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The impact of extreme weather conditions on long distance travel behaviour

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ABSTRACT

This paper examines traveller attitudes and responses towards disruption from weather and natural events. An internet-based travel behaviour survey was conducted with more than 2000 respondents in London and Glasgow. Of these respondents, 740 reported information on over 1000 long distance trips affected by extreme weather and natural events over the previous three years. Results show respondents are generally cautious towards travelling during extreme weather events. For a slight majority in the case of air and public transport, and a greater one in the case of car, travellers did not considerably alter their travel plan following the disruption. This was explained not only by less disruptive weather conditions (with heavy snow and volcanic ash being the most disruptive) and impact, but also by the relative importance of their trips. Differences between transport modes were not substantial. Business trips sometimes appeared to give travellers more flexibility, some other times not. Origin and destination did have an impact on reaction, as well as the presence of children whilst travelling. Mixed results were obtained about socio-economic and attitudinal variables. Age in particular did not appear to have a significant effect. Whilst most respondents did acknowledge no external influence in their decision, results showed an important contribution of transport organisation staff, as well as home and mobile internet technology. A limited but still considerable number of respondents indicated their closest friends/relatives as the main influence of their decisions. The results will help planners deploy strategies to mitigate the negative effects of weather related disruptions.

1. Introduction, context and objectives of this research

The impact of weather and climate on human behaviour and economic activity, from life satisfaction (Maddison and Rehdanz, 2011) to college enrolment (Simonsohn, 2010), passing through migration (Rehdanz and Maddison, 2009) and consumer spending (Murray et al., 2010) has been demonstrated by several empirical studies.

The impact of weather and climate on various transport variables such as road safety (Andersson and Chapman, 2011), traffic and/or congestion levels (Hooper et al., 2013; Lam et al., 2008), as well as transport systems resilience and maintenance issues (Jaroszweski et al., 2010; Koetse and Rietveld, 2009) has also been analysed. However, fewer studies have concentrated on the impact of weather on individual travel behaviour. In those cases, including in a number of very recent

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papers published on this journal, historical traffic or travel data (the latter from either electronic surveys or diaries) were generally used to analyse and predict the effect of weather on mode and destination choices, public transport ridership or propensity to cycle or walk (Arana et al., 2014; Nosal and Miranda-Moreno, 2014; Sabir et al., 2013; Saneinejad et al., 2012; Singhal et al., 2014).

In this paper we focus on the impact of extreme weather (and natural) events on long-distance travel behaviour using data collected from a primary survey carried out in the UK in late 2011/early 2012. Recent studies have provided evidence that extreme weather events will become more frequent as a consequence of climate change (see for example Bronnimann et al., 2012). Whilst last winter (2013/2014) was relatively mild in the UK in temperature terms, it was the wettest since 1910 (Press Association, 2014), and a number of storms hit various regions causing considerable disruptions to buildings and travel infrastructures, with the cost for the railway system estimated at £170 million (Odell, 2014). The winters of 2009/2010 (the coldest for 31 years) and 2010/2011, which were covered in our survey, were also particularly severe in the UK, as well as across Europe (Vajda et al., 2013), causing a number of disruptions not only to travel, but also to electricity and water supplies.[1] Travel disruptions, in particular, were estimated to cost £280 million per day to the UK Economy during the 2010 and 2011 severe spells (Prior and Kendon, 2011a,b). In the same period, the eruption of the Eyjafjallajökull volcano in Iceland, and the consequent closure of part of the European airspace, also caused considerable disruptions to UK travellers (Budd et al., 2010; Oxford Economics, 2010). Various passengers' satisfaction surveys conducted during or before the most disrupted periods, showed a considerable low percentage of travellers satisfied with the way the relevant transport operators had handled the disruptions and their consequences. For example, a survey and focus groups about winter disruptions conducted by the UK Civil Aviation Authority (CAA) in 2011 showed that 74% of air travellers were dissatisfied with the amount of information they received during disruptions, and 81% with the assistance they received (CAA, 2011). Dissatisfaction level were lower for rail passengers in the same period but still considerable at 65% (Passenger Focus, 2010); and whilst the UK Parliament has recently recognised that some progress has been made in the years following the major disruptions of 2009/2010/2011, also as a result of milder weather, the Transport Committee has also recommended an increased attention to passenger welfare (House of Commons, 2013). Finally, although long-distance travel accounts for only 2% of trips in the UK, it clearly covers a much larger proportion of total distance travelled (Dargay and Clark, 2012), and the disruptions and resulting uncertainty are likely to be more severe for travellers, who may find themselves much farther away from home and, possibly, in unfamiliar locations.

In this paper we aim to better understand the way travellers change or adjust their plans when facing uncertainty due to extreme weather conditions prior and during travelling for long-distance trips. In particular, we seek to provide an answer to the following research questions: What trip and/or travellers' characteristics affect the reaction to the disruption the most? What are the main sources of information before or during disruptions? What is their influence on the travellers' final decisions? In particular, concerning the last point, we also want to see whether referring to a closest friend/relative is an important tool when individuals take decisions under uncertain conditions. Understanding the way travellers react to disruptions has a particular importance to inform transport operators and local and national policy makers in their efforts to avoid or mitigate both the disruptions and their consequences. Disruptions, and the way the system (providers, infrastructure and users) reacts and adapts to them, can also be seen as sort of experiments and opportunities to plan more radical changes in transport policy (Marsden and Docherty, 2013), and their analysis is therefore of particular policy and practical relevance. In our survey, respondents were asked to report information about recent past long distance trips (in the previous three years) that were disrupted by extreme weather events (from heavy snow to extreme heat) or other natural causes (like volcanic ash or landslides).

The remainder of this paper is organised as follows. In Section 2 we review the existing literature on the impact of weather on travel behaviour. Section 3 introduces our travel behaviour survey and methodology. Section 4 contains the results of our analysis, whilst Section 5 provides a discussion and conclusions.

2. Literature review on the impact of weather on travel behaviour

As noted in the introduction, studies have demonstrated that changes in weather conditions have indeed a strong impact on various transport and travel dimensions. Here we briefly review those studies focusing on the impact on travel behaviour that are more relevant to our research (for a full review see Böcker et al., 2013a; Koetse and Rietveld, 2009).

Overall, travel behaviour studies have mainly looked at the relation between weather and propensity to cycle (Böcker et al., 2013b), walk (Clark et al., 2013) and use public transport, either for commuters or leisure travellers (Arana et al., 2014; Sabir et al., 2013). Whilst various studies have demonstrated that, with different magnitudes, public transport ridership generally increases during adverse weather conditions (Aaheim and Hauge, 2005), others have observed the contrary (de Palma and Rochat, 1999; Guo et al., 2007). In Saneinejad et al. (2012), for example, the utility of public transport seems to be positively affected by cloudy and rainy conditions, but only for male travellers, whilst Cools et al. (2010) revealed that snow has the highest impact on commuting trips, whereas extreme temperature, both warm and cold, have the least impact. Kalkstein et al. (2009) analyse the effect of air masses (which include all weather variables such as precipitation levels, temperature, wind speed, cloud cover and humidity) on demand for rail travel in three US cities, and identify a significant

[1] For an excellent account of weather- (and volcanic ash) related delays and costs for the EU transport system (also in comparison with the US, China and Australia), as well as passengers protection regulations please see the very recent report by the Mowe-It Project (Mowe-It, 2014).