Transport-related economic stress and vulnerability to fuel price spikes: intermediate findings from the *(t)ERES* project

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Abstract

In the UK at present domestic energy policies are framed in terms of reducing energy consumption and emissions while at the same time taking into account issues of affordability, which are part of the established fuel poverty agenda. Similar energy affordability issues in transport have not yet drawn the same attention. This is despite increasing recognition in international research that the costs of daily mobility, notably by car, can have important economic stress impacts, e.g. leading households to curtail expenditure in other essential areas. Different terms are used in the literature to indicate such problems, including 'forced car ownership', 'transport poverty', 'oil vulnerability', 'commuter fuel poverty', 'transportation affordability', '*précarité énergétique des transports*' and 'car-related economic stress'. This paper reports on the intermediate findings of the *(t)ERES* project linked to the DEMAND Research Centre. It begins with a discussion of the relationships and parallels between issues of affordability in the housing, transport, and domestic energy sector. We then draw on two pieces of quantitative secondary data analysis to quantify the incidence of car-related economic stress in the UK and identify the characteristics of the population concerned. The first study applies a definition modelled on the current official definition of fuel poverty in England, i.e. as the overlap of low income and high transport costs (LIHC), to the most recent wave of the Living Costs and Food Survey (LCFS 2012). The second study employs the UK sample of the EU-SILC survey, focusing on households who own a car despite being in 'material deprivation', i.e. unable to afford several other essential items. The analysis brings to light a number of factors associated with 'car-related economic stress', as well as overlaps between transport-, housing- and domestic-energy affordability problems.

1. Introduction

The aim of this paper is to provide a brief overview of the findings of the research project *(t)ERES* ("Energy-related economic stress in the UK, at the interface between transport, housing and fuel poverty") as of March 2016. The project started in November 2014 and is linked to the DEMAND Research Centre. The main goals of the project are:

- to conceptualise the relationships between transport, housing and domestic energy affordability in an interdisciplinary and international perspective
- to investigate the prevalence of 'transport-related economic stress' in the UK, and the profile of the affected population

The study potentially contributes to current research in three fields. First, research on transport disadvantage and related social exclusion (Lucas, 2004; Lucas et al., 2016; SEU, 2003). Second, research on the vulnerability and resilience of urban and transport systems to fuel price increases (Dodson & Sipe, 2007; Lovelace & Philips, 2014; Newman et al., 2009). Third, recent debates on energy justice and energy vulnerability (Bouzarovski & Petrova, 2015; Sovacool & Dworkin, 2015; Walker et al., 2016), although these have so far predominantly focused on uses of energy within the home. Also, our work adds to a growing body of studies that has drawn parallels between issues of affordability in domestic energy and transport (Berry et al., 2016; Mayer et al., 2014; Jouffe & Massot, 2013; ONPE, 2014; Sustrans, 2012).

The paper is structured as follows. In Section 2, we briefly discuss the results of a multilingual literature review on the relationships between transport, housing and domestic energy costs. In Section 3, we discuss the similarities and differences between the affordability of domestic energy and the affordability of transport costs, taking the British fuel poverty debate as a point of reference. In Section 4, we discuss the findings of the analysis of family expenditure survey data, aimed at identifying households with low income and high running motor vehicle costs. In Section 5, we discuss the findings of the secondary quantitative data analysis of income and living conditions data, focused on households who own cars despite being in 'material deprivation'. For more details on these findings, the reader is referred to other papers arising from the project (Mattioli, 2015; Mattioli et al., 2016; Mattioli et al., forthcoming).

2. The relationships between transport, housing and domestic energy affordability: a multinational literature review

Based on a multilingual literature review, we have investigated if and to what extent the relationships between household transport costs, housing costs and domestic energy costs have drawn attention in France, Germany and the UK. The graphs in Table 1 are an attempt to depict graphically the situation in the three countries. A more detailed discussion of the findings is provided in Mattioli (2015).

The situation in France is probably the most integrated. The notion of 'energy precarity' ('*precarité énergétique*') is a sort of equivalent to the British notion of fuel poverty but: (i) has emerged only recently, in connection with energy transition policies; (ii) perhaps as a result of this, it is often seen as embracing both domestic energy *and* transport affordability issues. This has motivated a number of studies that have investigated the similarities, differences and relationships between the two issues. Also, the relationships between transport and housing costs have been researched for quite some time in France, leading to research on household residential location choices and the cumulated 'residential cost' ('*cout residentiel*').

In Germany, interest for domestic energy affordability (referred to as 'energy poverty' or '*Energiearmut*') has only recently emerged in the research field, and this problem is generally approached in isolation from similar issues in transport. Since at least 2008, however, a number of studies has focused on the potential impacts of rising fuel prices on travel patterns, as well as on the residential location choices of households and housing costs.

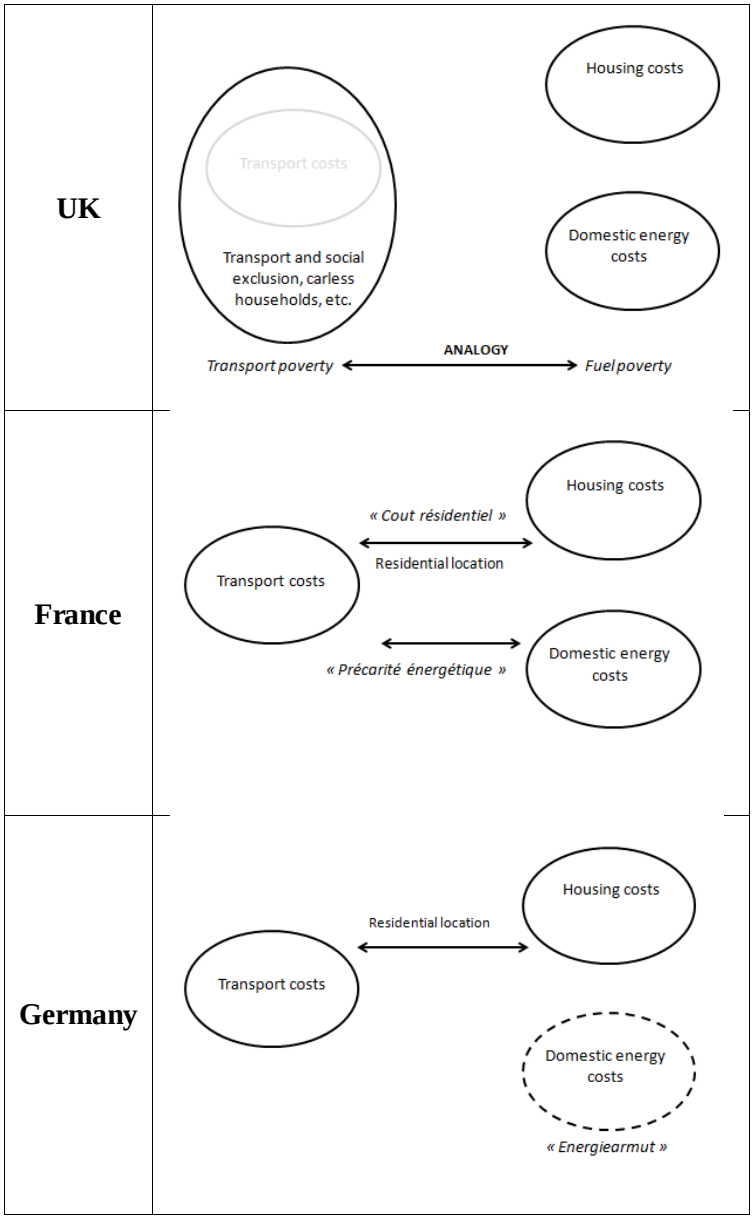

Table 1 - Diagrammatical representation of research and policy interest for the relationships between transport, housing and domestic energy affordability in France, Germany and the UK. Based on Mattioli (2015).

In the UK, there is strong policy and research attention for poverty and deprivation, both in general and specifically in the domestic energy, transport and housing sectors. There is however an intriguing lack of interest for the relationships between the different sectors. The question of household residential location choices, for example, has attracted nowhere near as much attention as in the other two countries. Also, 'transport and social exclusion' research and policy-making has tended to focus more on low-mobility and carless households than on the economic stress arising from high expenditure on travel.

Fuel poverty research and policy making are well established in the UK but narrowly focused on domestic energy and, even more narrowly on heating (Simcock & Walker, 2015). In this context, the notion of 'transport poverty' has been put forward, building on an analogy between (recognised) fuel poverty and (neglected) transport poverty issues (e.g. RAC, 2012; Sustrans, 2012). In the next section

we take the parallel seriously, trying to move from the widespread analogy to a proper comparison of the similarities and differences between fuel and 'transport' poverty.

3. Transport poverty and fuel poverty in the UK: from analogy to comparison

Table 2 discusses the similarities and differences between the mainstream understanding of fuel poverty in British debates and questions of transport poverty and affordability, under three headings: drivers, consequences and metrics. We discuss a number of factors of complexity which, we argue, should warn against an uncritical adoption of fuel poverty concepts and metrics in the transport sector. Based on this discussion, we draw a number of implications and propose solutions for the development of concepts and metrics of 'transport affordability'.

The main conclusions of this exercise are as follows:

- while in developed countries affordability can legitimately be seen as the sole obstacle to warmth within the home, there is a very large number of possible drivers of 'lack of access', many of which are non-economical in nature. Therefore, 'transport affordability' is only a subset of a broader 'transport poverty' problem (Lucas et al., 2016). The analogy holds between 'fuel poverty' and 'transport affordability', not between 'fuel poverty' and 'transport poverty' as a whole
- there is a recursive relationship between income generation and transport affordability, whereby income is needed to pay for transport, but at the same time spending on commuting is required to work and generate income. This is situation has no parallel in domestic energy, i.e. the relationship between poverty and fuel poverty is unidirectional. Transport research suggests that this fact leads households to give high priority to spending on commuting, curtailing other areas of expenditure. Hence the interest of investigating material deprivation among car-owning households (Section 5)

In the lower half of the table, we discuss a number of more specific points related to official fuel poverty metrics, with reference to the 'ten per cent ratio' (TPR) indicator that was adopted from 2001 to 2012 (DEFRA, 2001) and the 'low-income-high-cost' (LIHC) indicator that has been adopted since then (Hills, 2012). The implications drawn for the development of similar metrics of transport affordability have guided the analysis presented in the next section.

Fuel poverty (UK)		Transport	
		Factors of complexity	**Implications / proposed solution**
Drivers	Agreement in 'mainstream' fuel poverty research and policy that drivers are (i) (low) income; (ii) (high) energy prices; and (iii) (poor) energy efficiency (although this is contested by recent 'energy vulnerability' research).	There are many more drivers of 'lack of access' to services, opportunities and social networks. Most of these drivers are non-economic in nature.	'Transport affordability' is only a subset of a wider issue of 'transport poverty' (Lucas et al., 2016).
Consequences	The clear and widely publicised negative consequences of the 'lack of affordable warmth' on physical health are an important factor underpinning the political saliency of fuel poverty. Fuel poor households also face a choice between enduring cold temperatures, incurring debt, and cutting expenditure in other areas	Less obvious causal chain between lack of transport and its negative social consequences. 'Recursive relationship' between transport affordability and income generation may lead households to give high priority to commuting expenditure.	Relative lack of policy and attention for transport affordability. Interest of investigating households who spend disproportionate amounts on transport while cutting back on other areas of expenditure.
Metrics	<u>*Expenditure considered*</u> Modelling of *required* energy use and related expenditure based on temperature standards (based on WHO guidance) and four heating regimes (based on activity status of adults and under-occupancy). Key advantage: it allows to include 'underspending' households.	Overwhelming complexity of defining activity participation standards given their highly individualised and context-specific nature. Each required trip would need to be assigned destination, travel distance and mode, based on an assessment of geographical context, individual abilities and time availability.	Transport affordability metrics should be based on *actual* (rather than modelled) expenditure. Other approaches must be adopted to assess under-spending and suppressed travel demand.
	<u>*Affordability threshold*</u> • TPR: 10% as twice the actual median cost burden of domestic energy in the UK in 1988 • LIHC: median required costs of domestic energy estimated for that year, equivalised based on ad-hoc factors	10% or other thresholds originally estimated based on domestic energy costs data are not suited for use in transport.	Any threshold of transport affordability should be derived by data on *transport* spending.
	<u>*Income threshold*</u> • TPR: absent, but regressive distribution of domestic energy costs ensures that most non-poor households are excluded anyway. • LIHC: 60% of median residual income (after housing and required domestic energy costs)	Transport costs are not necessarily regressively distributed, therefore a simple cost burden threshold will not ensure that well-off households are excluded.	An income threshold is necessary for an indicator of transport affordability. LIHC approach should be preferred to TPR.

Table 2 – Comparison of the (UK understanding of) fuel poverty and transport poverty / transport affordability. Source: Mattioli et al. (forthcoming)

4. Family expenditure data analysis

In this section, we propose an indicator of 'car-related economic stress' that is inspired by the LIHC indicator of fuel poverty. We apply this to data on family expenditure in Great Britain (Living Costs and Food Survey – LCFS 2012). The indicator identifies households who have high (actual) costs for 'running motor vehicles' *and* low income. Fig. 1 illustrates graphically how these households where identified. A fuller discussion of the methodological choices involved in developing this indicator is provided in Mattioli et al. (2016).

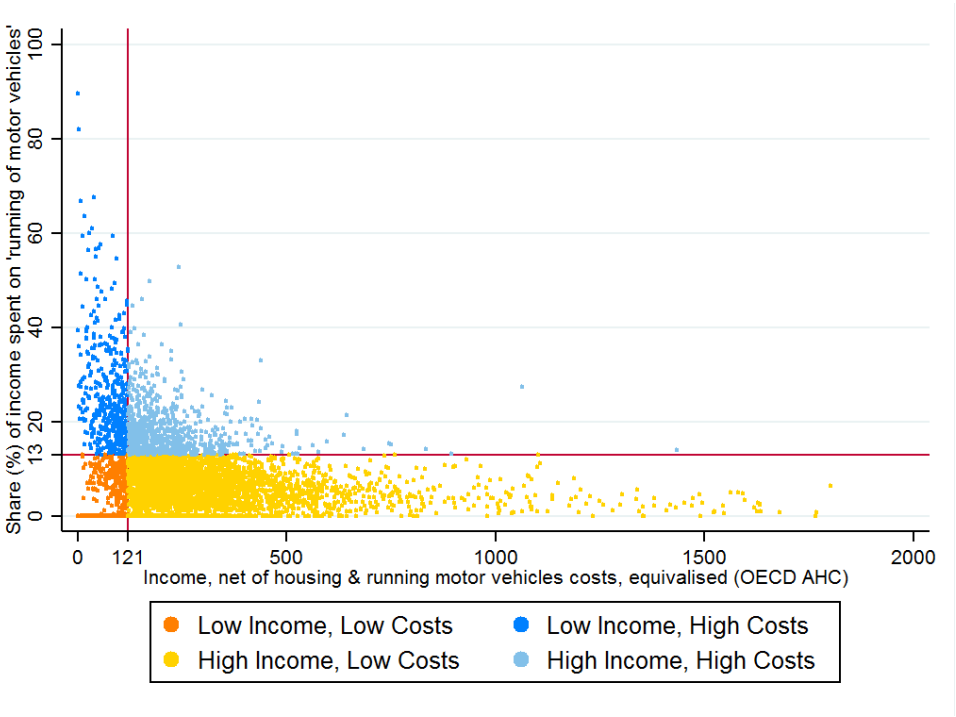

Fig. 1 - Diagrammatical representation of the 'Low Income High Costs' indicator for running motor vehicles expenditure. Source: own elaboration based on LCFS 2012 (N=5,593) (see Mattioli et al., 2016).

In 2012, 9% of households in Great Britain (corresponding to roughly 2.3 million households) were in low income and high costs. This is in the same ballpark as official estimates of fuel poverty (affecting 2.28 million, i.e. 10.4% of households in England in 2012; DECC, 2014).

The results of logistic regression models (discussed in detail in Mattioli et al., 2016) suggest that LIHC households are not so different from the average of the British population, with respect to the socio-demographic and housing-related predictors included in the model. Greater differences are observed when the LIHC group is compared to the 'low-income *low-costs*' group (LILC), suggesting that LIHC households differ more from other low income households than from the average Briton.

The following factors are identified as correlates of 'high costs' in the low income population: employment (full- or part-time); the number of children; a household size of three or four; mobility difficulties; living in (semi-)detached housing; home ownership (both outright and with mortgage - rental purchase).

Ongoing work (not reported in detail in this paper) has focused on trends in the size of the LIHC group over this period 2007-2013, which has seen a significant increase in fuel prices. The preliminary findings suggest that the population share of the LIHC group has remained remarkably stable over this period (9-10% of households). Further analysis suggests that this is the net product of two counteracting trends: (i) an increase in motor fuel prices and the share of income spent on running motor vehicles; (ii) a relative decrease in the 'after housing costs' poverty rate (DWP, 2015). As a result, while the share of LIHC households has stagnated in the population as a whole, it has increased *within the low-income group*.

Further work on LCFS data will use geographically detailed data on motor fuel prices to derive estimates of disaggregate household price elasticities. Previous research has shown that elasticities vary systematically across different sectors of the population, with multi-car, multi-wage earner and urban households showing greater elasticity (Wadud et al., 2009, Wadud et al., 2010). Therefore, disaggregate household price elasticities "can be used to determine the distribution of welfare among households as a result of a policy that increases the price of gasoline" (2010, p.22), or as a result of other, non-policy-induced fuel price spikes. The same approach can be used to estimate the 'windfall gains' of a decrease in motor fuel prices, such as that witnessed since 2014. In our work, we will use disaggregate household price elasticities to predict how the size and composition of the LIHC group would change in response to rapid increases or decreases in the price of fuel (Lucas et al., forthcoming).

5. Income and living conditions data analysis

In research on transport affordability and vulnerability to fuel price spikes, there is evidence to suggest that, in certain circumstances, households cope with disproportionate transport costs by cutting back on other areas of expenditure. However, representative quantitative evidence on material deprivation among households in transport-related economic stress is generally lacking. Arguably, this is indicative of a more general disconnect between transport poverty research and quantitative research on poverty and material deprivation. In this section, we seek to fill this gap with an analysis of the British sample of the EU Statistics on Income and Living Conditions (EU-SILC) dataset.

We use EU-SILC data to define a material deprivation-based measure of car-related economic stress. The material deprivation scale is an indicator of absolute poverty adopted by the EU, which takes into account whether households are able to afford the following nine items (Fusco et al., 2013): to face unexpected expenses; one week annual holiday away from home; to pay for arrears; a meal with meat, chicken or fish every second day; to keep home adequately warm; to have a washing machine; to have a colour TV; to have a telephone; to have a personal car. Households who report not being able to afford at least three out of the nine items are considered to be in 'material deprivation' (MD), with four items corresponding to 'severe material deprivation'.

We use information on car ownership and material deprivation to break down the UK population in four groups, as illustrated in Fig. 2: (i) households who do not own a car because (they state that) they 'cannot afford it'; (ii) households who do not own cars for other reasons; (iii) car owning household not in MD; (iv) households who own at least a car despite being in MD. We define the latter as at risk of 'car-related economic stress' (CRES), based on the assumption that they are (at least potentially) trading off motoring expenditure against expenditure in other essential areas. Between 2005 and 2013,

the percentage has oscillated between 4% (2007) and 7% (2012), with a tendency towards increasing prevalence.

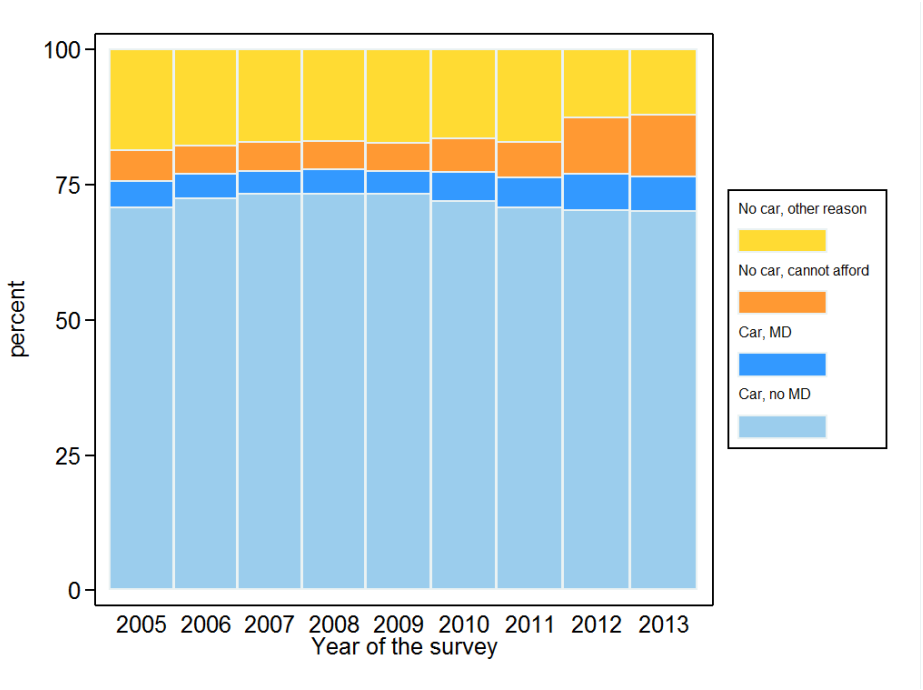

Fig. 2 - Composition of the UK population between 2005 and 2013 according to a classification based on car ownership, material deprivation, and reasons for lack of car ownership. Source: own elaboration based on EU-SILC 2005-2013 (see Mattioli et al., 2016).

The results of logistic regression models for 2012 data (discussed in detail in Mattioli et al., 2016) suggest that CRES households are not so different from the average of the British population, with respect to the socio-demographic, spatial, and housing-related predictors included in the model. At the same time, the model suggests that the following factors are associated with an increased probability of CRES in this analysis: low income; low work intensity[1]; a 'household reference person' in their 40-50s; living in semi-detached housing; 'great' difficulties in access to public transport; being a mortgage borrower or a renter; a high housing cost burden ratio (around 40% of income).

Greater differences appear when households with cars in MD are compared to households who cannot afford cars, suggesting that households at risk of CRES differ more from households who cannot afford car ownership than from the average Briton. Intriguingly, however, there are no statistically significant differences between the two groups in terms of income once other factors are controlled for, suggesting that households who own cars despite material deprivation are *not* wealthier than those who report not being able to afford them. On the basis of the model, the following are identified as factors that might lead households who struggle to afford the costs of motoring to buy and use cars, despite having to curtail expenditure in other essential areas: large household size; mobility difficulties; 'medium' work intensity; living in thinly populated areas; living in detached and semi-detached housing; having a house mortgage; a high housing cost burden ratio.

[1] The official EU indicator of 'work intensity' is the ratio between the number of 'worked' and 'workable' months, in the 12 months preceding the interview, for working age members. Households with a work intensity value lower than 0.2 are defined as 'low work intensity' and are considered ipso facto 'at risk of poverty or social exclusion'.

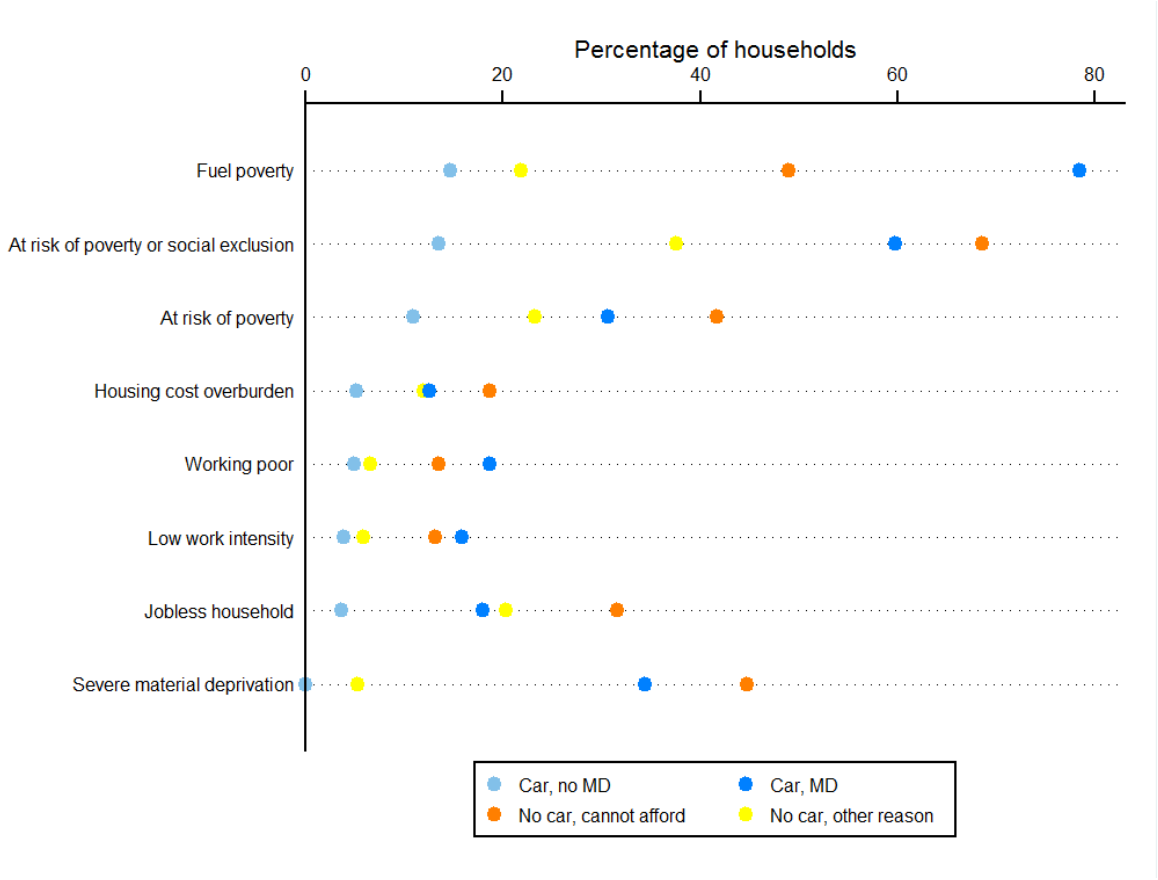

Fig. 2 - Profile of the four groups from Fig.1 (in 2012) according to EU indicators of poverty, social exclusion and deprivation. Source: own elaboration based on EU-SILC 2012.

In Fig. 2, we profile the four groups identified above according to a range of poverty, deprivation and social exclusion indicators drawn from the EU-SILC dataset. All indicators are officially adopted by the EU except the fuel poverty indicator, which is based on subjective indicators as proposed by Thomson and Snell (2013). The graph shows that, for most indicators, households who cannot afford cars score higher than the others. This is to be expected, as they have lower average income. However, it is interesting to note that in a few cases, it is car-owning households in material deprivation who are at the greatest disadvantage. This is the case for fuel poverty (79%), in-work poverty (18%) and low work intensity (18%).

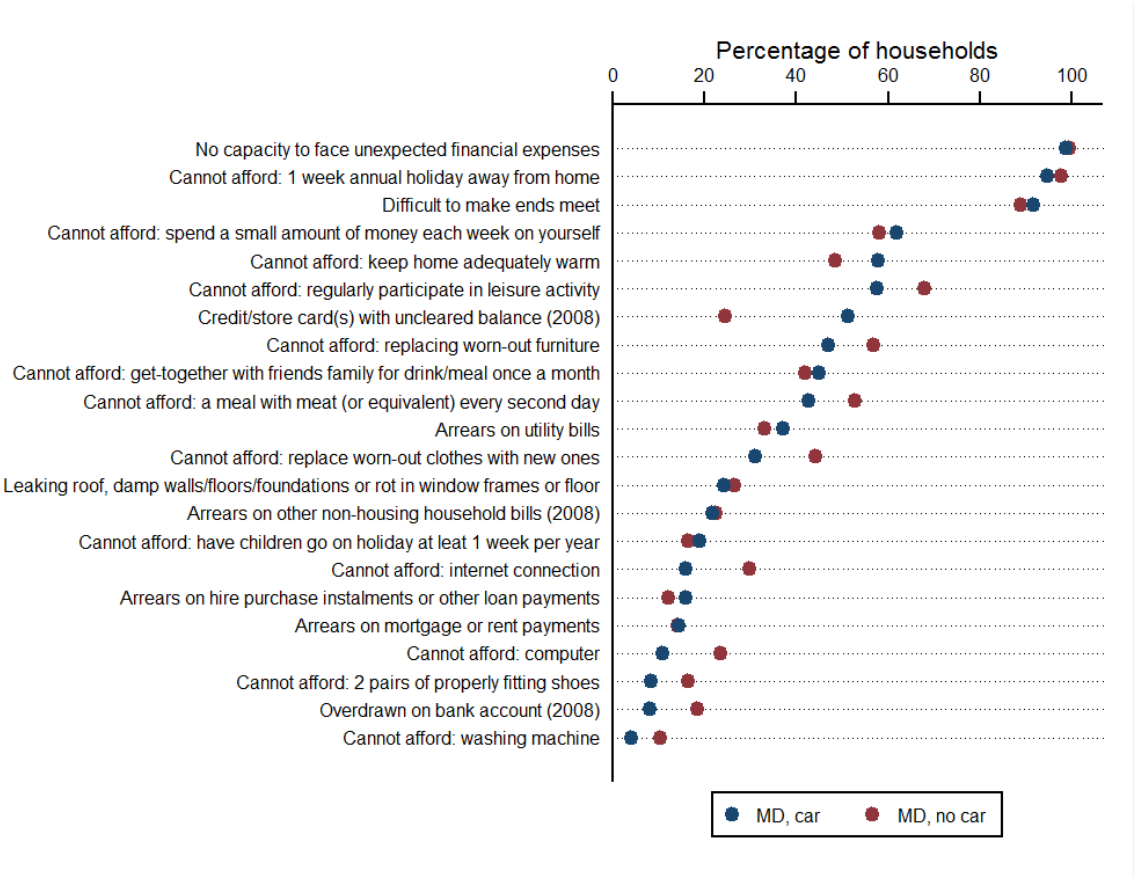

Fig. 3 - Material deprivation and indebtedness items for households in material deprivation with and without cars. Source: own elaboration based on EU-SILC 2008-2009.

Fig. 3 allows us a deeper look into patterns of material deprivation and indebtedness, based on data drawn from the 2008 and 2009 survey waves, where more bespoke items were included. The graph compares car-owning households in material deprivation with other (carless) households in material deprivation. The graph shows that, for most indicators, carless households score higher than their motorised counterparts. This is to be expected, as they have lower average income. It is interesting to note therefore that car-owning households in material deprivation are more likely to not be able to "afford to keep home adequately warm" (58%) and to be in "arrears on utility bills" (37%). Also, households that we defined as at risk of CRES are more likely to have credit cards in with uncleared balance (51%) and to be in arrears on hire purchase instalments and other loan payments (16%). These insights are consistent with research suggesting that households facing disproportionate transport costs households are more likely to maintain their commuting travel patterns and reduce domestic energy consumption than the other way round (Jouffe & Massot, 2013; Desjardins & Mettetal, 2012). The possible links between car ownership and indebtedness have also been highlighted (Walks, 2015). Finally, it is worth noting that 99% of households with cars despite material deprivation report not being able to face unexpected financial expenses. We can speculate that this puts them in a weak position when the vehicle breaks down.

6. Conclusions

The intermediate findings of the *(t)ERES* project point to four main conclusions. First, the parallel between issues of affordability in domestic energy and transport is instructive, but care should be taken to evaluate critically the adoption of concepts, frameworks and metrics developed in fuel poverty research. Transport is different (and arguably more complex) than heating, and so a variety of different concepts and multi-layered measurement approaches is needed. These *include, but are not limited to*, notions of transport affordability (Berry et al., 2016; Lucas et al., 2016).

Second, what we have defined as a 'car-related economic stress' affected a large number of households (1.7-2.3 million) in Great Britain in 2012. Our analysis also suggests that it has become more prevalent since 2005-2007, at least among low-income households.

Third, the regression models highlight a number of socio-economic factors associated with CRES, which can be construed as increasing the ratio between the (car) travel needs of the household and its income base (e.g. household size, presence of children and underemployment). CRES also appears to be associated with factors (middle adulthood, large household size, children and access to home ownership) which are typical of a certain stage of the family life cycle. The finding that CRES is associated with living in low density areas confirms previous research (e.g. Dodson & Sipe, 2007).

Fourth, and related to this, we present evidence of an overlap between economic stress in the three areas of interest. The EU-SILC analysis shows that households in car-related economic stress are more likely to be in 'housing cost overburden' and in fuel poverty. This is in stark contrast with the 'silo-approach' to affordability that we have identified in the UK.

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