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Households facing constraints. Fuel poverty put into context

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Abstract

The present paper discusses the concept of fuel poverty taking into account the arbitrages made by households when they are facing economic constraints. Fuel poverty is still lacking a common definition throughout Europe: while the UK and France have (different) official definitions, there is still no definition in a country like Germany, or at the European level. Where definitions exist, they often consider that fuel poor households have high energy needs. The possibility of being fuel poor even without having high energy needs and the various arbitrage possibilities of households – i.e. to under-spend and use too little energy – are not systematically discussed. Our paper tries to fill that gap by putting fuel poverty into the larger context of constraints faced by households. Based on a graphical analysis, it shows that different situations of fuel poverty might occur. It results in the identification of two distinct fuel poverty problems: an "energy inequality" problem, reflected by the fact that some households pay disproportionately high energy bills, and an "energy affordability" problem that can affect a larger share of the population. It finally explores the two types of fuel poverty for European countries and discusses policy implications.

1. Introduction

Fuel poverty, as a policy issue, has entered the public debate in an increasing number of European countries. In a context where households have been confronted with significant energy price increases over several years, fuel poverty is no longer a topic limited to a sphere of experts in contact with populations suffering from cold homes or struggling to pay their energy bills. The concept however, is still lacking a precise definition in most European countries, and often its understanding seems to be an intuitive one. It is associated with diverse problems like poverty in general; bad thermal insulation of dwellings, health problems of people living in cold homes, and restriction behaviours induced by the difficulty of affording high energy bills.

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Despite an active debate on fuel poverty throughout Europe, only four countries have an official definition of fuel poverty: the UK, the Republic of Ireland, France and Slovakia (European Economic and Social Committee, 2013). For England, the government has adopted a new definition following the recommendations of the Hills Review (2012) in 2013. In Ireland, and in France, the definitions of fuel poverty are rather vague. According to the Irish definition, *"a household is considered to be energy poor if it is unable to attain an acceptable standard of warmth and energy services in the home at an affordable cost"*[3]. France uses the term of "energy precariousness". Since 2010, the French law defines energy precariousness as the fact to "*meet in [one's] home particular difficulties to have the energy supply necessary to satisfy elementary needs because of the maladjustment of resources or housing conditions"*[4]. All of these definitions try to incorporate the fact that energy poverty is linked to the energy *needs* rather than to the actual energy consumption and that fuel poverty results from the fact that households are facing constraints in meeting these needs. The exact nature of these constraints is not explicitly discussed.

In light of the lack of definitions taking into account the various difficulties associated with fuel poverty, the present paper discusses the influence of economic constraints on the fuel poverty problematic. It analyses the variety of situations of fuel poverty looking at the different constraints faced by households. We first examine the policy discourse in different countries in order to highlight what policymakers, or experts that have contributed to shaping policies in each country, consider to be the primary fuel poverty problem. We then discuss economic approaches that analyse constraints faced by households. We review the literature that empirically assesses households' arbitrages related to fuel poverty. Finally, we analyse the diversity of situations of fuel poverty based on a graphical representation and discuss the policy implications of our findings.

2. Approaches of fuel poverty in policy discourse

Although fuel poverty increasingly appears to be a topic in the public debates of European countries, no universally accepted definition has emerged yet. The national policy debates as well as current EU legislation and documents do not follow a single and common line of argumentation. Rather, they show that the problem can be seen in various ways, reflecting the fact that the term "fuel poverty" actually covers a whole set of issues.

2.1. The UK

The most differentiated discussion can be found in the UK. Historically, the debate on fuel poverty focused on warmth (Boardman, 1991) and on the difficulties of

[3] Warmer Homes. A strategy for affordable energy in Ireland (2011)

[4] Loi n° 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement.

households who cannot afford to heat their homes adequately (DTI, 2001). It is recognized that fuel poverty is a problem that affects a high proportion of the population in the UK[5] and impacts on the health of affected people. At the same time, it coincides with other societal issues such as poverty, health and reduction of carbon emissions (Hills, 2011). In the UK, the official definition of 2001 considered a household as fuel poor if it needed to spend more than 10% of its income on energy bills to adequately heat its home (DECC, 2013). In 2013, the government adopted a new definition for England. According to that new definition, a household is considered as fuel poor if it has both a low income and high energy costs, following the criteria elaborated in the Hills review (2012).

Affordability of an adequate level of energy consumption is at the core of the problem (Boardman, 1991), where "affordability" refers to a "reasonable" cost for the household and "energy consumption" includes both warmth (DTI, 2001) and energy services provided by other appliances (Boardman in Liddell, 2012). Thus, the focus is not on the amount a household *actually pays* on energy but much rather takes into account the costs a household *would have to pay* to have an adequate level of energy consumption. Accordingly, households that ration their energy consumption are considered as fuel poor, even if the share of energy in their budget is less than 10% (in the definition of 2001) taking into account the fact that households arbitrate between energy and other necessities such as food or clothing (DTI, 2001).

In the debate on fuel poverty, one important element is the recognition that fuel poverty has three main causes: low incomes, low energy efficiency and high costs of energy. Fuel poverty is of a different nature as poverty in general as it results from inefficient heating systems or buildings. Consequently, fighting fuel poverty requires not only monetary transfers to households, but essentially the availability of a sufficient capital stock to improve energy efficiency (Boardman, 1991). This has been recognized in the UK fuel poverty policy launched in 2001, with an objective to eradicate fuel poverty until 2016 (DTI, 2001). However, the number of households in fuel poverty has not decreased since then. It was found that the number of households in fuel poverty depends largely on the level of energy prices. Since the 10% threshold also applies for households on very high incomes paying high energy bills at the same time, a re-examination of the UK definition has been initiated with the Hills review (Hills, 2011 and 2012) in order to develop a more differentiated definition of fuel poverty (DECC, 2013).

In the approach proposed by the Hills report (Hills, 2011 and 2012), a household is considered as fuel poor if it is on a low income and its required energy costs are above average (i.e. the national median level). One implication of the new indicator is that the evolution of the number of households in fuel poverty is less dependent on energy price variations. The new approach seems to implicitly consider that increases of energy costs for the *whole* population have no consequences on fuel poverty, and thus ignores the potential impact of price increases on the restrictions faced by households (typically, the fact that a higher budget share of energy will

[5] In the UK, 4.5 million households, i.e. 17% of all households were fuel poor in 2011 (DECC, 2013).

place an increasing number of households in situations where they will have to arbitrate between their energy consumption and other types of consumption).

2.2. France

In France, the fuel poverty debate has focused on the term of "energy precariousness". It is interesting to note that this debate has first been put forward by organisations of the energy sector: ADEME (Agence de l'Environnement et de la Mâitrise de l'Énergie), the French environment agency and CLER (Comité de Liaison Énergies Renouvelables), an association dealing with renewable energies[6]. In a first public document on fuel poverty, which is a common statement of these actors, the focus is on the payment difficulties of energy bills, particularly electricity bills, and the consequences for comfort and health (CLER et al., 2005).

The same observation was made in a document of the European research project EPEE (European Partnership for Energy and Environment, 2007-2009) and in the first French official report on fuel poverty (Plan Bâtiment Grenelle, 2009): payment difficulties, especially for electricity, and the resulting power cuts were considered as the starting point of a "spiral" of fuel poverty related problems. These include restrictions of the heating as well as health and safety problems due to the use of inadequate heating equipment, and social isolation. This reflection on fuel poverty has resulted in a definition of "energy precariousness" in a law of 2010. Instead of an "operational" definition (i.e. that would enable the precise measurement of the number of households in fuel poverty), the French legislator has opted for a vague definition, referring to the inability to satisfy one's basic energy needs, due to the maladjustment of a person's resources or housing conditions.

This official definition has been criticized for focusing solely on the energy use inside the home (i.e. heating and other domestic energy uses), ignoring other elements like energy uses for transports. The Observatoire National de la Précarité Énergétique (ONPE, 2013) argues that a range of other factors leads to the acuteness of the problem. Households face a multitude of "constrained expenses" including those related to housing and travelling to work, which reduce the available household income. At the same time, the suburban sprawl increasingly forces households to rely on a car for commuting. The situation is further worsened by the continuing rise in energy prices with more households ending up being vulnerable. Thus, the French debate adopts a broader perspective on fuel poverty, also raising the question of social inequalities in relation to the type of habitat and its localization, which are also influenced by households' resources. As the French observatory on energy poverty is still working on the measurement of fuel poverty, it is not clear to what extent these various constraints faced by households in their energy uses will be incorporated in an official measure of fuel poverty.

[6] In 2007, these organisations have created the French network on fuel poverty, called RAPPEL (Réseau des Acteurs de la Pauvreté et la Précarité Energétique dans le Logement).

2.3. Germany

In Germany, the debate is only superficial. There is no official definition of what fuel poverty actually is and no broad public debate does take place. Until very recently, fuel poverty was not considered as a specific problem. It was rather assimilated to a general poverty problem faced by certain households. The latest report on poverty and affluence (BMAS, 2013) only mentions heating costs as part of the social security of housing and thus of the overall basic financial security that needs to be guaranteed in a welfare state.

More recently, the German debate has evolved towards better recognition of the specificity of fuel poverty. Thus, a household is supposed to be fuel poor if it is no longer able to pay for its daily energy needs, covering spending on heating, lighting and energy used for electric appliances (Ministerium für Klimaschutz, Umwelt, Landwirtschaft, Natur- und Verbraucherschutz, 2012) or if it pays an above-average share of its income on fuel (VZ NRW, 2013). Some organizations, especially consumer associations, claim that low-income households often face a vicious circle: being unable to pay for energy bills leads to (higher) subsequent payments which make it impossible for these households to actually pay their energy debts and exposes them to power cuts[7]. It is acknowledged that extra support is needed for these households (VZBV, 2008 and VZ NRW, 2013). Like in France, the German debate seems focused on the negative consequences of the inability to pay for energy and electricity, in particular.

Even though, in the German debate there is no consensus on whether fuel poverty is an issue that is distinct from poverty in general, there is a continuing debate on how to address it. On the one hand, the federal government seems to consider that households on low income do not only face problems paying their energy bills but are generally suffering from poverty. The protection for low income households is guaranteed by the German social legislation that provides target-oriented but also sufficient support. Also, power cuts are generally checked for commensurability (BMWI, 2011). On the other hand, an association promoting consumer interests argues that working poor, social benefit recipients, pensioners and students are at high risk of being affected by fuel poverty. It also stresses that the social benefit scheme is not adjusted quickly enough to current energy price rises (VZ NRW, 2013).

The discussions on fuel poverty in Germany need to be considered mainly as a consequence of the German energy transition (the “Energiewende”) initiated in 2011. The decision to shut down all nuclear power plants by 2022 and mainly rely on renewable energies (BMWI, 2011) and its effects in terms of electricity price increases for consumers have led to a discussion on the impacts for the poorest households. Affordability problems are expected to become more severe for households with the lowest incomes (Ministerium für Klimaschutz, Umwelt, Landwirtschaft, Natur- und Verbraucherschutz, 2012). According to a recent study (IASS, 2013), fuel poverty occurs mainly in urban areas and in structurally weak

[7] In North Rhine Westphalia, the biggest German Land (8.843 million households), 120,000 households (i.e. 1.4%) were cut off the power supply in 2010.

regions increasing the inequality between households. Within the German debate, fuel poverty is part of a larger discussion on the affordability of energy for all households[8]. However, as a current minor interpellation of the parliament shows, decision makers are increasingly aware of the complexity of problems linked to current energy price rises and measures to protect vulnerable consumers are already in place (BMU, 2014).

2.4. The EU

In parallel to these national developments, there are elements of a reflection on fuel poverty at the European level. According to the Electricity and gas directives (2009) the protection of vulnerable consumers should be guaranteed by national energy regulators. Member states should ensure that the necessary energy supply is guaranteed to vulnerable consumers, define the concept of vulnerable consumers and may develop measures in accordance with their individual situation in order to protect these.

The European Economic and Social Committee (2010 and 2013) published opinions on energy poverty which highlights the necessity to protect vulnerable households in a situation of energy price increases. It highlights that the European Union has "neither a definition nor indicator of energy poverty, nor a specific European policy for addressing this problem" (European Economic and Social Committee, 2013). However, some statistical indicators related to fuel poverty are collected at the European level, through the Eurostat Survey on Income and Living Conditions (SILC). These indicators are (1) inability to keep home adequately warm, (2) arrears on utility bills and (3) the share of total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor.

The Committee considers a household as energy poor if it faces difficulties or is unable to adequately heat its home at reasonable costs and if its access to energy-related services is restricted or unaffordable. In line with the UK approach, it considers that a household is driven into energy poverty by low incomes, energy inefficient homes and rising energy prices. This can cause health problems, power cut offs, insufficient heating and an accumulation of debt. The improvement of energy efficiency is regarded as a key aspect to tackle fuel poverty (European Economic and Social Committee, 2010).

To conclude, the approaches presented do have the same understanding of the drivers of fuel poverty, but there are important differences. The UK and Germany can be considered as two polar cases. They disagree on whether fuel poverty should be considered as a sub-category of poverty (Germany) or as a specific issue (UK). They disagree on whether fuel poverty in a context of increasing energy prices is a problem for the whole population (Germany) or only for those with the lowest incomes and the highest energy costs (UK - Hills approach). In the reminder of this paper, we shed light on this debate by looking at fuel poverty from the perspective

[8] The Federal Ministry of Economics and Technology stated in 2011 that all households need to be protected in their access to energy supply.

of constraints faced by households. A household can be considered as being constrained when it faces difficulties to make ends meet. High energy costs, or increases in energy costs obviously have an effect on being constrained. We also consider the case where being constrained has consequences in terms of the ability to consume energy (i.e. rationing of energy use). We review the relevant literature (sections 3 and 4) and propose a way of looking at fuel poverty incorporating constraints (sections 5 and 6).

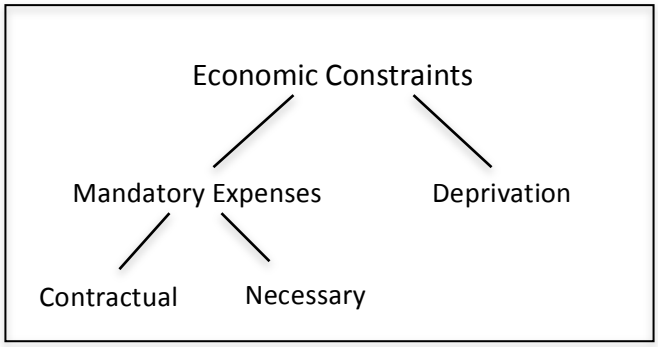
3. Economic approaches to constraints faced by households

Economic theory offers a variety of approaches and concepts that help analysing economic constraints relevant in situations of fuel poverty. So far, these constraints have not been taken into account in the definitions of fuel poverty, even if they are sometimes mentioned in experts' debates on fuel poverty. In France, economic constraints have been included to some extent in the fuel poverty discussion. An explanation might be that the general topic of the buying power of households has been examined by the French Ministry of economics and the statistical office INSEE in 2007 and 2008, in a context where households had to spend increasing shares of their budgets on types of expenses like rents, energy and telecommunications that are not easily modified on a regular basis. An analysis of these constrained expenses has revealed that the share of these expenses in households' budgets has increased continuously over 25 years, with particularly high shares for the households on the lowest incomes (Credoc, 2009).

There are different approaches to "being constrained", but all of them rely on the assumption that the constrained part of the budget cannot be easily modified, i.e. is inelastic. Interestingly, fuel poor households may not only face high energy expenses but also, more generally, high proportions of other expenses in their overall budgets, which in turn influences the ability of these households to afford enough energy services and/or to adapt to increases of energy prices.

Another, complementary way of assessing these constrained choices of households is to look at the elements on which households are deprived. This is done in the EU survey on income and living conditions, where information is collected on several elements of material deprivation, including the inability of households to heat their homes adequately. We therefore discuss two main streams of reflection on economic constraints faced by households. The first stream focuses on what people "must" consume and the second on those dimensions on which households are deprived.

Figure 1: A typology of economic approaches of constraints faced by households



3.1. "Mandatory" or "necessary" expenses

Within this stream, constrained expenses include anything a household must spend each month, either because of contractual or necessity reasons. This is relevant in the context of fuel poverty since energy use is part of "mandatory" or "necessary" expenses and can limit households in consumption choices within and beyond this mandatory or necessary spending.

3.1.1. Contractual approach

Some expenses are mandatory because they are made on a contractual basis or they are necessary for the everyday life of household members[9]. These expenses are fixed in contracts households agree on with the owners of their homes (rents) and with providers of different goods and services such as telecommunications, insurances or energy. Accordingly, a share of a household's budget is dedicated to these mandatory expenses, leaving a residual income that can be used for other types of consumption. Individuals cannot adjust the level of their mandatory expenses easily; they are confronted with some rigidity in their other consumption choices.

Based on this view, BIPE (2010) argued that statistical indicators on incomes and on price indexes do not give sufficient information on evolutions of the buying power of households. They have elaborated a measure of the "free" buying power of households and the (individual) consumer. This "free" buying power relates to the part of the budget that is not subject to constraints, i.e. to what consumers can freely arbitrate.

Box 1: The BIPE (2010) methodology for measuring the "effective buying power of the consumer"

Step 1: the macroeconomic evaluation of the income that can be arbitrated is calculated as follows.

Gross available income

– *constrained expenses*

= *income that can be "arbitrated"*

Where the gross available income is the sum of all activity and patrimony incomes plus social benefits after taxes. Constrained expenses are the sum of all (mandatory) spending types, i.e. payments on rents, utilities, mandatory insurances, collective transports, reimbursement of consumption and housing loans as well as telecommunications and television services.

[9] According to BIPE (2010), these expenses are mandatory because not paying them can be illegal (e.g. mandatory insurances), leads to a breach of contract (rent, credit) or because these expenses are necessary to the activity of a household (e.g. using transports to go to work). In France, these constrained expenses are also called "pre-committed expenses" (*dépenses pré-engagées*).

Step 2: calculation of the "free" buying power of households (in French: *pouvoir d'achat "libéré" des ménages*). This is the income without constrained expenses divided by the price index of the "free" consumption of households.

Step 3: the effective buying power of the consumer is equal to the "free" buying power of households divided by the number of consumption units.

Over the past years, the resulting (macroeconomic) index of evolution of the effective buying power of the consumer has been lower than the traditional indexes of buying power, reflecting the increase of the constrained expenses in households' budgets. As a consequence the consumption decisions of households have become less flexible due to the relative reduction of the amounts available for non-constrained purchases, typically food, clothes and leisure expenses. The implication in terms of constraints is that households can face deprivation if the budget share of these expenses increases to the point where the residual income only insufficiently covers for spending on necessity goods[10].

This problematic is related to fuel poverty because increasing mandatory expenses (and particularly energy budgets) affect the amount (or percentage of income) that is available for the non-constrained part of the budget. Thus, increasing energy budgets can influence consumption decisions in other areas, for example food, as highlighted in the literature on "eat or heat"(this will be discussed further in section 4).

3.1.2. Necessity Approach

A second approach focuses on the fact that certain expenses are mandatory because they concern necessities. Deciding which types of consumption are necessities and which ones are not is usually done with reference to a list of types of consumption that are considered as necessary. Alternatively, it can be done by looking at the price elasticities of the consumption of different types of goods (elasticities lower than one indicating that a particular type of consumption is a necessity). Engel (1895) argues that certain goods (food, clothes, housing, health as well as heating and lighting) are of necessity character as they are necessary for physical survival. It is in the utmost interest of households to consume these goods even though it is not mandatory by law. Households will purchase the necessities first, and if some budget is left, they will be able to buy goods that can be considered as "luxury" goods.

In comparison to the contractual approach, focusing on the necessities allows to identify households that are "constrained" in the sense that they are limited in their ability to buy other goods than necessities. Saunders et al. (2002) explore income thresholds and household expenditure in order to develop a poverty line. Since

[10] In addition, even if an increase in the constrained expenses does not push households into deprivation, spending on other goods generally declines and some households are restricted in their participation in social life.

households face *constrained choices* that determine their spending levels, expenditure data only gives insufficient information about households' actual needs and the extent to which these are served. It is argued that spending needs to be examined further to determine whether or not sufficient income is left over to be spent on durables or non-necessities.

As a first step, necessity goods need to be identified. In Saunders et al. (2002), these include shelter, food and clothing as well as spending on energy. If a household's spending on these goods is equal to its income, a household does not have any spending on durable and/or luxury items. Saunders et al. (2002) define this as a situation of deprivation. A constrained expenses indicator, CONEX, is constructed as a binary variable which is equal to one if a household does not have any spending on luxury/durable goods besides the spending on necessities.

This index is derived from the composition of household spending. Also, this index is interpreted as the minimum income level that a household needs in order to pay for all its necessities. At that income level underspending cannot be excluded either. According to Saunders et al. (2002) a household at this income level faces severely stretched resources. There are no means remaining to spend on major durable and luxury items.

Using the CONEX allows to analyse household energy spending in the context of spending on other necessities. For example, the impact of energy prices on households' (constrained) choices can be explored ceteris paribus as well as in the context of price changes of other necessity goods. However, the indicator does not assess constrained expenses directly. Like for the previous approach, the link with fuel poverty lies in the fact that for households with increasing energy budgets, consuming goods (including necessities) can become increasingly difficult, thus contributing to households being "constrained".

3.2. Deprivations approach

The second stream of reflection focuses on deprivation indicators. Deprivation indicators assess poverty with respect to living conditions. Rather than exploring the income that can be arbitrated (contractual approach) or the income that is left over to be spent on durables/luxuries (necessity approach), the indicators explore the multiple dimensions that reflect deprivation on certain elements of their consumption. This approach can be seen as a complement to the previous approaches in terms of constraints.

National and European surveys on living conditions collect this type of information. In the EU SILC survey, the "material deprivation" indicators are based on declarations of individuals or households (i.e. they are "subjective" indicators as opposed to poverty thresholds or consumption data, which are "objective" indicators of the level of poverty in a given country). Within the EU an indicator consisting of nine items is used to measure how many people are materially deprived. It indicates if people in the EU can afford necessary as well as "desirable"

goods[11] to guarantee a standard of living that is "acceptable". If three of these indicators apply for a household, this household is regarded as being in a materially deprived situation (Guio et al., 2012). In France, 27 indicators on households' living conditions were developed. A household who faces at least eight of those is regarded as poor in terms of living conditions. The French deprivation indicators are summarised by four dimensions: budget constraints, payment delays, consumption constraints and housing difficulties (Godefroy and Ponthieux, 2010).

Deprivation indicators implicitly include the visions of the contractual and the necessity approaches, (even if the populations identified by subjective and objective indicators do not necessarily overlap). Some of the subjective deprivation indicators are relevant for analysing fuel poverty, for example indicators on the inability to heat one's home adequately and on difficulties of payment of energy bills (or debts). They are useful complements to the two previous approaches because they take into account that some households may ration their energy consumption, which is not directly shown by the "objective" consumption data[12].

While the two previous approaches are helpful to understand to what extent high energy expenses *may* severely affect or *actually* affect a household's ability to afford other types of goods, the deprivation approach highlights another part of the fuel poverty problematic, i.e. how many households are facing restrictions on their energy consumption due to consumption arbitrages in favour of other types of consumption or to energy inefficient homes. When deprivation occurs in addition to being economically constrained, it can give an indication on the severity of certain situations of fuel poverty.

The three approaches on "being constrained" thus describe the complex nature of fuel poverty. Households might face constraints and be deprived but might still not be counted as being fuel poor according to the UK measures. Even though minimum income standards as explored in Heindl (2013) do capture essentials of the above-discussed approaches, they still do not cover the full picture. The choice dimension, the occurrence of under-spending as well as the dynamics and possible persistence of fuel poverty all add to the complexity of the problem.

In the UK debate, the discussion focuses on "energy needs" that implicitly capture arbitrage possibilities. Moore (2012) suggests looking at households that face a combination of low income and energy inefficient housing. Accordingly, a household is *not* in fuel poverty if its income exceeds the sum of housing costs, fuel costs and a minimum of living costs. He thus explores fuel poverty in the context of "required fuel costs" implying utility maximizing substitution between energy and other goods. In the following, we explore energy expenditure and explicitly take arbitrage into

[11] The indicators cover if households can cope with unexpected expenses; one week annual holiday; avoiding arrears, a hot meal every second day; keeping the home adequately warm; a washing machine; a colour TV; a telephone; a personal car (Guio et al., 2012).

[12] This type of difficulties is not necessarily captured by the previous approaches that do not take into account the deprivation aspect. So one could for example imagine households who are not constrained in the two first approaches, but who are rationing their energy use or struggling to pay their energy bills.

account. Overall this enables us to explore households that are constrained not only because of their level of "energy needs". We put fuel poverty into context and analyse the whole population rather than focussing on the group of households with high energy needs.

4. Evidence on constraints and rationing behaviours related to fuel poverty

Analysing rationing behaviour related to fuel poverty is not an easy task because of the various arbitrages that individuals or households can make when it comes to limiting their energy use or other types of consumption, including necessities. There is some empirical evidence on the existence of such rationing behaviour related to necessities both in general (Accardo et al, 2013) and related to fuel poverty (Anderson et al., 2009 and 2010). In France, the national statistical office INSEE has noted an increase of restriction behaviours on food among low-income households between 2006 and 2011 (Accardo et al., 2013). In 2011, when asked what they would do if their incomes increased by 10 per cent, 16% of households in the first income decile indicated that they would spend more on food (in contrast to 11% in 2006). In the UK, qualitative studies on coping and rationing behaviour of fuel poor households show that households flexibly adapt their consumption choices. Anderson et al. (2009) note that households perceive energy costs as a variable part in household expenditure and adjust their energy consumption based on affordability considerations and an overall budget balancing. However, the cut backs households make are more important in some areas than in others. According to a qualitative survey of Anderson et al. (2010), low income households adopt various measures to make ends meet: they mention in particular cutting back spending on (1) non-essentials (36% of low-income households), (2) food (35%), (3) heating (32%) and (4) other essentials (24%).

The variety of arbitrage possibilities explains why the choices made by households in constrained situations are difficult to analyse.

Several adaptation strategies related to rationing energy consumption exist. These include heating only one room to limit energy bills, wearing additional clothes to cope with lower indoor temperatures, preparing less cooked meals or reducing the lighting, etc. (Anderson et al, 2010).

If we extend the analysis to other types of consumption, rationing behaviours due to high energy budgets can appear in several domains. They include those consumptions necessary for the survival of the members of the household (typically food), the normal activity of the household members (e.g. commuting) or the maintenance of health. The last domain can be affected both by direct consumption choices in terms of healthcare (dental care, replacement of glasses) and by other choices necessary for the long term maintenance of peoples' health, like buying healthy food as opposed to cheap and unhealthy food.

The empirical literature on arbitrages between energy consumption and other domains has mainly focused on the "eat or heat" decision. Several studies have

analysed the effect of cold weather shocks on households' consumption choices. In the United States, Bhattacharya et al. (2003) examine the effects of cold weather periods on budgets and nutritional outcomes for a dataset of 34 000 people. In particular, they explore how expenditures on food, clothing and home fuel have changed during cold or warm months. Their findings show that all households increased their energy spending during particularly cold periods. Low-income households compensated this by decreasing spending on food by the same amount in order to balance out their budgets. High-income families however increased their spending on food. For poorer families, the food expense decreased during cold weather periods and caloric intake was reduced both for children and for adults (Bhattacharya et al., 2003). For the United States, Cullen et al. (2005) examine the same "heat or eat" decision, but they differentiate between anticipated and unanticipated variations (e.g. an unusually cold winter). For the anticipated variations, they find no evidence on excess sensitivity to variations in incomes, even for households without substantial financial assets. But in case of unanticipated income shocks, the reactions of different groups of households appear more contrasted: while those who are relatively well-off (25% of the sample) have not modified their consumption patterns significantly, those who are more likely to be liquidity constrained have significantly modified their consumption ("about 40 cents for each dollar's worth of surprise in home energy costs") (Cullen et al., 2005). In the UK, Beatty et al. (2011) statistically analyse coping behaviours of low-income households during cold weather episodes. They find "evidence that the poorest of older households are unable to smooth spending over the worst temperature shocks". According to their study, households adapt to cold weather episodes by reducing food expenditure. This is especially true for poorer households, who "have to go without other essentials in order to pay for the increased cost of staying warm".[13]

Whereas there seems to be some evidence on the existence of a "heat or eat" decision of some households, some qualitative studies (Anderson et al., 2010) insist on the complexity of actual adaptation strategies, due to the complexity of both individuals' needs and their responses to these needs.

There is much less evidence in literature concerning the other arbitrages fuel poor households can undertake. A recent study coordinated by the French charity Fondation Abbé Pierre (Ledésert et al., 2013) asked low-income households about the arbitrages they make on health expenses. This study of a set of 376 adults finds evidence on restrictions on health expenses. 34.5% of the respondents have declared that they have not been able to make certain health expenses for financial reasons. These restrictions appear more important for the fuel poor (41.4%) than for the non-fuel poor (26%), and these results are statistically significant. This non-take-up of medical care of the fuel poor is more pronounced for dental care and vision care, but also for medical consultations.

[13] They add that "such cutbacks, if they do occur, will have important welfare consequences (in terms of utility and perhaps long-run health) even if they do not show up in short-run mortality." (Beatty et al, 2011).

There is a variety of options when it comes to rationing the consumption of necessities, both inside the energy sphere and between the energy sphere and other necessities. These choices are different depending on the types of households; elderly people will not take the same decisions as families with young children.

The restriction behaviours of elderly people have been analysed for the UK in a qualitative study of Gibbons and Singler (2008). They find that "pensioner households appear particularly likely to ration fuel use – for example by under-heating bedrooms and turning heating off for some of the daylight hours. The reasons why pensioners behave in this way are complex and in some instances relate to beliefs that having fresh air in the bedrooms was healthy, as well as reflecting early life experiences of growing up in homes which often only had a solid fuel heated living room. Other actions to reduce fuel use included cutting back on the number of cooked meals and in some instances going without lighting" (Gibbons and Singler, 2008). In the United States, Nord and Kantor (2006) have analysed the seasonal variations in food security for different categories of households. They find that low-income households, especially those consisting entirely of elderly persons, experienced substantial seasonal differences in the incidence of very low food security (the more severe range of food insecurity) in areas with high winter heating costs and high summer cooling costs. This suggests that in their consumption choices, elderly people tend to give priority to the heating and (to a smaller extent) cooling of their homes at the expense of food security.

For families with young children, there is less evidence on the nature of the rationing behaviours of households. However, in the United States, the impact of the "heat or heat" decision on children's wellbeing has been demonstrated. Frank et al. (2006) have analysed a set of wellbeing indicators of children in low-income families that are eligible to the Low Income Home Energy Assistance Programme (LIHEAP). They find that the families who actually benefited from LIHEAP reported more household food insecurity than those who were not benefiting from the programme. However, in comparison with households not receiving the LIHEAP, the children in families that received the LIHEAP had better wellbeing indicators, which suggests that energy subsidies, through their effects on the ability of households to maintain "a more thermoneutral environment", alleviated some of the negative impacts of a limited caloric intake. (Frank et al., 2006).

Finally, there are elements in literature that suggest that the analysis of households' arbitrages and rationing behaviours should distinguish between situations that have been anticipated by households and unanticipated events. The studies of Bhattacharya et al. (2003), Cullen et al. (2005) are dealing with income shocks related to unexpected cold weather events. In terms of arbitrages made by households, this suggests that households who have to restrict on necessities are perhaps able to cope with the situation as long as no unexpected event occurs. A similar result is suggested by the study of Givecha et al. (2010) who analyse the impact of an increase of petrol prices on food spending patterns of households in the US. Although this study does not address energy poverty related to the heating (or cooling) of homes, but related to transports, it contributes to the understanding of

coping behaviours. Their finding suggests that increases in petrol prices induce changes in food spending, especially in the form of buying more products on sale.

To summarize, there is a significant body of evidence that households with limited budgets engage in rationing behaviours and arbitrate between different necessities. The nature of these arbitrages is not easy to characterise: it can take various forms, it is not the same for all types of households and it depends on whether the situation was anticipated or not. These considerations should be included in the analysis of fuel poverty: if a household has a limited budget and has to restrict its energy consumption and/or the consumption of other necessities, it would be reasonable to consider it as fuel poor under certain conditions. These conditions are discussed in the following section.

5. Fuel poverty as "being constrained": an economic analysis of the variety of situations faced by fuel poor households

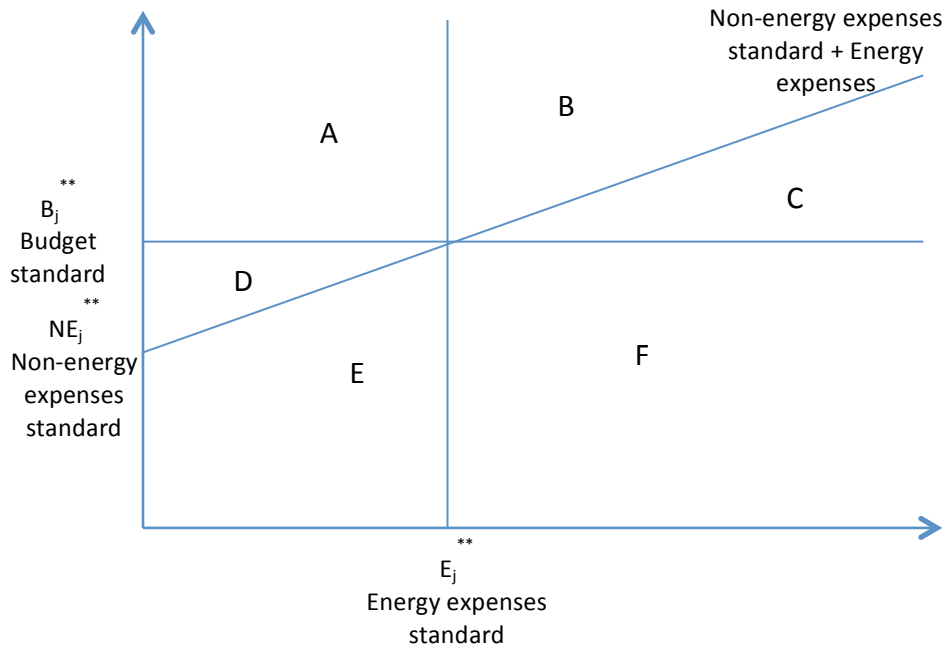
To operationalize the "constraints" approach to analyse fuel poverty, we consider the literature on "poverty related to a particular good". There is a difficulty when analysing this kind of poverty: it can occur without being poor "in general", but it can also be a particular type of poverty that can appear as one of the symptoms of being poor in general. The first case can be illustrated by a situation in which a household is above the poverty line, but its consumption of a particular good crowds out other types of consumption. An overconsumption of e.g. energy can lead to restrictions on the consumption of other goods. The second case refers to situations where a household is income poor and uses inadequate amounts of energy: either too much energy (this is the case for households living in very inefficient homes, who need to spend much on energy to keep their home warm) or too little energy (this is typically the case when households are rationing on energy).

The literature on housing poverty (Thalmann, 2003) provides a graphical illustration of the different housing poverty problems households can face. This literature is based on an analysis of the situation of households relatively to what could be considered as a budget norm. It is assumed that a consumption norm for each type of household can be determined. These kinds of approaches are empirically used in the reflections of what is a decent income for different types of households[14].

If we define a minimum or decent budget, it becomes possible to decide whether a given consumption is affordable or not with reference to a normalized standard of households budget and expenses. The resulting constraints can be of different types (figure 1), showing the diversity of fuel poverty situations.

[14] Figures on a minimum income standard have been produced for the UK by http://www.lboro.ac.uk/research/crsp/mis/ and figures on decent incomes are produced for France by the French family association UNAF.

Figure 1: Different constraints associated with energy affordability (adapted from Thalmann, 2003)



Each household $i, i = 1, \dots, n$ with budget B_i belongs to a specific category of households $j, j = 1, \dots, m$ where categories are formed e.g. based on socio-economic characteristics, type and energy efficiency standard of homes, prices and payment methods. According to figure 1, households with a budget B_i that exceeds the budget standard for their category of households B_j**should have no general affordability problems. However, if we look at actual energy budgets, it appears that some households can still be constrained. Households located in **areas A and B** are not in that situation, as their total budget exceeds the sum of the standard non-energy expenditures NE_j** plus their actual energy spending E_i.

The remaining groups can be classified into *hidden fuel poor* and *obvious fuel poor*.

Households in C and D belong to the group of hidden fuel poor households:

Arbitrager, Households in area C:

The households who are located in **area C** have budgets higher than the standard budget, but their energy expenses are higher than the standard energy expenses E_j**. This affects their ability to meet the standard non-energy expenses NE_j**. Typically, this could be situations of fuel poverty (although the household is not poor in general) where households are rationing on other types of expenses because of their high energy consumption. When this high energy consumption is caused by a low energy efficiency of the dwelling, the household is fuel poor and making arbitrages of the type “eat or heat”: in order to be able to heat his home, such a household reduces other expenses, including food and certain expenses for healthcare.

Self-constraining, Households in area D:

Households located in **area D** have a total budget below B_j^{**}, but they are able to meet standard non-energy expenses: $B_j^{**} > B_i > NE_j^{**} + E_i$. Here, the fact of "being constrained" takes the form of an energy consumption level that is below the standard: $E_i < E_j^{**}$. These households may be fuel poor, if they are not living in very efficient homes. If the energy needs of their homes are standard or higher than average, they are in fuel poverty. However, this fuel poverty is not taking the form of higher than average energy expenses because they are rationing their energy consumption (this is the other version of the "eat or heat" dilemma). These households are typically living in cold homes and may suffer from various health effects of cold homes.

Households in E and F belong to the group of obvious fuel poor households:

Low Income High energy budgets, Households in area F:

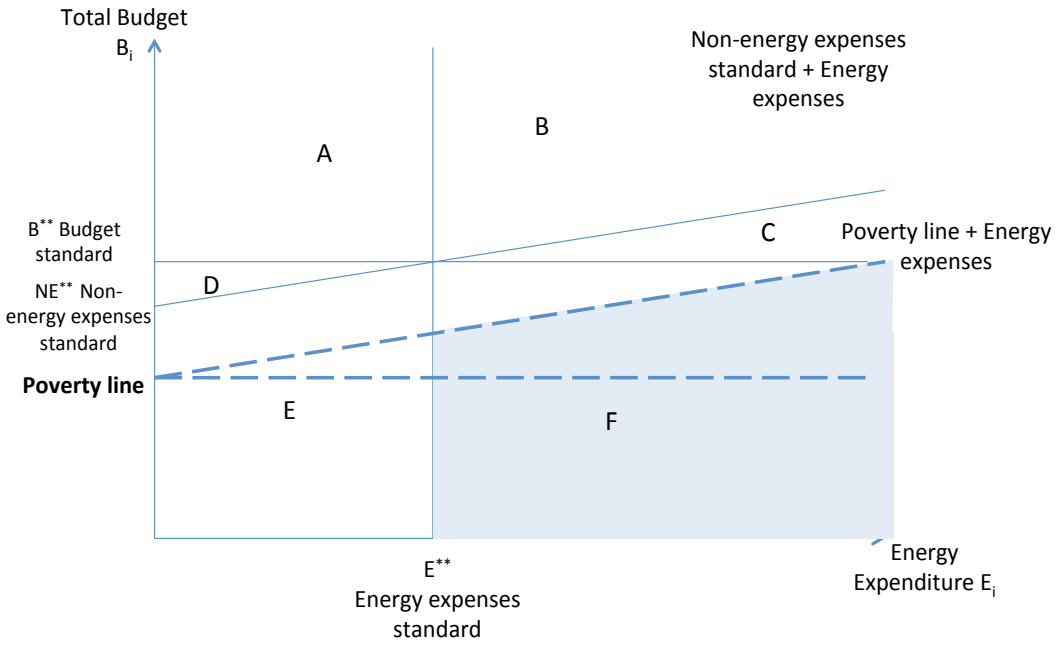
Households in **area F** also have a total budget below B_j^{**}, $B_i < B_j^{**}$, and higher than standard energy expenses, $E_i > E_j^{**}$. This group includes a variety of situations. Certain households (in the upper-right part of area F) are mainly in a situation of energy over-consumption. Other households (in the bottom left part of area F) are mainly income poor but have levels of energy expenses that are close to standard energy expenses. The households in the bottom-right part of area F are in the most severe difficulty because they have both very low incomes and high energy expenses. In that case, they are likely forced to self-restrict on other types of consumption.

General poor, Households in area E:

Households in **area E** have mainly a problem of insufficient income ($B_i < NE_j^{**} + E_i < B_j^{**}$). As they are not over-consuming energy, it is necessary to examine their difficulties more closely in order to assess what is the nature of their difficulties. Some of them may live in homes with high thermal efficiency. However, in general, the poorest households are not living in the most efficient homes. There is a high probability that these households self-restrict their energy consumption (and also their non-energy expenses) with the consequence that they live in cold homes.

The graphical representation of the diversity of situations of energy poverty aims to show that the fuel poor population is larger than group F. Group F has some similarity with the "fuel poor" as they have been defined in England 2013 following the Hills report (2012). Indeed, there is a resemblance of our group "F" and the "Low Income High (energy) Cost" group. However, as illustrated by Figure 2, the Hills approach is not based on an expense standard but rather uses a "poverty line + bills" approach in order to define who should be considered as fuel poor.

Figure 2: Comparison of our "constraints" approach with the Hills approach



The question of where to set the budget and energy expenses standards is outside of the scope of the present paper. For England, it has been discussed in detail by the Hills report and other studies (ACE, 2012).

What has been less discussed is the existence of fuel poverty outside group F. In Figure 1, only groups A and B are obviously not fuel poor. In groups C, D and E, some households may be considered as fuel poor, if they are obliged to ration their energy consumption to make ends meet, or if they have to ration their consumption of other goods (for example food) because they need to over-spend on energy, due to lacking energy efficiency of homes and/or equipment. If we consider the various forms of fuel poverty outside area F, it becomes understandable that certain households who are perhaps not fuel poor according to "objective" criteria may "feel fuel poor" according to their subjective perceptions (Waddams Price et al., 2007). In addition, recognizing the possible arbitrages between energy consumption and other types of consumption helps understanding the temporary nature of certain situations of fuel poverty. The existence of temporary fuel poverty has been recently mentioned in France by the consumer association 60 Millions de Consommateurs (2013) and statistically analysed in Spain by Phimister and Vera-Toscano (2013).

The question is then what proportion of households in areas C, D and E should be considered as fuel poor. This would require to know whether the high use of energy of households in group C is a result of constraints or of arbitrages. Similarly, for group E, it would require to know for what reason the households in areas D and E under-consume energy. Is it because they live in energy efficient homes or because of energy rationings (the latter being perhaps more probable if one considers that the poorest households' homes are also often the less energy-efficient homes). This

kind of evaluation of the "really" fuel poor would be difficult to realize. However, even without a quantification of the proportion of fuel poor households in these groups, recognizing the variety of fuel poverty situations has some policy implications.

6. Policy implications

A first policy implication relates to the policy measures that are best suited to address the difficulties of households. A second implication relates to the differences of fuel poverty profiles among countries and their evolutions over time.

6.1. Different policy approaches for different types of fuel poverty

Two extreme situations can be considered. A first situation is a household whose income is close to the budget standard, but who faces disproportionately high energy expenses. A second situation is a household with very low incomes and energy expenses that are lower than the standard. These two situations illustrate two types of fuel poverty. The first one relates to "energy inequality" and the second one to a larger problem of "energy affordability".

6.1.1. The role of energy efficiency measures to reduce energy inequality

Energy inequality can be evaluated by looking at the "horizontal" dispersion of a population on our graph. The distance from the standard of energy expenses is an indicator of inequality among households with regards to their consumption. It highlights how many households face disproportionately high energy expenses. It only imperfectly reflects the other fuel poverty problem which is affordability. Indeed, when energy prices increase, this will result in an upward shift of the standard energy expenses. The number of households in areas F and C will not necessarily increase, leaving the number of households in "energy inequality" constant.

The number of households in these groups can veritably be reduced through energy efficiency measures: they will result in a horizontal shift towards the energy expenses standard, thus reducing the fuel poverty "gap". These measures may take different forms, depending on the income situation of households and on their patrimonial situation which influences, among others15, their ability to invest in energy efficiency measures.

Obstacles to invest in energy efficiency measures are therefore of different kinds. Households in group C and households in group F who have the financial capacity to invest in energy efficiency measures may be motivated by fiscal instruments of public subsidies that will reduce the payback period for their investment. Households in the lower part of area F are in the most difficult situation, as their

[15] The other factors include especially occupancy status. Tenants have only little ability to invest in energy efficiency measures.

income is far below what would be necessary to be able to invest. For these households, thermal renovations will be an option only if they are 100% subsidized.

6.1.2. The income problem related to energy affordability

The second element highlighted by our segmentation is that households with incomes below the budget standard may be forced to arbitrate between energy expenses and other types of expenses (except if they are living in very energy efficient dwellings). In case of energy price increases, their distance to the energy expenses standard may remain the same, but their energy expenses will increase and the evolution of their incomes will not necessarily be sufficient to cover these additional costs. As a result, their distance to the new budget standard may increase.

This illustrates the second aspect of the fuel poverty problem: the fact that increasing numbers of households are facing difficulties of management of their budgets when energy prices increase. Even if their situation is not worsening relatively to other households, their situation is getting worse because they will be more affected by the need to arbitrate between different types of consumption. Graphically, this is reflected by the fact that a higher share of households will be below the line where the current income is insufficient to meet the budget standard.

This kind of difficulties is of a different nature than the previous energy inequality problem. It should however be an issue for policymakers because, energy price increases result in an increase of energy affordability problems. This has been highlighted by the UK energy regulator Ofgem (2012) as well as by the German government (as mentioned in section 2.3.).

6.2. Different fuel poverty “profiles”

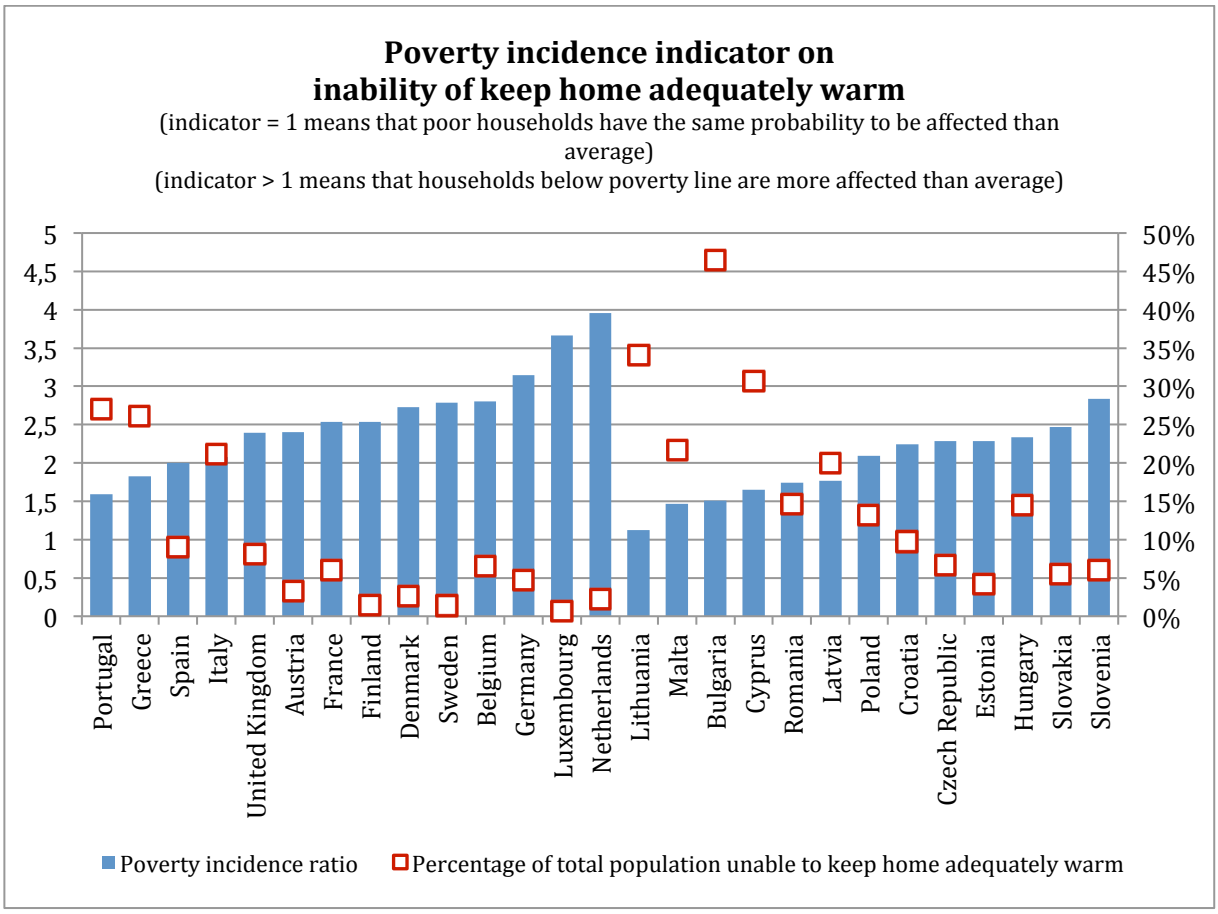
The consequences of growing numbers of households with affordability problems have not been investigated in detail or publicly debated, despite the fact that in some countries energy affordability problems are widespread and not limited to those households with the lowest incomes. Figure 3 shows the differences between European countries regarding the incidence of poverty in the indicator of “inability to keep home adequately warm”. The higher the indicator, the more households below the poverty line are disproportionately affected by that problem. When the indicator equals 1, there is no difference on that problem between the households below poverty line and other households, which means that energy affordability problems are affecting poor and non-poor households equally.

In the old member states, energy affordability problems are more widespread in the Southern part of Europe, where the poverty indicence is also less important. In countries of Northern Europe, energy affordability seems to be a problem that is limited to the poorest parts of the population. The proportion of the population affected by that problem is very low.

In the new member states, energy affordability problems are globally more severe and poverty incidence is lower, suggesting that energy affordability problems are more widespread among the population. There are also important variations in the poverty incidence of energy affordability problems. In the same time, the percentage

of households affected is high in countries like Bulgaria, Lithuania, Cyprus and Latvia. In these countries, energy affordability problems are clearly not limited to the poorest populations.

Figure 3: Comparison of our "constraints" approach with the Hills approach



Own presentation. Data drawn from Eurostat (EU-Silc survey for 2012).

One possible explanation is that the income differentials between old member states and new member states are still important, whereas the differences in energy costs are not of the same magnitude, these prices being defined on market which are often European.

In the new member states, energy affordability problems are so widespread that it would not be feasible to address them with measures of income support. In the high-income countries of Northern European countries, it is still feasible to address energy affordability problems of households with income support measures. Finally, in those countries who are in an intemediary position, income support may become less and less feasible, as energy price increases will lead to an expansion of the population facing energy affordability problems.

In a dynamic perspective, the number of households with energy inequality problems will not necessarily increase. However, the part of the population affected by energy affordability problems will most probably increase, if the incompes of

households do not increase in proportions that will allow them to face the new situation in terms of energy expenses.

7. Conclusion

Fuel poverty is hard to define because it can take various forms and therefore no single indicator can give an exact picture of the fuel poverty situation in a given country. The three indicators collected at the EU level actually reflect different aspects of the problem, which correspond with the three economic approaches we have identified. On the one hand, the indicators on "inability to keep home adequately warm" and "arrears on utility bills" reflect the "mandatory consumption" approach, i.e. the fact that energy is both a necessity (hence the concept of an "adequate" heating of homes) and a "constrained" expense (and therefore households have only limited flexibility to adjust their energy bills in the short term). On the other hand, the European indicator on "leaking roofs, damp walls, floors or foundation, or rot in window frames or floor" clearly relate to the deprivation aspect of some forms of energy poverty.

It is important for fuel poverty analyses to include both aspects – the "mandatory" aspect of energy consumption and the "deprivation" that occurs when a household is unable to consume enough energy. Indeed, these are the two sides of the fuel poverty "coin" and they both matter because households make choices, i.e. they arbitrate to some extent between energy consumption and other types of consumption. We have shown that, when households are economically constrained, this can translate into energy rationing or deprivation, but also into a rationing of other types of expenses, for example food or certain types of health expenses. These arbitrages make fuel poverty difficult to assess and to measure.

Taking into account the existence of arbitrages has an important consequence: a household can be fuel poor even if it does not have high energy expenses or energy needs. Fuel poverty in that sense affects large numbers of low or medium income households, who are confronted with increasing energy budgets due to the current trend of energy price increases.

Therefore the main argument of our paper is that there are two types of fuel poverty. We call the first one "energy inequality": it mostly affects the poorest households living in the less energy efficient homes. These households are facing disproportionately high energy expenses to satisfy their basic energy needs. We call the second one "energy affordability". This affects not only those households with the highest energy needs, but more generally some low- or medium-income households whose budget shares of energy are increasing as a result of rising energy prices. These households are increasingly confronted with the need to arbitrate between energy and other types of consumption, including necessities.

Throughout Europe, countries are not in the same situation regarding these two types of fuel poverty. In certain countries, the main fuel poverty problem is energy inequality, i.e. fuel poverty affects only the poorest populations (and relatively small shares of the population). In other countries, the main fuel poverty problem is energy affordability, i.e. fuel poverty is not limited to the poorest populations or to

those living in the worst homes. It is a problem for an important (and increasing) share of the population.

Knowing that there are two types of fuel poverty has implications regarding the policies that can be implemented. Whereas energy inequality (affecting a limited share of the population) can be addressed through social policy measures and targeted energy efficiency improvements, the problem of energy affordability is more challenging because it affects a larger share of the population. It cannot be fully addressed with measures of social policy like energy subsidies: this would require important public budgets for a long time, as energy prices are not expected to decrease in the next years. Consequently, if states want to prevent an expansion of energy affordability problems, it seems that the only solution is to engage into ambitious policies of energy efficiency improvement of buildings.

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