Neither Core nor Periphery: Searching for Competitive Advantage in the Automotive Semi-Periphery

Greig Mordue
McMaster University
Hamilton, Canada
The Story

1. The ‘Automotive Semi-Periphery’ ... What’s That?

2. Research Questions

   a. Can semi-periphery automotive countries continue to attract investment in traditional automotive manufacturing activities despite their diminished competitive advantages?

   b. What challenges do semi-periphery countries face in their attempt to transition beyond automotive manufacturing and towards knowledge-based activities more frequently associated with the core?

   c. Can Industry 4.0 make the automotive industries in the semi-periphery resilient / resistant?
Categorization of Automotive Regions and Countries

Core ... Periphery ... Integrated Periphery ... Semi-Periphery

- Sturgeon and Florida (2000)
- Chanarron (2004)
- Sturgeon (2008)
- Domanski and Lung (2009)
- Muniz, Raya and Carvajal (2011)
- Lampon, Lago-Penas, Cabanelas (2016)
- Jacobs (2016)
- Domanski (2017)
### Consideration

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Core</th>
<th>Semiperiphery</th>
<th>Integrated Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign ownership and control</td>
<td>Low to medium</td>
<td>High</td>
<td>Very high</td>
</tr>
<tr>
<td>Domestic global assembly firms</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Number of domestic suppliers in the global top 100</td>
<td>High</td>
<td>Low</td>
<td>None or very low</td>
</tr>
<tr>
<td>Structure of automotive FDI</td>
<td>Outflows predominate</td>
<td>Mixed</td>
<td>Inflows predominate</td>
</tr>
<tr>
<td>R&amp;D: Spending, number of R&amp;D workers, patent applications</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Structure of assembled vehicles</td>
<td>High share of expensive vehicles</td>
<td>Mixed</td>
<td>High share of cheap/small vehicles</td>
</tr>
<tr>
<td>Structure of produced components</td>
<td>Higher share of technologically advanced components</td>
<td>Mixed</td>
<td>High share of generic and labor-intensive components</td>
</tr>
<tr>
<td>Capabilities of domestic suppliers</td>
<td>High</td>
<td>Mixed</td>
<td>Low</td>
</tr>
<tr>
<td>Supplier linkages</td>
<td>Predominantly developmental</td>
<td>Mixed</td>
<td>Predominantly dependent</td>
</tr>
<tr>
<td>Labour costs per employee</td>
<td>High</td>
<td>Medium to high</td>
<td>Low</td>
</tr>
<tr>
<td>Wage adjusted labor productivity</td>
<td>Low</td>
<td>Low to medium</td>
<td>High</td>
</tr>
<tr>
<td>Examples</td>
<td>Germany, United States</td>
<td>Britain, Canada</td>
<td>ECE, Turkey, Mexico</td>
</tr>
</tbody>
</table>

**Pavlinek (2018)**

“Global Production Networks, Foreign Direct Investment, and Supplier Linkages in the **Integrated Peripheries** of the Automotive Industry”

**PLUS ...**

Brief discussion to the **Automotive Semi-Periphery**
Categorization of Automotive Jurisdictions:
- **Core**
- **Semi-Periphery**
- **Integrated Periphery**

Canada is the prototypical automotive semi-periphery nation.
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c. Can Industry 4.0 make the automotive industries in the semi-periphery resilient / resistant?
<table>
<thead>
<tr>
<th>Program</th>
<th>Jurisdiction</th>
<th>Sector</th>
<th>Purpose</th>
<th>Type</th>
<th>Time Period</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario Automotive Investment Strategy</td>
<td>Ontario</td>
<td>Automotive</td>
<td>Capital</td>
<td>Cash</td>
<td>2004-2012</td>
<td>500,000</td>
</tr>
<tr>
<td>Jobs and Prosperity Fund</td>
<td>Ontario</td>
<td>Manufacturing</td>
<td>Capital</td>
<td>Cash</td>
<td>2012-Present</td>
<td>1,230,000</td>
</tr>
<tr>
<td>Program for Strategic Industrial Projects</td>
<td>Federal</td>
<td>Automotive</td>
<td>Capital</td>
<td>Loan</td>
<td>2005-2008</td>
<td>303,716</td>
</tr>
<tr>
<td>Automotive Innovation Fund</td>
<td>Federal</td>
<td>Automotive</td>
<td>Capital</td>
<td>Loan</td>
<td>2008-2017</td>
<td>569,605</td>
</tr>
<tr>
<td>Strategic Innovation Fund</td>
<td>Federal</td>
<td>Manufacturing</td>
<td>Capital</td>
<td>Cash</td>
<td>2017-2022</td>
<td>1,260,000</td>
</tr>
<tr>
<td>Scientific Research and Experiment Development (SRED) Tax Credit</td>
<td>Federal</td>
<td>General</td>
<td>R&amp;D</td>
<td>Tax Credit</td>
<td>1986-Present</td>
<td>n/a</td>
</tr>
<tr>
<td>Ontario R&amp;D Tax Credit</td>
<td>Ontario</td>
<td>General</td>
<td>R&amp;D</td>
<td>Tax Credit</td>
<td>Present</td>
<td>n/a</td>
</tr>
<tr>
<td>Ontario Innovation Tax Credit</td>
<td>Ontario</td>
<td>General</td>
<td>R&amp;D</td>
<td>Tax Credit</td>
<td>Present</td>
<td>n/a</td>
</tr>
<tr>
<td>Sustainable Development Technology Canada</td>
<td>Federal</td>
<td>Manufacturing</td>
<td>R&amp;D</td>
<td>Cash</td>
<td>2001-Present</td>
<td>989,000</td>
</tr>
<tr>
<td>Automotive Partnership Canada</td>
<td>Federal</td>
<td>Automotive/University</td>
<td>R&amp;D</td>
<td>Cash</td>
<td>2013-2018</td>
<td>145,000</td>
</tr>
</tbody>
</table>
The Semi-Periphery’s Declining Relevance for Vehicle Assembly: Vehicle Production in the 25 Highest-Wage Countries (Core + Semi-Periphery)

Attracting Traditional Manufacturing Activities
## The Semi-Periphery’s Declining Relevance for Vehicle Assembly: Vehicle Production in Semi-Periphery

<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>2000</th>
<th></th>
<th>2018</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vehicle Production</td>
<td>Share of Global Production</td>
<td>Share of Regional Production</td>
<td>Vehicle Production</td>
</tr>
<tr>
<td>North America</td>
<td>Canada</td>
<td>2,961,636</td>
<td>5.07%</td>
<td>16.73%</td>
<td>2,014,485</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>1,813,894</td>
<td>3.11%</td>
<td>8.95%</td>
<td>1,604,328</td>
</tr>
<tr>
<td></td>
<td>Austria</td>
<td>141,026</td>
<td>0.24%</td>
<td>0.70%</td>
<td>164,900</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>3,032,874</td>
<td>5.20%</td>
<td>14.96%</td>
<td>2,819,565</td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td>301,343</td>
<td>0.52%</td>
<td>1.49%</td>
<td>226,000</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>1,033,294</td>
<td>1.77%</td>
<td>5.10%</td>
<td>308,493</td>
</tr>
<tr>
<td></td>
<td>Finland</td>
<td>38,926</td>
<td>0.07%</td>
<td>0.19%</td>
<td>112,104</td>
</tr>
<tr>
<td><strong>European Semi-Periphery</strong></td>
<td></td>
<td>6,361,357</td>
<td>10.90%</td>
<td>31.37%</td>
<td>5,235,390</td>
</tr>
<tr>
<td><strong>Total Semi-Periphery</strong></td>
<td></td>
<td>9,322,993</td>
<td>15.97%</td>
<td>NA</td>
<td>7,249,875</td>
</tr>
</tbody>
</table>
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Canada’s Transition to a Knowledge-Based Profile

R&D as a means by which to ...

“lock down and anchor the base, but at the same time, look to the future and be embedded at a very fundamental, elemental level in the technological disruption that will occur”

Government of Canada
Interview
Automotive R&D Spending in Canada 2001 - 2016

But ... there are problems with spending data ...

- Sector-level data not available
- No firm-level data
- Comparative analysis not available

Source: Statistics Canada (2018b; 2018c)
Patents

Why Patents?

• Reveal high-level patterns consistent with output-based statistics (i.e. spending)

But also ...

• Classified across technological fields (automotive, software etc.)

• Contain detailed geographic and firm-level information

What did our Database yield?

• 1,209,851 automotive-related patents filed between 2001 and 2016.

• Two methods to identify patents as automotive-related.
  1. International Patent Classification (IPC) of B60 (Automotive)
  2. Patents not classified as B60 deemed “automotive” if assigned to designated auto firms
Transition to Knowledge-Based Profile

Patents vs R&D Spending

Canadian B60 Patents (Left Axis)  % Global B60 Patents (Right Axis)
Canada’s Share of Global Vehicle Production, Vehicle Sales, and B60 Patents, 2001-2016
On the Importance of Automakers as a Means to Drive R&D ...

‘... there are only a handful of OEMs so attracting an OEM to your jurisdiction is an incredible thing. We’re so lucky that we have five. That’s an incredible base to start with and anybody else would die for that. And it’s an opportunity to not be squandered. You have to think of those OEMs as anchors that you can build around.’

OEM Executive Interview
Automakers’ Canadian Subsidiaries’ Total Patents, Vehicle Production, and Vehicle Sales as a % of Automakers’ Global Total, 2001-2016
If not the OEMs, what about the Tier 1s?

“I thought the way ahead for Canada, because we don’t have a Canadian-headquartered automaker, was to ensure that our Tier 1s were keenly aware of the capacity we had in technology.”

Senior Policy Maker
Interview
# Location of Canada’s Global Top 100 Patents, 2001-2016

<table>
<thead>
<tr>
<th>Company</th>
<th>Global Rank (2016)</th>
<th>Global Revenue US $000,000 (2016)</th>
<th>% of R&amp;D in Canada</th>
<th>% of R&amp;D Outside of Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magna</td>
<td>3</td>
<td>36,445</td>
<td>18.2%</td>
<td>81.8%</td>
</tr>
<tr>
<td>Linamar</td>
<td>59</td>
<td>3,527</td>
<td>2.7%</td>
<td>91.3%</td>
</tr>
<tr>
<td>Martinrea</td>
<td>68</td>
<td>2,951</td>
<td>26.8%</td>
<td>73.2%</td>
</tr>
<tr>
<td>ABC Group</td>
<td>98</td>
<td>948</td>
<td>57.4%</td>
<td>42.6%</td>
</tr>
<tr>
<td>Multimatic</td>
<td>99</td>
<td>940</td>
<td>82.2%</td>
<td>17.8%</td>
</tr>
</tbody>
</table>

*Transition to Knowledge-Based Profile*

Global Volume

Canada

Canada Share of Global Patent Applications

Transition to Knowledge-Based Profile
Global Location of Autonomous Vehicle Research

Share of Global AV-Related Patents

Michigan and California Share of Global AV-Related Patents
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Industry 4.0: A Strategy of Resilience? ... Resistance?

Q. Which of the following new production technologies are you currently using in your facility?

- Cybersecurity
- Collaborative/Smart Robots
- Internet of Things
- VR or 3D Simulations
- Additive Manufacturing
- Cloud Computing
- Big Data and Analytics
- Sensors

Q. Which of the following obstacles has your facility experienced implementing Industry 4.0?

- Lack of parent company interest
- Lack of customer interest
- Lack of relevant technological information
- Not relevant to the current operation of our plant
- Lack of financing
- Lack of skilled personnel
- High costs
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