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Agglomeration economies and transport investment

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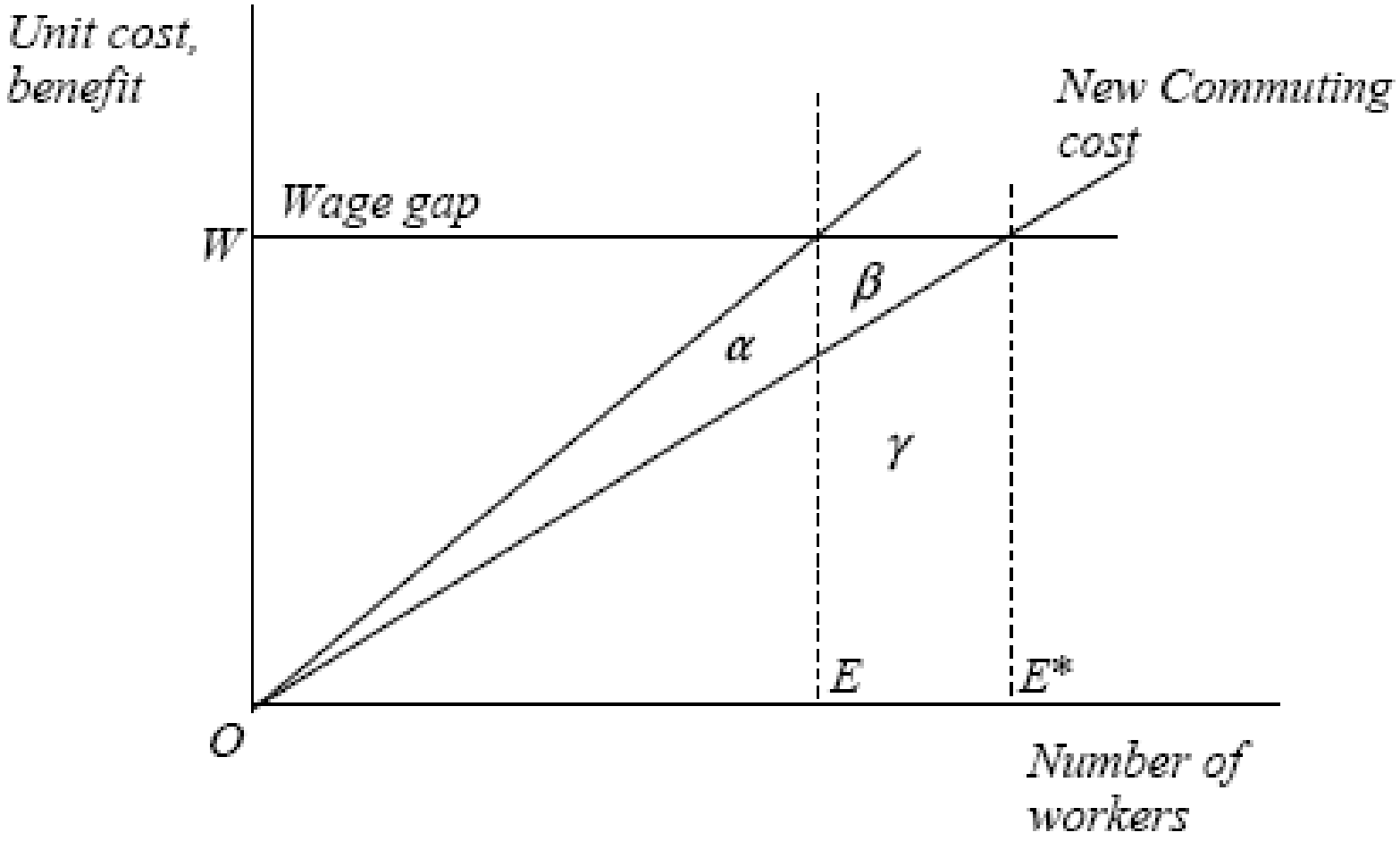
Transport and agglomeration economies

- Agglomeration economies – positive externalities that derive from spatial concentration
  - e.g. knowledge / technology sharing, specialization, labour market pooling, increase in market scale, sharing markets for inputs and outputs etc.

- Transport / generalised costs of travel are crucial to agglomeration:
  - transport (costs) in part determines economic densities: **accessibility**
  - transport constraints can inhibit agglomeration economies
  - new investment changes the *density* or *concentration* of activity (including labour) accessible to firms

- Agglomeration is an externality / market imperfection - as such it is not captured in a standard appraisal.

Venables model of infrastructure investment, agglomeration and productivity



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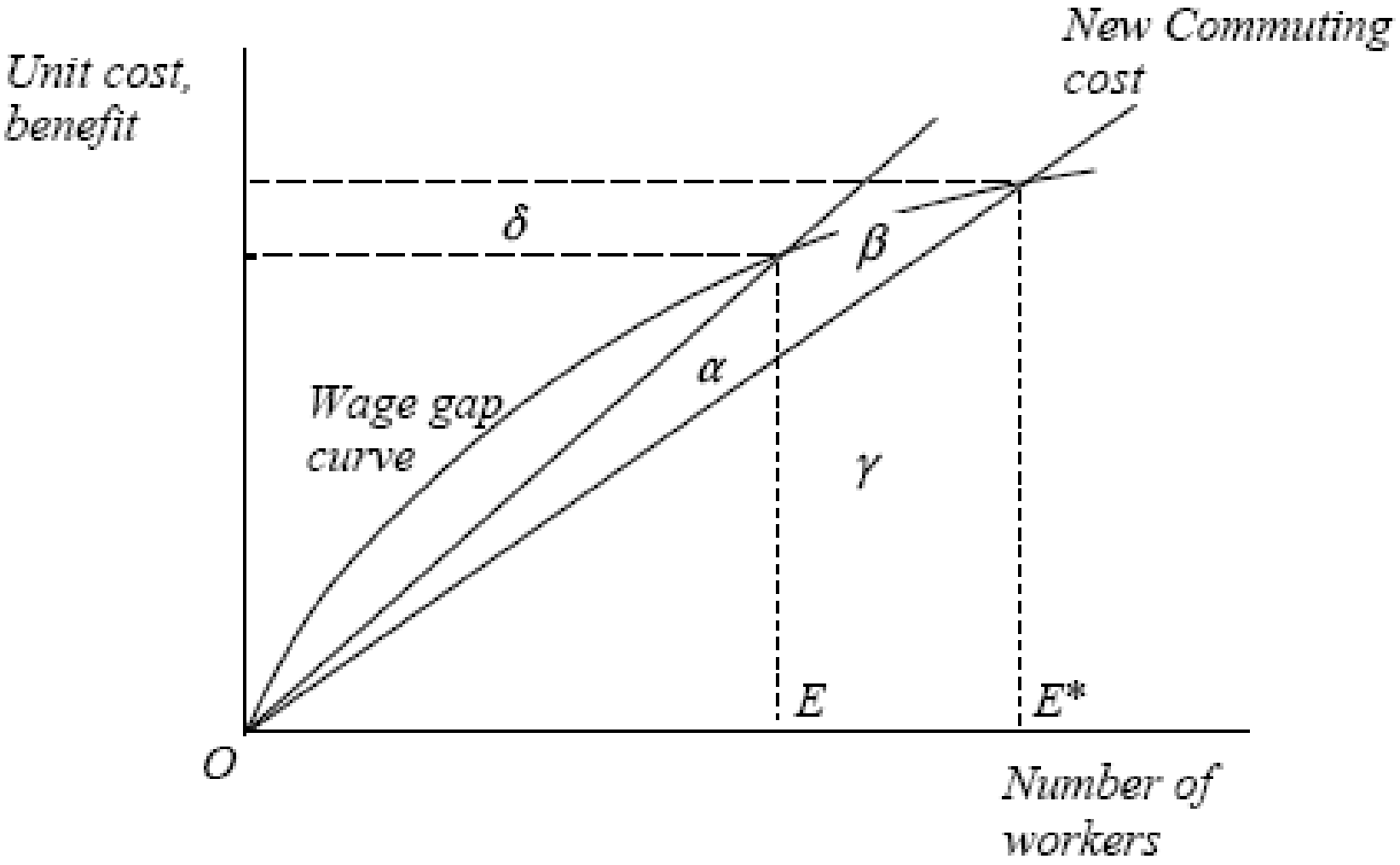

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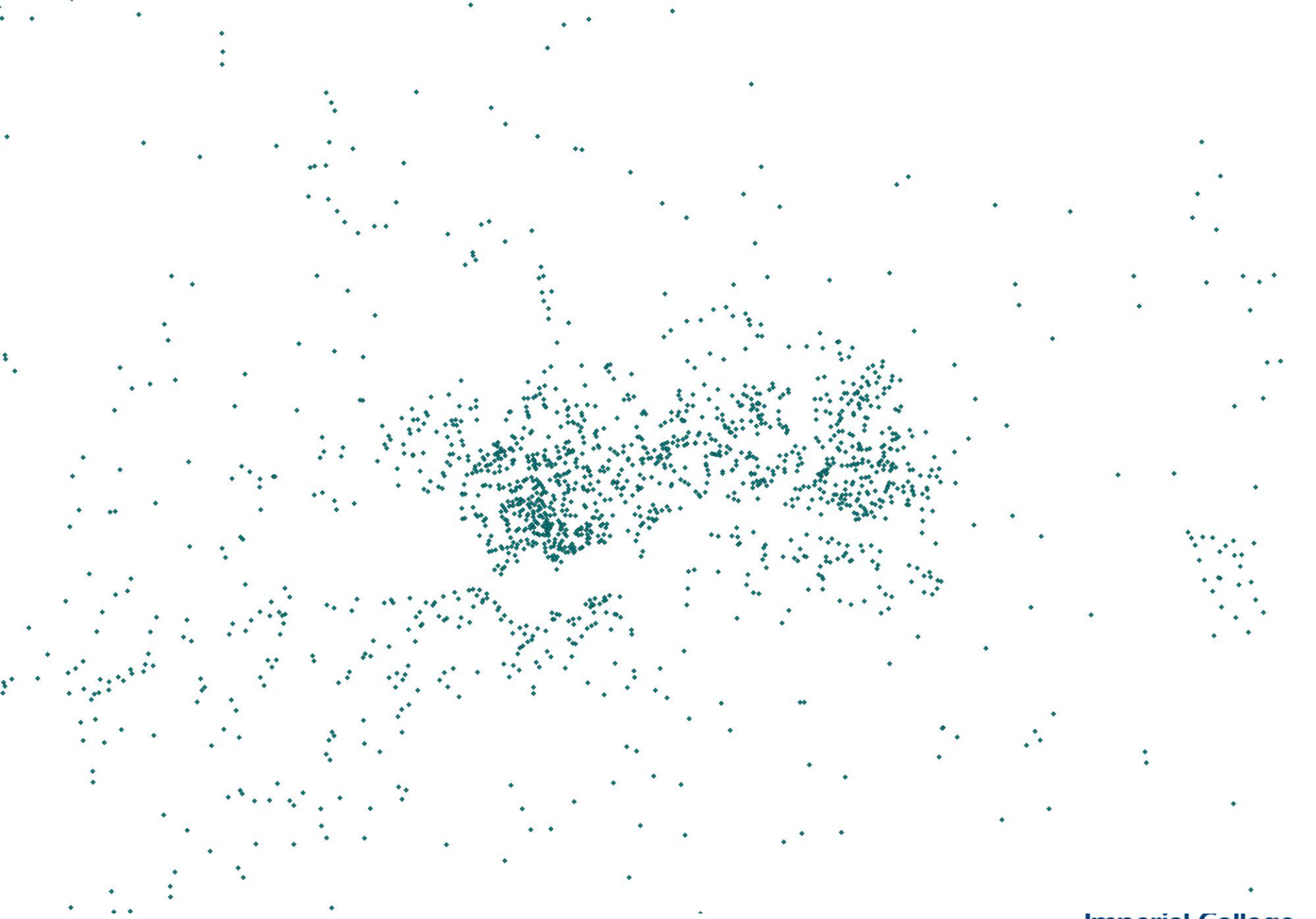
Measurement and estimation of agglomeration

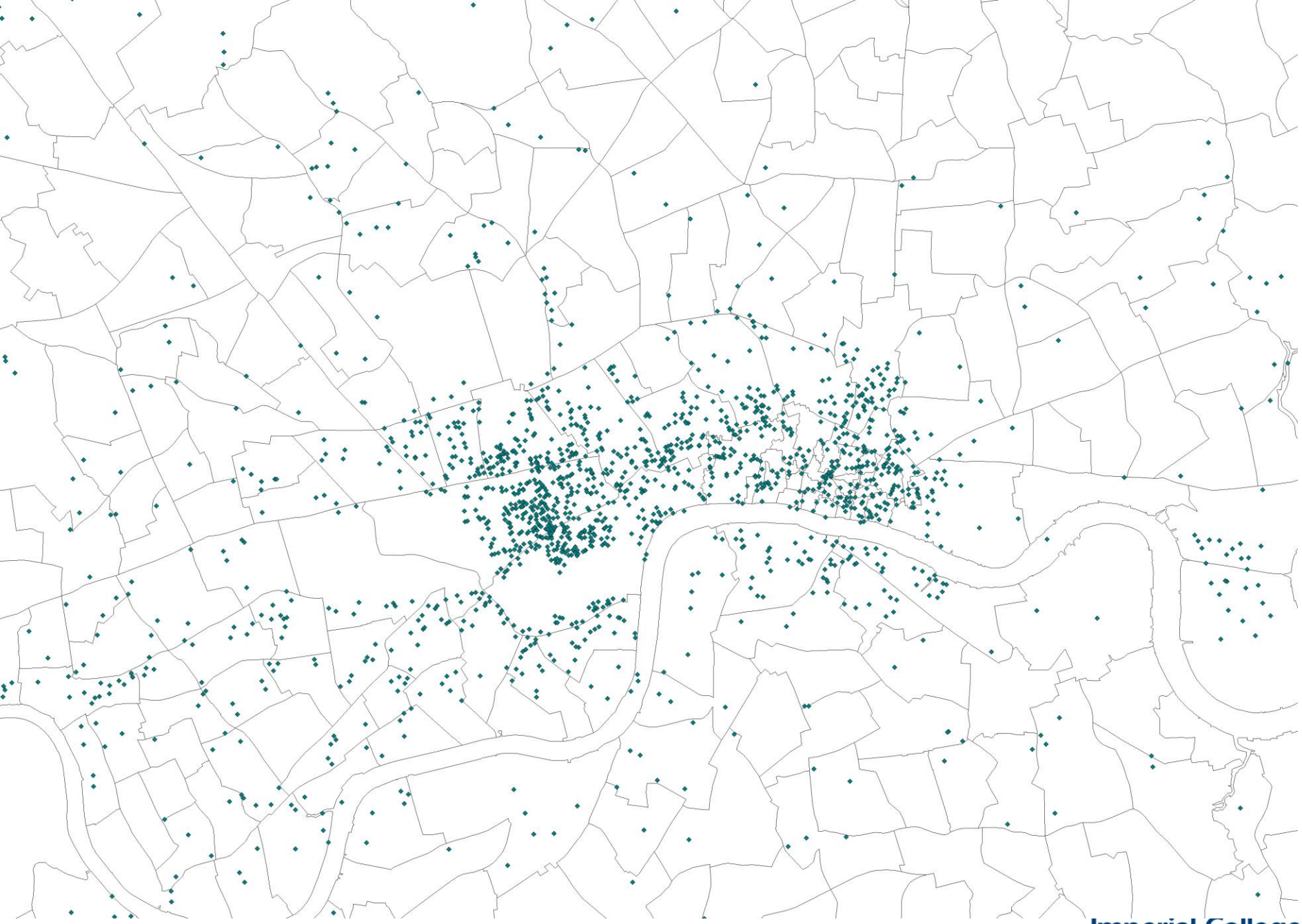
- **To evaluate agglomeration benefits we need estimates of elasticities of productivity w.r.t agglomeration**

i. Construct a national database of information about the productivity of firms across *all economic sectors*.

ii. Locate firms geographically in a GIS.

iii. Construct measures of the agglomeration 'experienced' by each firm in each location - *compatible with use in transport appraisal*.





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Measurement and estimation of agglomeration

iv. The total *effective density* that is accessible to any firm located in area i is

$$ED_i = \sum_{j}^{i=j} \left(\frac{U_j}{d_{ij}^{\alpha}} \right)$$

where U is some measure of activity (i.e. employment or population) and d_{ij} is the distance between areas i and j.

- captures scale and proximity
- highly flexible spatial framework
- incorporates an implicit transport accessibility dimension
- replace distance with travel times, generalized costs etc.

v. Estimation using the translog system – allows a flexible comprehensive model of production.

Results – agglomeration elasticities

industry	*elasticity*
Manufacturing	0.077
Construction	0.072
Distribution, hotels & catering	0.153
Trans, storage& communications	0.223
Real estate	0.192
IT	0.082
Banking, finance & insurance	0.237
Business services	0.224
Whole economy	0.119

Results - 1

- Positive and significant impact from urban density for most but not all sectors of the economy
- The magnitude of the agglomeration elasticity varies substantially across industries
- No agglomeration economies for primary industries
- Mixed evidence for manufacturing industries about the effect and strength of agglomeration economies
- Average manufacturing elasticity of 0.077 – compares reasonably well to previous estimates.

Results - 2

- Positive and significant agglomeration elasticities for most service industries.

- An increase of 20% in service sector productivity with a doubling of city size
  - 24% for Financial services
  - 22% for Business services

- On average an increase of 12% in total economic productivity with a doubling of city size (density).

- Evidence also of diminishing returns to agglomeration and of diseconomies, including congestion.

Applying the new appraisal to CrossRail (DfT calculations)

Benefits	*Welfare (£ million)*
Business time savings	4,847
Commuting time savings	4,152
Leisure time savings	3,833
Total user benefits (conventional)	**12,832**
Agglomeration benefits	2,440
Total benefits (inc agglom)	**15,272**

Appraisal of additional benefits from agglomeration

Mode	Scheme	Agglomeration
Rail	Crossrail	19%
Road	Leeds to Bradford Improved Highway	21%
Road	Leeds Urban Area Improved Highway	22%
PT	Leeds to Bradford PT Improvements	15%
Bus	Intra Leeds bus subsidy	11%
Road	Leeds to Sheffield Improved Highway	19%
Road	M6 shoulder	12%
Bus	West Yorkshire County bus subsidy	9%
PT	Leeds Urban Area Major PT Investment	9%
Bus	South & West Yorkshire Bus subsidy	7%
Bus	South Yorkshire bus subsidy.	3%

Conclusions

- Agglomeration economies exist in most industries – particularly services – and can have a substantial impact on productivity.

- Transport investments change the level of agglomeration experienced by firms and consequently give rise to externalities that are not captured in a standard cost benefit appraisal.

- The effect of agglomeration externalities is not trivial when considered in the appraisal framework - initial appraisals typically indicate additions of 10%-20% to standard user benefits.

Estimation issues and future directions for empirical research

- Endogeneity in agglomeration-productivity relationship.
- Omitted variables / unobserved heterogeneity.
- Sources of agglomeration and journey purposes – relative productivity effects arising from labour market pooling, economic interactions, freight movements.
- Geographic scope of agglomeration – alternative measures to test assumptions underpinning distance decay.