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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)



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The key contributions of the research are:

- Introduce the Generalised Cost based approach to modelling (Q)elastic 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 an attempt to work towards increasing insight into the reasons behind 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 modes, and
- Evaluate the generalised cost based substitution elasticities and illustrate the 'factors' that the resulting (if partial and regular) and long (quasi) elasticities in the UK, use as a basis of transitioning from energy intensive modes of travel to lower intensity and lower impact modes.

Data

The data used in the study are derived from the UK Experiment for Transport 'Traveler' and 'Traveler in Statute Book' and the Office for National Statistics Household. The data are time series data from 1980-2010 and represent annual and half-yearly transport movements by the various different modes of transport.

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 leads to the following preliminary conclusions:

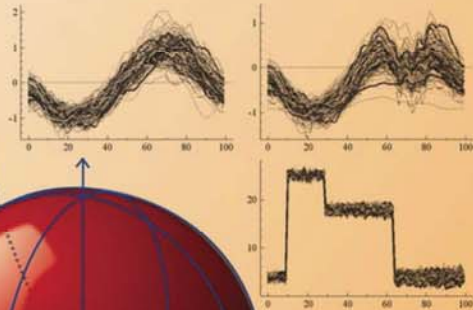
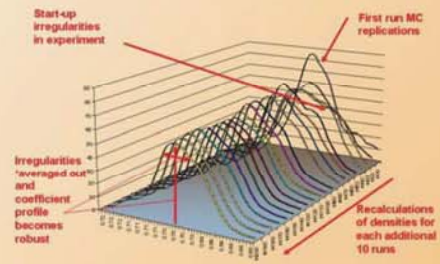
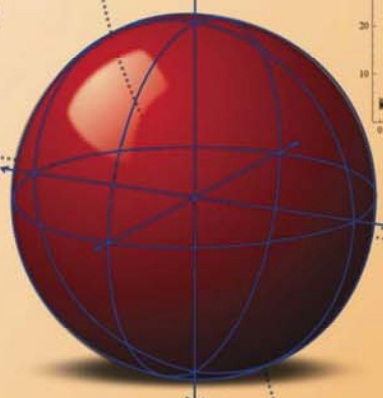
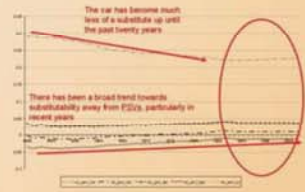
- The derived elasticities for all modes are plausible and broadly speaking what might be expected a priori, albeit with some interesting dynamic features. In a couple of cases weak complementarity in the latter part of sample period. The own price elasticities for all modes are of the order of -1, with the exception of cycling, in which the elasticity was strongly equal to -1.1. The implication of these results is that demand within the UK's cycling community is a lower energy intensive mode of travel - and that substitute as price are consistently met with long-run responses as an expenditure.
- This suggests that there are opportunities for making transition to a lower energy intensive use of transport, but the weaknesses in some of the relationships needs to be factored 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, unless the consumption of both occurs.
- This confirms with the above finding and highlights the embedded 'bottlenecks' 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 resulting social and physical infrastructure embedded in the UK, and its society, as well as wider global issues. Traditional use of the transport infrastructure involves a certain amount of fixed factors concepts that are energy intensive possibly being tied to all space time for other activities.

Decline in substitutability for car reflecting growth in the service economy of the UK, in e.g. less heavy industry, less need for heavy freight.

For freight all other modes are substitutes - intuitive as there are no other substitutes on road (i.e. intermodal services...)

There is a notable break in trend over the last 15-20 years where degree of complementarity remains largely stable (with some mild declines).

Increased complementarity relative to all modes suggesting that those who use cars spend less without those restricted by lack of substitutes, but that this segment of the economy is increasingly willing to support their travel needs with multiple modes of travel.



The extension to generalised prices
In the context of transport, the more modes of transport the observation of demand is not possible, especially over extended time periods (e.g. cycling, bicycles, in the context of transport it is commonly acknowledged the short running price are only a subset of the range of costs which behave as a 'generalised cost function'. The sales function advances offers better allowing the non short run demand, and lower consumer substitution (the cost of using generalised) and thereby the advances in technologies enabling and having market size have and including resources (difficult) existing over time to reflect changing social norms and attitudes, changes in legislation and government policies etc.

It follows that consumers will respond for changes in the relative energy intensity cost of the components and a generalised cost function. Given the complexity of the generalised cost function, and the theoretical and empirical issues of evidence to support its generalisation, it is reasonable that any alternative representation of the cost function might consider utility cost dependent dimensions. A conventional demand function requires demand as a function of price and income. However the general price, income, y , we will demand and as a function of generalised cost function, as price of income, y , w , allowing a long list of goods and services and allowing time by allowing it to refer to specific a generalised price-demand function for a single good within a wider set of goods.

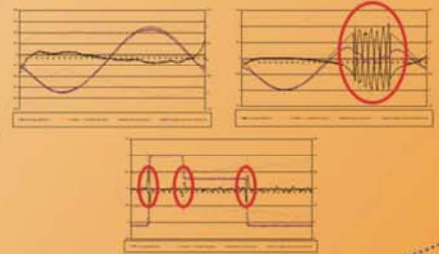
$$ln \pi_i = \alpha_i + \beta_i \ln \frac{y}{P_i} + \gamma_i \ln \frac{w}{P_i} + \delta_i$$

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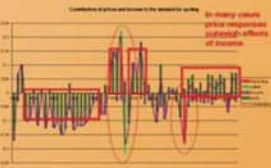
$$\pi_i = \alpha_i + \beta_i \ln \frac{y}{P_i} + \gamma_i \ln \frac{w}{P_i} + \delta_i$$

$$\delta_i = \delta_{i0} + \epsilon_i$$

Where $\pi_i = \frac{P_i}{y}$. Given that α_i is not constant and β_i is not constant it is more probable than the price index can be derived from the π_i than by any reasonable negative value. Indeed time and time series $\ln \pi_i = \alpha_i + \beta_i \ln \frac{y}{P_i} + \gamma_i \ln \frac{w}{P_i} + \delta_i$. This price index is then used to represent the generalised cost based required in the QUAIDS model, then being the GC-QUAIDS model.



Prices are non-trivial in the demand for cycling



Double movements for thought linked to economic growth?

