Location Trends for the U.S. Auto Industry

Geography of Auto Production-
Will Detroit Continue to be the Industry’s Hub?
Detroit, Michigan
November 3, 2003

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Federal Reserve Bank of Chicago
Outline

- Geography of today’s auto industry
- Looking back: How did we get here
  - assembly plants
  - supplier plants
- Looking ahead: Evolving location of industry
The Bird’s Eye View: Assembly Plants

Auto assembly plants
The Bird’s Eye View: add Captive Suppliers

Captive supplier plants
The Bird’s Eye View: The Entire Industry
Zoom: Detroit Area as Hub of Auto Industry
In the Midwest, all roads lead to auto...

<table>
<thead>
<tr>
<th>Share of Plants within 400 miles of Detroit</th>
<th>U.S.</th>
<th>CDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly plants</td>
<td>58%</td>
<td>100%</td>
</tr>
<tr>
<td>Captive Plants</td>
<td>84%</td>
<td>91%</td>
</tr>
<tr>
<td>Tier 1 suppliers</td>
<td>65%</td>
<td>94%</td>
</tr>
</tbody>
</table>
Data analysis shows: Supplier networks are regional

Crucial: ability to deliver within a day

<table>
<thead>
<tr>
<th>Assembly company</th>
<th>Number of suppliers</th>
<th>Median Distance</th>
<th>% &lt; 100 miles</th>
<th>% &lt; 400 miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honda</td>
<td>507</td>
<td>251</td>
<td>17</td>
<td>77</td>
</tr>
<tr>
<td>Toyota</td>
<td>452</td>
<td>285</td>
<td>10</td>
<td>76</td>
</tr>
<tr>
<td>A.-Alliance</td>
<td>360</td>
<td>242</td>
<td>29</td>
<td>65</td>
</tr>
<tr>
<td>Nissan</td>
<td>460</td>
<td>423</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>Saturn</td>
<td>300</td>
<td>477</td>
<td>8</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: ELM, state manufacturing directories
Recap

- Today’s auto industry is spatially concentrated
- The auto corridor extends north-south; reaches into Canada and Mexico
- Transportation infrastructure influences plant location
Looking Back -- Assembly Plants

- Increased fragmentation of light vehicle market impacts location choices of assembly plants
  - Central location again preferred due to economics of transporting final good to entire market
Assembly Plants Re-Concentrate in Center

(Percent of light vehicle assembly plants in auto corridor -- WI, MI, IL, IN, OH, KY, TN)
Looking Back -- Supplier Plants (1)

- Long-term comparison reveals noticeable change in geography
From East-West to North-South in 55 Years

Distribution of Plants in SIC 3714

<table>
<thead>
<tr>
<th>State</th>
<th>1937</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>NY</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>OH</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>PA</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>6%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>1937</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>69%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54%</td>
</tr>
</tbody>
</table>

Source: Census
Looking Back -- Supplier Plants (2)

- More recent trends: Where have new supplier plants located since 1980?
Within Auto Corridor: More Rural/ Further South

County coded by first year of entry
Yet: Hub of Industry Continues to Attract Plants

County coded by last year of entry
On net: auto corridor has been extending south
Looking ahead - Evolving location of industry

- Border effect
- Location of assembly plants
- Location of supplier plants
Assemblers and suppliers are tightly linked across the U.S.-Canadian border. Yet physical movement of goods relies on few crucial border crossings. Ambassador Bridge alone is gateway for 27% of all US Canada US border traffic.

Security measures implemented in light of 9/11 increased the potential for delay at the border and have raised costs across the supply chain.

Bottom line: U.S. - Canada border now matters. Situation continues to be tenuous.
Who is likely to reduce assembly capacity?

Big Three vs Foreign Nameplate Share

Source: Ward's Automotive Yearbook
Assembly plant geography - recap

- Big 3 dominate the northern end of the auto corridor (WI, IL, MI, IN, OH). Today over half of all US light vehicle assembly plants remain in that region - 81% of these are Big Three facilities. Southern end of auto corridor is home to about 20% of assembly plants, half of which are foreign producer facilities.
Outlook for Supplier locations

- Changing regional distribution of assembly facilities matters
- Supply chains are regional, yet distance to customer assembly plants matters
- Supplier location choices influenced by:
  - assembly customer mix
  - assembly customer location
Who are your assembly customers?

The auto corridor has two parts

<table>
<thead>
<tr>
<th>Domestic supplier plants</th>
<th></th>
<th>Japanese supplier plants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer</strong></td>
<td>All</td>
<td>only Big 3</td>
<td>All</td>
</tr>
<tr>
<td>MI</td>
<td>31.3</td>
<td>40.0</td>
<td>OH</td>
</tr>
<tr>
<td>IN</td>
<td>10.9</td>
<td>11.4</td>
<td>KY</td>
</tr>
<tr>
<td>OH</td>
<td>10.4</td>
<td>10.2</td>
<td>TN</td>
</tr>
<tr>
<td>TN</td>
<td>6.3</td>
<td>4.2</td>
<td>IN</td>
</tr>
<tr>
<td>KY</td>
<td>4.1</td>
<td>1.8</td>
<td>MI</td>
</tr>
<tr>
<td><strong>Top 3</strong></td>
<td>52.6</td>
<td>61.6</td>
<td><strong>Top 3</strong></td>
</tr>
<tr>
<td>Number of plants</td>
<td>607</td>
<td>166</td>
<td></td>
</tr>
</tbody>
</table>

Supplier plants that opened between 1980 and 1997
Distance to customer matters

- Reliability of delivery crucial for operation of tight supply chains.

- Auto corridor’s transportation infrastructure is well developed and allows suppliers to serve multiple assembly plants from one location.

- Over what distance? Can ship from Grand Rapids, Michigan, to Louisville, Kentucky within a day (450 mile delivery radius), but not to San Antonio, Texas.
Distance to customer matters

2 Honda assembly locations

% suppliers within 400 miles

Honda Ohio  77%
Honda Al.   28%
Summary

- Border has become location factor

- Big Three assembly and parts capacity concentrated at the northern end of the auto corridor

- Suppliers value ability to serve multiple assembly plants from one location
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