Place-biased technological change: A review and (tentative) framework

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“Some cities have been well positioned or able to adapt more easily than others because their locations, infrastructures, businesses or populations are more suited to the new economy….

Thus the history of US cities is in one sense a story of cities growing and prospering during certain technological epochs and then either adapting to the next phase, or not, making the transition, or declining and stagnating in real or relative terms”

Summary

- Technological changes have pronounced economic impacts. Economists have long considered the impact of technological change on the labour market: skills biased technological change (SBTC).

- Yet economic geographers / spatial economists have not considered how different technologies will influence places - place biased technological change. Instead we focus on ‘nuance’ – place is considered too complicated.

- But skills are also complicated, and simplification / formalisation can help address this important question - for research (does it help explain regional decline?) and policy (likely impact of drones? Self-driving cars).

- This paper presents a very preliminary sketch of (a) the evidence on how past (b) a framework for thinking about how future technological change may influence places, (c) an application of this framework to future technological change.
Technological change and cities

• Cities were partly the result of new technologies – improvements in agricultural productivity allowed actors to specialise and agglomerate (Atkinson, 1998)

• British cities developed because of new mass-production technology, surplus labour from agricultural productivity, but need for particular natural environment

  • Wet weather meant soft wool

  • High transport costs meant manufacturers located near resources

• Technological change has impacts which are rarely spatially neutral, but analysis on technological change focused on internet rather than other technologies
Example 1: The economic geography of the internet
**Flat world**

(Friedman, Ohmae, Cairncross etc.)

New technology has created a level playing field (internet, workflow software etc)

It is possible to compete anywhere

Location no longer matters

Regional disparities will decline

**Spiky world**

(Florida, Atkinson, Rodríguez-Pose & Crescenzi)

New technology has heightened importance of agglomeration

Cities function as nodes in production

Localised assets, knowledge-spillovers and ‘buzz’ still matter hugely

Regional disparities will continue
The internet and economic geography

Improved technology — Reduction in spatial transaction costs

Supply: Deagglomeration of routine production

Demand increases: Greater extent of market

Areas of routine production decline

Increased complexity

Agglomeration of knowledge based activities

New combinations

Premium on innovation

Adapted from Learner & Storper, 2001
Information versus communications technology

- Information technology – may help disperse economic activity, as it provides
  - e.g. Empowered nurses (Bloom et al., 2015)

- Communications technology – may centralise control functions
  - e.g. Ceremonial ambassadors

- Tensions within technologies meaning they do not simply have agglomerating / disagglomerating activities but both
More examples: Electricity, cars + containerization
(Selective) history on technological change

- **Electricity transmission** – freed power-intensive manufacturing activity from location near rivers / coal (Swinney & Thomas, 2015)
  - e.g. Manufacturing in South Wales

- **Cars and highways** – more efficient transport technology allowed spreading of economic activity
  - e.g. Milton Keynes or US deconcentration of US manufacturing (Atkinson, 1998)

- **Containerization** – put a premium on large ports, reduced labour use and changed (Levinson, 2006)
  - e.g. Shift from shallow San Francisco to deep Oakland
Long-term urban change in the UK

Swinney & Thomas (2015) regress share of knowledge jobs in 2011 against industrial structure in 1911 (53 cities)

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>Beta (se)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy industry</td>
<td>-.0124* (0.064)</td>
</tr>
<tr>
<td>Light industry</td>
<td>-.123 (0.057)</td>
</tr>
<tr>
<td>Extraction</td>
<td>-.203** (0.063)</td>
</tr>
<tr>
<td>Dock working</td>
<td>-.857** (0.231)</td>
</tr>
<tr>
<td>Rail</td>
<td>.066 (0.196)</td>
</tr>
<tr>
<td>Knowledge services</td>
<td>.565* (0.318)</td>
</tr>
<tr>
<td>General labourers</td>
<td>-.1635** (0.812)</td>
</tr>
<tr>
<td>Seaside</td>
<td>-.061** (0.026)</td>
</tr>
<tr>
<td>Cons.</td>
<td>.173** (0.055)</td>
</tr>
</tbody>
</table>

Some persistent advantages

- Cities with share of knowledge services then still tend to have share of knowledge jobs

Decline of natural advantages

- Importance of docks (dock working, seaside)
- Extractive industries
Persistent advantage in the US / Canada

Long-term persistence of higher order activities in US cities (Storper 2013)

- Land grant colleges still explain almost 10% of variation in share of STEM occupations (see figure)

30 year persistence in higher-order services in Canada (Polese & Shearmur, 2004)
Three ways of thinking about the impact

- **Agglomeration versus disposal** – will the new technology help spread economic activity or bring it together?
  - e.g. will the internet create a flat world?

- **First nature economic geography** – rainfall, temperature, access to sea, natural resources (Krugman, 1991)
  - e.g. recycling plants + 50% regulation led to a decline in Canadian logging towns (Polese & Shearmur, 2006)

- **Second nature geography** – scale economies, home markets. Interpreted more broadly: types of sector or function of the economy
  - e.g. will new production technology wipe out a sector?
<table>
<thead>
<tr>
<th>Technology</th>
<th>Agglomeration / dispersal</th>
<th>First nature geography</th>
<th>Second nature geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet</td>
<td><strong>Dispersal of information</strong> intensive-activity leads to complexity and agglomeration of knowledge-based, f2f functions</td>
<td>No clear prior Potential bias towards quality of life</td>
<td>Focus on existing knowledge-intensive agglomerations Decline in routine production in industrial cities</td>
</tr>
<tr>
<td>Electricity</td>
<td>Allowed dispersal of activity from power sources</td>
<td>Decline of coal agglomerations - Manufacturers no longer needed to be near a source of power</td>
<td></td>
</tr>
<tr>
<td>Containerisation</td>
<td>Reduced shipping cost and facilitated dispersal of production Agglomeration of shipping activity in mega-ports</td>
<td></td>
<td>Reduced employment in port cities</td>
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</table>
Some futurology:
Autonomous vehicles, 3D printing
<table>
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<tr>
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<th>Agglomeration / dispersal</th>
<th>First nature geography</th>
<th>Second nature geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous vehicles</td>
<td>Dispersal of residential, but reduces agglomeration diseconomies – increasing potential for agglomeration</td>
<td>?</td>
<td>More efficient knowledge-intensive agglomerations</td>
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<td></td>
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<td>Rebirth of country pub</td>
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<td></td>
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<td>Decline of the truck-stop</td>
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<tr>
<td>3D Printing</td>
<td>Dispersal of some manufacturing (impact limited)</td>
<td>?</td>
<td>Proximity of designers to manufacturing</td>
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<td></td>
<td>But allow it to happen in niche locations (agglomeration)</td>
<td></td>
<td>But may reduce manufacturing employment in cities</td>
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| E-commerce (not really futurology) | Dispersed shops decline  
Agglomeration in warehouse near transport links | Proximity to ‘central core’ likely to matter | City centres may thin-out / change their functions                                        |
|                        |                                                                                          |                        | Road network may become more important / proximity to people less important                |
E-commerce

“… a significant share of activities such as banking, travel reservations, and shopping that occur in neighbourhood shops could be replaced by electronic interactions. This would lead to the development benefits shifting from dispersed face-to-face businesses in neighbourhoods and malls to concentrate in a few back office and warehouse locations where such services are administered. These are likely to locate in lower cost regions and lower cost areas of the metro, usually outer suburbs or exurbs”

Conclusions

• Cities shape and are shaped by technological change

• Long tradition of speculative work on changing technology and economic geography, but little work attempting to systematically consider how changing technologies influence ‘place’

  • Autonomous vehicles – some agglomeration forces, but also help disperse around core. These impacts will be nuanced: the country pub versus the truck stop.

• But framework only developing. Future work needs to add clarity on each of these dimensions
“Rapid technological change means rapid obsolescence of physical facilities and skills alike. By that token it poses particularly serious adjustment problems to areas like the Pittsburgh region which have especially large proportions of their physical and human resources committed in terms of earlier technical conditions” –

“The disparity among places in terms of attractiveness may well be growing. This dispersal is highly selective and uneven and not all places will do well.”
Atkinson, 1998: 150