Mapping vulnerability to fuel price increases in England

Giulio Mattioli & Ian Philips *
Institute for Transport Studies, University of Leeds
G.Mattioli@leeds.ac.uk; I.Philips@leeds.ac.uk

*with contributions from: Jillian Anable & Tim Chatterton
‘Car-owning households who need to spend a disproportionately high share of their income to get where they need to go, with negative consequences in terms of restricted activity spaces and/or spending cuts in other essential areas’

≈ ‘forced car ownership’, ‘transport poverty’…
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A material deprivation-based indicator of CRES</td>
<td>1. EU-SILC 2005-2014 (UK)</td>
</tr>
<tr>
<td>2. A ‘low-income high-costs’ indicator of CRES</td>
<td>2. Living Costs and Food Survey (LCFS) 2006-2014 (UK)</td>
</tr>
<tr>
<td>3. A spatial index of vulnerability to fuel price increases</td>
<td>3. Anonymised MOT tests with keeper and derived results data, income data and accessibility statistics (England LSOA)</td>
</tr>
</tbody>
</table>
Motivations

1. Fuel price concerns

2. Great data in UK, but little policy/research interest

3. Contribution to debates in transport & urban studies
Motor fuel and oil prices, UK 1990-2017

Source: DBEIS, 2017
The ‘Oil vulnerability’ debate

Dodson et al. (e.g. Dodson & Sipe, 2007)

Australian city = “regressive city” –

2 urban structural effects:

1. “low socioeconomic status and high car dependence are strongly co-located” (Dodson & Sipe, 2007, p.57)

2. socioeconomically less advantaged households are spatially co-distributed with less efficient motor vehicle technologies (Li et al., 2013)

BUT “the socio-spatial structure of Australian cities differs from many overseas jurisdictions, particularly (...) Europe (...) given different socio-spatial and transport geographies” (Dodson & Sipe, 2007, p.58)
The ‘suburbanization of disadvantage’ debate

Australia/US:
- shifting location of social disadvantage from inner cities to suburbs
- result of: neoliberal economic policies, income polarization + urban renewal, gentrification
- mediated by housing market processes

(Randolph & Tice, 2014)

➢ Is the UK following suit?
The ‘suburbanization of disadvantage’ debate

3 spatial components of vulnerability to fuel price increases - England

Spatial resolution is LSOA

1. Exposure:
   Cost burden ratio = per household expenditure on fuel / median income

2. Sensitivity
   Median household income

3. Adaptive capacity
   Travel time to 8 key services by public transport / walking

(Anonymised MOT tests and results)  (Experian Median Income data)  (UK Government Accessibility Statistics)
Exposure: Fuel cost / income

(Also called the cost burden ratio)

- MOT test certificate
- DVLA stock table
- Annual mileage of a vehicle, LSOA of registered keeper, fuel type engine size
- Fuel economy (litres/100km)
- 2011 average prices £1.33 litre petrol, £1.39 diesel £0.73 for LPG (DECC, 2012).
- LSOA aggregate data
- per household expenditure on fuel (amongst car owning households) / median income by LSOA

MOT project safe data haven

Experian LSOA income estimate

(see Chatterton et al., 2017)
Accessibility by public transport

Journey time to nearest service by PT & or walk
- Employment
- Primary school
- Secondary school
- Further education
- Doctor (GP)
- Hospital
- Food shop

Sum of journey time to reach all 8 services

Adaptive capacity: Total travel time to 8 destinations by Public transport & or walking

DfT LSOA accessibility statistics 2011
Standardise each component variable (z-scores)

vulnerability to fuel price increases (VFP)

\[ VFP = f(Exposure, Sensitivity, Adaptive Capacity) \]

\[ VFP = \text{cost burden} - \text{income} + \text{travel time} \]
A spatial index of vulnerability to fuel price increases - England, 2011

Correlation with IMD rank: $r = -0.22$
English city regions, 2011

London

West Midlands

Greater Manchester

Sheffield CR
Car dependence & income: a regressive spatial distribution?

Dodson et al. (e.g. Dodson & Sipe, 2007)

Australian city = “regressive city” –
2 urban structural effects:

1. “low socioeconomic status and high car dependence are strongly co-located” (Dodson & Sipe, 2007, p.57)

2. “socioeconomically less advantaged households are spatially co-distributed with less efficient motor vehicle technologies” (Dodson et al., 2013, p.10)

BUT “the socio-spatial structure of Australian cities differs from many overseas jurisdictions, particularly (…) Europe (…) given different socio-spatial and transport geographies” (Dodson & Sipe, 2007, p.58)
Car dependence & income: a regressive spatial distribution?

<table>
<thead>
<tr>
<th>Income</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>4,112</td>
<td>4,029</td>
<td>2,417</td>
</tr>
<tr>
<td>Medium</td>
<td>3,158</td>
<td>3,578</td>
<td>3,821</td>
</tr>
<tr>
<td>High</td>
<td>3,118</td>
<td>3,119</td>
<td>4,320</td>
</tr>
</tbody>
</table>

$r = +0.10$
Car dependence & income: a regressive spatial distribution?

**Car dependence**

<table>
<thead>
<tr>
<th>Income</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>4,112</td>
<td>4,029</td>
<td>2,417</td>
</tr>
<tr>
<td>Medium</td>
<td>3,158</td>
<td>3,578</td>
<td>3,821</td>
</tr>
<tr>
<td>High</td>
<td>3,118</td>
<td>3,119</td>
<td>4,320</td>
</tr>
</tbody>
</table>

$r = +0.10$ (England)

$r = +0.22$ (excluding London)
Car dependence & income: a regressive spatial distribution?

West Midlands

Greater Manchester

West Yorkshire

Sheffield CR

\[ r = +0.23 \]

\[ r = +0.22 \]

\[ r = +0.23 \]

\[ r = +0.22 \]
Regressive city or regressive *country*?
Regressive city or regressive country?

![Graph showing the relationship between median income (£) and total travel time by PT-walking (mins) for various regions. The correlation coefficient is r = -0.74.](image-url)
Regressive city or regressive *country*?
Regressive transport funding?

London gets 24 times as much spent on infrastructure per resident than north-east England

Of course London gets more transport funding than the north. It's addicted to it

New transport figures reveal London gets £1,500 per head more than the North – but North West powerhouse ‘catching-up’

Here’s why London gets so much of Britain’s transport funding

Fuel economy & income: a regressive spatial distribution?

Dodson et al. (e.g. Dodson & Sipe, 2007)

Australian city = “regressive city” – 2 urban structural effects:

1. “low socioeconomic status and high car dependence are strongly co-located” (Dodson & Sipe, 2007, p.57)

2. socioeconomically less advantaged households are spatially co-distributed with less efficient motor vehicle technologies (Li et al., 2013)

BUT “the socio-spatial structure of Australian cities differs from many overseas jurisdictions, particularly (...) Europe (...) given different socio-spatial and transport geographies” (Dodson & Sipe, 2007, p.58)
Fuel economy & income: a regressive spatial distribution?

Correlation litres per km / vulnerability index: $r = -0.042$

Legend
Fuel economy (liters per 100km)
(qintiles)
- 6.514248 - 6.928230
- 6.928231 - 7.014344
- 7.014345 - 7.102928
- 7.102929 - 7.226601
- 7.226602 - 9.107515
Fuel economy & income: a regressive spatial distribution?

\[ r = +0.60 \]
Conclusions

• Regressive spatial patterns?

  ➢ at city-region level: not the same as Australia (yet?)
    ➢ in England VFP ≠ known patterns of deprivation

  ➢ …but: capital/global city vs. other city regions

  ➢ vehicle efficiency not part of the problem (yet?)
1. Housing + Transport affordability analysis (DfT proposal)

2. ‘Double Energy Vulnerability’: Transport vs. Fuel poverty analysis

3. Vulnerability to fuel prices vs. cuts to public transport subsidies since 2010

4. Transport & fuel poverty vs. spatial patterns in wellbeing / anxiety
Thank you for your attention!

G.Mattioli@leeds.ac.uk @giulio_mattioli
I.Philips@leeds.ac.uk @ianphilipsITS

https://teresproject.wordpress.com/@TranspPoverty

www.demand.ac.uk @DEMAND_CENTRE

www.MOTproject.net
Read more:

Acknowledgements
The work has been undertaken under EPSRC grants EP/M008096/1 and EP/K000438/1. Contains National Statistics data © Crown copyright and database right 2012.

