Does productivity vary with accessibility?
A firm-level analysis

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• Motivation
  – Productivity is believed to reflect prosperity
  – Infrastructure investment known to boost productivity
  – Should we see a spatial pattern of productivity at a point in time?
  – And how does that pattern evolve over time when infrastructure investments are relatively minor?

• Standard theory
• Data
• Results
• Conclusion
Figure 1: Labour productivity in 2005

Labour productivity in 2005
Standard deviations
- < -2
- -2 - -1
- -1 - 1
- 1 - 2
- > 2

Source: Webber and Horswell (2009)
• Motivation

• Standard theory
  – H M Treasury (2001) detailed productivity drivers
    • skills, investment, innovation, enterprise, competition
      – all vary spatially
  – Clustering of large firms in urban areas
    • Association between firm size and productivity is debatable, with many conflicting results
  – Rice et al. (2006) showed association between productivity and economic mass disappears beyond 80mins to centre of London (Reading)
  – Graham et al. (2006) estimated elasticities of productivity wrt accessibility for 28 sectors and found +ve, -ve and insig estimates
  – Webber et al. (2017) showed areas with low productivity have managers that lack focus on raising prices and experience low sales volume due to low levels of demand

• Data

• Results

• Conclusion
• Motivation
• Standard theory

• Data and results
  – ABS (2014)
  – Plant level data
  – GVA at basic prices per FTE employee
  – Single plants
    • Multi plants data reflect methods of apportionment to branches rather than genuine information on productivity at the local level
    • Small firms more numerous than large plants, generator of ideas and can drive local economy
    • Sampling frame of ABS. Only 10% of SMEs with fewer than 250 employees surveyed each year, on a random basis
  – Merge in area level data, incl. accessibility indicators
  – Excluded London and South East

• Results
• Conclusion
# Productivity gap between Wales and England (excl. L&SE)

<table>
<thead>
<tr>
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<th>% point gap</th>
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<tbody>
<tr>
<td>Initial estimate</td>
<td>13.7</td>
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<tr>
<td>Including industry controls</td>
<td>11.3</td>
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<tr>
<td>Including ownership controls</td>
<td>12.1</td>
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<td>Including population density control</td>
<td>10.8</td>
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<tr>
<td>Including education quality of local labour force</td>
<td>11.4</td>
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</table>
| **Time to London** | = the time it takes by road, using legal speed limits, to travel between the centroid of a district in which the firm is located to City of London.  
*Source: authors’ estimations* |
| **Distance to London** | = the distance by road between the centroid of a district in which the firm is located to the City of London.  
*Source: authors’ estimations* |
Manufacturing productivity for single plant firms in Wales & distance/time to London
| **Ave Time** | = the average time it takes by road, using legal speed limits, to travel between the centroid of a district in which the firm is located to the centroid of the five cities of Birmingham, Glasgow, Leeds, Manchester and Westminster.  
Source: authors’ estimations |
| **Min Time** | = the time it takes by road, using legal speed limits, to travel between the centroid of a district to the nearest centroids of either of the five cities of Birmingham, Glasgow, Leeds, Manchester and Westminster.  
Source: authors’ estimations |
Manufacturing productivity for single plant firms in Wales & AveTime and MinTime

![Graph showing制造业生产力对单个工厂的单个植物在威尔士的情况及平均时间和最小时间的关系图。]
| Peripherality (kms) | Population weighted gravity model using distance in kms.  
|---------------------|-----------------------------------------------------------
| Source: authors’ estimations following Keeble et al. (1981). |
| Peripherality (mins) | Population weighted gravity model using distance in travel time, based on legal speed limits.  
| Source: authors’ estimations following Keeble et al. (1981) |
Manufacturing productivity for single plant firms in Wales & Peri(km) and Peri(min)
| **Mean accessibility** | An area-weighted average time-based accessibility index combining access to towns (15 minute [5] and 30 minute [1] thresholds) and cities (15 [5], 30 [4], 45 [3], 60 [2] and 90 [1] minutes thresholds). The values in square brackets indicate how areas within each distance threshold are scored. These were summed giving a maximum potential score of 10. The value represents the area-weighted average of the combined (town and city) surface of the accessibility.  
Source: authors’ estimations. |
Manufacturing productivity for single plant firms in Wales & Mean accessibility
| **3ml agglomeration** | The number of 5-digit postcode areas within 3 miles weighted by the distance to get there given the local road infrastructure. This reflects the potential economic footprint of each 5-digit postcode area.  
**Source:** authors’ estimations following Fraser et al. (2012). |
|-----------------------|---------------------------------------------------------------------------------------------------------------|
| **15ml agglomeration** | The number of 5-digit postcode areas within 15 miles weighted by the distance to get there given the local road infrastructure. This reflects the potential economic footprint of each 5-digit postcode area.  
**Source:** authors’ estimations following Fraser et al. (2012) |
| **Agglom. ratio**     | The ratio between 3ml agglomeration and 15ml agglomeration.  
**Source:** authors’ estimations following Fraser et al. (2012) |
Manufacturing productivity for single plant firms in Wales & 3ml/15ml/agglom.ratio
# Productivity regressions – single plants

(incl. L, K, ind-dum, Ls, popden, ownership)

<table>
<thead>
<tr>
<th>Periperality (kms)</th>
<th>-0.026 (0.017)</th>
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Perhaps the weakening spatial effect due to...

- Growth of digital communications, reducing need for physical proximity

- Growth of e-sourcing with associated disappearance of geographically determined freight charge differentials

- Reduced labour and business relocation rates following financial crisis

- Persistence of low productivity “zombie” firms obscuring impact of productivity drivers

- Increased congestion costs with apparent high accessibility

- Less competition in remote areas, reducing input costs and increasing output prices compared with accessible locations

- Artis et al. (2012) showed the association disappears when intangible knowledge / human capital is included
Conclusions

• Aggregate productivity gaps exist (E.g. 14% between Wales and E (excl. London and SE))

• Sector, ownership, population density and local labour quality differences explain part of this gap (E.g 14% falls to 11%)

• Accessibility variables do not offer a stat. sig. explanation of gap
  – Single plants not found to be disadvantaged in terms of productivity by relative remoteness from centres of economic activity

• Perhaps gap due to variations in managerial objectives or other issues not included in estimated model

• Follow up: weakening effect of accessibility not new. But does the effect of accessibility on productivity vary over the business cycle, and if so then why?
THANK YOU

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Productivity regressions - **all plants**

(incl. L, K, ind-dum, Ls, popden, ownership)

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Q1: what do we think productivity means?

Answers?

• A measure of the *efficiency* of converting inputs into outputs
  – “The UK economy, like any other, is a system which converts work into the output of goods and services. *Productivity measures this rate of conversion*” (Davies, 2017)

• The *effectiveness* of effort as measured in terms of the rate of producing output per unit of input
  – Accomplishing what the firm intended to do
Productivity is a measure of the **efficiency** of production

- Efficiency is the ability to avoid wasting time, effort, energy and materials in doing something or in production (Dictionary definition)
- Efficiency is about making the best possible use of resources. Efficient firms *maximise outputs from given inputs*, and so *minimise their costs*.

Productivity “is a measure of total efficiency of a production process and as such the **objective to be maximised in production process**” (Wiki)

“Productivity isn’t everything, but in the long run it is almost everything. A country’s ability to improve standard of living over time *depends almost entirely* on its ability to raise its output per worker” (Krugman, 1992, p.9)