

**Transport investment, agglomeration
and urban productivity.**

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Structure of the presentation

- i. Introduction and purpose of the research
- ii. Agglomeration and urban productivity
- iii. Methodology
- iv. Results
- v. Conclusions

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Introduction – 1

- Research has been commissioned by the UK Department for Transport (DfT) and concerns the economic appraisal of transport investment.
- Are there external benefits for the economy from transport investment that are not captured in a standard cost-benefit appraisal?

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Previous studies of agglomeration and productivity
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- Data used is for aggregate metropolitan area
- Urbanisation measured by total metropolitan population or employment, localisation measured by total metropolitan industry employment
- Estimates concerned almost entirely with manufacturing industries.

Relationships between agglomeration, productivity
and transport investment for the UK

- The research addresses some specific challenges
 - i. We do not have aggregate data for British metropolitan areas
 - ii. Conceptual difficulties of defining distinct metropolitan areas for Britain
 - iii. Need to find a way of representing variation in the 'agglomeration' experienced by firms across the UK
 - iv. Coverage of all sectors of the economy
 - v. Desire to incorporate some implicit transport dimension

Methodology -1

- Firm level analysis – estimate the effects of agglomeration on the productivity of firms in different sectors of the economy
- Locate the firms as a grid reference point on a map
- Construct measures of the agglomeration 'experienced' by each firm

Methodology - 2



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Methodology - 3

- There are 10,759 wards in the UK.



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Measuring agglomeration – effective density

- The total *effective density* of employment and population that is accessible to any firm in industry o located in ward i is given by

$$U_{io} = \frac{P_i + E_i}{\sqrt{(A_i/p)}} + \sum_j^{i \neq j} [(P_j + E_j) \cdot d_{ij}^{-\alpha_o}]$$

- where E_i is total employment in ward i , P_i is total population in ward i , A_i is the area of ward i , and d_{ij} is the distance between wards i and j .

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Advantages of this measurement of agglomeration – *effective density*

- Allows for a highly flexible spatial framework which is not constrained by predefined spatial units such as administrative areas or metropolitan definitions.
- Implicit transport dimension - reflects the importance of *scale* and *proximity* (accessibility) of economic activity to each firm
- Allows us to investigate how agglomeration economies attenuate with distance and we can therefore compare the geographic scope of agglomeration for different industrial sectors.
- Can be calculated for very small areas of the country

Estimation

- Simultaneous estimation of a variable returns to scale translog production system with primary production function and factor cost share equations
- Agglomeration variable enters as a Hick's neutral external shift parameter which shifts Total Factor Productivity (TFP)
- Estimation of the translog system using Non Linear Seemingly Unrelated Regression Equations
- Estimations conducted separately for twenty eight industry groups comprising two digit SICs

Results – Primary industries

- SIC 01 to 14 - agriculture, hunting, forestry, fishing, mining, and extraction
- b_U 0.003 **(0.099)**

Results – manufacturing industries

industry	b_{ij}	S.E.
SIC 15 Food products and beverages	0.095**	(0.031)
SICs 17 & 18 Textiles	0.129**	(0.036)
SIC 20 Wood and wood products	-0.005	-0.039
SIC 23 Publishing & printing	0.107**	(0.016)
SIC 24 Chemical and chemical products	0.000	(0.000)
SICs 27 & 28 Metals and metal products	0.071**	(0.010)
SIC 30 Office machinery and computers	0.000	(0.000)
SIC 32 Radio, TV and communications	-0.026	(0.014)
SICs 34 & 35 Motor vehicles and transport equipment	0.214**	(0.061)
SICs 40 & 41 Electricity, gas and water	-0.030	(0.126)
SIC 45 Construction	0.072*	(0.034)

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Results – service industries

industry	b_{ij}	S.E.
SICs 50, 51 & 52 Wholesale & retail	0.057**	(0.020)
SIC 55 Hotels & restaurants	0.015	(0.019)
SICs 60, 61, 62 & 63 Transport & supporting services	0.336**	(0.045)
SIC 64 - Post & telecommunications	0.133	(0.086)
SICs 65, 66, 67 Finance & insurance	0.116**	(0.015)
SIC 70 Real estate activities	0.130**	(0.025)
SIC 72 Computer & related activities	0.069**	-0.018
SIC 7414 - Business & management consultancy	0.200**	(0.027)
SIC 742 Architecture & engineering activities	0.000**	(0.000)
SIC 744 Advertising	0.101**	-0.011
SIC 745 Labour recruitment & provision of personnel	0.000**	(0.000)
SICs 921 & 922 Motion picture and video, radio & TV	0.256**	(0.067)

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Results – Elasticity of productivity with respect to effective employment density for regions and sectors

	East	East Midl.	Leid on	North East	North West	South East	South West	West Midl.	York Humb.	England
Primary industries										0.00
Light Manufacturing	0.02	0.02	0.07	0.02	0.02	0.01	0.02	0.01	0.03	0.02
Heavy Manufacturing	0.03	0.04	0.03	0.04	0.03	0.03	0.04	0.04	0.04	0.04
Electricity, gas & water										0.00
Real estate & business services	0.04	0.03	0.05	0.03	0.04	0.05	0.04	0.04	0.04	0.04
Construction	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Wholesale & retail	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Transport, storage & communication	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Financial intermediation	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Public admin & other										0.00
All sectors	0.04	0.04	0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.04

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Conclusions -1

- For many sectors of the economy, and particularly services, there appears to be a strong link between higher productivity and the effective density of activity available to firms
- Urban growth provides a number of challenges but also important opportunities for economic productivity
- Investment in transport infrastructure supports the efficiency of cities
- It can also change the effective densities available to firms and in so doing have an effect on productivity

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Conclusions – 2

- The economic case for infrastructure investment can be informed by an understanding the productivity – agglomeration relationships.
- The method presented here provides one way of quantifying productivity effects for economic appraisal.
- The method by-passes the difficult problems of simultaneity bias in estimating the effects of infrastructure investment
- Transport investment can help to foster the conditions for city size to make an impact on the efficiency of firms

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