Mapping vulnerability to fuel price increases in England

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Motor fuel and oil prices, UK 1990-2017

Policy-driven

Market-driven

Source: DBEIS, 2017
Policy interest

(Cochez et al., 2015)  (Gertz et al., 2009)
The ‘Oil vulnerability’ debate

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

Australian city = “regressive city” – urban structural effect:

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

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)

(Dodson & Sipe, 2008)
(High) Vulnerability = (High) Exposure

(High) Exposure = (High) Sensitivity

(High) Sensitivity = (Low) Adaptive Capacity

(see Adger, 2006; Brooks, 2003; Büttner et al., 2013; Leung et al., 2015)
1. Exposure

**Definition**
“the nature and degree to which a system experiences stress”
(Adger, 2006, p.268)

**Indicator**
Cost burden ratio = per household expenditure on fuel / median income

**Data**
Anonymised MOT tests and results + Experian Demographic Data

**Year**
2011

**Spatial resolution**
LSOA (ca. 700 households)
2. Sensitivity

Definition: “the degree to which a system is modified or affected by perturbations” (Adger, 2006, p.268)

Indicator: Median household income

Data: Experian Demographic Data

Year: 2011

Spatial resolution: LSOA (ca. 700 households)
3. Adaptive Capacity

**Definition**

“the ability of a system to evolve in order to accommodate (stress) and to expand the range of variability with which it can cope”

(Adger, 2006, p.268)

**Indicator**

Travel time to 8 key services by public transport / walking

**Data**

DfT Accessibility statistics

**Year**

2011

**Spatial resolution**

LSOA (ca. 700 households)
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 | West Yorkshire | Sheffield CR

Legend
Index v1 (national ranking)
- 1
- 2
- 3
- 4
- 5

Histograms for vulnerability distribution.
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?

West Midlands

Greater Manchester

West Yorkshire

Sheffield CR

Legend
- Car
- Bicycle
- Foot

Legend
- 0 To 2.5
- 2.5 To 4
- 4 To 5.5
- 5.5 To 7
- 7 To 9
- 9 To 11.5
- 11.5 To 20

Legend
- Low (1-2)
- Medium (3-4)
- High (5+)

Legend
- Low to medium
- Medium-high
- High

Legend
- 0 To 2
- 2 To 3.5
- 3.5 To 5
- 5 To 6.5
- 6.5 To 8
- 8 To 10

Legend
- No data

$r = +0.23$

$r = +0.22$

$r = +0.23$

$r = +0.22$
Regressive city or regressive *country*?

![Graph showing the correlation between median income (£) and total travel time by PT-walking (mins) with the correlation coefficient r = -0.74.](image)
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

Greater Leeds is thought to be the largest city in Europe without a metro network. Image: Reprioter/Wikimedia Commons.
Regressive *cuts*?

**Cumbria County Council**

100 per cent cut since 2010 - stopped supporting bus services in 2014/15.

**South Yorkshire - SYPTE Integrated Transport Authority**

33 per cent cut in bus funding since 2010.

(Source: http://bettertransportmaps.org.uk/map-bus-cuts-2015.html)
Conclusions

- VFP ≠ known patterns of deprivation

- spatial patterns at city-region level ≠ Australia (no regressive city)

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

- from a VFP perspective:
  - regressive public transport funding –improves adaptive capacity of least vulnerable areas
  - regressive bus cuts?
Thank you for your attention!

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

www.demand.ac.uk @DEMAND_CENTRE

www.MOTproject.net
A spatial index of vulnerability to fuel price increases - England, 2011

Standardise each component variable (z-scores)

Vulnerability to fuel price increases (VFP)

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

\[ VFP = \text{cost burden} - \text{income} + \text{travel time} \]
West Yorkshire: Exposure

Legend
Cost burden ratio (WY quintiles)
- 0.005656 - 0.029945
- 0.029946 - 0.033928
- 0.033929 - 0.037250
- 0.037251 - 0.041835
- 0.041836 - 0.089584
West Yorkshire: Sensitivity

Legend
Income (WY quintiles)
(quantiles)
- Red: 10176 - 21886
- Orange: 21887 - 26392
- Yellow: 26393 - 31007
- Light green: 31008 - 36432
- Blue: 36433 - 62807
West Yorkshire: Adaptive Capacity
West Yorkshire: Vulnerability
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

Chatterton et al 2017 http://dx.doi.org/10.1016/j.tranpol.2016.12.007
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