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Surrey Energy Economics Centre (SEEC)

University of Surrey, UK

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NOTE:

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Making the transition from an energy intensive transport system: Evidence from a generalised cost based quadratic almost ideal demand system (GC-QUAIDS)

SEEC

Halcrow

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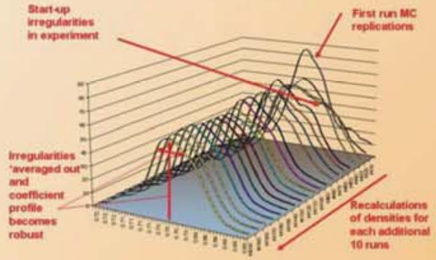
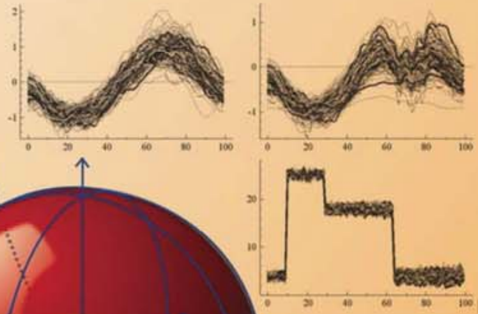
The key contributions of this research are;

- Introduce the Generalised Cost based approach to modelling (QUadratic) Almost Ideal Demand Systems (GC-QUAIDS), which estimates demand system parameters and derives substitution elasticities using a combined generalised price index as opposed to a pure money price index;
- In so doing the work provides innovative insights into the consumers demand responses to changes in income, but also the observed responses to 'generalised cost' based price movements, which provides an alternative viewpoint which can help potentially add-value to regulatory assessments of travel markets; and
- Evaluate the generalised cost based substitution elasticities and illustrate the 'frictions' that the existing soft (social and regulatory) and hard (physical) infrastructures in the UK mean in terms of transitioning from energy intensive modes of travel to lower intensity and lower impacts modes.

Data

The data used in the study are derived from the UK Department for Transport 'Transport Trends' and 'Transport Statistics Great Britain' and the Office for National Statistics Bluebook. The data are annual data from 1949-2006 and capture all road based transport movements by the various different modes of transport.





The extension to generalised prices

[illegible]

$$\ln z_t = \alpha \ln \frac{g_t}{P_t} + \beta \ln \frac{m_t}{P_t} + \varepsilon_t$$

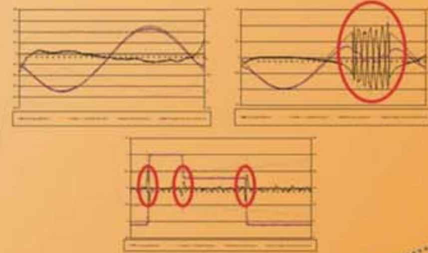
[illegible]

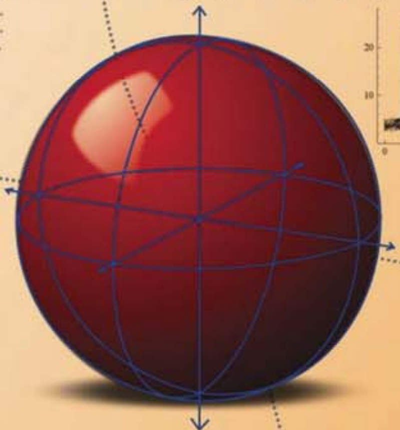
$$\ln z_t = \mu_t + \beta \ln \frac{m_t}{P_t} + \varepsilon_t$$

$$\mu_t = \mu_{t-1} + \delta_t + \eta_t$$

$$\delta_t = \delta_{t-1} + \zeta_t$$

[illegible]

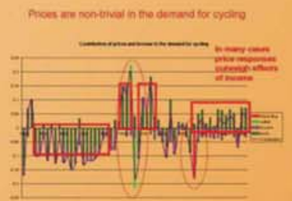


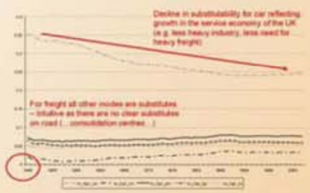


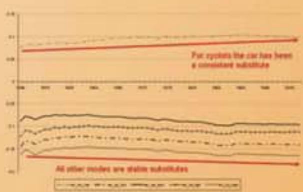
Analysis and Preliminary results

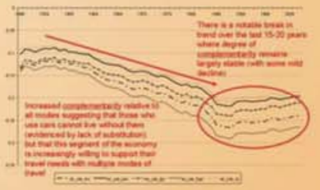
The results have important implications for understanding the short/medium term potential to transition the UK transport system to one which has a lower energy intensity and subsequently a lower environmental impact. The analysis lends itself to the following preliminary conclusions:

- The derived elasticities for all modes are plausible and broadly speaking what might be expected a priori, albeit with some interesting dynamic features. In a couple of cases weak complementarity in the early part of the sample period has been replaced with weak substitutability in the latter part of sample period. The own price elasticities for all modes was of the order of 1, with the exception of cycling, in which the elasticity was roughly equal to 1.1. This implies that there exists latent demand within the UK's cycling community – a lower energy intensive mode of travel – and that reductions in price are consistently met with disproportional rises in expenditure.
  - ***This suggests that there are opportunities for making transition to a lower energy intensive use of transport, but the weakness in some of the relationships needs to be fostered through further policy intervention and regulation.***
- For car transport, it is seen that all modes of transport are complement goods. That is to say, a reduction in the cost of any other mode of transport is not met by a replacement of car transport with that mode, rather the consumption of both increases.
  - ***This conflicts with the above finding and highlights the imbedded 'frictions' that are faced in the UK in moving towards a low energy intensity use of transport to support the purchase of other goods and activities.***
- Making the transition from an energy intensive transport system will be a complicated process due to the existing social and physical infrastructures imbedded in the UK and its society, as well as wider global issues. Traditional use of the transport infrastructure necessitates a certain amount of long distance journeys that see energy intensity essentially being traded off against time for other activities.




Decline in substitutability for car reflecting growth in the service economy of the UK (e.g. less heavy industry, less need for heavy freight)
For freight all other modes are substitutes – intuitive as there are no clear substitutes on road (…consolidation centres…)




There is a notable break in trend over the last 15-20 years where degree of complementarity remains largely stable (with some mild decline)
Increased complementarity relative to all modes suggesting that those who use cars cannot live without them (evidenced by lack of substitution) but that this segment of the economy is increasingly willing to support their travel needs with multiple modes of travel