DENSE ENOUGH TO BE BRILLIANT: PATENTS, URBANIZATION, AND TRANSPORTATION IN NINETEENTH CENTURY AMERICA
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INTRODUCTION

I explore the geographical distribution of patenting in the 19th century U.S., revisiting the Sokoloff (1988) hypothesis that increasing market access through transportation infrastructure led to an acceleration of innovation. Travel over land without mechanical power was costly; before railroads, waterways were the most efficient means of transport. Transportation brings ideas and people, allowing for greater specialization and access to formal credit institutions. Nineteenth century changes made transportation faster, cheaper and safer, effectively reducing the distance between locations, with the most profound effect on places on the periphery of the transportation network.

DATA

The data used here have the advantage of being a complete picture of a long time period.

- Tom Nicholas’ dataset of patents issued from 1836-1900
- Jim Shaw’s spreadsheet of patents issued 1790-1836 linked to the AniMap 3.02 Historical Atlas
- Jeremy Atack’s Transportation Data
- U.S. Census Data, including minor civil divisions from Michael Haines
- OCRed Text from Westlaw

BASIC REGRESSIONS

The regression below uses cardinal direction lines from important ports in 1826 as an IV, suggesting that 30-70% of the increase in patenting between 1850 and 1860 was caused by the spread of the railroad.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>10K Ppl</th>
<th>10K Ppl</th>
<th>10K Ppl</th>
<th>10K Ppl</th>
<th>10K Ppl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pat per % RR</td>
<td>0.0726**</td>
<td>0.0177*</td>
<td>0.0296*</td>
<td>0.0282</td>
<td>0.0585</td>
</tr>
<tr>
<td>Instrument</td>
<td>0.0148</td>
<td>(0.0468)</td>
<td>(0.0368)</td>
<td>(0.0363)</td>
<td></td>
</tr>
<tr>
<td>% within 5 mi</td>
<td>0.256</td>
<td>(3.255)</td>
<td>0.166</td>
<td>(6.933)</td>
<td></td>
</tr>
<tr>
<td>Port</td>
<td>3.890**</td>
<td>15.55**</td>
<td>0.425*</td>
<td>11.65+</td>
<td></td>
</tr>
<tr>
<td>% Urban</td>
<td>0.150</td>
<td>13.66**</td>
<td>(0.157)</td>
<td>(1.572)</td>
<td></td>
</tr>
<tr>
<td>Year Dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

More Detail

The figures to the left show the βs from Patents Per 10K Ppl, α + βYearsArrivedDummies + ε, split into two categories: places that patented before they received transport and places that did not. The increase in patenting is gradual process—the effects are felt for many years after transport arrival.

TIMING OF INCREASES

These figures explore the timing of town formation and urbanization to transportation vis-à-vis infrastructure.

SPREAD OF THE RAILROAD AND PATENTING

The tables to the right explore the geographical distribution of patenting in the canal era, but precedes the railroads (see below); increased urban population follows both and is highly correlated with patenting.

THE SPREAD OF INFORMATION

Patents are treated as collections of words (or n-grams). In each year new n-grams to all counties are found, along with when that n-gram first appeared in the patent record. The speed is the number of 10,000 person-years needed for one new word to arrive in that year. Such n-grams include “cam-era” (1851), “reaping ma-chine” (1853), and “carbon-ate soda” (1855). Some important categories of patents are highlighted below.

FUTURE DIRECTIONS

While improved transport increases patenting, it isn’t an immediate jump. There is a puzzle left (not shown): Why primarily railroads and canals, but not ports? Further steps in the project include exploring potential shocks to market access, information and bureaucracy.

REFERENCES