charts 39 and 40, the only policy which seems to consistently reduce both the rate of LIHC transport affordability difficulties and their depth measured by the LIHC gap is to target expenditure reductions at those households in the 10% of households with the highest expenditure shares on transport.

**Chart 37: Percentage of Households with an Expenditure Share on Transport Exceeding Twice the Median following Different Interventions**
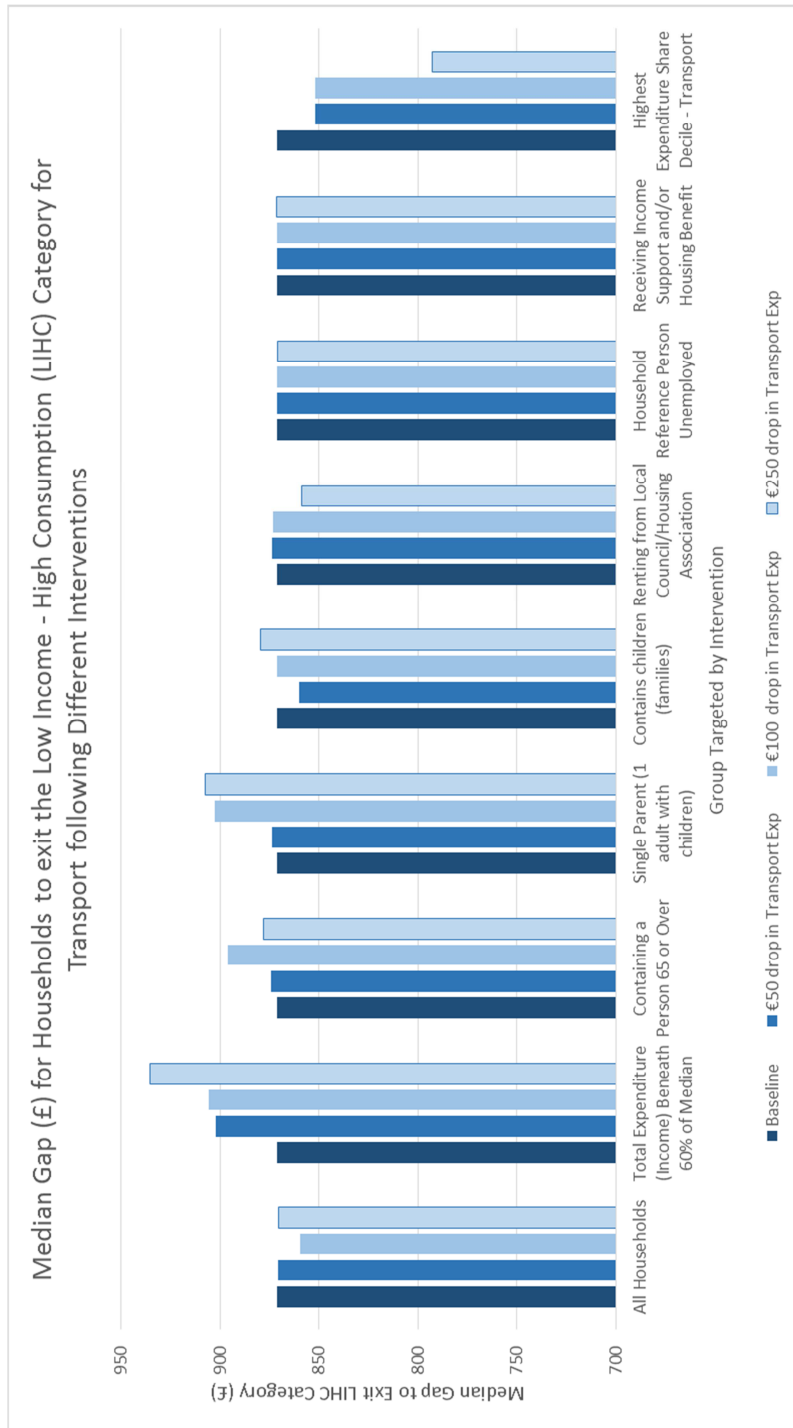
*Source: Living Costs and Food Survey, 2012*

**Chart 38: Percentage of Households in the Low Income – High Consumption (LIHC) Category for Transport following Different Interventions**
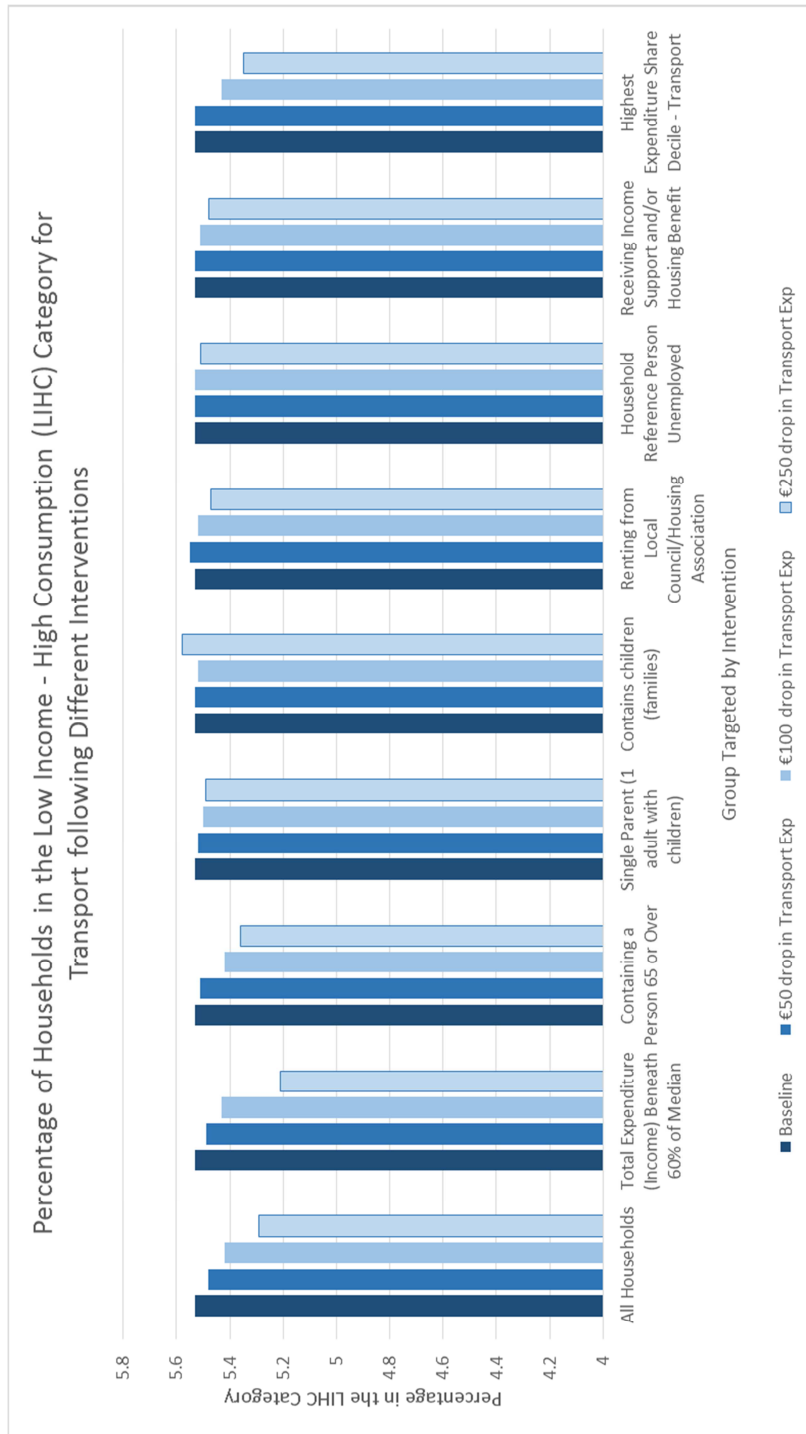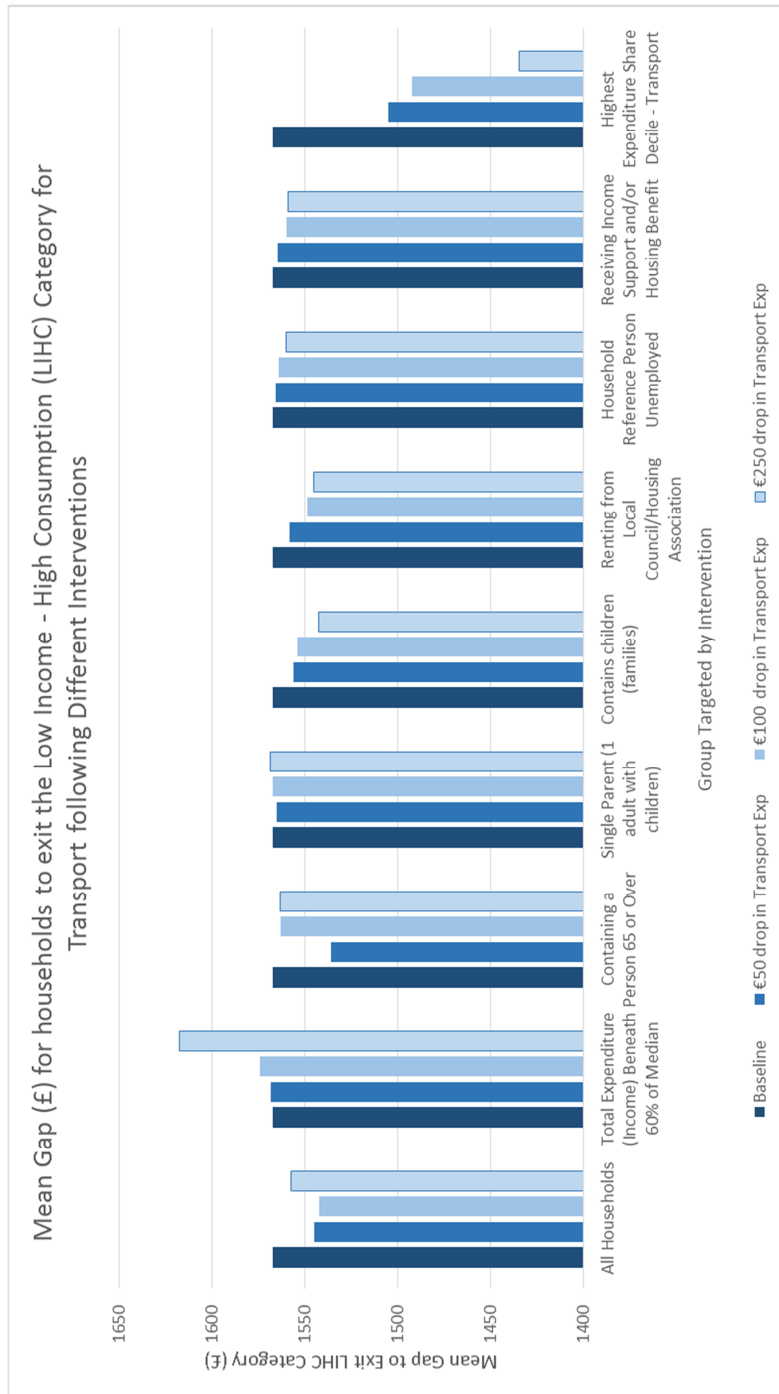


*Source: Living Costs and Food Survey, 2012*

**Chart 39: Median Gap (£) for Households to exit the Low Income – High Consumption Category for Transport following Different Interventions**



*Source: Living Costs and Food Survey, 2012*

**Chart 40: Mean Gap (£) for Households to exit the Low Income – High Consumption Category for Transport following Different Interventions**



*Source: Living Costs and Food Survey, 2012*