cerre Centre on Regulation in Europe
Improving network industries regulation

Affordability of utilities' services: extent, practice and policy

Research Paper 1: Affordability Metrics

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Executive Summary

This Research Paper introduces the rest of the project by reviewing the different methods used to measure affordability in the four utility sectors being studied, based on academic literature. Firstly, contrasts are drawn between the inter-related terms of 'affordability', 'poverty' and 'vulnerability'. Secondly, for each utility sector, a tabular review is provided of the main affordability metrics proposed by different authors and organisations. A brief summary of existing cross-country studies looking at the affordability of utilities in the EU then follows.

Section 6 has a rather different focus, as it is a literature review evaluating the benefits of the Internet to citizens and consumers. This review begins by considering the implications of new technology in the retail energy market and summarises the status of the roll out of smart meters in different Member States. The review then extends its scope, considering the impact of the Internet in all retail markets, the labour market and in the political sphere.

Key messages from this Research Paper include:

- While 'affordability' and 'vulnerability' are related, they are distinct concepts with vulnerability being a much broader and more difficult to quantify concept. There is only a partial overlap between those who face affordability difficulties and those who are vulnerable.
- The quantification of affordability difficulties is most advanced in the energy sector. Developments in this arena have often been led by initiatives in the UK.
- There are three broad types of metrics used to measure affordability difficulties:
    - Fixed thresholds e.g. 10% of expenditure spent on energy
    - Relative thresholds e.g. twice the median expenditure share
    - Residual income e.g. Hill's Low Income – High Consumption metric
- Each metric has its own advantages and disadvantages. The metrics are best suited to different tasks.
- An alternative measurement approach is to record householders' subjective perceptions of their affordability difficulties.
- Assessing transport affordability is particularly difficult as transport expenditure is explicitly linked to housing choices. Also, as with the water sector, it is challenging to separate essential expenditure from discretionary expenditure.
- The extent to which smart meters have been rolled out varies significantly across Member States. In some Member States no decision regarding the roll out has been made, while in others the roll out is complete.
- The central value of the Internet is in reducing 'search' costs so that individuals have increased information regarding products/services and their prices.
- To understand the impact of the Internet individual markets/situations need to be studied using sophisticated empirical methodologies.

1. Introduction

This document provides an initial review of the literature on the measurement of affordability in energy, telecoms, water and transport. This literature review aims to provide a comprehensive collation of the different approaches to measuring affordability in these utility sectors across Europe. This survey of affordability metrics has informed decisions on the affordability metrics applied during the policy simulations (Research Papers 4-8). Policies used to tackle affordability issues in different member states are reviewed in Research Paper 3. The need for research into affordability at the European level has been recognised by the European Fuel Poverty and Energy Efficiency project (EPEE) (2009).

The literature on measures of affordability contains a number of core themes, as well as differences in emphasis between the utilities being studied. The first issue is how to distinguish affordability, poverty and vulnerability. Second, should affordability be judged by actual observed expenditure or the cost of an ideal/minimum service bundle? Third, poverty measurements may be linked either to average expenditure or to a fixed threshold specifying expenditure as a particular percentage of income. Lastly, there are issues over the precise definitions of income and expenditure to use. For example, should corrections be applied for the size of households? The literature on energy is the most advanced in addressing these issues.

An important question in measuring fuel/energy poverty is whether to link measures to population averages or to use a fixed threshold. The appeal of each approach may depend on whether the focus is to implement policies to reduce fuel poverty or to judge when energy costs are likely to have particular salience among consumers/citizens. Another concern that emerges if actual expenditure figures are used is that actual expenditure may underestimate the costs of energy as households may respond to higher prices by rationing their consumption.

In telecoms, the main measurement challenge is how to account for the rapid improvement in the quality and range of services available. Historically there have also been issues related to the one-off costs of connection as well as the affordability of ongoing running costs. Turning to water affordability, much of the literature emphasises the availability of water in less developed countries (LDCs) and there is a focus on establishing the minimum quantity a household requires for healthy living. Lastly, assessing transport affordability is complicated by the fact that it is often 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.

Alongside debating these issues 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 publically adopt particular quantified affordability metrics. The

adoption by the UK (and its constituent countries), Ireland and France of quantified measures of fuel poverty appear to be the exception rather than the rule.

The review proceeds as follows: section 2 discusses the differences between affordability, poverty and vulnerability, while section 3 discuss measures of affordability used in the energy sector and section 4 discusses affordability metrics in the telecoms, water and transport sectors. Section 5 describes pan-European evidence on affordability in these four industries. Recognising that actual expenditure shares on telecoms may be increasing, despite lower unit costs[1], section 6 discusses the evidence of the benefits of the Internet to consumers/citizens which may explain increased consumption. Finally, section 7 concludes.

[1] The possibility that households are spending an increasing proportion of their income on telecoms despite significant price drops is a hypothesis to be tested rather than a conclusion.

2. Distinguishing affordability, poverty and vulnerability

2.1 Affordability and poverty

Affordability measures the relative ability to pay or proportion of income spent on a particular service by any household within the population. Kessides et al (2009) when reviewing the literature on affordability in developing and transition economies defines affordability as the "ability to purchase a necessary quantity of a product or level of a service without suffering undue financial hardship". The distinction with a threshold measure of poverty is that households in poverty lie on the 'wrong' side of the threshold so that the spending on a utility is deemed unaffordable. Often a definition of poverty will be designed with explicit reference to the impact of the definition on policies used to alleviate poverty.

A key concern is to design poverty measures that avoid the incentive for policymakers to focus on moving those just below the poverty threshold to be just above the threshold while ignoring individuals in severe poverty. In relation to general poverty, Sen (1976) defines a set of axioms to define an idealised poverty measure. In essence, the challenge is to identify a poverty measure that increases whenever there is a transfer from a poorer to a richer individual, including when both individuals lie below a poverty threshold. Common headcount measures of poverty and aggregate poverty gap measures do not satisfy all of Sen's required axioms. Despite this, and probably due to their simplicity, basic poverty thresholds remain common, particularly when considering the affordability of utilities.

2.2 Vulnerability

'Vulnerability' is a more amorphous concept which suffers from being more difficult to define quantitatively than affordability or poverty. Definitions of vulnerability are less closely linked to income and incorporate a wider range of factors which affect a consumer's ability to engage with markets such as disability, educational attainment, age (old or young) and physical location. Vulnerability is a different concept to either affordability or poverty. Those who are vulnerable may not face affordability difficulties in any sector, nor are those who face affordability difficulties necessarily vulnerable. As a result, the design of policies may differ depending on whether the purpose of the policies is to address vulnerability or affordability.

Andreasen and Manning (1990) define vulnerable consumers as those "at a disadvantage in exchange relationships where that disadvantage is attributable to characteristics that are largely not controllable by them". A key issue with defining vulnerability is to identify observable characteristics of consumers that are unique to individuals who are truly vulnerable. For

example, among those of pensionable age there will be many individuals who are rich and well educated, and may therefore not be vulnerable in the relevant context. Illustrating this point, Boardman (2010) reports that in Scotland in 2007 only 54% of single pensioners were actually fuel poor.

The lack of clearly defined vulnerability metrics is highlighted by Boardman (2010)'s comparison of definitions used by UK government departments in the early 2000s. In the UK's Fuel Poverty strategy of 2001, the vulnerable were identified as older householders, families with children, the disabled and those with long-term illnesses. However, the Department of Communities and Local Government in 2008 classified vulnerable households as those receiving one of the principal means tested (low income) or disability related benefits/tax credits. Lastly, the Office of Gas and Electricity Markets (Ofgem), the British energy regulator (in common with many British regulators), has statutory duties to consider the needs of consumers who are of pensionable age, chronically sick or disabled, live in rural areas or are in receipt of low income. Ofgem has no statutory duty to consider households with children as vulnerable.

In outlining its vulnerability strategy, Ofgem (2013) adopts a definition of vulnerability which is arguably even broader, defining it as a situation when a consumer is: "(i) Significantly less able than a typical consumer to protect or represent his or her interests in the energy market; and/or (ii) Significantly more likely than a typical consumer to suffer detriment, or that detriment is likely to be more substantial." Ofgem (2013) also quotes the British Standards Institute who suggest that vulnerability is a dynamic concept in that vulnerability will vary through time depending on the urgency and complexity of the decision a consumer faces.

At the European level, the European Commission (EC) (2010) states there is an "obligation on Member States to define the vulnerable consumers that a Member State wishes to protect" and further notes that the definition chosen "may refer to the concept of energy poverty where it has been clearly identified". Prior to this European requirement, a report by the European Regulators Group for Electricity and Gas (ERGEG) (2009) found that only 8 out of 27 Member States actually used a term akin to 'vulnerable customer'[2]. More recently, the Citizens' Energy Forum (CEF) (2013) notes that 17 out of 26 Member States had a concept of vulnerable customers defined somewhere in law. The Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER) (2014) instead draw a distinction between Member States with explicit and implicit definitions of vulnerability. ACER-CEER report that in 13 Member States vulnerable consumers are defined explicitly and in 12 Member States they are defined implicitly, with only Latvia and Norway not yet having a definition. ACER-CEER classifies implicit notions of vulnerability for energy being when there is no specific reference to vulnerability in energy policies, but the ability to afford energy is covered by the wider social welfare safety net. Austria and Germany are given as examples of this latter approach.

[2] The eight countries identified as doing so were: Belgium, Bulgaria, Great Britain, Greece, Hungary, Ireland, Italy and Slovenia.

Lastly, not only may vulnerability lead to individuals having limited income and a low ability to engage in markets, the intrinsic characteristics of the vulnerable may mean they have to use more of a utility or incur additional expenses. For example, the Body of European Regulators for Electronic Communications (BEREC) (2010) notes that disabled people often need additional equipment to access telecom and transport services.

3. Affordability metrics for energy

While the discussions in this section refer to energy, most of the principles about the suitability of different metrics/indicators are applicable to measuring affordability/poverty in other utility sectors e.g. the desirability of using the median rather than mean as an average.

Most of the papers investigating the affordability of energy are linked to issues of fuel poverty. In the European context, it is important to note that the EU makes a technical distinction between fuel poverty and energy poverty. EC (2010) notes that energy poverty refers specifically to expenditure on electricity and gas, whereas fuel poverty refers to a wider range of energy sources. In general, fuel poverty appears a more appropriate definition as this is more inclusive of national variations in fuel types, such as Northern Ireland households' heavy reliance on fuel oil. For simplicity, the terms energy and fuel are used interchangeably in this paper other than in Tables 1 and 2 when metrics are defined.

3.1 Observed energy affordability metrics and fuel poverty

The majority of energy affordability metrics explicitly link income and/or total expenditure with energy expenditure. The author often credited with bringing prominence to fuel poverty is Boardman (1991) who argued that the fuel poor were those who spent more than 10% of their total expenditures on energy. Boardman noted that in the 1988 Food and Expenditure Survey this definition coincided with two other intuitive statistical measures of energy cost pressure: (i) 10% was the average expenditure of the 30% of households with the lowest income; and (ii) 10% was twice the average proportion spent on energy by the population as a whole. However, Liddell et al (2012) cites the earliest definition of fuel poverty as coming from Isherwood and Hancock (1979) who defined it as being when households spend over twice the median amount on fuel, light and power. Table 1 outlines affordability and fuel poverty metrics suggested by different authors, organisations and countries.

The EC (2010) proposes that a 'considerable expenditure share' spent on energy should be defined with reference to national average expenditure shares. The use of national averages recognises that choices about poverty alleviation are ultimately determined at Member State level and there are large variations between Member States concerning climate, housing standards and energy/heating technologies.[3] However, the European Economic and Social Committee (2011) recommends that "existing statistics should be harmonised so that the most rigorous assessment possible can be made of the energy poverty situation in Europe." The committee emphasises the need for consistency through the example of a discrepancy between the European Union Statistics on Income and Living Conditions (EU-SILC) survey data which

[3] EPEE (2006b) also reports that there is no common definition of general poverty among EU countries (EPEE (2006b) defines general poverty as being below 60% of a country's median income).

supposedly states no one in the UK is in arrears on fuel bills and Ofgem's data which estimates the figure at 5%.

Table 1: Quantifiable Energy Affordability and Fuel Poverty Metrics

Author, Organisation or Country	Title of Metric	Description
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 services (as % of total expenditure) by bottom 30% of income distribution
United Kingdom (1998)	Fuel poverty	>10% of income spent for heating (adequate[4] for health and comfort)
Proposed revision to Directive 2002/91/EC	Energy poverty	>10% of income spent heating home to acceptable standard identified by the World Health Organisation (WHO)
Scotland (2002)[5]	(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)[6]	Energy precariousness	>10% of income spent on actual energy expenses
European Commission (2010)	Considerable expenditure share	> twice the national average 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

[4] 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".
[5] Quoted in Liddell et al (2012).
[6] 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.

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 (proposed)[7]	Energy poverty	"A household is considered energy poor if its income is below the at-risk-of-poverty threshold and, at the same time, it has to cover above-average energy costs"

Source: Authors' own work

In addition to quantifiable affordability metrics, various descriptive definitions of affordability or energy/fuel poverty have been provided by different organisations. Table 2 details these varying definitions. For reference, the EC's definition of general poverty is also included.

[7] See E-Control (2014). E-control clarifies that household size and housing costs should be considered when determining income and that "above-average energy costs" refers to electricity and heating costs that are "considerably above the median". Page 17 of E-Control (2014) suggests that 140% or 167% of median energy costs have a certain logic as potential energy expenditure thresholds given that the Austrian general poverty threshold is set at 60% of median income.

Table 2: Descriptive Definitions of Energy Affordability and Fuel Poverty

Author, Organisation or Country	Topic being defined	Definition
Bradshaw and Hutton (1983)	Fuel poverty	"Individuals, families and groups…when they lack the resources to obtain the reasonably warm and well-lit homes which are customary, or at least widely encouraged or approved in the societies to which they belong"
European Commission (2007)	General poverty	"Persons, families and groups of persons whose resources (material, cultural and social) are so limited as to exclude them from the minimum acceptable way of life in the Member State to which they belong"
European Fuel Poverty and Energy Efficiency (2009)	Fuel poverty	"Fuel poverty as a household's difficulty, sometimes even inability, to adequately heat its dwelling at a fair, income indexed price"
France (2010)[8]	Energy precariousness	"anyone who meets, in its home, particular difficulties to have the necessary energy to meet its basic energy needs because of the inadequacy of its resources or of its housing conditions"
European Economic and Social Committee (2011)	Energy poverty	"the difficulty or inability to ensure adequate heating in the dwelling and to have access to other essential energy services at a reasonable price"
National Energy Action (2012)	Energy poverty	"is a diminished or unequal ability of an individual (or groups of households) to convert a low income into adequate internal temperatures within the dwelling to protect the health and wellbeing of the occupants"
International Energy Agency[9]	Energy poverty	"a lack of access to modern energy services. These services are defined as household access to electricity and clean cooking facilities (e.g. fuel and stoves that do not cause air pollution in houses)"

Source: Authors' own work

Further detail on official metrics to identify energy poverty is provided by CEF (2013) reporting a survey of EU regulators. CEF (2013) reports that in 10 member states there is an official definition of the energy poor or of a "non-affordable energy income threshold". France, Greece, Malta and Romania are listed as using income thresholds with the French threshold being set at €24,360 per annum for a family of four persons in July 2013. In Romania, the income threshold is set at the same level as the minimum wage and in Greece, there is an additional requirement that individuals consume a low volume of electricity. In Belgium, Romania, Slovenia and Spain consumers are defined as 'vulnerable' based on a variety of criteria concerning health problems,

[8] Quoted by Dubois (2012) from the 2010 'Grenelle 2' law.
[9] Quoted in CEF (2013)

age or their socio-economic situation. Making pan-European comparisons of energy poverty on the basis of households qualifying for/receiving energy related support measures has the disadvantage that the eligibility criteria for support measures varies across Member States. Nevertheless, ACER-CEER (2014) provides information on the percentage of households classified as 'vulnerable' under local criteria in a number of Member States. Of the 12 Member States that provided figures for electricity, Romania reported the greatest proportion of households as being vulnerable (around 12.5%). Of the six Member States who reported figures for gas, Belgium had the highest proportion of households classified as vulnerable (about 8.5%).

3.2 Income and expenditure based metrics

Table 1 shows there are three main ways to assess fuel poverty/affordability: (i) a threshold approach, (ii) a relative approach, and (iii) a residual income approach. With the threshold approach, a fixed threshold is set for energy expenditure as a proportion of income/expenditure and any household with expenditure lying above this threshold is deemed fuel poor. With the relative approach, the threshold for fuel poverty is set relative to the average expenditure on fuel of a reference group of households. The fact that relative metrics define the average as a median rather than mean is important. The median has the advantage that it is less of 'a moving target' than the mean; moving an individual out of fuel poverty and towards the median will not change the position of the median. If the average were defined as the mean, poverty alleviation would be much harder as each time a fuel poor household had their fuel expenditure reduced it would also lead to reduction in the mean fuel expenditure.

As already noted, a key difference between fixed threshold and relative metrics of energy poverty is that the former are much more sensitive to energy price fluctuations. In the Hills Report (2012) this sensitivity was given as an explicit reason for recommending that the UK government move from using a fixed threshold to a relative metric of fuel poverty. While a fixed threshold metric identifies when more households are spending greater amounts on energy, a relative metric classifies those households who consistently spend a disproportionately high amount on energy relative to other households. Those consistently fuel poor households may be the most appropriate targets for a fuel poverty alleviation strategy.[10]

Developing an effective strategy to target households who are fuel poor also supports the use of individual level survey data where possible, rather than averages from national figures. . This is because the fuel poor are likely to be in the 'tails' of distributions and so are not effectively identified by national averages; the fuel poor will generally be in the top tail of the energy expenditure distribution and the bottom tail of the income distribution.

[10] Liddell (2012) also points out that performance evaluation using a fixed threshold metric will be difficult during periods of rising energy prices as successful poverty reduction efforts are likely to be masked by the effect of price increases.

The final broad metric of energy poverty is the residual income approach described by Kessides (2009). The advantage of the residual income approach is that it explicitly recognises that households need to spend their income on a range of purchases beyond the utilities. The metric captures the principle that the remaining income, after expenditure on utility services is deducted, must remain above some pre-specified level deemed to be adequate, if the cost of the utility services is to be judged affordable. The LIHC definition of fuel poverty used in the UK represents one application of this approach.

Once the broad concept of an energy affordability/poverty metric has been defined there are further issues regarding the definition of particular elements such as income and expenditure. For example, the Department of Energy and Climate Change (DECC) (2014) notes that the UK's old 10% threshold for fuel poverty defined income as full income before housing costs, including benefits, and with no adjustments for household size or composition. In contrast, the UK's current LIHC definition uses income after housing costs and equivalisation to account for household characteristics.[11] While the new UK definition may be more precise, Heindl (2014) notes that moving between definitions often involves trade-offs. Although controlling for housing costs may help control for factors linked to a home's energy efficiency, it also makes it more likely that households who choose to live in large homes relative to the number of household members will be classified as fuel poor. This seems inappropriate if the size of home is a household's choice.

Similar trade-offs exist with the decision to measure energy expenditure by actual expenditure or using a model to determine the energy required to attain a specified temperature. Using actual expenditure suffers from the possibility that households ration their energy usage when facing affordability pressures[12], while using models of required consumption potentially ignores individual-specific characteristics regarding heating requirements. When a model is used to calculate the theoretical heating requirement of a home its methodology and the assumptions it embodies also become important. For example, Mould et al (2014) report that the Scottish government calculates the theoretical heating requirement for elderly individuals as involving a living room being heated to 23°C whereas DECC (2014) only requires the same 21°C as applies to other households.

3.3 Proxy indicators of fuel poverty

Rather than using explicit expenditure metrics, several studies use proxies for energy affordability difficulties such as the proportion of households in arrears with their bills. The advantage of this approach is it is often easier to find comparable data across multiple

[11] The length of DECC (2014) highlights the potential complexity of establishing a 'gold standard' fuel poverty measure.
[12] Liddell et al (2012) reports a 2009 estimate that in England actual expenditure figures needed to be increased by 21% for them to be equivalent to 'need to spend' figures.

jurisdictions, such as the EU-SILC. EPEE (2009) provides a comprehensive list of potential proxy indicators of fuel poverty: an inability to pay energy bills, cold and damp living conditions, a disconnected energy supply, self-disconnection (in some countries), debts owed to energy suppliers, health impacts linked to poor living conditions and homes with poor energy efficiency. While the EU-SILC dataset is a valuable source of data, EPEE (2006a) highlights that when making cross-country comparisons it is important to understand country-specific policies which may distort the comparisons. For example, EPEE (2006a) explains the UK's low percentage of households recorded as being in arrears with their energy bills by the prevalence of prepayment meters.[13]

When using proxy indicators it is also possible to form indices of poverty by combining multiple proxy indicators. The use of multiple indicators to identify fuel poverty fits with Eurostat's[14] approach to measuring material deprivation. Eurostat classifies households as severely deprived when they cannot afford four out of nine 'deprivation items'. Three of the deprivation items relate to utilities, namely not being able to afford: (i) to pay rent/mortgage or utility bills on time, (ii) to keep the home adequately warm, and (iii) a telephone (including mobile phone).

3.4 Objective vs subjective indicators

A final issue is that there may be a mismatch between those households identified as fuel poor by 'objective' indicators and households identifying themselves as being fuel poor on a subjective basis. Waddams Price et al (2007) compare households who actually spent more than 10% of their income on energy with those answering 'no' to one of the following questions: "In general, do you feel that you are able to heat your home adequately?" or "Do you feel that you can afford enough fuel for all your water heating and cooking needs?". Waddams Price et al find that 16% of respondents felt fuel poor compared to 28% of respondents who actually spent more than 10% of their income on energy. More significantly, only 26% of individuals spending over 10% of their income on energy felt fuel poor, while 12.4% of individuals spending less than 10% of their income on energy felt fuel poor. Scott et al (2008) found a similar discrepancy between subjective and objective measures of fuel poverty in the Republic of Ireland.

[13] Prepayment meters may create their own measurement issues. Firstly, O'Sullivan et al (2011) note that users of prepayment meters face an additional non-financial transaction cost in terms of the time taken to top-up their meter. Secondly, prepayment meters probably provide particularly strong incentives for energy rationing and the opportunity to 'self-disconnect' which will affect the actual expenditure figures that these consumers report.
[14] See Eurostat (2012)

4. Affordability metrics for telecoms, water and transport

4.1 Measuring the affordability of telecoms

All the telecoms affordability metrics that have been identified (see Table 3) look at the cost of a specified bundle of services. The most comprehensive data on telecoms affordability comes from the International Telecommunications Union (ITU). ITU (2012) provides details of how the cost of a standard basket of fixed telephony, mobile telephony and fixed broadband services as a percentage of average gross national income (GNI) per capita is calculated for all ITU members. In Appendix 1, an explanation of the services included in the basket and its method of calculation is provided. The main advantage of the ITU's figures is the standardised methodology and their global breadth allowing affordability in EU countries to be compared against a wide variety of nations. However, two notes of caution regarding the ITU's methodology are required: (i) prices are those of the supplier with the largest market share in a market rather than averages, and (ii) the ITU recognises that the usage amounts in the mobile telephony bundle are low, relative to usage in OECD countries.[15]

Table 3: Telecoms Affordability Metrics

Author, Organisation or Country	Title of Metric	Description
Broadband Commission for Digital Development (2011)[16]	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

Source: Authors' own work

[15] An interesting point about these affordability metrics in relation to the net neutrality debate is that they implicitly assume that consumers only pay for broadband services through their explicit payments to broadband access providers. If broadband services were partly paid for by revenues from Internet content providers, it would be much harder to assess the affordability of broadband services: consumers would partly pay for their broadband service implicitly via their payments to Internet content providers.

[16] Discussed in ITU (2012)

4.2 Measuring the affordability of water[17]

A range of papers include discussion of water affordability. Most of the literature (not reviewed here) considers water availability and cost in less developed countries. While a major concern in the development literature is accessibility to clean water supplies and the potential costs of connection/time spent travelling to clean water sources (see Hutton, 2012), in developed countries the affordability issue relates to the ongoing consumption of water services. Nevertheless, in all circumstances a strong emphasis on equity is apparent in the debate on water affordability. For example, Hutton (2012) quotes the following extract from the UN Committee on Economic, Social and Cultural Rights' General Comment 15: "Any payment for water services has to be based on the principle of equity, ensuring that these services, whether privately or publicly provided, are affordable for all, including disadvantaged groups. Equity demands that poorer households should not be disproportionately burdened with water expenses as compared to richer households." Moreover, the history of billing for water services varies considerably across EU countries, with consumption of very few Scottish households and fewer than half of households in England and Wales measured[18], and no separate charge made for water in Northern Ireland. Indeed the lively debate and practical difficulties over introducing water charges in the Republic of Ireland illustrates the special emotions that surround the funding of water services.

Despite this emphasis on equity, Garcia-Valinas et al (2010) points out that in developed countries it probably does not make sense to be concerned about the affordability of a household's total water spending, instead, the genuine concern is about the 'basic' quantity of water required for a reasonable standard of living. For example, in Mediterranean countries it might be questioned whether water expenditure related to garden sprinklers and swimming pools should be included in affordability metrics. Garcia-Valinas et al suggest that a total water usage of 100 litres per capita per day is a reasonable amount for healthy living. The challenge with specifying an 'acceptable' quantity of water usage is that household surveys rarely record actual water usage. As a result, when performing empirical analysis Garcia-Valinas et al can only report the average cost of their 'basic' water usage figure as a percentage of the average income in a particular geographic area.

Table 4 describes different water affordability metrics suggested in the literature. The affordability rule of the US's Environmental Protection Agency (EPA) is particularly interesting. The EPA (2006) uses its affordability rule for the purpose of determining whether a new water compliance standard can be met in an 'affordable' manner. The EPA (at least in 2006) could exempt small water systems from meeting water quality standards if the technology required would mean the post-investment cost of water would exceed 2.5% of median household

[17] Water services generally include provision of sewerage services, but this is not always explicit in the literature.
[18] The remainder are charged an amount related to the value of their house rather than measured consumption

income. Local water systems were simply required to use the best available technology that would meet this affordability threshold.

Table 4: Water Affordability Metrics

Author, Organisation or Country	Title of Metric	Description
Chile[19]	Threshold for receiving water subsidies	>5% of monthly income spent on water and sewerage services among low-income households
World Bank (2002)[20]	"received oral wisdom" (Herrington, 2003)	3-5% of total household income/expenditure on water
Asian Development Bank (2003)[21]	N/A	5% of total household income/expenditure on water
United Kingdom[21]	Hardship measure "for illustrative purposes" (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 and waste water >5% of household expenditures
Walker (2009)	N/A	Individuals in lowest three income deciles spending >3% of disposable income (before housing costs) on water bills
Lithuania[21]	Unaffordability threshold	Expenditure on water and sanitation >2% of individual household's disposable income
Northern Ireland[21]	Unaffordability threshold	Expenditure on water and sanitation >3% of individual household's disposable income
France[21]	Unaffordability threshold	Expenditure on water and sanitation >3% of individual household's disposable income
United States[21]	Unaffordability threshold	Expenditure on water >2% of median household's disposable income
Portugal[22]	Unaffordability threshold	Water (for 120 litres per capita per day) and wastewater bill should not >2% of income

Source: Authors' own work

[19] Described by Gomez-Lobo (2001)
[20] Reported in Table 1 of Fankhauser and Tepic (2007). Unfortunately, either the source documents are unavailable or a specific measure is not easily identifiable in the source document.
[21] Quoted in Table 1 of Hutton (2012) and recorded as originally being collated in Smets (2014). A range of affordability thresholds for different middle income and less developed countries are also quoted by Hutton (2012) however, for brevity, these are not reported here.
[22] Quoted in Hutton (2012).

4.3 Measuring the affordability of transport

Compared to the other utilities, little literature has been found discussing the affordability of transport services explicitly. However, there is recognition that transport difficulties can lead to social exclusion. For example, Bonsall and Kelly (2005) evaluate how introducing road user charging in the UK city of Leeds would impact on different 'at-risk' groups.

One area where affordability issues have been considered is in relation to whether mass transport systems in cities are affordable to low income individuals and whether this justifies the provision of subsidies. Cervero (2011) highlights the metric suggested by Armstrong-Wright (1986) for transport outlays to be judged as 'fair' (see Table 5). As with water affordability there is a debate regarding which transport expenditure should be considered 'essential' and that which is discretionary. Kessides (2009) suggests travel to school, work and the local market (in less developed nations) should be considered essential travel activities.

Table 5: Transport Affordability Metrics

Author, Organisation or Country	Title of measure	Description
Armstrong-Wright (1986)	'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[23]	Maximum spending threshold for 'vale-transporte' travel pass	Employer pays for travel to work in excess of 6% of worker's gross income

Source: Authors' own work

[23] Described by Gomide et al (2004)

5. A European perspective on affordability

Concern about the affordability of utilities arises because some, in particular water and energy, are essential to a healthy life; while others, in particular telecoms and transport, impact significantly on an individual's ability to engage in a nation's economy and society. Moreover, if expenditure on utilities is high it reduces the resources available for households to spend on other needs/wants, thus resulting in a presumed reduction in welfare.[24] Welsch and Biermann (2014) explicitly consider the impact of changing energy prices on subjective well-being. Surveying 200,000 individuals across 21 countries, these authors find that an increase in energy prices is associated with a small but statistically significant drop in the well-being index used by the authors. The impact on subjective well-being is stronger for those in the lowest income quartile and during periods when energy prices can be expected to be high.

5.1 Energy affordability

Increased policy importance

The increasing political interest in energy affordability can be linked to rising residential energy prices. For example, National Energy Action (NEA) (2012) reports that between 2008 and 2012 EU household electricity prices increased on average by 4% per year, while gas prices increased by 3% per year. Prior to this, EPEE (2009) notes that between 2005 and 2007 the price of domestic gas had already increased by an average of 18% and the price of domestic electricity had increased by an average of 14% across the EU. Unsurprisingly, Fiorio and Florio (2011) find that higher energy prices are associated with a lower likelihood of perceiving electricity prices to be 'fair' in Eurobarometer surveys. However, Fiorio and Florio also find institutional factors are important in perceptions of price fairness with a high degree of public ownership being associated with a wider perception of fairness.

A number of bodies explicitly include energy affordability as an objective. For example, the CEER-BEUC[25] 2020 Vision for Europe's Energy Customers outlines four principles which energy regulators should adhere to: Reliability, Affordability, Simplicity and Protection and Empowerment (RASP) (CEER, 2014). Furthermore, the Citizens Energy Forum (CEF) formed a Vulnerable Consumers Working Group in 2012. This working group is designed to map vulnerability quantitatively and qualitatively; to recommend definitions of vulnerable consumers; and to spread best practice in order that the number of vulnerable consumers (and those in energy poverty) can be reduced.[26] The gradual rise to prominence of energy

[24] This logic is challenged if people choose to increase expenditure on a utility due to the new benefits it brings, as may be the case with broadband connections.
[25] Bureau Européen des Unions de Consummateurs (BEUC, or The European Consumer Organisation)
[26] See CEF (2013)

affordability within EU policymaking circles is explored by Bouzarovski et al (2012). An obvious question in mid-2015 is whether this emphasis will continue if fossil fuel prices do not return to their peak levels prior to 2014.

However, affordability issues may result from specific policy choices and investment demands rather than underlying resource prices. Vaasa ETT (2013) argues that market forces only affect around half of the end user price for gas and electricity in European residential markets. As an example of a specific policy choice, Heindl (2014) highlights the promotion of renewable energy in Germany. Heindl notes that the cost of renewable energy promotion rose from 0.4 cents per consumed kilowatt-hour of electricity in 2003 to 5.3 cents in 2013. This converts into an annual cost of 185 euros for a three-person household consuming 3,500kWh of electricity in Germany in 2013.[27] CEF (2013) provides a wider perspective on this issue of 'tax' increases with taxation in 11 Member States causing gas bills to rise by more than 5% between 2011 and 2012.

Pan-European comparisons of affordability

EC (2010) provides estimates of the average percentage of household expenditure spent on energy using data from Eurostat's collated national household budget surveys over the period 2005-2008[28]. There is considerable variation in the figures with the average percentage of expenditure spent on energy varying from 1.8% in Malta to 14.5% in the Slovak Republic. EC (2010) also reports the percentage of households where the proportion of expenditure on energy is twice the average proportion within each Member State (labelled 'considerable expenditure share'). Again, there are large variations, with 6.1% of households in Latvia spending twice the average percentage on energy compared to 19.7% of households in Estonia. Households in newer Member States generally spend a greater proportion of their expenditure on energy. Across the EU27 as a whole, EC (2010) estimates that 13.1% of households can be classified as spending a considerable expenditure share on energy which converts to 27.1m households and 65.3m individuals. This figure lies within an earlier estimate by EPEE (2009) which put the number of fuel poor Europeans in the range of 50-125m people.

The most recent affordability figures come from Vaasa ETT (2013) and ACER-CEER (2014). Vaasa ETT (2013) reports that in 2012, across the EU15, consumers on average spent around 3.5% of their disposable income on electricity, with figures varying from under 1% in Luxembourg to just under 6% in Portugal. For gas, the EU15 average is around 5% of disposable income with the figures varying from 1.5% in Luxembourg to 8% in Greece.

[27] However, Vaasa ETT (2013) notes that while Germany had the second highest electricity prices in the EU (measured in euros in 2012), when measured as a proportion of disposable income Germany only had the 8th least affordable electricity prices in the EU.
[28] Eurostat acknowledges that data collection methods may vary between Member States and the year when data was collected also varies between Member States.

Within Member State variations

Even within particular member states there can be substantial variations in fuel poverty across regions. Heindl (2014) reports that, using the 10% expenditure threshold, 15% of households in England were identified as fuel poor in 2011 compared to 42% in Northern Ireland. That 42% of households in Northern Ireland were classified as fuel poor using the 10% expenditure threshold (Liddell et al, 2011 reports median energy expenditure in Northern Ireland was 9%) highlights that a common fuel poverty threshold may not be suitable for the targeting of fuel poverty alleviation measures in all areas. A central part of policy is targeting the limited resources available at those areas/groups where fuel poverty is most severe. To this end Liddell and Langdon (2013) develop an area-based assessment tool that identifies areas in Northern Ireland where on average 78% of individuals were identified as fuel poor. Another approach could be to target households based on the extent of their fuel poverty. Liddell et al (2011) note that in 2009 in Northern Ireland 10.9% of households would have had to spend over 20% of their income on energy to achieve an adequate heating level and 4.8% of households would have needed to have spent over 25% of their income on energy. Miniaci et al (2008) find similar differences between the needs and affordability of households in different geographical areas of Italy.

Different fuel poverty measures

The definition of a fuel poverty threshold can have a dramatic impact on the picture of fuel poverty, especially through time. DECC (2013, 2014a) highlight the effect of changing from a fixed expenditure threshold to a relative residual income metric. Under the new LIHC (relative) definition of fuel poverty, DECC (2014a) shows the proportion of households classified as fuel poor in England is very stable through time, with figures of 11.8% in 2003 and 10.4% in 2012. In contrast, if fuel poverty is defined as those spending more than 10% of their income on energy, DECC (2013) shows a dramatic rise in the proportion of households classified as fuel poor over the period 2003 to 2011 with the proportion rising from 5.9% to 14.6%. While the LIHC definition of fuel poverty means the proportion of households identified as fuel poor is less sensitive to fuel price movements, the accompanying 'fuel poverty gap' measure is explicitly linked to fuel prices. This fuel poverty gap indicates the sum of money required to take a household out of LIHC fuel poverty. DECC (2014a) reports that the average fuel poverty gap per household in fuel poverty rose from £254 in 2003 to £443 in 2012.

Another definitional issue which affects the fuel poverty picture is whether actual expenditure is considered or a model estimating adequate expenditure is used. Liddell et al (2011) report data from Northern Ireland to highlight this issue. In the late 2000s, the proportion of households classified as required to spend over 10% of their income on energy by an adequate expenditure model was around 40%, while in 2008 the actual proportion of households spending over 10% of their income on energy was only 24%.

Evidence from proxy indicators

EPEE (2009) provides a comparison of fuel poverty and how it is dealt with in Belgium, France, Spain, Italy and the UK. EPEE concludes that there are large regional disparities regarding fuel poverty within individual countries and that tenants are more likely to be fuel poor than owner-occupiers. EPEE (2009) goes on to contrast the UK's considerable emphasis on fuel poverty with Belgium and Spain where there was little recognition of the issue. Earlier work by Healy and Clinch (2002) used data from the European Community Household Panel to consider fuel poverty across 13 EU countries during the 1990s. While dated, this research highlights how severe fuel poverty appeared to be in Mediterranean countries during the time period studied when measured using proxy indicators. Healy and Clinch report that across the period 1994-1997 more than 70% of Portuguese households reported being unable to heat their houses adequately with the equivalent figure being over 50% in Spain, over 40% in Greece and over 20% in Italy.[29]

EPEE (2006b) provides detailed figures for the percentage of households that suffer from individual indicators of fuel poverty in the five countries discussed in EPEE (2009) using data from EU-SILC in 2005. The percentage of households who said they could not afford to keep their house adequately warm varied from 5.7% in the UK to 14.6% in Belgium. Regarding living in a home with a leaking roof, or with problems of damp or rot, the figures varied from 12.2% in France to 22.7% in Italy. Lastly, the percentage of households reporting arrears with their utility bills varied from 0.1% in the UK to 9% in Italy. EC (2010) reports more recent figures on the proportion of the population in arrears and for the whole EU27. Again, there was great variation in 2008, from fewer than 2% of households being in arrears in Luxembourg to over 30% in Bulgaria (the EU-27 average was 8%). ACER-CEER (2014) provides some further figures on disconnection rates in 14 EU countries. The percentage of household metering points disconnected in 2013 for non-payment, varied from less than 0.1% in the UK to 6.7% in Portugal (for gas the respective figures were less than 0.1% and over 4%).

Energy efficiency as a solution

The documents and papers discussed above generally suggest the desirable policy remedy for energy affordability issues is increasing energy efficiency, particularly with regard to housing (e.g. EC, 2010). The selection of this policy intervention is generally justified on three grounds: (i) in the long-run, one-off investments in energy efficiency will cost less than continuously subsidising energy prices; (ii) providing energy subsidies distorts the market; and (iii) energy efficiency improvements are also likely to benefit the environment. However, NEA (2012) highlights that a central challenge to raising household energy efficiency is providing the funds to cover the upfront capital cost of the efficiency improvements. This issue is particularly

[29] By comparison, for the United Kingdom and the Republic of Ireland in the same time period the figures fall in the range 2.5%-9%.

important if those struggling to afford utilities are on low incomes and, hence, least likely to have the necessary funds available. This raises questions of whether any market failure lies not in the utilities themselves, but in the markets for raising the necessary finance.

5.2 Telecoms affordability

Harker et al (2013) note that within the EU there is a requirement for Member States to ensure the availability of fixed telephony services at an affordable price throughout their territories as part of Universal Service Obligations (USOs). Regarding broadband provision, Harker et al note that specific broadband provisions within USOs are rare, with broadband only being mentioned in the USO legislation of Spain, Finland and Malta. One interesting question for the future is whether USOs involving fixed line telephony will remain relevant if many individuals switch to obtaining telephony and Internet services solely via mobile devices.

The EC Communications Committee (2014) highlights that in 2013 there was considerable variation across the EU in the percentage of the population subscribing to broadband, the prices of broadband and the cost of broadband as a proportion of income. The Committee reports that in Hungary and Cyprus the median cost of a 12-30Mbps Internet connection exceeded 5% of gross disposable income per capita while the same service represented only around 1% of gross disposable income per capita in Sweden and the Netherlands. Unsurprisingly the report finds a negative correlation between affordability and the penetration rate of fixed broadband.

The ITU (2012) provides extensive information on the affordability of basic telephony and broadband services across the EU in 2011. For fixed telephony services, the most affordable country was Norway where the cost of the specified basket of services was 0.3% of average GNI (Gross National Income) per capita while the least affordable country was Bulgaria at 2.2%. For the mobile services basket, the affordability figures ranged from 0.2% in Norway and Denmark to 6.3% in Bulgaria. Lastly, the cost of the broadband basket ranged from 0.6% in Luxembourg and the UK to 2.6% in Bulgaria. The ITU figures also allow comparison of the affordability of telecoms services in the EU with countries across the world. For example, in the US in 2011 the fixed telephony basket cost 0.3% of average GNI per capita, the mobile telephony basket cost 0.9% and the broadband basket cost 0.5%.

At the international level, the ITU (2012) provides evidence confirming that telecoms affordability has increased over time. The ITU's ICT Price Basket (IPB) for developed countries fell from 2.6% of average GNI per capita in 2008 to 1.6% in 2011. The biggest increase in affordability in developed countries related to the mobile telephony basket with the cost of this halving from 4.0% of average GNI per capita in 2008 to only 1.9% in 2011. Focussing on the 38 countries in the 'Europe' region, the value of the IPB fell by an average of 11.1% in 2008-2009, 14.2% in 2009-2010, but only 1% in 2010-2011.

The final piece of information which ITU (2012) provides relates to the affordability of mobile broadband. The ITU looked at the subscription costs for 1GB of mobile broadband downloads per month. For a prepaid handset-based subscription, the cost as a percentage of average GNI per capita varied from 0.2% in Denmark to 5.9% in Spain.

5.3 Water affordability

Herrington (2003) provides a comparison of the affordability of water charges in eight Organisation for Economic Co-operation and Development (OECD) countries.[30] Unfortunately, genuine comparisons are difficult due to variability regarding the income/expenditure measures used and the data for different countries coming from different years. However, variability is present with average expenditure as a percentage of disposable income being 0.5% in the US compared to 1.4% in the Netherlands. In addition, in all the countries Herrington (2003) reports on, the proportion of income spent on water charges falls the higher one moves up the income distribution.

The only other international comparison identified regarding water affordability in EU countries is in Fankhauser and Tepic (2007). Fankhauser and Tepic provide information on the affordability of water for transition economies that have joined the EU as well as for former Soviet Republics. Among new EU Member States, average expenditure on water as a percentage of total household expenditure ranged from 0.8% in Latvia to 4.1% in Hungary. Fankhauser and Tepic discuss how utility affordability was a major issue in transition economies as tariff rebalancing (the removal of state subsidies) occurred in the 1990s.

Within the EU, Gawel and Bretschneider (2011) note that one of the drivers for water affordability becoming an issue has been the drive to remove subsidies and the shift to full cost recovery as outlined in Article 9 of the EU's Water Framework Directive. Gawel and Bretschneider report OECD figures for England and Wales in 1999-2000 that show those in the lowest income decile faced water charges as a percentage of income over seven times higher than those in the top income decile (3.75% vs 0.4%). Taking the UK government's 'illustrative' guide that households spending more than 3% of their disposable income on water experience hardship, OECD (2003) reports figures from the Department of Environment, Transport and the Regions on the percentage of households in England and Wales lying above this threshold. In 1994-95 21.8% of households in England and Wales spent more than 3% of their disposable income on water, while in 1997-98 this figure had fallen to 18.4%. Reynaud (2006) provides equivalent figures for France noting that 4.3% of French households spent more than 3% of their income on water charges in 2001. For those households in the highest income decile, 0.61% of

[30] The countries compared are: England and Wales, Scotland, Hungary, the Netherlands, Mexico, the US, France, Italy and Denmark.

their income was spent on water charges, while the poorest 1% of households spent on average 4.8% of their income on water charges.

Walker (2009) also highlights the considerable regional variation within England and Wales concerning the percentage of low-income households facing water affordability issues. The percentage of households in the bottom three income deciles spending over 3% of their disposable income (before housing costs) on water varied from 6% in the Thames Water region to 72% in the South West Water region.[31] Additionally, Walker reports Water Services Regulation Authority (Ofwat) figures on perceptions of water affordability in England and Wales with 25% of households believing water services to be unaffordable, which rises to 36% for households identified as being in the lowest socio-economic group.

In terms of a European situation where water supplies are under stress, Garcia-Valinas et al (2010) consider the affordability of obtaining a basic quantity of water in different Spanish municipalities. Garcia-Valinas et al conclude that basic quantities of water are relatively affordable with the average cost of basic water consumption in the least affordable municipality forming only 2.3% of average household income in that municipality. Although, using area average figures may mask the true affordability issues in particular population groups.

5.4 Transport affordability

So far the only evidence found on transport affordability in developed countries refers to the US. Roberto (2008) reports that the 'working poor' spend a much higher share of earnings, 6.1%, reaching their jobs than the non-poor, 3.8%. Being reliant on car use further increases the proportion of earnings the working poor spend on commuting to 8.4%.

As noted in the introduction, there is a potential trade-off between housing costs, travel time and transport costs. Viewing housing and transport as a bundle reinforces the disparity between the working poor and non-poor found by Roberto, with working poor homeowners spending 25% of their income on housing and transport costs, compared with 15.3% for non-poor home-owning households (for renters the figures are 32.4% and 19.7% respectively). Cervero et al (2006) finds that the housing cost versus transport cost trade-off is less beneficial for those in lower income brackets in seven US metropolitan areas. Cervero et al find that for households in the top third of the income distribution, a 10% increase in commuting time is associated with an 8.9% drop in housing costs, while for the bottom third of households the drop in housing costs is only 3.5%.

[31] OECD (2003) also provides information on regional variations in the affordability of water for Italy and Hungary.

6. Identifying the value of the Internet

The Internet has become increasingly central in our lives over the past 20 years. The increasing proportion of time which individuals spend on the Internet compared to other activities, suggests that the Internet adds considerable value to individuals' lives by a simple revealed preference argument[32]. Importantly, the value of the Internet is derived from the services delivered through a connection, since simply being connected to a broadband network has little intrinsic value without the content of the Internet which can be received through the connection. While the presence of effective infrastructure is a necessary condition for consumers and citizens to receive value from the Internet, it is not sufficient to realise these benefits. Once infrastructure is in place, distributional concerns relating to the Internet involve differential usage by different individuals. That the value of the Internet is derived from the services delivered through a broadband connection also gives rise to the net neutrality debate and whether or not there should be concern about differences in the quality/speed of services provided to different consumers.

This section aims to provide briefly some insights regarding: (i) how consumer technology is changing consumer engagement in the residential energy market; (ii) econometric evidence on the general benefits of the Internet to individuals; and (iii) the extent of the 'digital divide' in Europe.

6.1 Consumer technology's impact on the residential energy market

The Internet's apparent importance in enabling consumers to engage effectively with utility markets is highlighted by Ofgem/Taylor Nelson Sofres (TNS) (2014). Although only providing descriptive statistics, Ofgem/TNS (2014) suggests that UK consumers rely heavily on the Internet to provide information about deals in the energy market and to enable switching. For example, of those who reported switching energy supplier in the previous 12 months, 44% did so via an online price comparison service, over twice the percentage of people using the next most popular method, by phone (21%). In terms of those simply comparing tariffs and deals in the previous 12 months, 59% did so using the Internet.[33] The importance of the Internet in providing information is further reinforced by the fact that of those who felt it was easy to compare different energy tariffs, 65% put it down to the information available on price comparison websites.

[32] Revealed preference involves the following intuition: if I am a rational individual maximising my happiness (utility), who is currently spending time on activity A and, using my free will, I choose instead to spend time on activity B, it must be the case that activity B gives me greater happiness (utility) than activity A (assuming constant prices).
[33] 39% used a price comparison service, 11% used their own supplier's website and 9% used another supplier's website.

While these statistics are suggestive of benefits from the Internet, they also suggest that the Internet may be associated with increased division in society as those without Internet access are unable to obtain its benefits. Again, Ofgem/TNS (2014) provides some indicative statistics showing that 42% of regular Internet users in the UK think it easy to compare tariffs compared with only 22% of those without regular Internet access. The main need for caution regarding these statistics is that they make no attempt to control for other factors correlated with Internet use which may affect the understanding of tariffs, such as educational attainment.

Another example from the UK energy market where telecoms technology may improve engagement in one group of consumers, but at the risk of increasing the differences in outcomes achieved between different consumer segments, is the introduction of Quick Response (QR) codes on energy bills. Individuals with smartphones can scan the QR code to transmit their energy bill details easily to potential suppliers, enabling accurate and very simple price comparisons/switching. However, the potential benefits of this policy intervention are clearly limited to those with access to a smartphone. The CEF (2013b) views it as crucial that consumers can access their energy data even if they do not have access to a smart phone.

In the UK, such differential access should not be a problem once smart meters have been installed in all homes, though three issues remain. Firstly, just because all homes have access to a technology does not mean all households will use it to the same extent. CEF (2013b) notes that without correct framing, the quantity of information generated by smart meters could actually make comparisons of bills more challenging and may not necessarily lead to improved outcomes. Secondly, at least in the short run, the capital cost of installing smart meters will be paid for in the UK by an additional charge on energy bills potentially lowering energy affordability. Thirdly, and most importantly, there are questions about the amount consumers may save through the use of smart meters. One critical benefit of smart meters is that they allow Real Time Pricing (RTP), i.e. a different price of energy for each hour of the day. If consumers are to benefit from these additional pricing signals, they must have demand which is sufficiently elastic to allow them to move consumption away from peak periods. Allcott (2011) investigates this issue by studying an experimental roll out of smart meters in Chicago.

In Allcott's study, individuals self-selected into the experiment but were then randomly assigned between two groups, only one of which received smart meters. Allcott finds that while RTP reduces electricity demand in peak periods it did not lead to people shifting consumption to off-peak periods. Overall, it is estimated that introducing smart meters increased an individual's consumer surplus by around $10 per year (a reduction in costs of 1-2%). Given that a meter's installation cost was $150, Allcott concludes that consumer savings alone did not justify the expense of installing the smart meters. However, there are some notes of caution to accompany Allcott's study. Firstly, as individuals self-selected into the study the results may not generalise to the population as a whole. If one assumes that those with the most to gain from smart meters are most likely to participate in the trial, the figures above may overestimate the likely

savings. Second, saving figures are likely to be location specific and change according to the variability of the electricity price (the greater the variance the greater the potential for savings). Lastly, Allcott finds evidence suggesting the level of demand response is linked to the precise technology used to display price and usage information.

Regarding the actual rollout of smart meters in Europe, ACER-CEER (2014) provides some headline figures. While the majority of EU countries have made limited progress regarding the installation of smart meters, over 95% of homes in Finland, Italy and Sweden have a smart meter for electricity. The widespread installation of the smart meters in these countries suggests that they may provide lessons for the rest of Europe regarding the benefits and issues resulting from the rollout of this technology. Greater detail on countries' plans to roll out smart meters is provided by EC (2014) which gives a comprehensive summary of the energy markets in all Member States. EC (2014) highlights that the roll out of smart meters to 80% of consumers by 2020 is only required by EU law when the Cost Benefit Analysis (CBA) reports a positive result, i.e. the benefits of the roll out exceed the costs. Table 6 provides a comprehensive report on the roll out of smart meters across Member States based on the information contained in EC (2014). Not only have many countries not started the full roll out of smart meters, Table 6 shows that a number of countries had not even taken a decision about whether or not they intended to roll out the technology. Additionally, it is notable in EC (2014) that for six countries, namely Bulgaria, Croatia, Germany, Hungary, Luxembourg and Portugal, there is no information on the position of the smart meter roll out.

Table 6: Measures of Transport Affordability

Member State	Number of Smart Meters Installed	Additional Comments
Austria	590	Positive CBA for both electricity and gas. Ministerial decree requires roll-out to be completed by end of 2019, but up to 5% of consumers can refuse a smart meter installation
Belgium	-	Negative CBA for both electricity and gas. Decision on roll out of smart meters postponed to 2020
Cyprus	3,000	Smart meters installed as pilot project
Czech Republic	50,000	Negative CBA. In 2014 EC formally requested that all consumers have individual meters
Denmark	1.63 million	Roll out for electricity began in 2010/11 with completion scheduled for 2020. Positive CBA for electricity means an additional 1.38m homes will receive smart meters. No plans for large scale roll out of gas smart meters
Estonia	-	No CBA yet performed and no decision made regarding roll-out for gas. Roll out for electricity to be made in 'Energy Sector Development Plan 2030'. All electricity consumers must have a 'remote reading device' by 2017

Finland	97% penetration	Along with full smart meter roll out, hourly settlement has been introduced at the domestic level
France	270,000	Positive CBA means full roll out for gas and electricity smart meters. Linky pilot project from 2010 aims to roll out 300,000 electricity smart meters, full roll out: 35 million meters. Gazpar pilot project from 2013 aims for 150,000 gas smart meters by 2016, with 11 million by 2022
Greece	-	Committed to smart meter roll out. Pilot programme covering 160,000 smart meters due for completion in 2015
Republic of Ireland	10,000	In addition to smart meters installed in trial, 1,000 in-home displays were provided. CBA performed and full roll out expected in 2016-2019
Italy	32 million	Roll out programme complete
Latvia	-	No CBA performed and no formal decision taken regarding roll out
Lithuania	-	CBA for electricity smart meters completed, but no formal decision taken. CBA for gas smart meters currently being undertaken
Malta	170,000 (in 2012)	62% penetration of smart meters had been reached by 2012, with the roll out scheduled for completion in 2014
Netherlands	490,000	Positive CBA means full roll out is scheduled to start in 2015. The aim is for 100% penetration of electricity smart meters and 80% penetration of gas smart meters by 2020
Poland	400,000	
Romania	-	Roll out of electricity smart meters considered feasible. Gas smart meter roll out is optional with decision taken by Distribution System Operators (DSOs). Pilot projects being promoted as of 2013
Slovakia	-	Roll out of smart meters still being discussed. DSOs installing smart meters on a voluntary basis
Slovenia	-	Formal decision on smart meter roll out not yet taken
Spain	7.9 million	
Sweden	100% penetration	2009 requirement for monthly household meter readings spurred smart meter roll out. Some smart meters require additional investment to allow hourly reading. Since 2012 DSOs must provide hourly meter readings to customers requesting them
UK	89,400 residential, 0.5 million non-residential	Government has committed to the full roll out of smart meters to replace 53 million existing meters

Source: European Commission (2014)

6.2 The value of the Internet

Before presenting some of the econometric evidence on the value of the Internet, it is important to note the boundaries of this review. Firstly, this section is not aiming for a comprehensive review of the evidence on the Internet's value, as the literature is very large and not necessarily focused on affordability. Nevertheless, we present a representative selection of high-quality economics papers aiming to identify the benefits of the Internet. Secondly, we do not attempt to review the literature on how the Internet/ICT may affect macro-economic growth; instead we focus on the impact of the Internet in micro-economic settings. All the studies are inherently backward looking, i.e. they cannot evaluate the very latest technological developments. To achieve robust statistical results, data are required over a reasonable time period and the research/publication process itself can take several years. The papers reviewed below largely fall into three areas of an individual's life: (i) political engagement, (ii) retail/consumer markets, and (iii) the labour market. A common theme running through much of the research is that the key benefit offered by the Internet is increased provision of information at a lower cost or, in more technical language, the Internet lowers 'search' costs.

While papers about the Internet and economic growth are not the focus of this review, several papers do attempt to link the spread of communication technologies and the Internet to subjective well-being in cross-country studies. For example, Graham and Nikolova (2013) find a positive correlation between Internet access and subjective measures of well-being in Gallup World Poll data for 2009-2011. This relationship is robust to the inclusion of various individual and household level controls along with country and year dummies.

Measurement issues

A robust estimate of the value of the Internet requires recognition of the intrinsic differences between those who do and do not use the Internet. This implies that any improved outcomes for those using the Internet may, in part, be due to differences in individual characteristics regarding education, income or other characteristics. Studies assessing the value of the Internet must control for these observable characteristics. An even greater challenge for researchers is to control for 'unobservable' differences between Internet users and non-users such as social confidence and willingness to take risks/try new things.

Finally, the direction of causation may be difficult to establish: did obtaining broadband Internet cause an individual to spend more time on the Internet or did the desire to engage in additional Internet activity cause an individual to obtain a broadband Internet connection? For example, Kolko (2010) notes in his study of differences in Internet usage between broadband and dial-up users that he is unable to deal with this issue of causation. Putting the direction of causation to one side, Kolko finds that US households who adopted broadband in the period 2004-2006 spent more time on the Internet following broadband adoption. Kolko also finds that most of

this increase resulted from music downloading and online purchasing, while acquisition of broadband seemed to have less effect on the usage of potentially more 'socially beneficial' websites related to jobs, careers and the government.

The impact on political engagement

To overcome the issue of causation and unobservable characteristics, researchers ideally aim to find datasets where there is an exogenous, or 'independent', reason for differences in Internet access/usage. An example of this approach is Bauernschuster et al (2014) who take advantage of the fact that in the 1990s certain areas of the former East Germany were connected to a particular telecoms system which delayed the rollout of broadband. Baurernschuster et al find that the differential access across areas showed a significant positive impact on individuals' social capital[34] and political engagement from broadband access. Falck et al (2014) extend this analysis on the impact of broadband on political engagement in Germany by investigating its impact on voter turnout at elections. Again, they exploit exogenous variation in the ease of broadband rollout and extend the study to incorporate the former West Germany. Falck et al find that broadband access was associated with lower voter turnout in the former West Germany, particularly for non-local elections. They attribute this drop in turn-out to the fact that Internet use was a substitute for television viewing and in Germany television viewing was the primary source of information about non-local elections. However, the authors caution that these results are specific to broadband and relate to a time period, 2005-2008, that is largely before the period when social media influenced the political process.

Recognising concerns that the Internet could cause increased political and social division with individuals self-selecting into 'echo-chambers' of news and comment sites, Gentzkow and Shapiro (2011) investigate this issue in America. The higher number of information sources on the Internet might enable greater self-segregation or it might reduce the cost of receiving information from multiple sources containing differing opinions. Gentzkow and Shapiro take data from websites, market research firms and social surveys to identify the ideological segregation (on a liberal-conservative spectrum) of the news individuals receive via websites, the news they receive via conventional media and the topics discussed in face-to-face interactions. Gentzkow and Shapiro find that the information individuals receive via the Internet is more segregated than television, but is less segregated than national newspapers and is much less segregated than individual's face-to-face social interactions. However, the authors recognise that they can only evaluate the content of the information sources, they are unable to assess how individuals interpret the information they receive from different sources.

[34] Social capital is defined as involving going out, meeting other people and participating in voluntary organisations.

The Internet's positive impact in retail markets

Turning to more typical microeconomic topics, key benefits of the Internet to consumers are seen as increased choice and, even more fundamentally, an improved ability to 'search' through this increased choice. The impact of the Internet in reducing search costs and the effects this has had on various markets forms the bedrock of microeconomic research into the Internet. For example, Brynjolfsson et al (2011) conclude that the Internet led to the distribution of sales across different products being stretched to encompass a wider range of products, and find that this resulted not only from sellers being able to stock a greater choice of products, but also from buyers having greater access to information on 'niche' products. Brynjolfsson et al draw this conclusion by comparing the sales distributions of a retailer across their catalogue and Internet sales channels when the product range and prices were common to both channels. After controlling for observable characteristics, individuals purchasing via the Internet made orders containing a greater proportion of niche products than those who used 'bricks and mortar' outlets.

Choi and Bell (2011) provide a study outlining the more direct benefits of online retailers being able to stock a wider range of products than 'bricks and mortar' stores. Choi and Bell investigate a particularly bulky product, diapers, and identify areas where mothers of new-borns are likely to form a 'preference minority' due to their geographic neighbourhood containing a disproportionate percentage of elderly citizens. The authors find that even when areas contain the same absolute number of potential customers, in those areas where indicators strongly suggested a 'preference minority', online sales were 50% higher than in those areas where such indicators were particularly weak. Similarly, in likely preference minority areas, the diapers from 'niche' brands or which had niche characteristics were even more reliant on online sales. The authors note that the Internet allows the aggregation of individuals who are isolated from a geographic or preference perspective into a market sufficiently large to be served profitably.[35]

Beyond the prospect of increased choice, one might think that if the Internet had reduced search costs, this may have led to increased competition and lower prices. Goldmanis et al (2010) find implicit evidence supporting this hypothesis. Using US panel data Goldmanis et al look at the size distribution of 'establishments' at the local level for travel agents, bookstores and new car dealers. As the proportion of consumers making purchases online in a particular area increases, the number of small establishments in each of these industries declines, while the number of large establishments shows no change or increases. Under the assumption that smaller establishments have higher costs, and with the support of a theoretical model involving search, the authors argue that this finding is consistent with the Internet's increased search capabilities leading to the market share of low cost firms rising. Consumer welfare will rise if these lower costs feed through to lower prices for consumers.

[35] However the study does not establish the relative benefit of the Internet over the previous available technology: mail-order catalogues.

More direct evidence of the lower prices available via the Internet is provided by Sengupta and Wiggins (2014). Sengupta and Wiggins investigate the impact of online purchasing of airline tickets. Importantly, the authors use data on actual transaction prices rather than posted prices and control for a range of ticket related characteristics. After controlling for these characteristics, the tickets purchased online are found to be 11% cheaper than those purchased offline. However, Sengupta and Wiggins note that if ticket characteristics were not controlled for one would erroneously find that online tickets were 30% cheaper than their offline counterparts. The authors find that the higher proportion of tickets bought online for a particular route does not result in lower average offline prices, i.e. there is no spillover from lower Internet prices into the offline world.

Another potential positive effect of the Internet is that it enables disadvantaged or discriminated groups to obtain better deals than they would otherwise obtain in the offline world. Scott Morton et al (2003) investigate this claim using data on car transaction prices in online and offline markets in the US in 1999. They find that offline African-American and Hispanic purchasers pay around 2% more than other consumers, although the authors point out that 65% of this difference can be explained by characteristics such as income, education and neighbourhood. In an online environment, where face-to-face negotiations do not take place, the difference in prices received by different races virtually disappears. However, Scott Morten et al are careful to note that even in the online marketplace they study, if car dealers wanted to, it would be a relatively easy task to discriminate against ethnic minorities since all consumers have to provide their name and address to the car dealing website involved in the research. The authors conclude that, rather than dealers treating ethnic minority individuals differently in the offline environment, certain characteristics of the bargaining process disproportionately disadvantage those from an ethnic minority background. The authors argue that the Internet provides these otherwise disadvantaged individuals with greater information and reduces potential non-racial cues regarding willingness to pay that may be present in a face-to-face situation. However, whether this benefit of anonymity still exists on the Internet in the world of 'Web 2.0' and increased data mining/tracking may be open to question.

New challenges in retail markets

Levin (2011) identifies three powerful new tools that the Internet has enabled: (i) price comparison websites; (ii) consumer auction platforms; and (iii) online recommendation/reputation systems. While these new services are often associated with making search easier, firms may respond to lower search costs in ways that may not be beneficial to consumers. Levin notes that firms faced with lower search costs may have an incentive to obfuscate, in other words take actions that make search more difficult. Ellison and Ellison (2009) explain that obfuscation could include making product descriptions more technical, creating multiple versions of an otherwise identical product or selling add-ons at a late stage of the purchasing process.

Ellison and Ellison (2009) investigate the topic of obfuscation further by investigating the pricing of computer components in a situation where competition is driven via a price comparison website. In the market Ellison and Ellison consider, they suggest the obfuscation strategy involves a low quality product being sold at a low price to get a high position in the search ranking, followed by encouragement of individuals to switch to a higher quality product at a much higher price. The authors base this conclusion on evidence that the price elasticity of demand for low quality computer memory is very elastic and that charging a low price for low quality products increases the sales of medium and high-quality products. Ellison and Ellison suggest that in the particular market they are considering the price comparison website studied is very good at identifying the cheapest price in the marketplace, but has only a limited capacity for non-price characteristics. As a result, consumers appear to use the price comparison website to shortlist suppliers who appear cheap 'in general', and then are reliant on each supplier's individual website's search function to identify the product that best suits their specific needs.

Another example of how firms might react to apparently increased consumer power is provided by Mazylin et al (2014). Mazylin et al investigate the incentives for hotels to post fake user reviews on travel websites. To do this they exploit a difference in the rules for posting user reviews on the Expedia and TripAdvisor websites. Only customers of a hotel are able to leave ratings on Expedia, while anyone can leave a review on TripAdvisor. Hence, one would expect fewer 'fake' reviews on Expedia compared to TripAdvisor. While Mazylin et al can never know whether an individual review is 'fake', they note that different types of hotels in different situations have differing incentives to post fake reviews. The key hypothesised incentives are as follows: (i) hotels with neighbours are more likely to receive fake reviews from other hotels than isolated hotels, and (ii) small owners/independent hotels are more reliant on reviews than branded hotels and so the former have an increased incentive to fake positive reviews. Conforming to the hypothesis, and after controlling for a range of observable characteristics, Mazylin et al find that on TripAdvisor an independent hotel owned by a small owner will have 7 more five-star reviews than a chain hotel with a large owner, while a hotel located next to an independent hotel with a small owner will have 6 more one- or two-star reviews compared to an isolated hotel. The authors recognise that a key weakness of their approach is that by just considering the number of reviews they are assuming all reviews have an equal effect on consumer behaviour.

Considering a very different topic, Pozzi (2012) investigates the impact of Internet consumers using certain 'tools' which are claimed to increase the convenience of a shopping experience, when these tools may not be wholly beneficial. Pozzi (2012) looks into the likelihood of individuals purchasing a brand of cereal they have not consumed before in a grocery store with an online and offline presence. Pozzi uses data on complete purchases for 11,000 households obtained via a store's loyalty card system over the course of two years. Amongst households who purchase both online and in-store, Pozzi finds that households are ten percentage points more likely to try a new brand offline than online. This result may be influenced by online

purchases being more likely when an individual is under time pressure and so less interested in trying new brands. To handle this, Pozzi models a two-stage decision process, where the first stage concerns an individual's choice between the online and in-store shopping channels. Moreover, a website's features can alter the likelihood of exploring new brands. The store's website had a 'one-click' function to re-order a previous shopping list and when this function was switched off, new brand trials increased by 23%. Pozzi's main conclusion is that switching costs may not disappear in the online world and that the structure of online shopping may create new forms of barriers to switching and to entry.

The Labour Market

Kroft and Pope (2014) consider the impact of the Internet in two markets which are viewed by economists as being particularly reliant on search: the labour and housing markets. The authors investigate the impact of Craigslist (an online service similar to small adverts in local newspapers) in the US and exploit the considerable geographic variation in the availability of Craigslist during 2005-2007. Kroft and Pope find that while the availability of Craigslist reduced the vacancy rate for rented apartments/houses there was no impact on unemployment rates, although the introduction of Craigslist in a locality did reduce the number of classified job adverts in local newspapers. On average, the introduction of Craigslist was associated with a 10% (1 percentage point) drop in the local housing vacancy rate and a 7% drop in the number of job adverts in local newspapers. In explaining the difference in results between the housing and labour markets, Kroft and Pope emphasise the capacity of alternative 'search technologies'. In the labour market, other websites/message boards already provided facilities similar to Craigslist and, indeed, the marginal benefit of Internet job adverts over newspaper adverts might be relatively small. In contrast, in the housing market the ability for Craigslist to include multiple photographs with details made searching for housing much more efficient than through newspaper adverts.

Kuhn and Mansour (2014) also investigate the labour market and provide results suggesting the impact of the Internet on the effectiveness of job searches may have changed through time. Kuhn and Skuterud (2004) found that for US data in the period 1998-2001, once an individual's observable characteristics were controlled for, using the Internet either had no impact on the time to find a job or even increased it. Kuhn and Skuterud concluded that this finding probably resulted from Internet job seekers having unobservable characteristics which made them undesirable recruits. In contrast, Kuhn and Mansour (2014) find that for US data in the period 2005-08 those who searched online found jobs 25% faster than those who did not search online, even after controlling for observable characteristics. Kuhn and Mansour suggest several reasons for this change of result: (i) job websites improved; (ii) network externalities[36] increased the value of Internet search; and/or (ii) the negative signal sent by searching for jobs online was

[36] Network externalities are when the value of a good or service increases the more individuals use the good or service.

reduced. Certainly, the use of the Internet by the unemployed in the US rose dramatically between 1998-2000 and 2008-09, from 24% in the earlier period to 74% in the latter period.

Kuhn and Mansour also make the important point that just because the Internet provides advantages to individual job seekers this does not automatically reduce unemployment rates at the aggregate level. Instead, using the Internet may just give one job seeker an advantage over another who does not use the Internet. Alternatively, in a situation where most individuals are using the Internet, the relative advantage offered by using the Internet might be neutralised.

Conclusions

It is difficult to draw overall conclusions from these separate econometric studies on very specific impacts of the Internet. This in itself is a key conclusion; with a technology as powerful and diverse as the Internet broad conclusions may miss important complexities about how the Internet influences the behaviour of consumers and suppliers and distributes benefits. In terms of the evidence reviewed in this subsection, the Internet seems to provide benefits to consumers in retail situations, but with regard to broader elements of an individual's welfare concerning labour markets and the political process the results are more nuanced. However, a consistent outcome of the studies is that the Internet: (a) lowers the cost of obtaining information and (b) offers a new set of activities to engage in.

One note of caution is warranted before this evidence is used to argue for greater public investment in services such as superfast broadband; all this evidence concerns the advance of previous Internet technologies. As Kenny and Kenny (2011) point out, it is probably unwise to extrapolate from previous advances to predict the impact of future developments such as further increases in bandwidth. Evidence provided by natural experiments in countries who are early adopters of particular technologies will probably represent the best available evidence in this regard.

6.3 The Digital Divide

Recognising that the Internet potentially offers important benefits, concern has grown about a 'Digital Divide' developing with differences in Internet access and use leading to different outcomes between individuals. Initial concern regarding a Digital Divide related to access, whether this be to computers, the Internet or, more recently, broadband/superfast broadband/mobile broadband. However, with the falling cost of access and improved infrastructure the debate has turned to consider how the extent and type of Internet usage varies across groups. For example, Martens and Pantea (2013), after considering 20,000 Internet users across five EU countries, conclude that, conditional on internet adoption, time spent online is not reduced by having a lower income or lower educational attainment. However, they

do find that the content that individuals view varies, with low-income individuals spending a higher proportion of their time on leisure websites rather than those related to human capital.

Questions concerning the extent of a Digital Divide are likely to become more important in policy discussions as there are shifts to e-government: government services are disproportionately used by the disadvantaged and there are findings that the disadvantaged are less likely to use the Internet. For example, BEREC (2011) outlines how government support and/or the requirements of USOs have been needed to ensure disabled users have equal access to telecoms services without having to bear the additional costs associated with making these services accessible in their circumstances.

Helsper (2011) provides data on the different usage of the Internet across socio-economic and demographic groups in the UK which may suggest the presence of a Digital Divide. Firstly, Helsper notes a difference in broadband access in the home across groups. In 2009, 90% of those who were highly educated and employed had a broadband connection compared to only 24% of those with a low educational attainment and who were unemployed. A similar gap was found in Internet usage, with 99% of the former group compared to only 25% of the latter group having used the Internet in the previous 12 months. Additionally, dramatic differences were found by age group: 97% of the under-25s had used the Internet at some point in 2009, compared to only 16% of the over-75s. However, Helsper (2011a) notes that some of these divides may be moderated by the phenomenon of 'proxy users'. Helsper reports how in the UK around a third of non-users of the Internet relied on friends or family to complete online tasks on their behalf. Nevertheless, Helsper notes that proxy access is probably only effective in performing relatively simple tasks such as acquiring information or making a basic purchase.

The UK's Office of Communications (Ofcom) (2014) provides recent information regarding broadband access and Internet usage across the EU. It is clear that, at least with respect to fixed line broadband, absence of service provision is no longer a major issue. At the end of 2012, in all EU Member States except the Slovak Republic, at least 95% of households were in an area served by fixed broadband. Similarly, in only six Member States were less than 95% of households in areas served by mobile broadband and in all countries 85% of households were covered. In contrast, there were significant variations in access to superfast broadband (>30Mbps) across Europe with the percentage of households in areas served by superfast broadband varying from 10-15% in Italy to over 95% in Belgium, the Netherlands and Malta.

Despite widespread access to fixed line broadband, Ofcom (2014) reports considerable variations in the rate of connection between Member States. In Italy, there are only 50 fixed broadband connections per 100 households compared to 83 fixed broadband connections per 100 households in the UK. There is an even greater variation in the number of mobile broadband connections per 100 people with the figure varying from approximately 25 in Hungary to approximately 105 in Finland.

Variations in usage across the EU are an important factor in explaining the Internet's impact on individuals. At the start of 2013, Romania and Bulgaria were in the weakest position. Ofcom (2014) reports that the percentage of individuals using the Internet at least once a week varied from 45% in Romania to over 90% in Denmark, the Netherlands, Sweden and Luxembourg. Perhaps even more worryingly, over 40% of individuals in Romania and Bulgaria had never used the Internet, compared to fewer than 10% of individuals in the UK, Finland, Luxembourg, the Netherlands, Denmark and Sweden.

The sophistication of Internet usage may also be important. Ofcom (2014) reports that less than 10% of individuals had bought something over the Internet in the previous 12 months in Romania compared to 77% of individuals in the UK. Regarding interacting with the government via the Internet over the past 12 months the percentage of the population varied from around 5% in Romania to around 85% in Denmark.

Further evidence on the sophistication of Internet usage in Norway, Austria, Sweden, Spain and the UK is provided by Bae Brandtzaeg et al (2011). These authors identify five different levels of Internet use from 'Non-Users' to 'Advanced Users' and find age and level of Internet access to be the most consistent predictors of Internet usage. Bae Brandtzaeg et al found the distribution of users in the UK was particularly unequal with almost 20% of users being classified as 'Advanced Users' and 40% as 'Non-Users'.

7. Conclusion

This literature review demonstrates that considerable thought has been given to how to measure the affordability of utility services; however, while the descriptive definition of affordability/poverty may be clear, there is a lack of consensus regarding the precise quantifiable metrics to evaluate affordability. The most advanced research on the topic has been conducted for fuel poverty in the UK. There are 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 standardised/ideal bundle approach.

Regarding pan-European evidence on the affordability of utilities, in general the evidence is patchy with researchers having to trade-off precision of affordability metrics against the availability of data. Probably the most comprehensive dataset is provided by the ITU and concerns the affordability of a standardised bundle of telecoms services across the world. Comparisons across the EU are also possible regarding energy poverty; however, these have had to be made on the basis of proxy indicators of fuel poverty rather than actual expenditure. The evidence on water affordability in the European context is generally limited to individual country studies and virtually no evidence has so far been found on the affordability of transport services. For energy and telecoms, the evidence suggests considerable variability in affordability across Member States.

Lastly evidence is reviewed on how new consumer technology may affect individuals' engagement with the energy market along with evidence on how the Internet may benefit individuals in a variety of other decision settings. While descriptive statistics suggest that the Internet offers considerable benefits to individuals with Internet access, it is crucial to separate the impact which is attributable to the Internet itself from the selection effects regarding the types of individuals who are heavier users of the Internet and the products and services provided through the Internet. At its heart, the Internet provides increased information to individuals at a lower cost, thus enabling individuals to search for goods and services in a more effective manner. However, as one would expect with such a fundamental technological advance, novel services, such as widespread user reviews, often result in new issues and challenges for consumers.

Exploring additional evidence on the affordability of energy, telecoms, water and transport services across multiple EU Member States while making cross-sector comparisons appears to be a valuable and important process.

8. Appendices

Appendix 1 – ITU's ICT Price Basket (IPB) Methodology

The ITU's IPB aims to provide an affordability metric for a combined bundle of fixed telephony, mobile telephony and fixed broadband services. The cost is identified for a standardised basket of services across countries. The overall IPB figure is a simple average of the affordability of the separate fixed telephony, mobile telephony and broadband consumption bundles with the weight attached to each component being equal. Since the ITU reports figures for less developed countries there is a rule that for any one service the maximum affordability percentage is capped at 100%, i.e. the true cost in countries where a service's cost exceeds 100% of the average GNI per capita is not recorded.

The bundles of services for which costs are obtained are the following:

Fixed Telephony – monthly subscription + 30 calls (15 peak and 15 off-peak) each lasting 3 minutes

Mobile telephony – 30 outgoing calls (spread across on-network, off-network and fixed line destinations as well as across peak, off-peak and weekend periods) + 100 text messages (50 on-network and 50 off-network)

Fixed broadband – Monthly subscription for an entry-level service involving 1GB of downloads

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