Transportation Research Part A 113 (2018) 227–242

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Vulnerability to fuel price increases in the UK: A household level analysis

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ARTICLE INFO

Keywords:
Oil vulnerability
Price elasticities
Distributional impacts
Fuel demand
Transport affordability
Low-income households

ABSTRACT

In highly motorised countries, some sectors of the population own and use cars despite struggling to afford their running costs, and so may be particularly vulnerable to motor fuel prices increases, whether market-led or policy-driven. This paper proposes a novel, disaggregated approach to investigating vulnerability to such increases at the household level. We propose a set of indicators of 'car-related economic stress' (CRES), based on individual household level expenditure data for the UK, to identify which low-income households spend disproportionately on running motor vehicles, and to assess the depth of their economic stress. By subsequently linking the dataset to local fuel price data, we are able to model the disaggregated price elasticities of car fuel demand. This provides us with an indicator of each household's adaptive capacity to fuel price increases. The findings show that 'Low Income, High Cost' households (LIHC) account for 9% of UK households and have distinct socio-demographic characteristics. Interestingly, they are characterised by very low responses to fuel price increases, which may cause them to compromise on other important areas of their household expenditures. Simulations suggest that a 20% increase in fuel prices would substantially increase the depth, but not the incidence of CRES. Overall, the study sheds light on a sector of the population with high levels of vulnerability to fuel price increases, owing to high exposure, high sensitivity and low adaptive capacity. This raises challenges for social, environmental and resilience policy in the transport sector.

1. Introduction

One of the major uncertainties for transport policy and practice concerns the level of future fuel prices, and thus their affordability for the domestic and commercial travellers. Oil derived fuels still account for the overwhelming majority of energy consumption in the transport sector (EEA, 2015), making it very exposed to oil price fluctuations. These may be sudden and hard to predict (Baumeister and Kilian, 2016; Gronwald, 2016; Alexander, 2017), although the longer-term outlook is for overall increases in the real price of crude oil worldwide (World Bank, 2016).

At the same time, climate change mitigation efforts may lead to higher motor fuel prices, as governments increase taxes and/or reduce fossil fuel subsidies (Ross et al., 2017). Whether market-led or policy-driven, increases in motor fuel prices have important effects on the transport system, including, crucially, on levels of car use (Bastian et al., 2016; Wadud and Baierl, 2017). They can be used to encourage modal shift, and to support compact city planning and transit-oriented development (De Vos and Witlox, 2013;

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https://doi.org/10.1016/j.tra.2018.04.002
Received 22 May 2017; Received in revised form 23 March 2018; Accepted 5 April 2018

Guimarães et al., 2014; Gusdorf and Hallegatte, 2007; Ortuño-Padilla and Fernández-Aracil, 2013), as well as the uptake of more efficient and alternative fuel vehicle technology (Li et al., 2009; Schäfer et al., 2009; Wadud, 2014).

An issue that has received limited attention, however, is the hardships that motor fuel price increases may inflict upon some lower-income sectors of society. There is some research evidence to suggest that in highly motorised countries a number of households already struggle to afford the running costs of cars, while relying on car mobility to satisfy their accessibility needs (Belton Chevallier et al., 2018; Curl et al., 2018; Currie and Delbosc, 2011; Litman, 2016; Lucas, 2011; Mattioli, 2017; Mullen and Marsden, 2018; Ortar, 2018; Rock et al., 2016; Taylor et al., 2009). This can make these households particularly vulnerable to motor fuel prices increases, which is problematic from a social equity perspective. Also, from an environmental policy viewpoint, it may hinder the implementation of measures such as carbon taxes and the reduction of fossil fuel subsidies due to worries about social inequalities. It is possibly partly for this reason that, to date, most governments have been reluctant to substantially increase fuel prices, due to public and political non-acceptability issues (Lyons and Chatterjee, 2002; Ross et al., 2017), even though such increases would appear to be common-sense from an energy-reduction policy perspective.

In this paper, we put forward a set of indicators to assess the incidence and depth of 'car-related economic stress' (CRES) in the UK. We then use econometric modelling methods to estimate disaggregated price elasticities of fuel demand, which we take to be indicative of the degree of car dependence and adaptive capacity of individual households. Finally, we use these elasticity estimates to model the impact of fuel price increases on CRES in the UK.

In particular, the study makes two novel scientific contributions. First, it highlights the household characteristics associated with vulnerability to fuel price increases, complementing the emphasis of previous research on the importance of spatial factors. Second, it demonstrates how a social indicator approach to transport (un)affordability can be combined with econometric analysis to produce realistic estimates for future price-based scenarios. The proposed approach can be implemented in any jurisdiction where household expenditure and fuel price data with enough spatial and temporal variation is available, and has thus the potential to be used as a diagnostic and planning tool in transport, land use and social policy making, in the UK and elsewhere.

The article is structured as follows. Section 2 reviews the relevant literature. In Section 3, our approach is set out in detail, along with the data used. Section 4 presents the findings, which are discussed in Section 5. In Section 6 we draw conclusions and discuss policy implications.

2. Literature review

This study draws from and builds upon three contemporary strands of research: (i) transport and social exclusion, (ii) 'oil vulnerability' and (iii) the heterogeneity in the response to fuel prices. These are briefly reviewed below.

2.1. Transport, social exclusion, and affordability

Research on transport and social exclusion (Lucas, 2012; Ricci et al., 2016; Schwanen et al., 2015; Titheridge et al., 2014) investigates the causes and consequences of reduced access to key services and opportunities, highlighting for example the socio-economic factors associated with low levels of travel activity (Lucas et al., 2016a). Studies have generally focused on low-income carless households, given their limited opportunities to travel and accessibility to opportunities (e.g. Klein and Smart, 2017). Perhaps slightly less attention has been given to car-owning households, who may be struggling to afford the cost of their travel. However, rapidly fluctuating fuel prices, stagnating real incomes and increasing car ownership among low-income groups in many advanced economies has drawn increasing attention to questions of affordability within the transport sector (AAA, 2016; Guerra and Kirschen, 2016; Litman, 2016; Mattioli et al., 2017a). The costs of daily mobility, most notably by car, can have important negative impacts on household finances, leading households to curtail their expenditures in other essential areas, to restrict their activity spaces, and/or to tip them into debt, all of which can ultimately result in social exclusion (Belton Chevallier et al., 2018; Curl et al., 2018; Currie and Delbosc, 2011; Lucas, 2011; Mullen and Marsden, 2018; Ortar, 2018; Rock et al., 2016; Taylor et al., 2009; Walks, 2018).

Different terms are used in the literature to describe the condition of households who need to spend a disproportionately high share of their income to get where they need to go. These include 'forced car ownership' (Curl et al., 2018; Currie and Senbergs, 2007), 'transport poverty' (Gleeson and Randolph, 2002; Sustrans, 2012), 'commuter fuel poverty' (Lovelace and Philips, 2014) and 'transport affordability' (Litman, 2016; Lucas et al., 2016b). In this paper, we use the term 'car-related economic stress' (CRES) (Mattioli and Colleoni, 2016) to refer to a subset of transport affordability problems, solely related to *expenditure on motoring*. Existing research on developed countries has largely focused on the affordability of owning and operating motor vehicles (Lucas et al., 2016b), reflecting the fact that motoring accounts for around 80% of all household spending on transport in OECD countries (Kauppila, 2011).

2.2. Oil vulnerability

Historically high oil prices between the early-2000s and 2014 have triggered a wave of studies into 'oil vulnerability' in urban areas, notably in Australia (Dodson and Sipe, 2007, 2008; Fishman and Brennan, 2009; Leung et al., 2015; 2018; Runting et al., 2011), but also increasingly in Europe (Büttner et al., 2013; Gertz et al., 2015; Lovelace and Philips, 2014; Mattioli et al., 2017b; Nicolas et al., 2012). These set out to identify the areas where households would be most severely affected by motor fuel price increases, typically through the use of composite indicators at the small-area level.

Drawing on notions of 'social vulnerability' (Adger, 2006; Brooks, 2003), recent contributions (Büttner et al., 2013; Leung et al., 2015; 2018; Mattioli et al., 2017b) argue that oil vulnerability indicators should cover three elements: (i) *exposure* to fuel price