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Reducing Spatial Imbalance? : The Changing Geography of Advanced Manufacturing in Britain

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Rediscovery of Industrial Policy

- UK Government aspirations for sectoral and spatial rebalancing since 2008
- New national ‘industrial strategy’ and ‘local industrial strategies’ based on ‘innovation missions’, core focus on ‘advanced manufacturing’ (AM)
- Defined as more capital and knowledge intensive, higher level of technology, service provision and specialist skills
    - Higher productivity, higher paid more skilled jobs, export-earning, innovation and knowledge spillovers
    - Areas of comparative advantage and international strength, revival by FDI

Spatial Rebalancing Policy Ambitions

- Severe regional imbalance through loss of export industries in Northern regions and uneven service growth
- Policy ambition that AM can lead spatial rebalancing by supporting clusters in all regions
- Influenced by discourse on revival of ‘urban innovation districts’, belief that Northern cities can be regenerated by innovation hotspots
- Key role attached to university research centres and facilities with industry partners

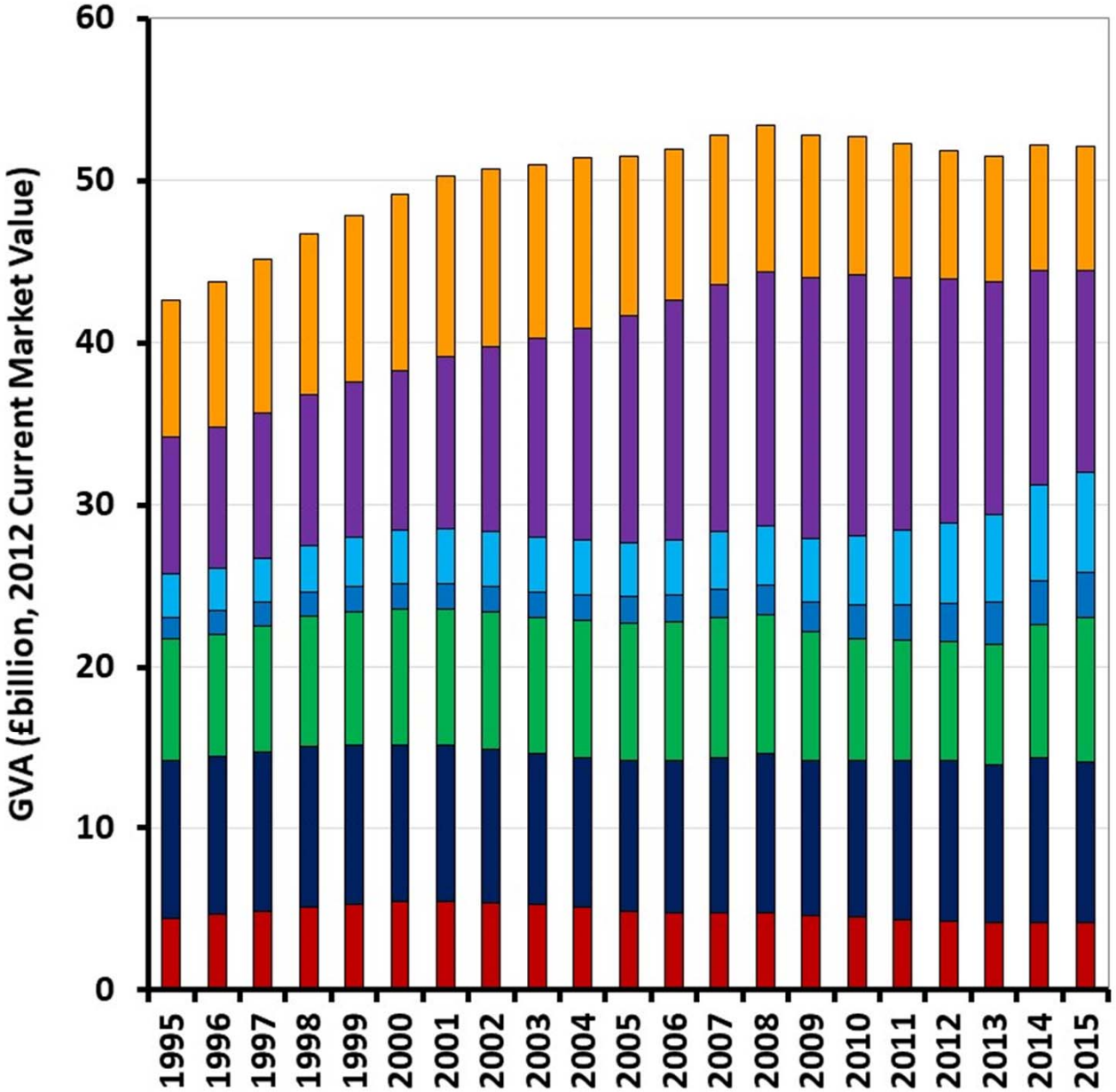
Geographical Unknowns

- Lack of knowledge on geography of target industries
- Consensus that policy can not build clusters from scratch, but where are potential clusters, in which industries?
- Can the regional spread of advanced manufacturing be sustained or increased? Brexit costs and impacts?
- Are Traditional Industrial Regions benefitting or losing out from changes in AM – are they conducive locations ?
- Are locational changes in AM reducing imbalance or are they intensifying local and regional disparities?

Structure of Paper

1. The End of Regional Dispersal?
2. Uneven AM Performance in Traditional Industrial Regions
    - Differences between 'Analytical' and 'Synthetic' Knowledge Base Industries
3. Disjunctures between Innovation systems and AM
4. Conclusions and Implications

Advanced Manufacturing industries



Very High Technology:

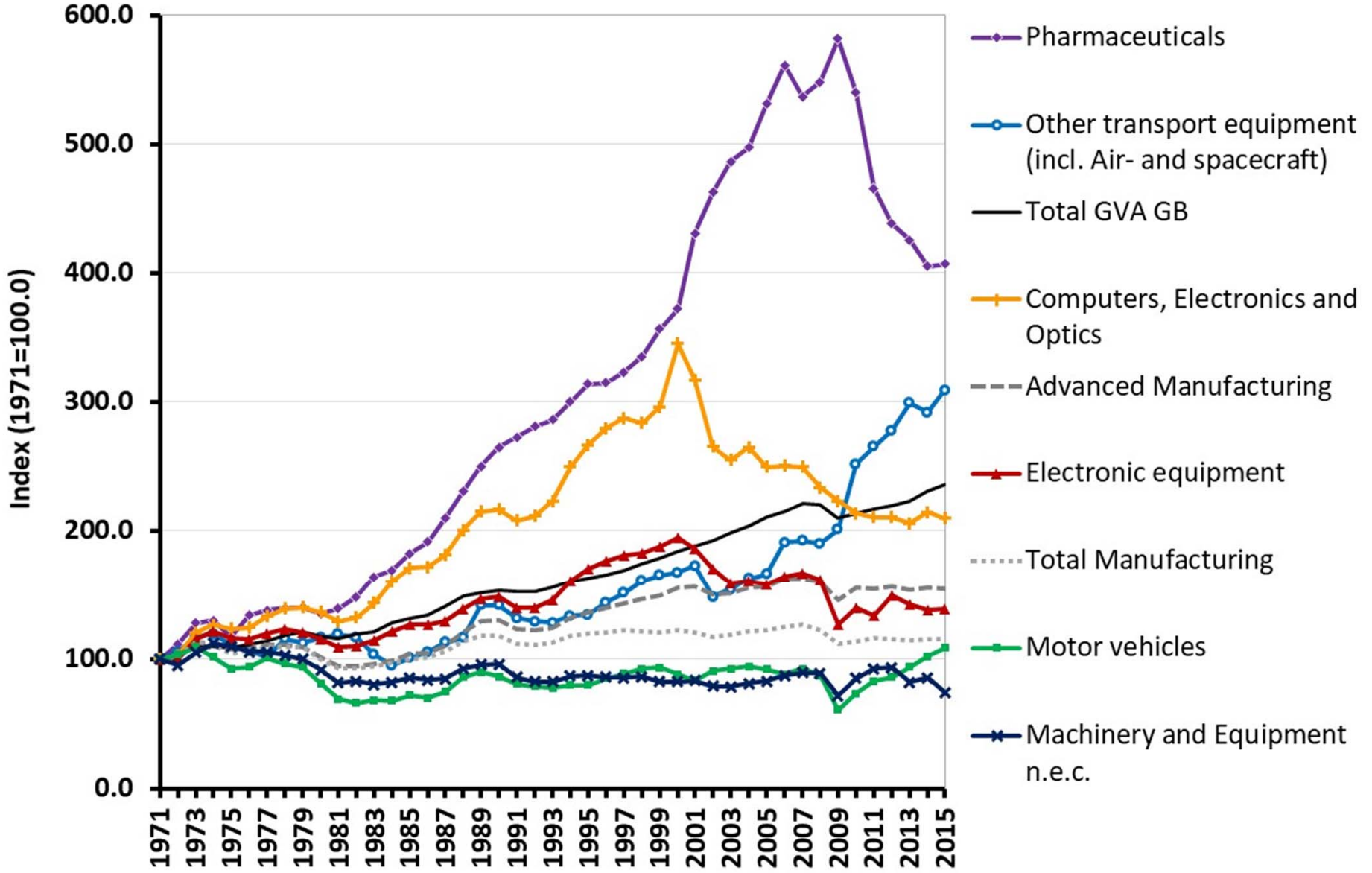
- Computers, electronic and optical products (SIC 2007: C26) (0.57%)
- Pharmaceuticals (SIC 2007: C21) (0.93%)
- Air- and spacecraft (SIC 2007: C30.3) (0.46%)

Moderately High Technology:

- Other transport equipment, other than Air and spacecraft (SIC 2007: C30 excl. C30.3) (0.20%)
- Motor vehicles, trailers and semi-trailers (SIC 2007: C29) (0.67%)
- Machinery and equipment n.e.c. (SIC 2007: C28) (0.73%)
- Electrical equipment (SIC 2007: C27) (0.31%)

Based on shares of science and engineering occupations of employment in industry. According to Helper et al., 2012, Table 1, p. 7.

Development of output in different advanced manufacturing industries in Britain 1971-2015



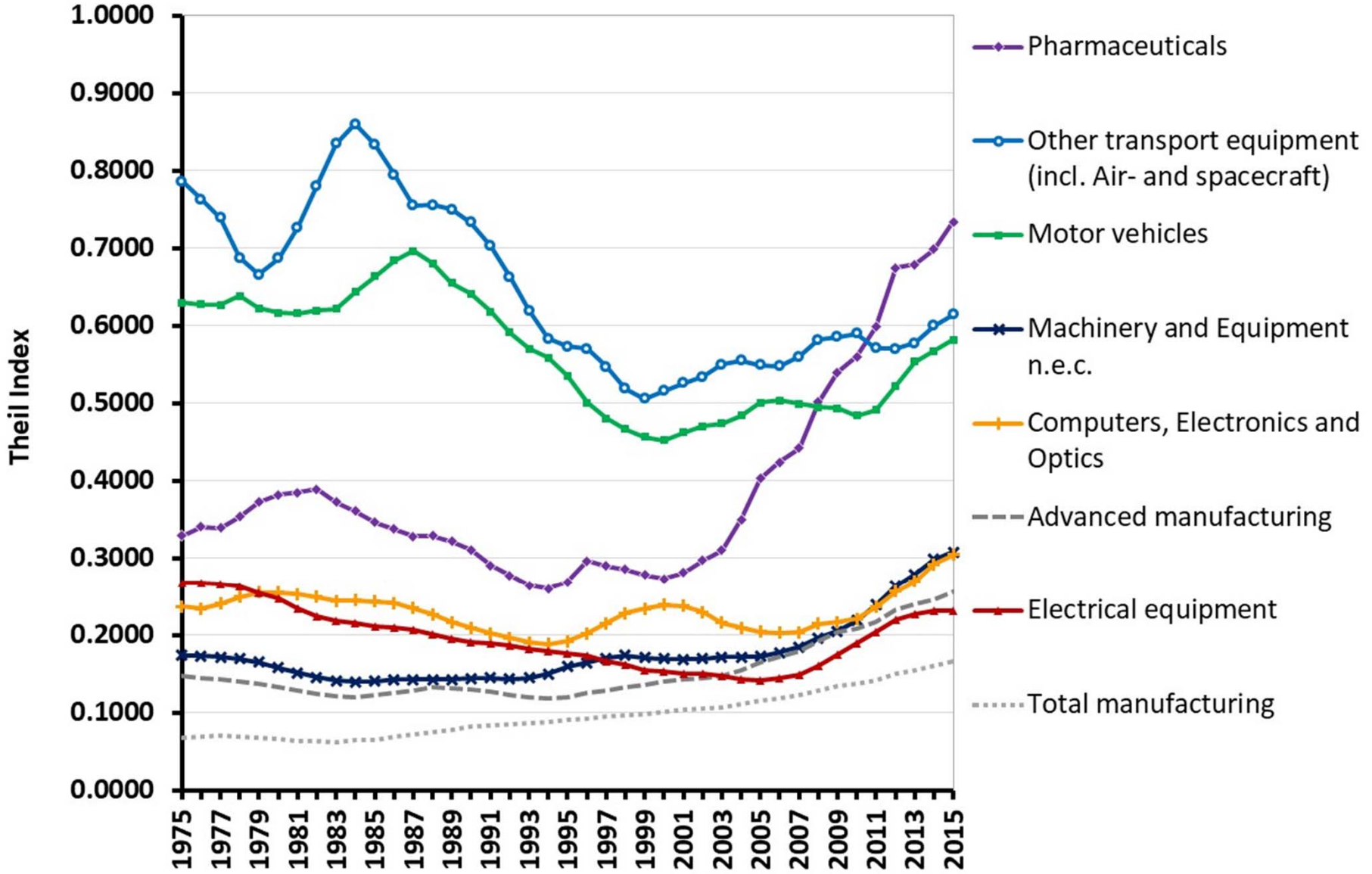
Source: Cambridge Econometrics GVA series

1. The End of Regional Dispersion?

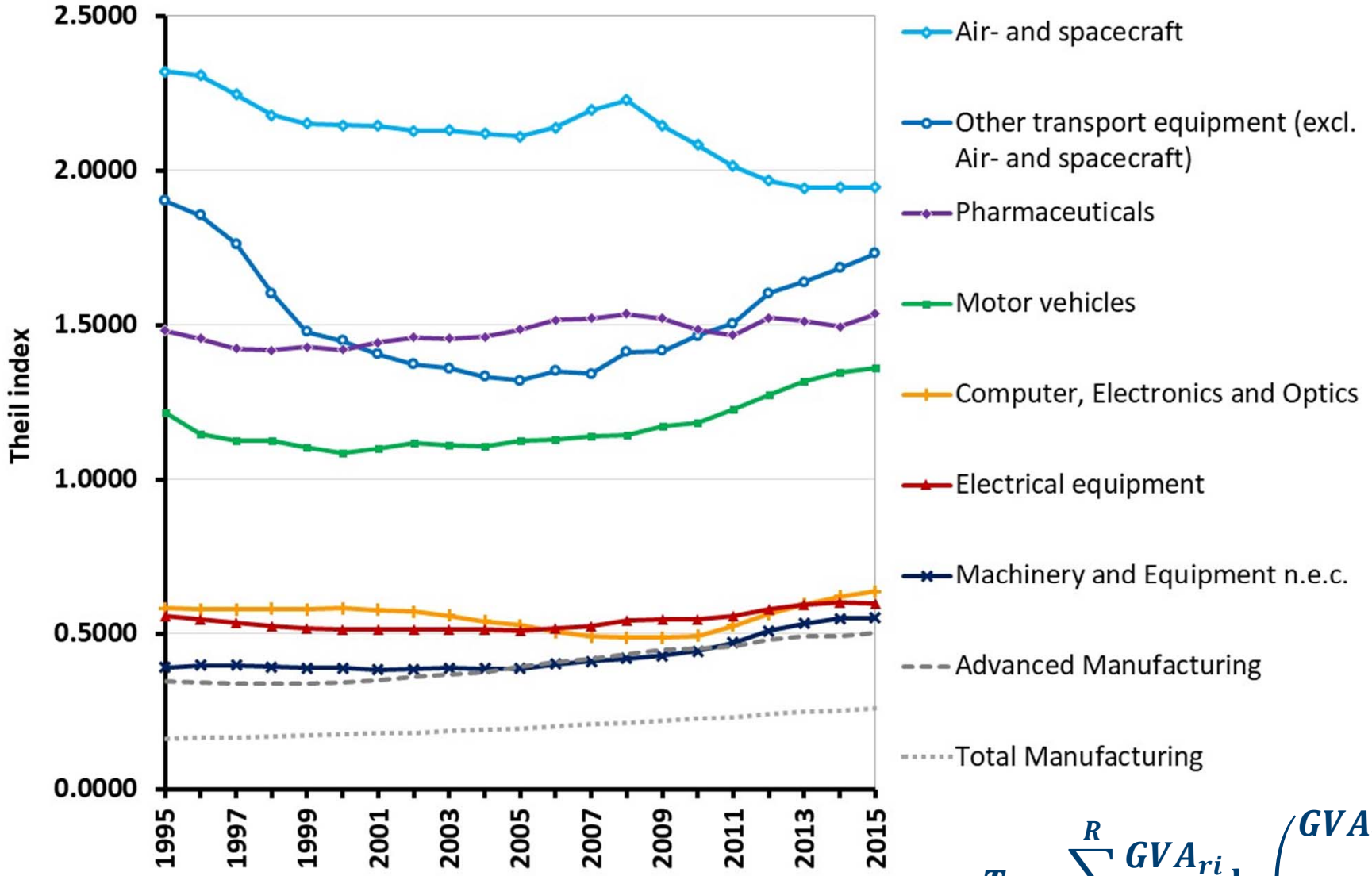
Regional Dispersal in Manufacturing

- Studies find long-term dispersal of manufacturing – urban-rural shift, rising need for space, contraction effects (Crafts and Klein, 2017; Dauth et al, 2015).
- Product cycles – older industries shift to lower cost locations
- Disintegration of large firms – use of contractors in cheaper locations and offshore
- Measure degree of relative concentration using the Theil Index (higher indicates stronger concentration)
- $$\sum_{r=1}^{R} \frac{GVA_{ri}}{GVA_i} \ln \left(\frac{GVA_{ri}/GVA_i}{GVA_r/GVA} \right)$$

Development of Theil-index (based on GVA), based on 5-year moving averages of GVA 1971-1975 – 2011-2015 NUTS2 regions

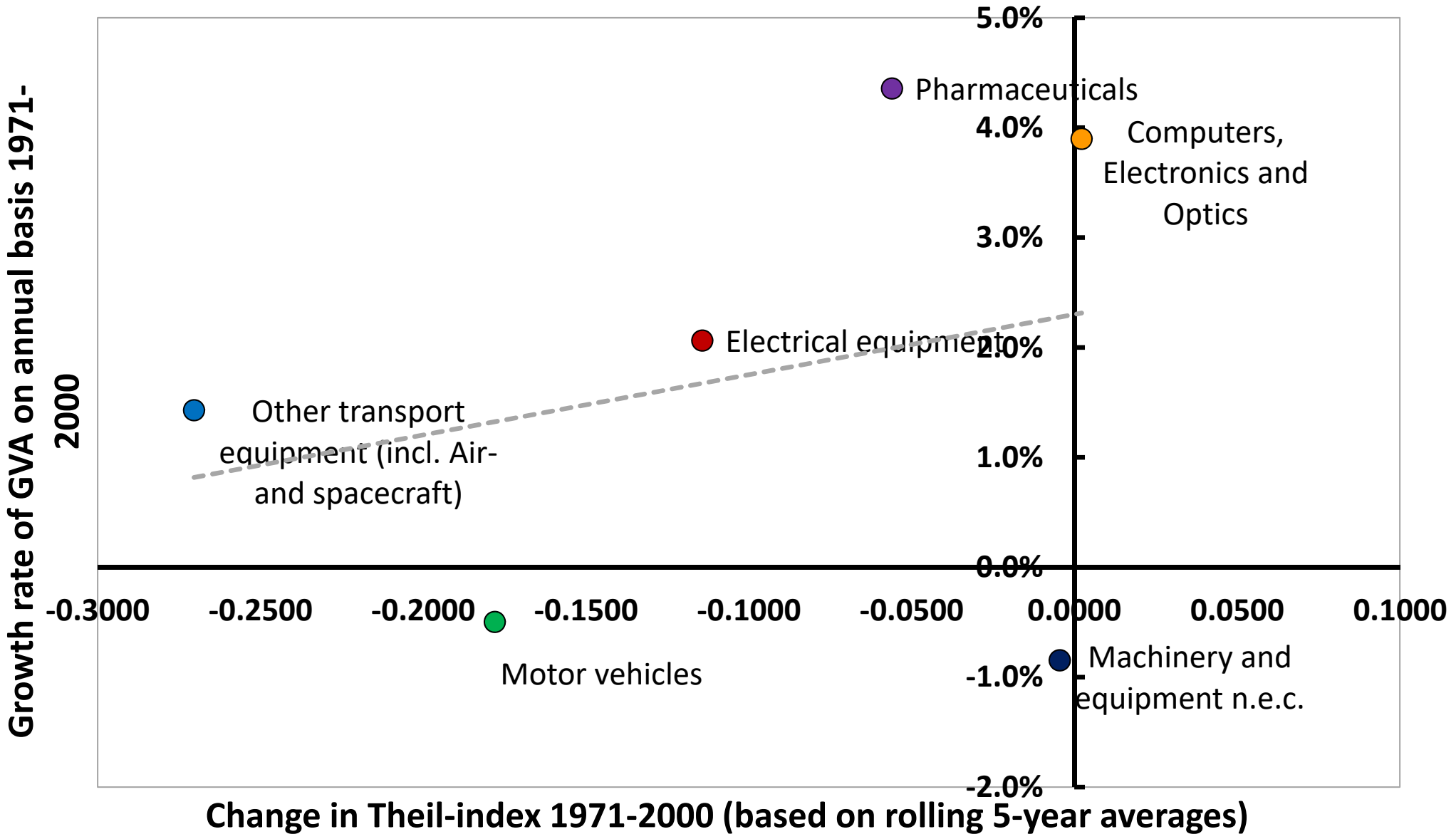


Development of Theil index for AM industries based on shares in GVA of LADs

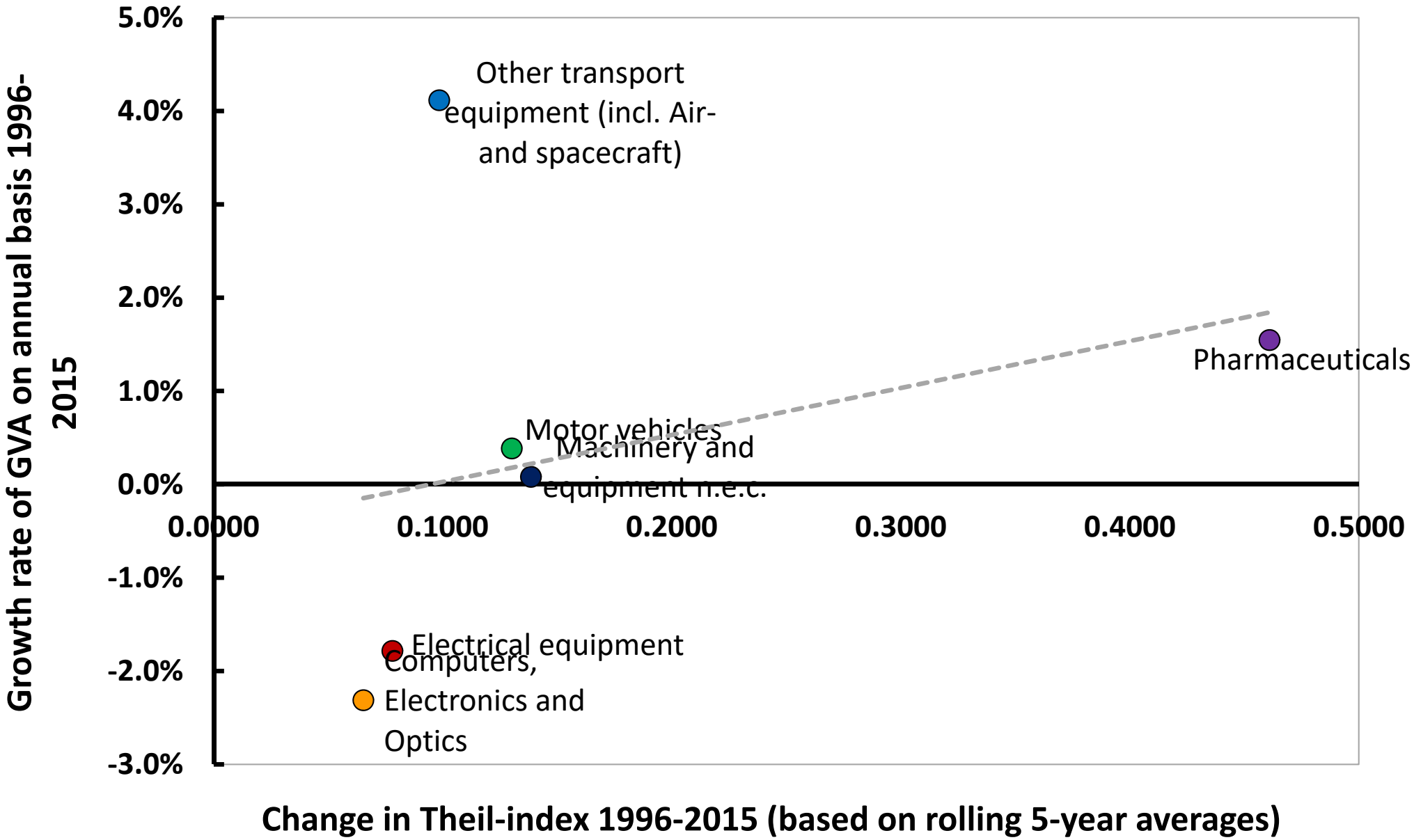


$$T_i = \sum_{r=1}^{R} \frac{GVA_{ri}}{GVA_i} \ln\left(\frac{GVA_{ri}/GVA_i}{GVA_r/GVA}\right)$$

Change in Theil-index (GVA), vs. average annual growth rate of GVA by Industry, based on 5-year moving averages of GVA 1971-1975 – 1996-2000 by NUTS2



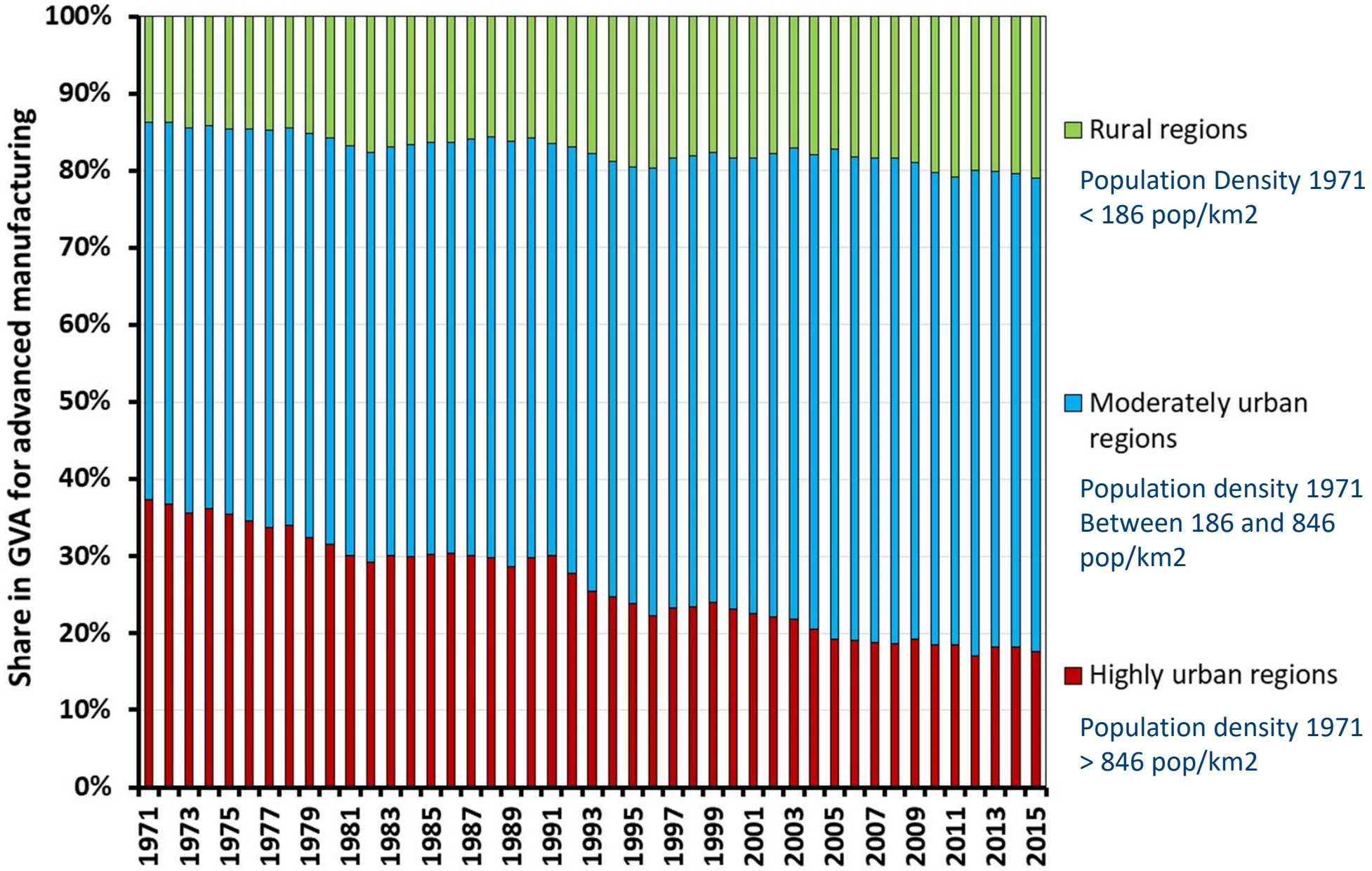
Change in Theil-index (GVA), vs. average annual growth rate of GVA by Industry, based on 5-year moving averages of GVA 1996-2000 – 2011-2015



Shift Towards Concentration

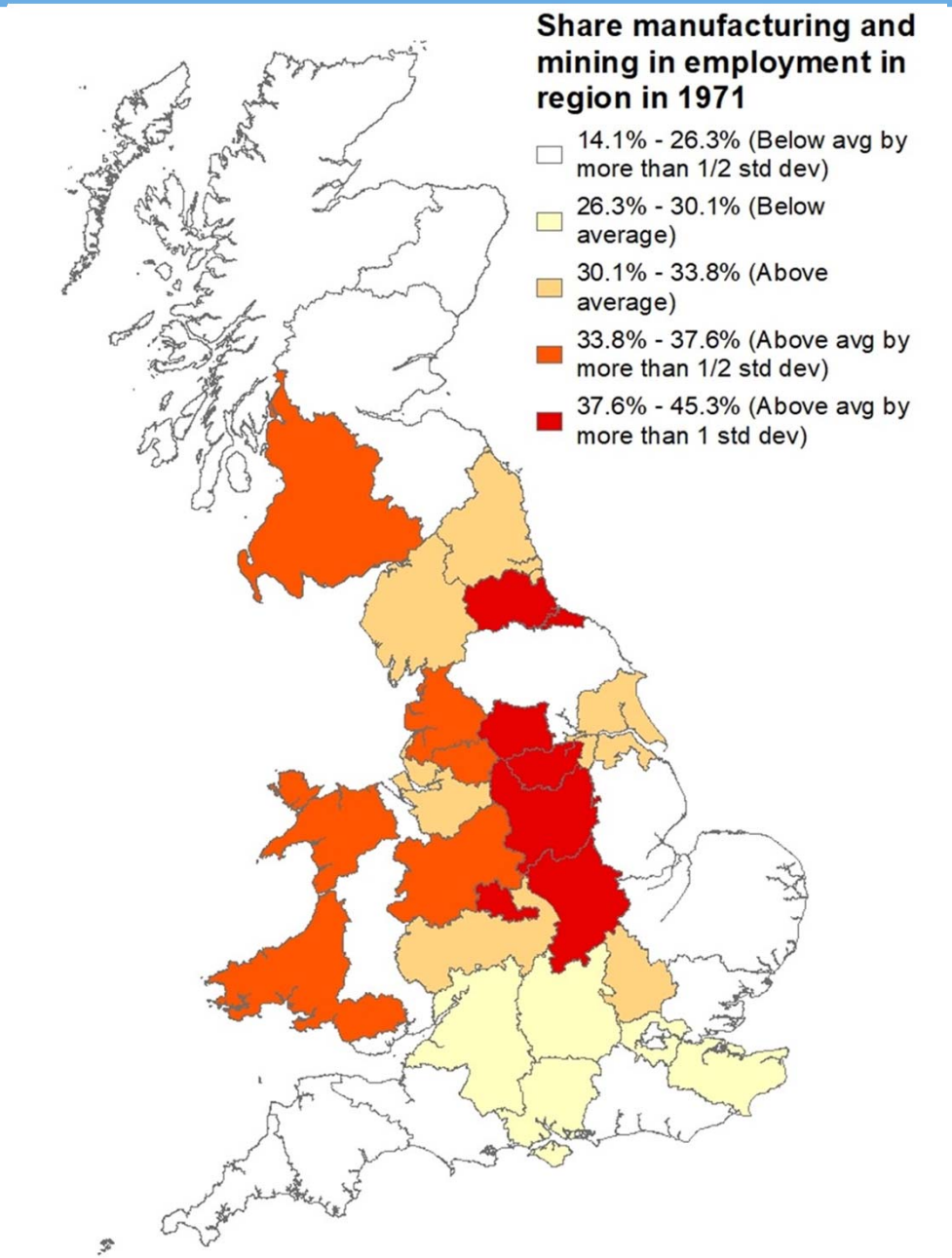
- Slight tendency towards increasing concentration since turn of the Century in most industries.
- But is this due to formation of regional clusters and ‘ecosystems’?
- AM industries have struggled in competitive global environment in this period - with the exception of aerospace, output either fallen or remained stable
- More likely that concentration is due to selective consolidation, firm rationalisation and disappearance of some sites
- AM remains located primarily outside dense centres of large cities in semi-urban and smaller cities

Development of shares by type of region (NUTS 2) in GVA Adv. Manufacturing



2. Highly Uneven Outcomes in Traditional Industrial Regions

Traditional Industrial Regions: Manufacturing and Mining share of employment in 1971



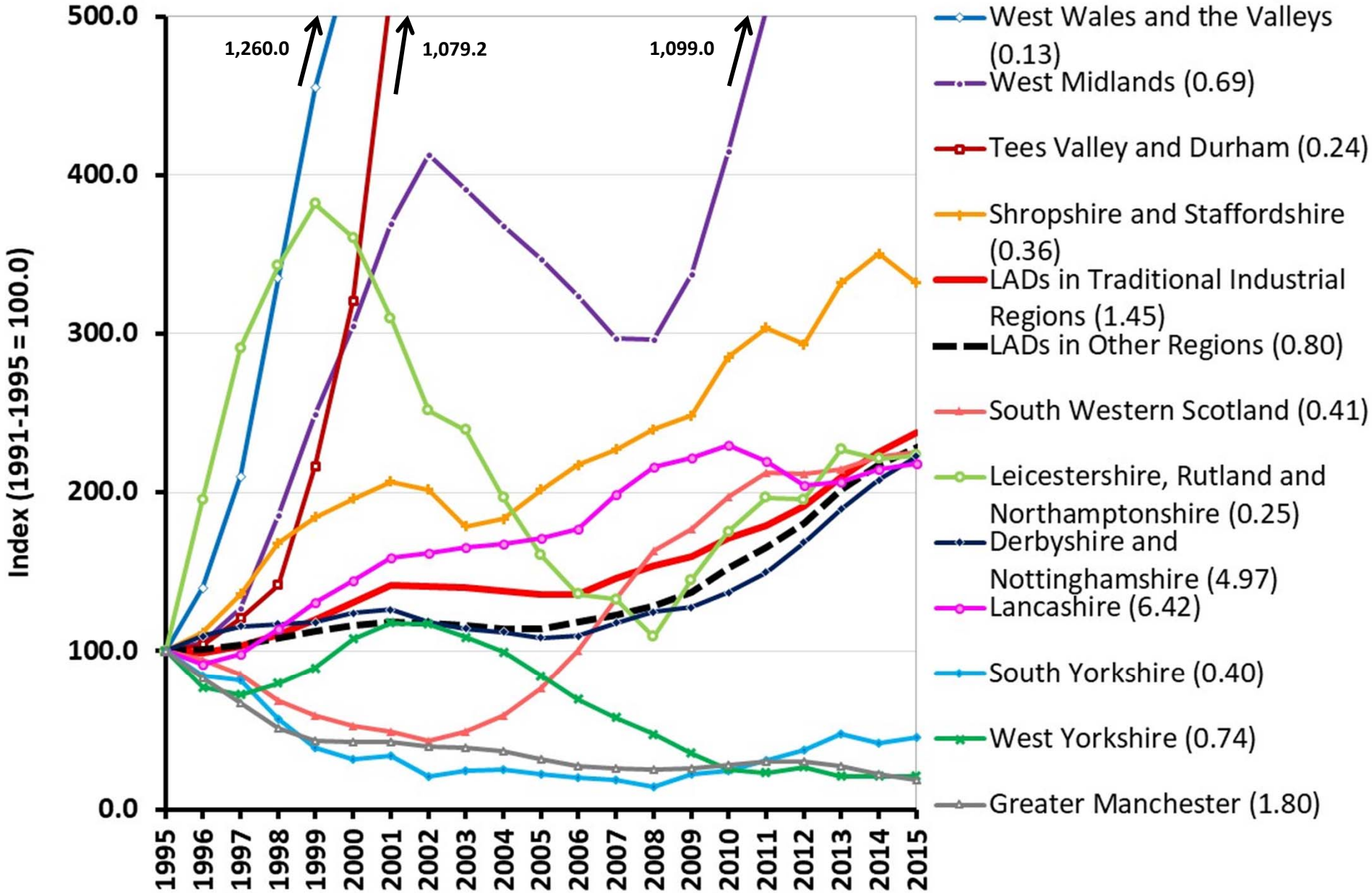
Traditional Industrial Regions (TIRs)

- Some theory sees traditionally industrial areas as **obstructive** to AM growth:
  - Glaeser (2012) 'cursed legacy' of heavy industry - low-skill, outdated infrastructure, problems of 'lock-in' and hysteresis.
  - Higher technology industry has distinctive location requirements (Hall et al, 1987).
- Alternative theory suggests these areas are **conducive**:
  - 'Phoenix industries', SMEs re-use knowledge assets and networks (Christopherson, 2009), revival of research institutions. Core regions find new design roles (Doussard and Shrock, 2015)
  - Relatedness of other manufacturing produces diversification.

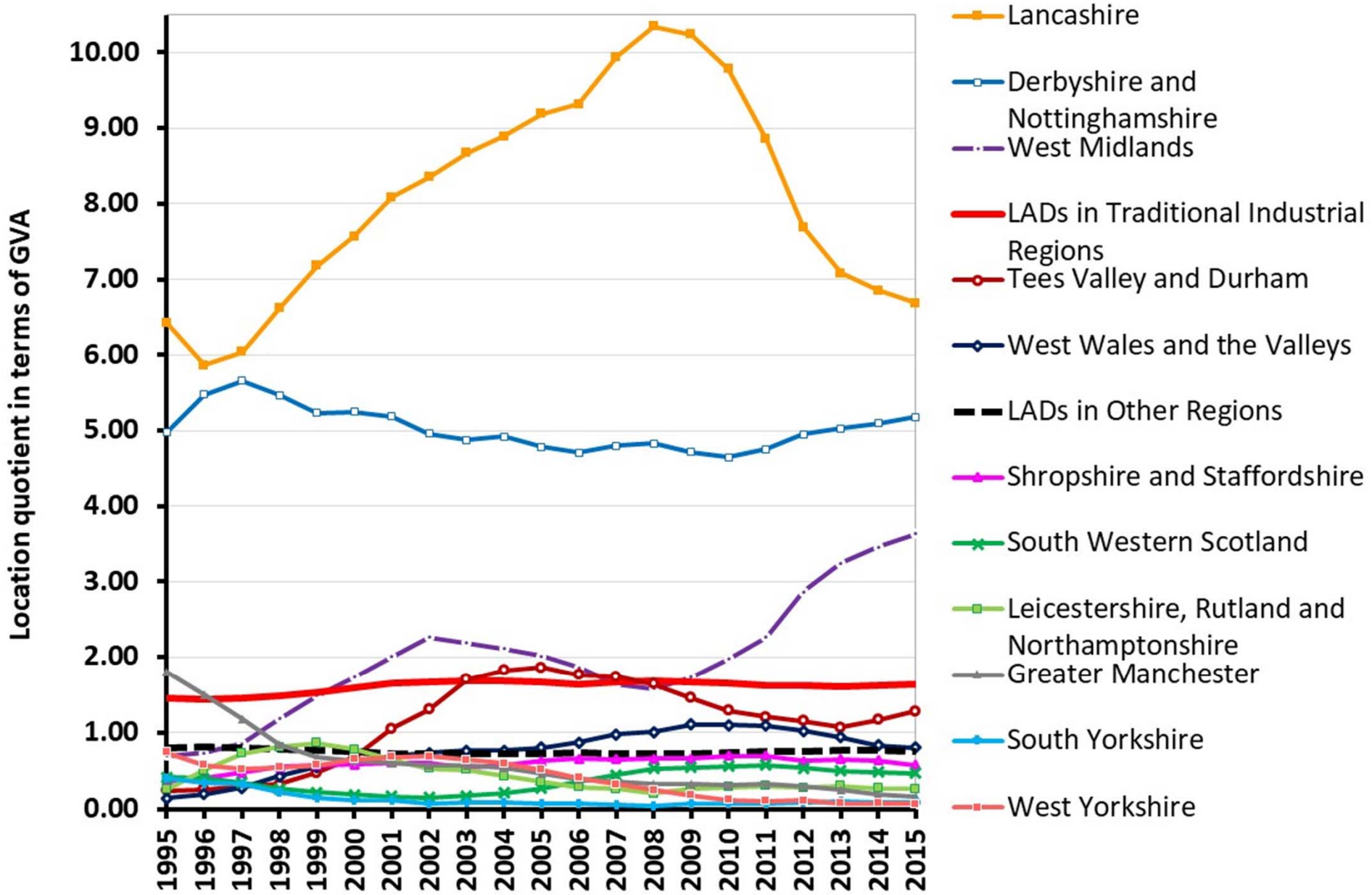
Differences between AM sectors and performance in TIRs

	Concentrated sector	Dispersed sector
Does relatively well in (some) TIRs	• Aerospace • Motor vehicles • Other transport equipment (excl. aerospace)	• Machinery and equipment
Does not do well in TIRs	• Pharmaceuticals	• Computers, Electronics and Optics • Electrical equipment

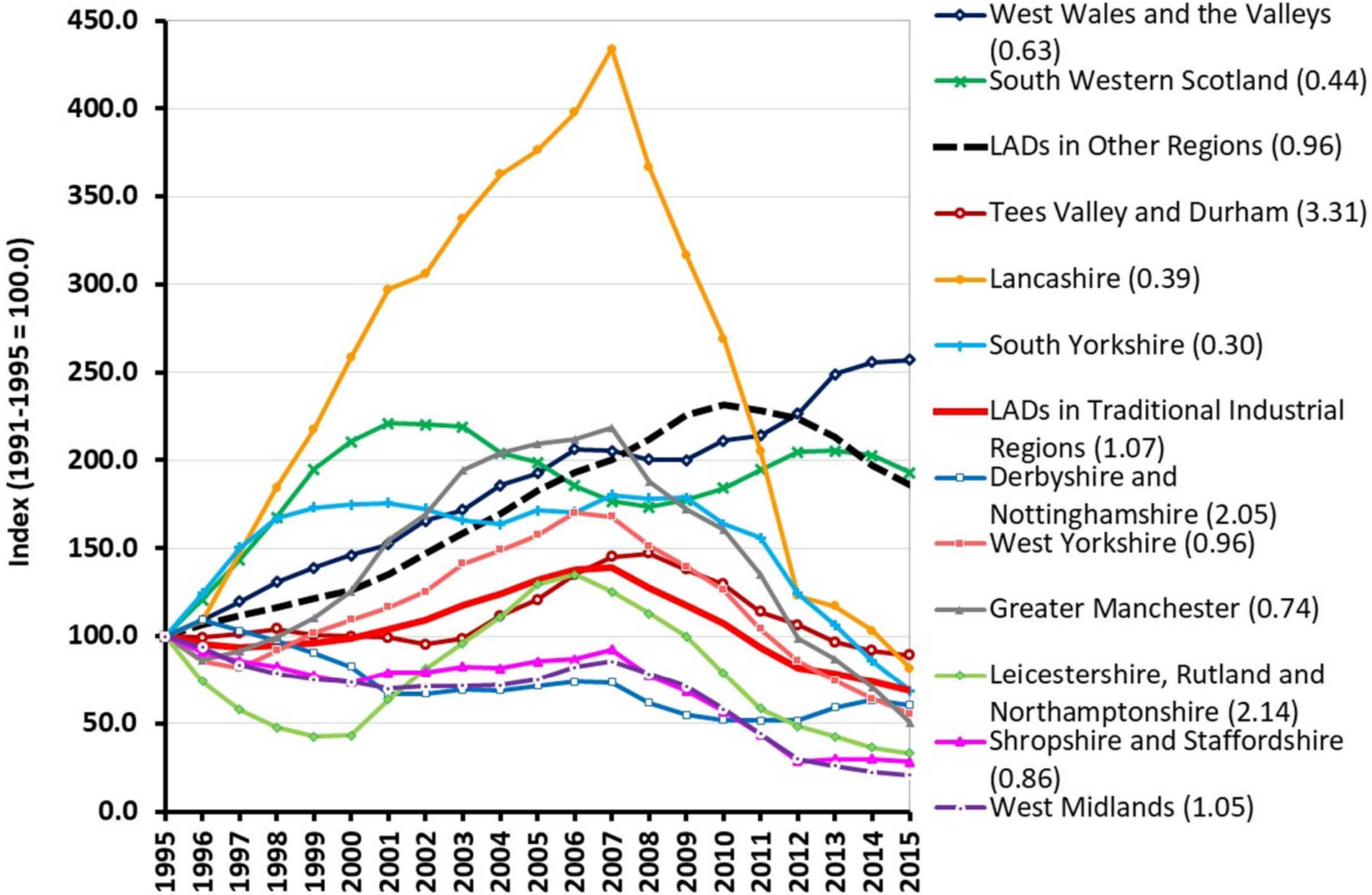
Development of Aerospace across TIRs (indexed development of GVA, 5-year moving average)



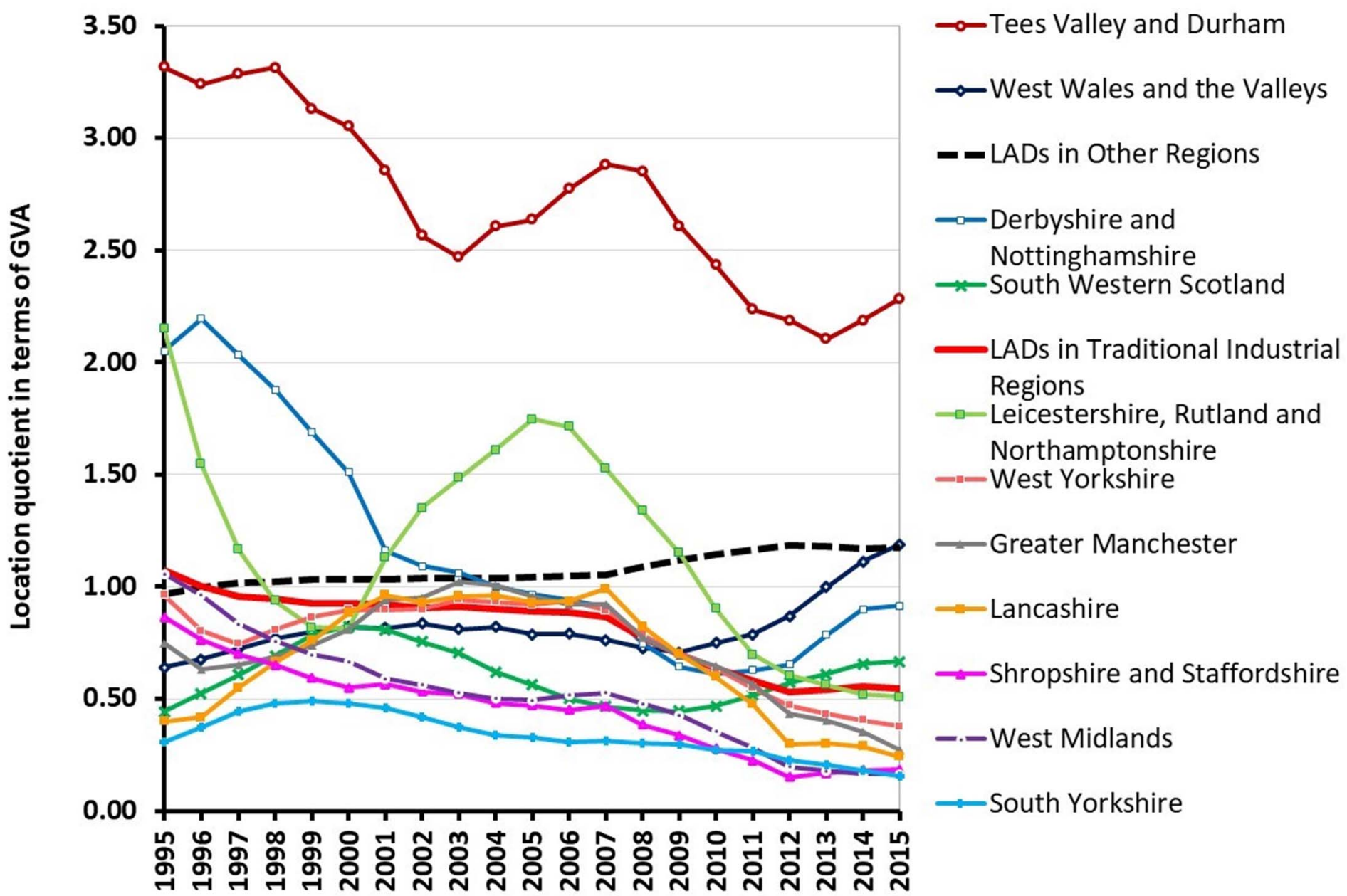
Specialisation in Aerospace across TIRs
(Location quotients of GVA 5-year moving average)



Development of Pharmaceuticals across TIRs
(indexed development of GVA, 5-year moving average)



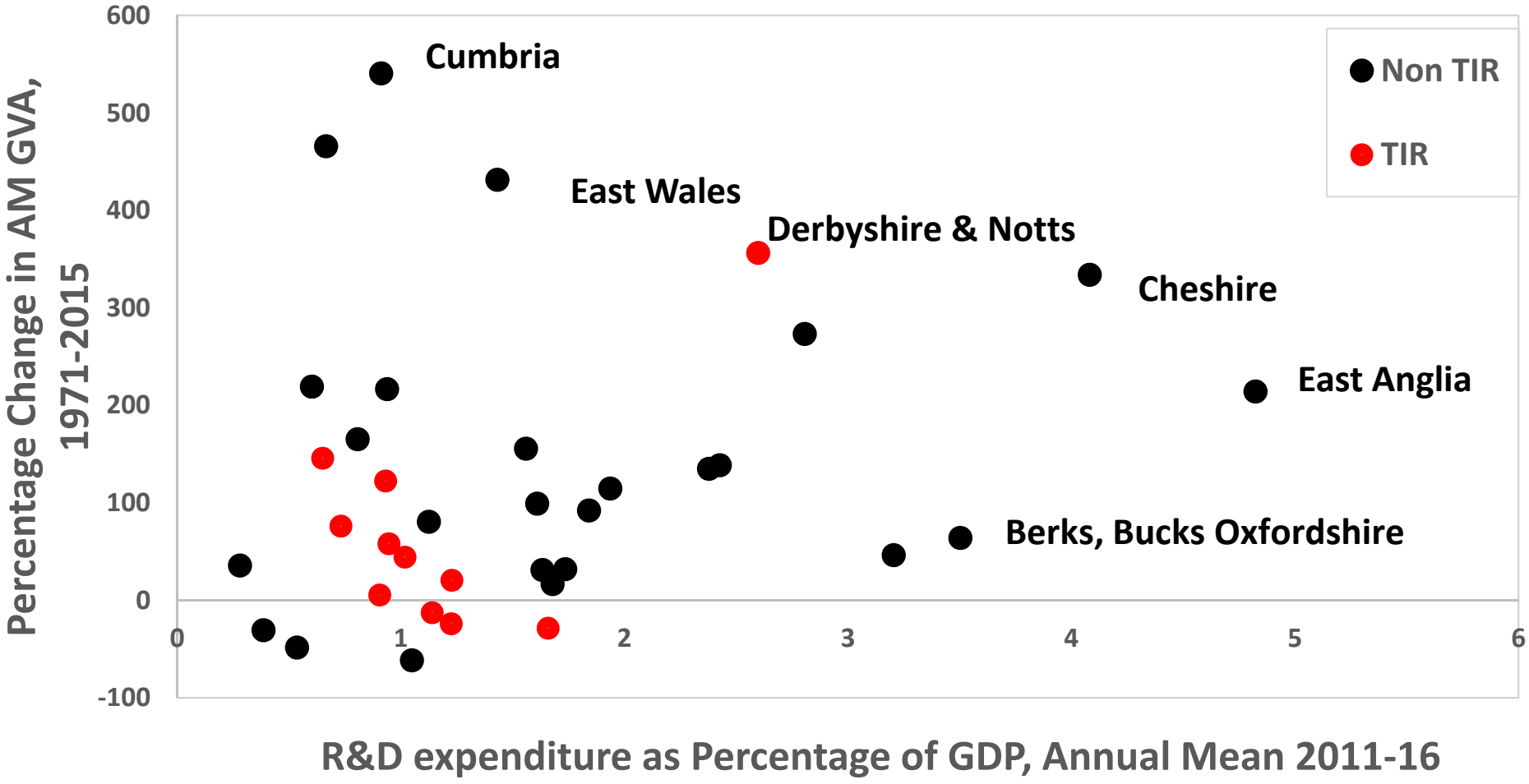
Specialisation in Pharmaceuticals across TIRs (Location quotients of GVA 5-year moving average)



Analytical and Synthetic Knowledge Bases

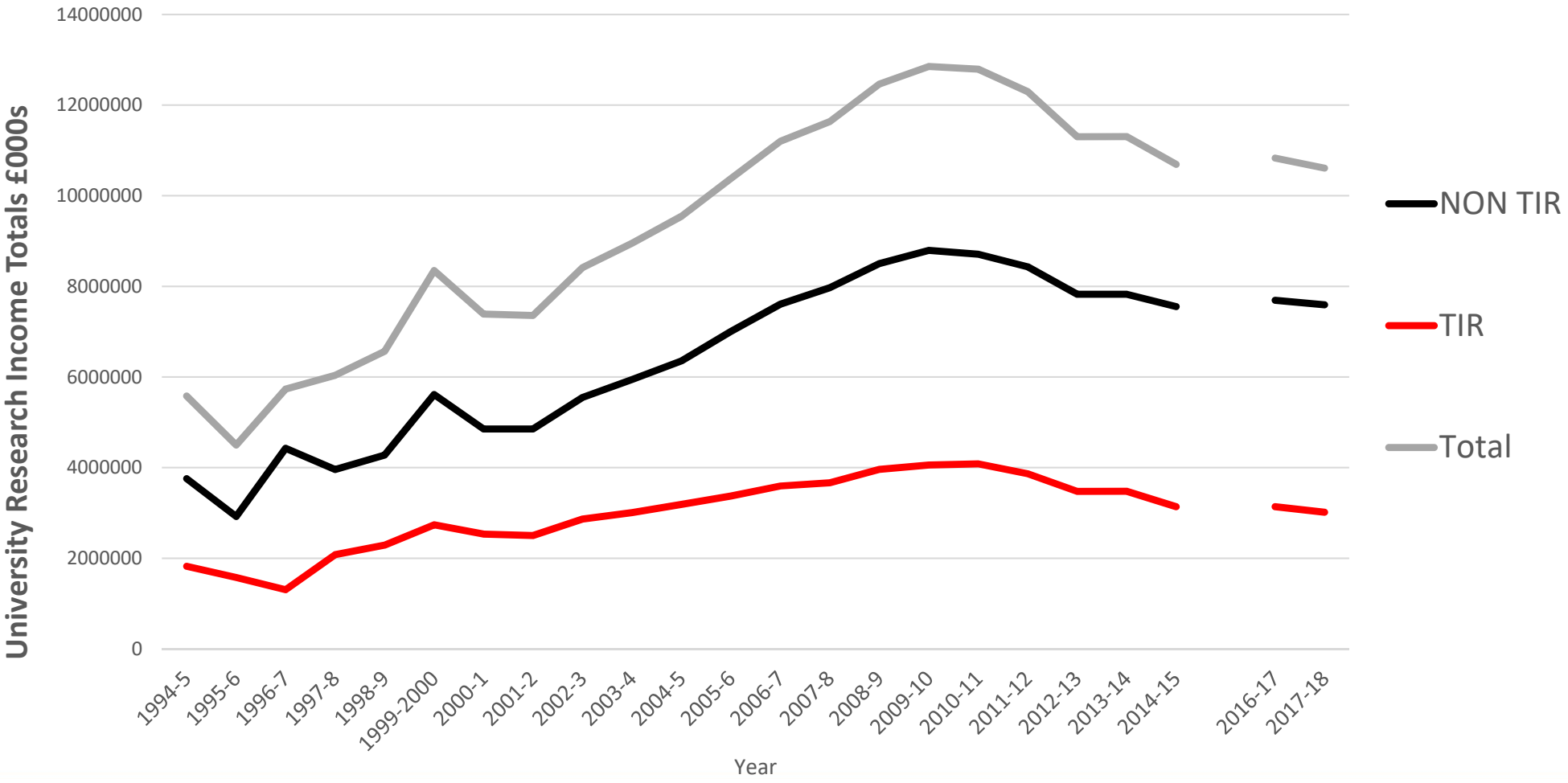
- In AM industries with more ‘synthetic’ knowledge base, some evidence of ‘Phoenix industry’-effects:
  - Growth in Aerospace, Motor Vehicles, but also Other transport equipment
  - Centres in TIRs continue to do well; and some new expansion into other TIRs (but also into non-TIRs); especially in East Midlands, North West and West Midlands.
  - Machinery and Equipment n.e.c., and to lesser extent Electrical equipment, growing in some TIRs in context of overall stagnation.
- AM industries with more ‘analytical’ knowledge seem averse to TIRs – pulled towards innovation, R&D systems?

R and D intensity in Regional (NUTS2) GDP (2011-16) against Growth of AM GVA, 1971-2015



Source: GERD Eurostat STI Database

University Research Income (Block and Grants) by TIR and Non TIR NUTS2 Regions, 1994-5 to 2014-15



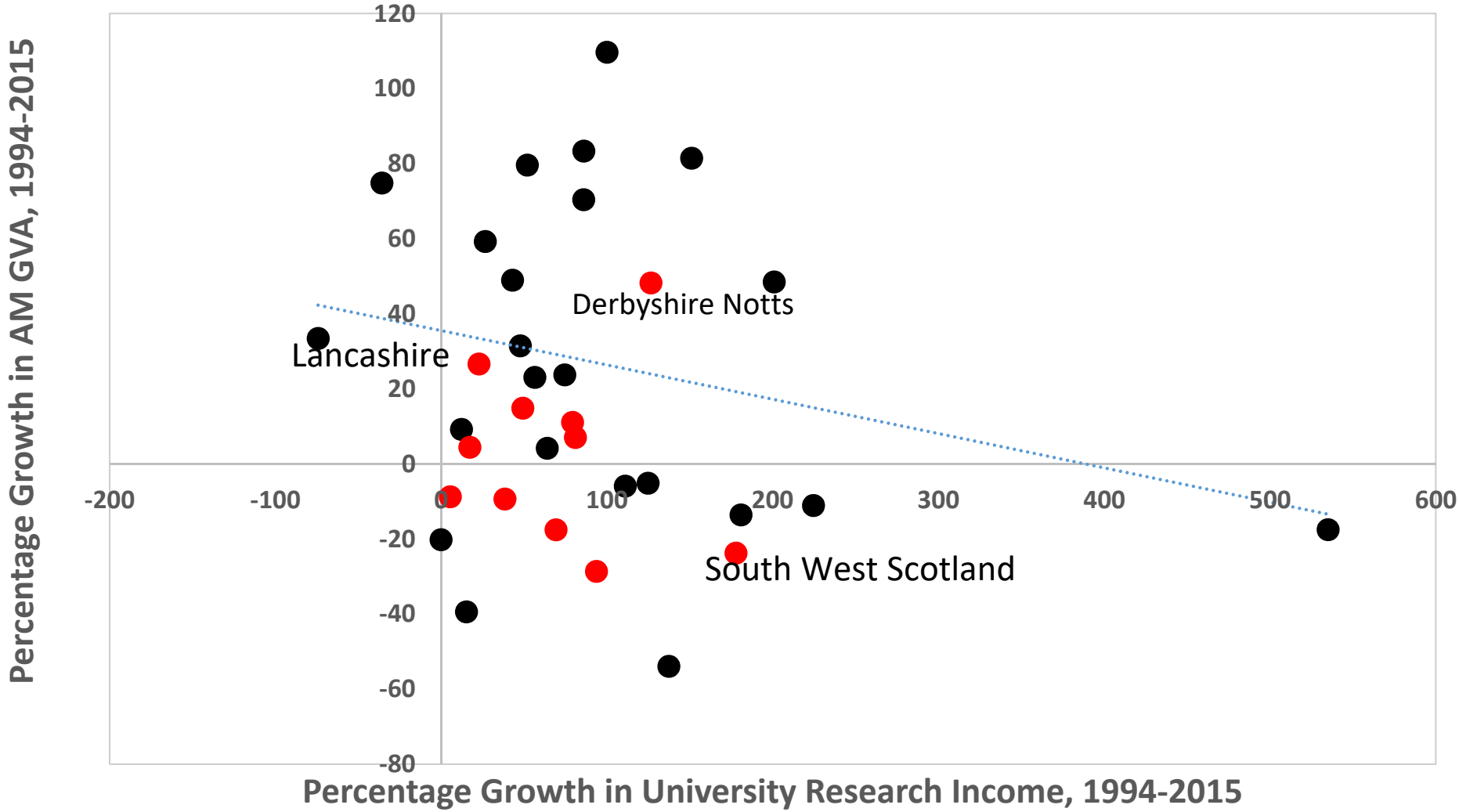
University of Southampton

University of Cambridge

Durham University

Newcastle University

Change in University Research Income against Change in AM GVA, 1994-2015 by NUTS2 Region



Conclusions

- Shift to period of concentration in AM – why? Some clustering, consolidation and dependence on anchor firms and government contractors
- Potential for growth is limited to only some industries and evidence of strong instability
- Strong differences between TIRS within same industries, causes need further research
- Growth of AM in some Northern regions will require place-specific support

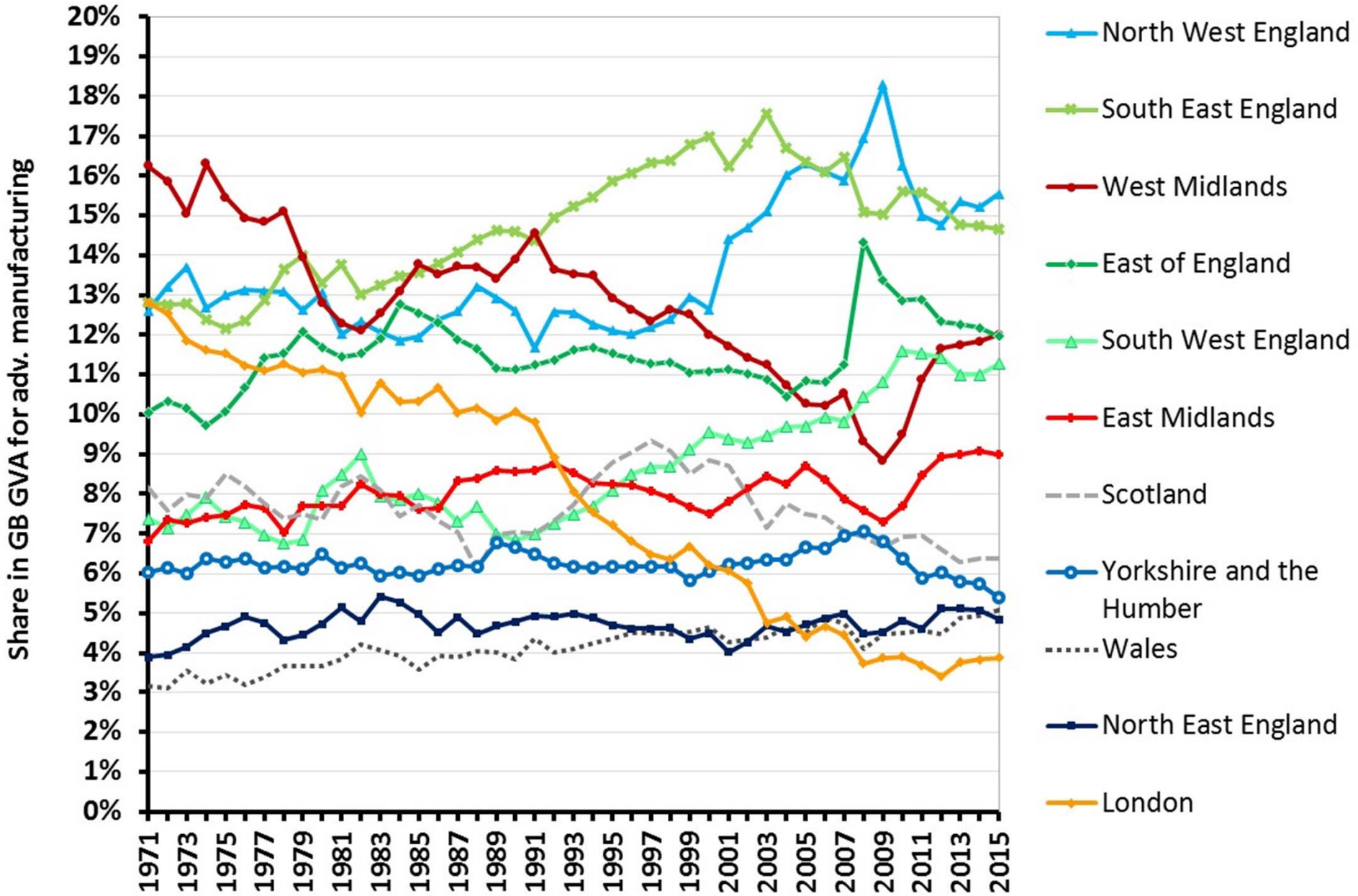
Conclusions

- Policy model of innovation districts based on University research will no doubt benefit some AM sectors, but unlikely to be a major force for rebalancing in AM
- Requires radical change in innovation systems to connect with AM local growth areas
- Potential growth industries are already concentrated around key firms - better support these existing regional clusters and supply chain systems
- Many of these industries at most risk from a poor Brexit

Thank you for your attention!

Spare slides

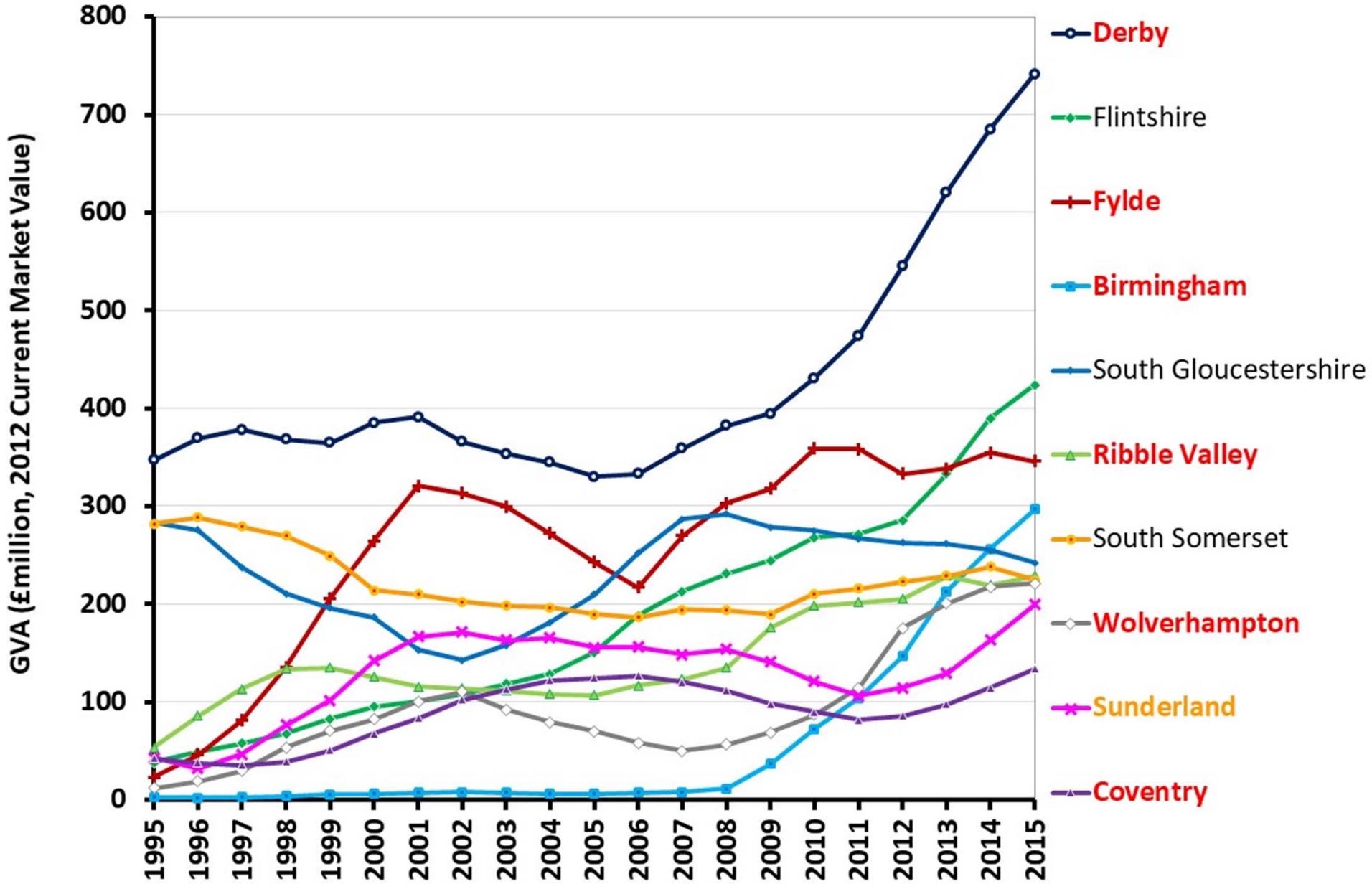
Regional Shares of Advanced Manufacturing GVA



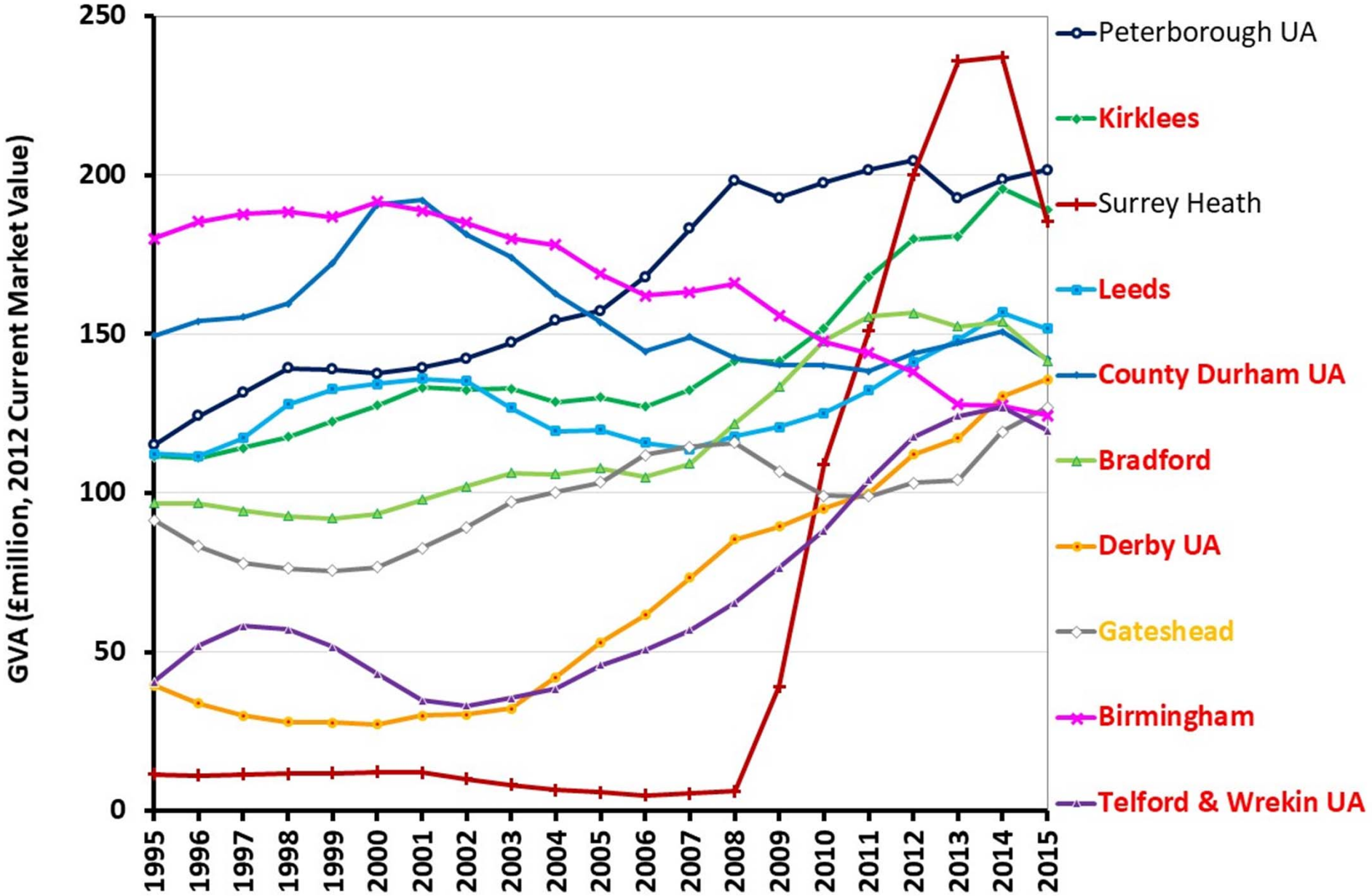
Debates on Concentration (1)

- Some theory foresees **increasing concentration** of advanced manufacturing:
  - New economic geography predicts concentration to realise local externalities with falling transport costs (Krugman, 1993; Brülhart, 2001).
  - In knowledge-intensive industries, local spill-overs and 'brain-hubs' are increasingly important (Moretti, 2013; Storper, 2013).
  - Localised ecosystems and 'industrial commons' are needed for the health of advanced supply chains (Helper et al, 2012).
  - Foreign direct investment attracted by agglomerations (Barrell & Pain, 1999; Jones, 2017).

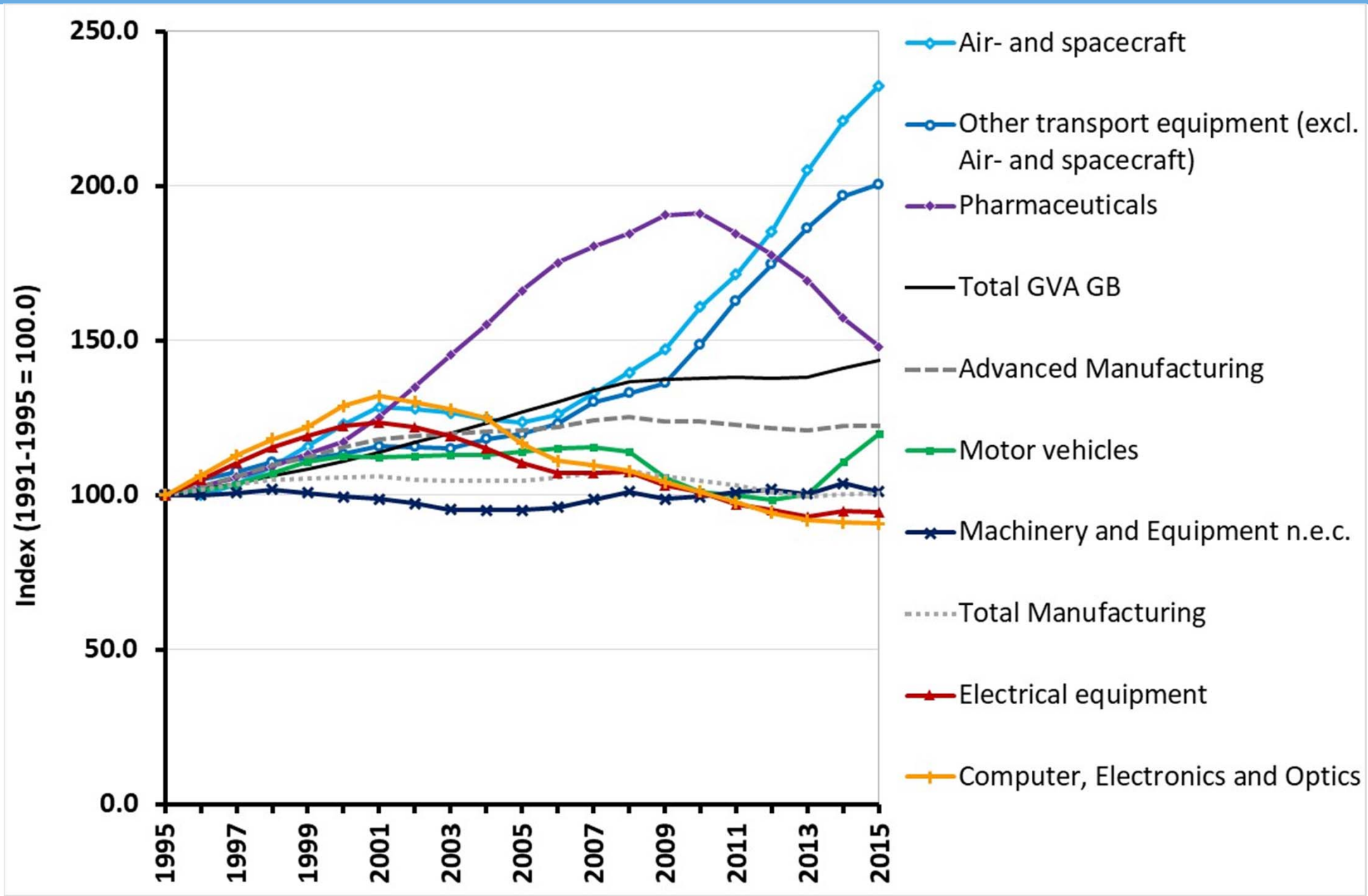
Development of GVA of current Top 10 LADs for Aerospace (5-Year moving average)



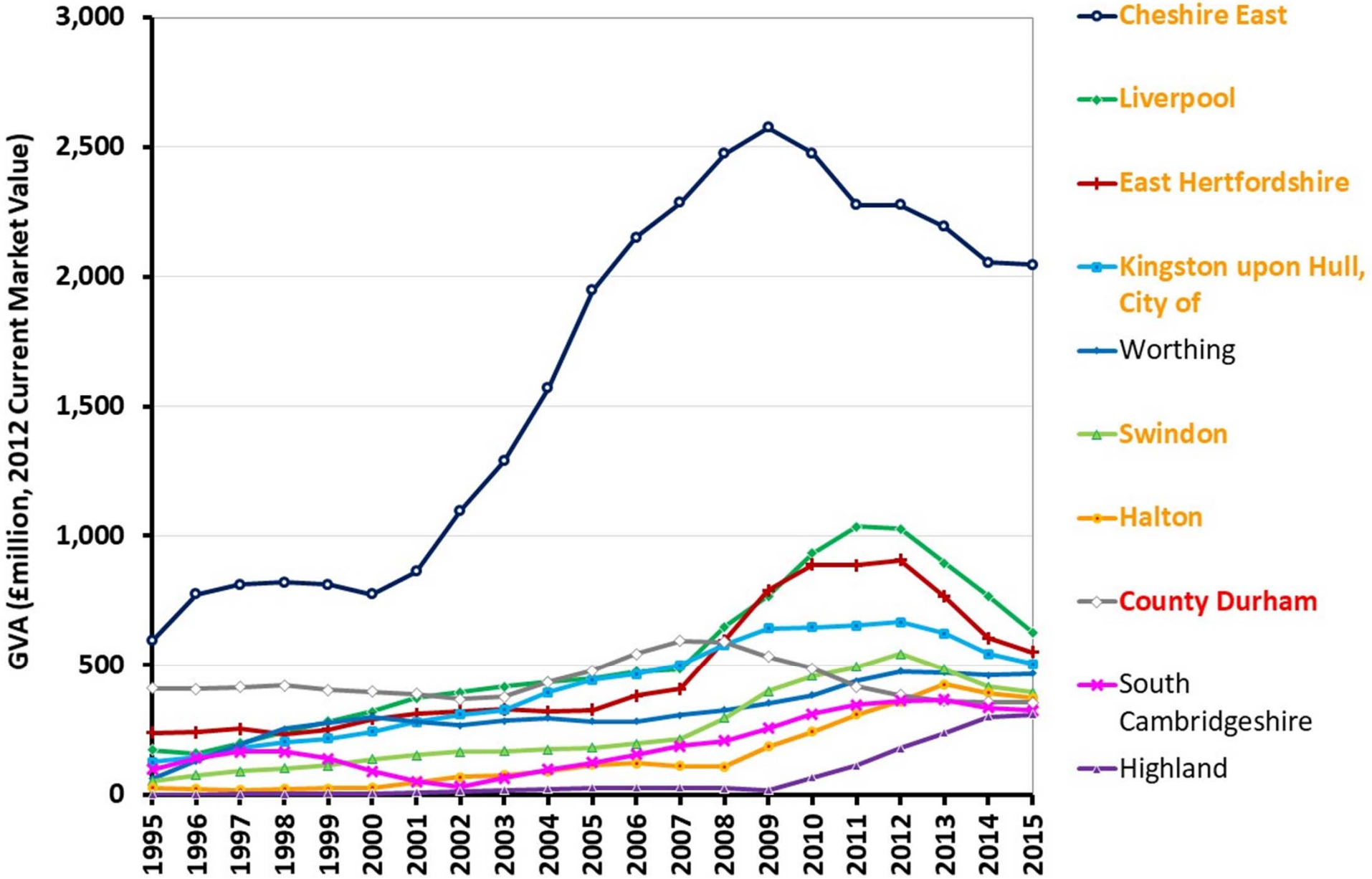
Development of GVA of current Top 10 LADs for Machinery and Equip. (5-Year moving average)



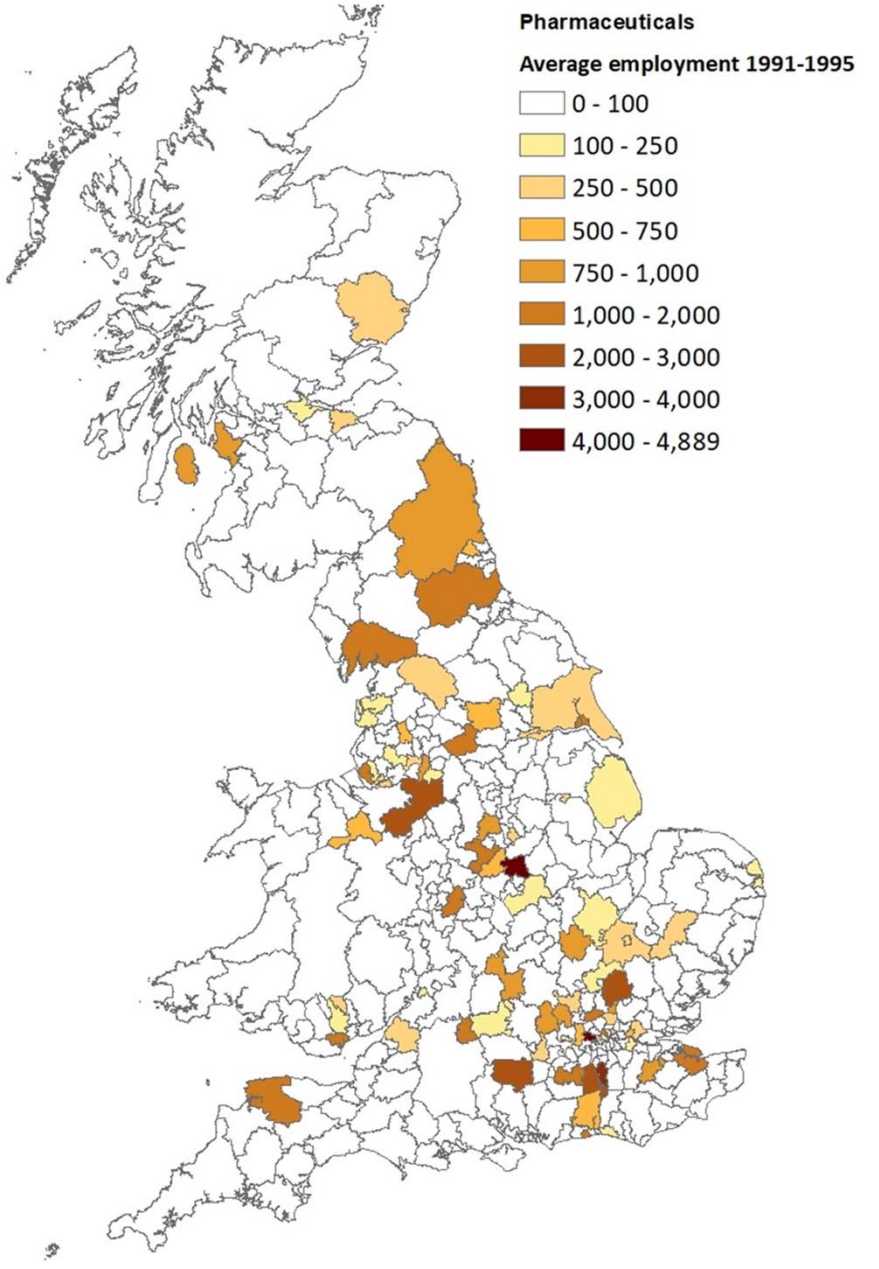
Development of Advanced Manufacturing industries (5-year moving averages 1991-2015)

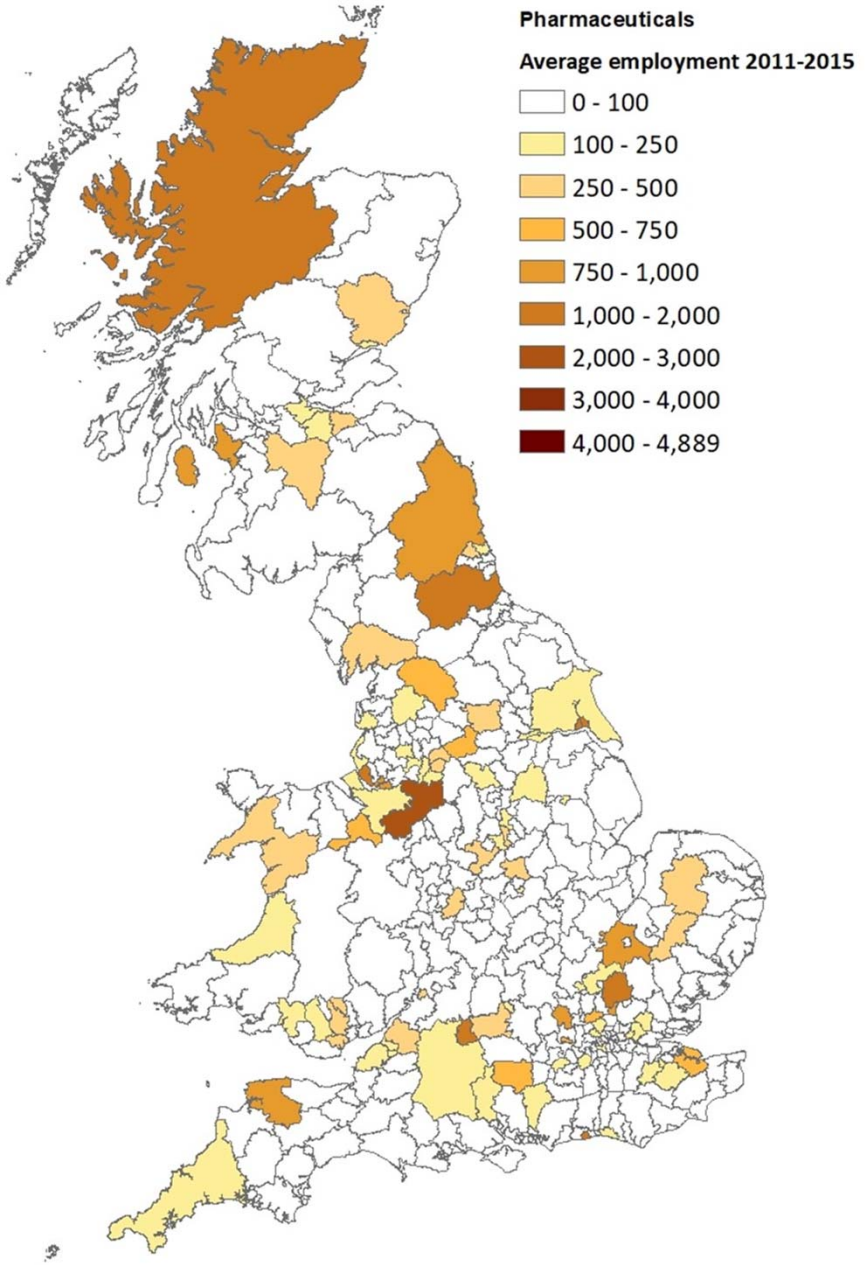


Development of GVA of current Top 10 LADs for Pharmaceuticals (5-Year moving average)

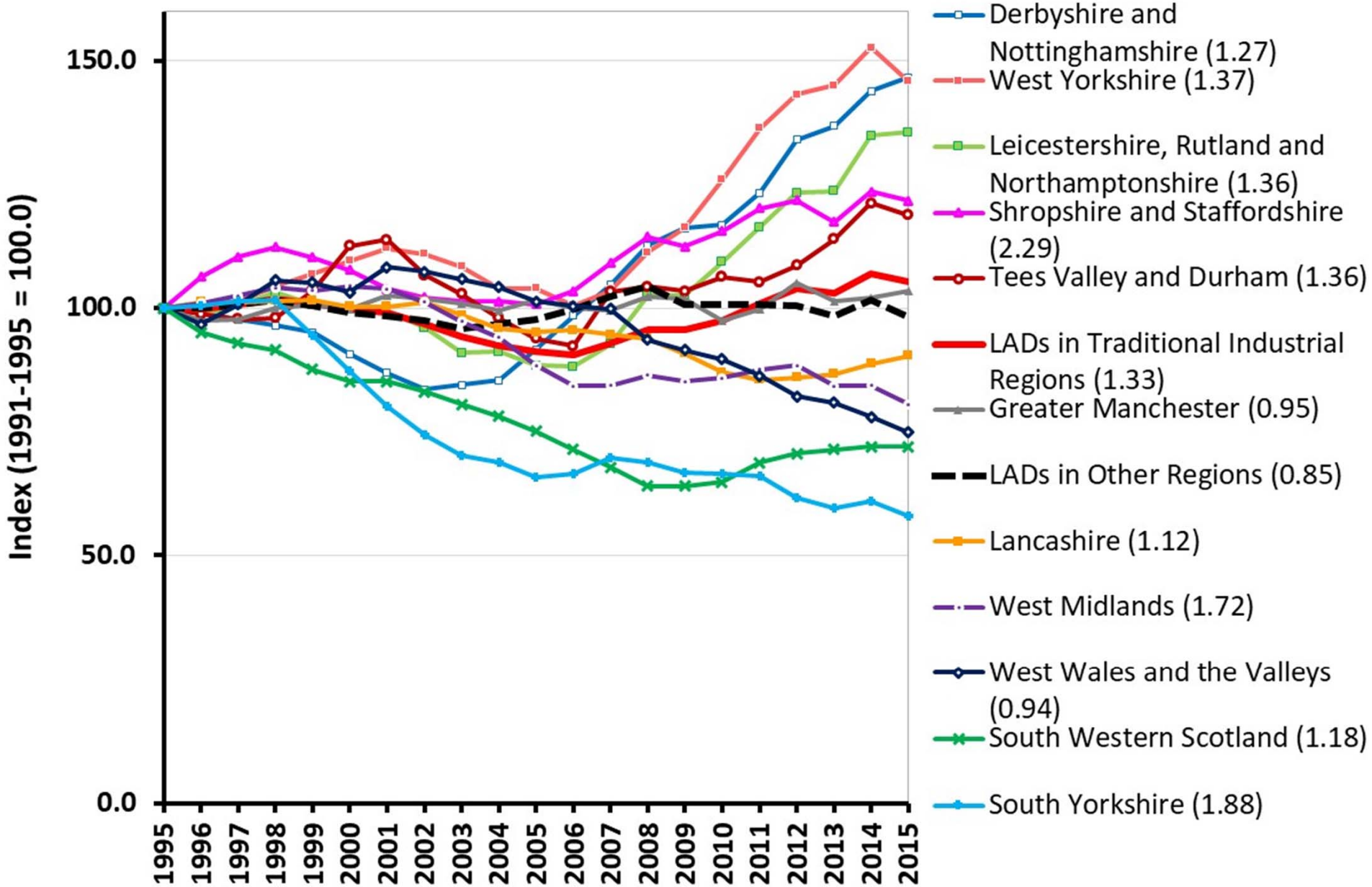


Employment in Pharmaceuticals across LADs, 1991-1995 and 2011-2015





Development of Machinery and Equip. across TIRs (indexed development of GVA, 5-year moving average)



Specialisation in Machinery and Equip. across TIRs (Location quotients of GVA 5-year moving average)