

“From Equilibrium to Evolution”

**Do we need an evolutionary model of travel behaviour?
Some food for thought**

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Proposition

- We have made many advances in travel demand modelling over the decades, from a three -> four-stage aggregate transport model, to activity-based and agent-based simulation models
- This has involved disaggregation/sophistication at many levels:
 - Household characteristics as zonal averages -> trackable individuals
 - Discrete trips -> daily activity patterns
 - Origin & destinations at zonal level -> point locations
 - Peak period travel blocks (e.g. 07.00 – 10.00) -> continuous temporal recording
-while, in contrast, travel times and costs have always been precisely reported - albeit initially from zone centroids
- All in conjunction with a shift from data description and trend extrapolation to behavioural choice modelling and micro simulation
- BUT: this is still largely based on equilibrium, snapshot modelling

Topics

1. The case for moving away from equilibrium modelling

- 1A: Asymmetrical responses to an external stimuli
- 1B: Leads and lags – and other time-related effects

2. Some remaining gaps in choice modelling

CAVEAT: I'm not familiar with the full details of all current models, so some of my points might be addressed already - in which case, apologies

1A: Asymmetrical responses to an external stimuli

- It is normally assumed that the strength of behavioural response is independent of the direction of change, but there is some evidence that this is not always the case:
 - Supply: A unit of travel time lost has a higher value than a unit of time gained – yet most VTTS studies and practice don't take this into account (and historically have focused on time savings)
 - Demand: Asymmetrical responses to car purchase – panel study shows that the income at which a household gives up a car is lower than that at which they first purchased one
- But why?
 - Economics: if strength of response is based on proportional change rather than absolute change, then declining marginal utility would suggest that a unit gain would have lower value than a unit loss
 - Psychology: 'losers' feel more strongly than 'gainers' – hence the former are more vocal in meetings
 - Lifestyle: households get used to owning a car and modify their lifestyles accordingly (e.g. move to a car dependent housing development)
 - Also a lag effect – discussed later – as issue of ownership particularly applies when there is a need to replace a household car

1A: Asymmetrical responses to an external stimuli

Does this matter?

Yes, in a world where real incomes for some groups is falling, and congestion gets worse

- Modelling: it affects the accuracy of travel choice and car ownership modelling
- Appraisal: it does not reflect observed consumer preferences: in the UK growing disregard for urban congestion among professionals/politicians, but not the public

What might we do about it?

VTTS/L

- Conduct SP surveys – limited evidence to date is contested
- With agent-level modelling, possible to identify ‘winners’ and ‘losers’ and apply different values

Car ownership

- Estimate likelihood of taking a decision to purchase/replace a car, in the latter case including age of car
- Assess ease of maintaining current travel patterns if lose a car
- Assess changes in circumstances: job move, lifecycle shift..... -> links to longitudinal effects

1B: Leads and lags – and other time-related effects

- The link between changes in behaviour and their causes may not be simultaneous – as is evidenced by long-term elasticities (e.g. rail fares or petrol prices) being higher than short-term ones (by up to a factor of 2 or 3) - hence with equilibrium modelling, scope to significantly underestimate – or overestimate – long terms impacts.

Leads

- Act in anticipation of a future change – either in supply (e.g. in advance of new transport infrastructure – JLE EXAMPLE) or demand characteristics (e.g. before retiring – EXAMPLE)

Lags

- Delay response, either because it does not affect person immediately (e.g. buy annual ticket just before price rise), or of wider short-term constraints in the household (e.g. waiting until child moves school – EXAMPLE)

1B: Leads and lags – and other time-related effects

Habitual behaviour

- Most travellers are ‘satisficers’ not ‘optimisers’; so once a habit established not modified unless critical level change in conditions.
- EXAMPLES: UK national rail strike; Formby bus demonstration project

History (previous experience) matters

- General use of average values in choice modelling and in service planning (e.g. bus waiting times)
- Some attempts to model impact of reliability, as an additional variable
- But, choices may be based on more extreme experiences – usually negative ones (e.g. ‘I once had to wait an hour in the pouring rain for a bus’); some organisations recognise this, for example taxi provided for person who car shares, if need to change plans (e.g. child taken ill at school – hardly ever needed, but provides security)

Long-term transforming effects

- As David Metz points out, despite having spent many £100bn in the UK on major transport infrastructure, on the basis of the benefits of travel time savings, on average people still spend an hour a day travelling – in the long run, time savings have mainly been invested in longer distance, not more, trips

1B: Leads and lags – and other time-related effects

Does this matter?

Yes, these mechanisms can significantly affect accuracy of model calibration as well as forecasting, especially when no longer dealing with 'business as usual', or when attempting to encourage major behaviour change (e.g. CO₂)

What might we do about it?

Three possible strategies:

1. Retain equilibrium but make some adjustments, for example:
 - Replace averages with '1 in X' values
 - Use future supply values for a % of agents
 - Restrict opportunities for destination shift
2. Introduce 'backward' and 'forward' looking elements from one point in time
3. Simulate change over time, through the evolution of 'life histories' of agents - similar in concept to land use modelling, but adding a forward-looking element

2. Some remaining gaps in choice modelling

2A. Mode choice: the importance of 'image'

- The private sector spends billions of dollars annually on advertising, in order to:
 - Create a desire/need
 - Promote their product as the answer
 - For more luxury/high end goods and services, this is all about **image** (and social norms)
- Margaret Thatcher was reputed to have said that anyone over 30 using a bus was a 'loser'
- Case study 1: Business man
- Case study 2: Park and Ride
- Case study 3: Grenoble

Easy to measure and incorporate as an attitudinal variable?

Some remaining gaps in choice modelling

2B. Destination choice: choice set formation & mental maps

- Destination choice receives much less attention than mode choice; it precedes it in conventional four-stage modelling and, arguably, it is the biggest influence on mode choice! ...Maybe because economists and engineers don't have a strong spatial interest?
- Difficult to handle, for two reasons:
 - Very limited research into trip attraction factors, compared to modal attributes
 - Very large number of potential destinations – so, how cap?
- What is missing? Concept of restricted 'mental map'
- Evidence of its existence: underestimation of demand for new cross-city rail lines: Munich, Zurich, London (ThamesLink and Elizabeth Line) – more than generalised cost

Closer links to geographical research; need for spatial mapping experiments

Thank you for listening

...and now thoughts turn to food!