Road Transport Improvements: the effects on firms

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Motivation

- Road transport dominates passenger and goods transportation
- UK: 90% of passenger and 65% goods
- Intra EU: 92% of passenger and 47% of goods
- Considerable road infrastructure investment
- 2500 miles (1%) added to UK stock 2000-2010; Up from 185,000 in 1950 (+33%)
- £1.5 billion spent in England on infrastructure improvement in 2007/8
Motivation

- Many proposed economic (and social) benefits
- Employment, productivity, wages, labour supply, local and national economic performance, development etc.
- Widespread cost-benefit analysis of projects based on ex-ante ‘appraisal’
- But almost no large scale ex-post evaluations
- This research fills this gap
- Research presented here relates to effects on firms
Theoretical effects for firms

• Transport cost reductions: complex impacts
• Direct effects due to lower output transport costs, input costs, business travel. Input substitution, increases in scale.
• Agglomeration benefits, and ‘wider benefits’ e.g. better matching of firms needs and worker skills, knowledge spillovers
• Aggregate effects (sorting, selection) e.g. competition forces out less efficient firms, or amenity value attracts better firms and workers
Scope of this study

- Not modelling the theoretical linkages
- Focus on key policy-relevant firm outcomes
- Employment: local (ward) and at plant level
- Numbers of local (ward) businesses (i.e. entry-exit)
- Output, value-added, output per worker
- Estimate the effect of transport improvements on these outcomes from firm micro data
- Policy evaluation methods based on actual infrastructure changes 1998-2007 in Britain
Measuring firms’ exposure

• We want to know how much firms are influenced by road transport changes
• But no data on firms’ use of road transport
• Potential exposure to road transport improvements imputed from ‘employment accessibility’ at plant location
• ‘Employment accessibility’= ‘market potential’=‘effective density’
• Computed from employment and road network data at ‘electoral ward’ level
Measuring firms’ exposure

• ‘Accessibility’: how much economic activity can be reached per unit of travel time along the road network from a given firm location

• Accessibility changes can be caused by relocation of employment or changes in the road network

• Our research design predicts accessibility changes caused by specific road network improvements.

• Initial (1997) employment used to construct accessibility indices
Employment accessibility

\[ A = \frac{1000}{0.1} + \frac{500}{0.4} + \frac{100}{0.2} + \frac{2000}{1} = 13750 \]
Employment accessibility

A = \frac{1000}{0.1} + \frac{500}{0.4} + \frac{100}{0.2} + \frac{2000}{0.5} = 15750

Change = 15750 - 13750 = 2000

Or 14.5%
Data used: firms

- Office for National Statistics Business Structure Database (BSD): administrative register of businesses, including location, industry, employment. 98% coverage
- Used for accessibility indices and ward-aggregate analysis
- Annual Respondents Database: large sample of firms: information on outputs and input costs. Smaller sample, but better quality
- Used for plant level analysis
Data used: road network

- Generalised primary road network from Department for Transport, 2008
- ‘A-roads’ and motorways, 12.8% of total road length, 63.8% of traffic
- Uncongested link travel times (for 2003) from traffic data via DfT National Transport Model
- 31 major road schemes 1998-2007 with significant new infrastructure (318km)
- Recreate 1997-2006 network by deleting links.
- Origin-destination travel time matrix from GIS
Changes 1998-2008

- 0.00% - 0.05%
- 0.051% - 0.50%
- 0.501% - 5.00%
- 5.001% - 51.11%

Map showing changes in a specific region from 1998 to 2008, with different color codes indicating percentage change.
Potential biases

- Transport improvements potentially targeted at places with growing/declining productivity or employment
- Compare firms that are relatively local to the projects – within various distance buffers 10km, 20km, 30km
- Accessibility improvements to local firms are incidental to main aims of projects – trunk road improvements, bypasses
- Various other controls for pre-existing employment/productivity trends
Results
# Accessibility changes

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<th></th>
<th>Wards</th>
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<th>Std. Dev</th>
<th>90th percentile</th>
<th>Max</th>
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<td>1.71%</td>
<td>1.57%</td>
<td>31.37%</td>
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</tbody>
</table>
Ward employment: by sector
Ward businesses: by sector
Employment results (ward level)

- Evidence of positive effects on ward total employment
- Roughly 0.3% increase in total employment for 1% increase in accessibility
- Implied gain from these schemes nationally is about 27000 jobs.
- No evidence of increases in employment within businesses – all the gains are from new plants
Results on output
Plant outputs: % response
Output results

• Evidence of plant level effects on productivity and output

• The plant level productivity effects imply implausibly (?) large aggregate gains

• £41000 per year average gva per worker in Britain in 2008, so transport improvements between 1998-2008 generated £62 per person per year.

• £1.8 billion per year in total (compared with costs of £1.5 billion in 2007/8)
Output results

• But sadly, no evidence of this at aggregate ward level, or when weighting plants by size (employment)

• Suggests gains to small plants only, so the plant level effects do not translate into large aggregate gains

• Further work required to investigate differences by plant size

• Sector-specific results uninformative (imprecise)
Robustness

- Alternative ‘accessibility’ measures – population, plants, different travel time weightings. Similar findings.

- Similar effects exist within distance bands – 1-10km, 10km-20km, 20km-30km, though employment effects weak within 10km. Suggests impacts not caused by displacement to sites close to improvements.

- Cannot completely answer whether effects are due to displacement to sites that experience accessibility growth, within these bands.
Conclusions

- Major road transport infrastructure improvements in Britain generated local changes in employment accessibility
- Increased businesses and employment in local areas through firm entry/exit
- No effect on plant level employment
- Output and productivity effects at plants, but these do not show up at local aggregate level
- Crude CBA implies rather large net benefits