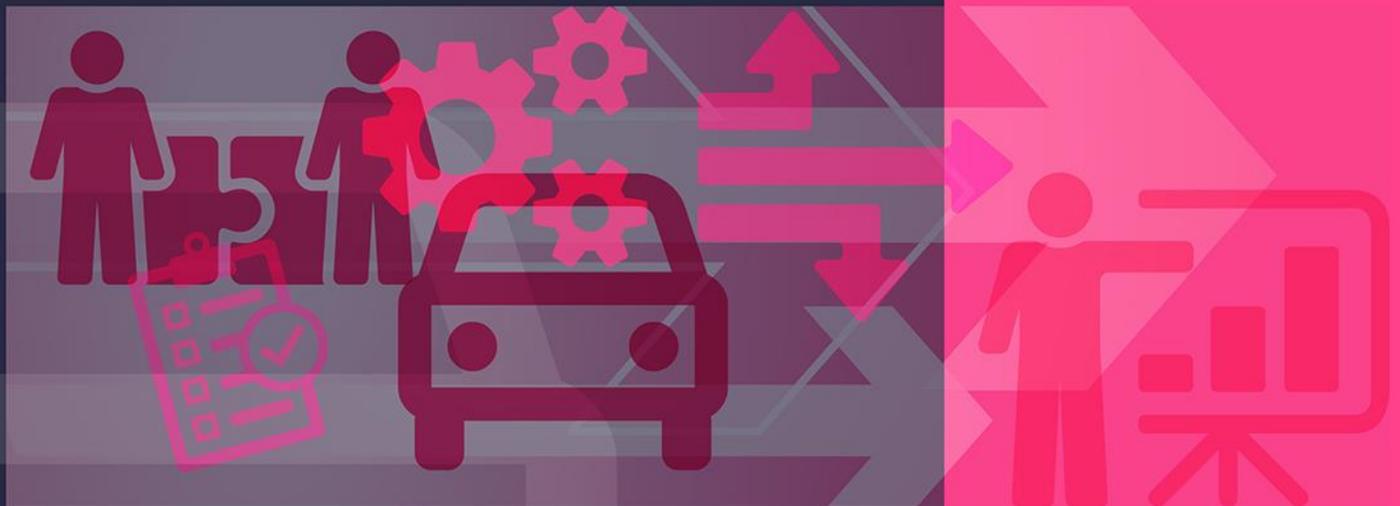


# AUTOMOTIVE INDUSTRY LABOUR MARKET ANALYSIS

## THE ECONOMIC IMPACT OF EXPANDING AUTOMOTIVE PRODUCTION



The project is a collaboration of the Canadian Skills Training and Employment Coalition, Prism Economics and Analysis, and the Automotive Policy Research Centre.

August, 2021

[futureautolabourforce.ca](http://futureautolabourforce.ca)

**THIS PAPER** was prepared for the Auto Labour Market Information (LMI) Project, now known as the Future of *Canadian Automotive Labourforce (FOCAL) Initiative*.

The goal of the project is to help stakeholders better understand the automotive labour market. The Project will create industry-validated, regional, occupational supply and demand analyses and forecasts and skill profiles for skilled trades and other key skilled occupations in the broader automotive sector including vehicle assemblers, parts manufacturers and technology companies that supply the industry. The project will also examine various labour market trends in the sector and facilitate discussions among stakeholders about how to address any forecasted skills shortages and other labour market challenges. The planned outcome of the project is enhanced regional labour market information that will support colleges, employers, policy makers and other stakeholders in taking practical steps to address skills shortages and other labour market challenges in the automotive sector.

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## EXECUTIVE SUMMARY

This report uses Statistics Canada Input-Output tables to assess the size and the extent of the supply chain for automotive production in Canada. Auto assembly and parts manufacturing are core automotive production industries and are among Canada's largest manufacturing industries. Findings reveal important and distinctive links that further expand the size and strategic importance of the industry. The report also confirms connections to industries that have not been traditionally included in automotive activity.

FOCAL research asserts that traditional definitions and descriptions of the automotive industry have underestimated its true size. Input-Output (IO) based research adds depth to the analysis in the FOCAL report "Defining the Broader Automotive Sector". Similarly, findings here describe how raising production, across the broader industry, will change a large workforce and key occupations. Related human resource management challenges are the topic of a FOCAL report "Upside and Downside Risks in Labour Markets".

Analysis starts with the core automotive industries: vehicle assembly and parts manufacturing. The Statistics Canada Input-Output model is used to generate two simulations that track the expansion of supplying industries, income, spending and employment as production increases. The simulation results reveal the distribution of change across supplying industries, imports, income, and employment. Further, simulations track the differences in assembly and parts supply chains and their distinct connection to other primary supplier industries.

IO tables provide the most detailed accounting of supply chains across the economy. A computerized model of these links translates a chosen increment to industry production or demand into measures the expanding effects of a change across production and employment at each point in the economy.

To illustrate the economic impact of the sector, FOCAL ran two IO model simulations increasing activity by 20%. The selected 20% change reflects historical cycles in production levels over a period of one or two years. For example, if Canadian employers in the automotive assembly can add to the number of production mandates they have, the Canadian economy and its workforce would benefit greatly. Similarly, changes in trade conditions could

open important opportunities for parts exports into the broader North American automotive market.

The first simulation increased production in the assembly industry by 20%. This increase represents a \$12 billion increase in the base production levels of \$61.4 billion (2015). This is roughly the equivalent of the addition of two new assembly plants operating at capacity. A total employment change of 34,900 jobs would result from the production increase. This increase is divided among 7,800 in assembly, 3,700 in parts manufacturing, 5,900 in other primary automotive supplier industries and 17,500 jobs created across the broader economy<sup>1</sup>.

The second simulation increased exports in the parts industry by 20%. This increase represents a \$4.1 billion change in base export activity of \$20.5 billion (2015). The total employment change of 22,850 is distributed across 8,500 jobs in parts manufacturing, 3,850 jobs in assembly and other primary supplying industries and 10,500 jobs across the broader economy.

Important economic and technological benefits flow through the economic linkages described in this paper. Research by FOCAL measures these impacts and provides detailed analysis of the human resource management, training, and policy challenges that are likely in the automotive production industry's future<sup>2</sup>.

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<sup>1</sup> One finding in the FOCAL research was that the traditional definition of automotive production as assembly and parts manufacturing does not recognize the critical roles of 31 "Other primary supplier industries". See, "Defining Broader Automotive Sector, Future of Canadian Automotive Labourforce Initiative (FOCAL), 2019."  
<https://www.futureautolabourforce.ca/trend-report/defining-the-broader-automotive-sector/>

<sup>2</sup> Insert reference to Upside / Downside reports for Ontario and Quebec

## INTRODUCTION

This FOCAL report is a companion to the “The importance of Automotive Production in Canada”. FOCAL research identifies a broader view of the industry that includes dedicated suppliers beyond the core assembly and parts manufacturing industries. This report uses the Statistics Canada’s Interprovincial Input-Output (IO) table to explore the details of this extended supply chain and to track changes associated with an increase in Canadian Automotive Production. The extent of these changes is measured with two simulations to the IO model. The first changes in automotive assembly production. The second tracks a change in exports of parts.

Simulation results and their implication for activity in specific industries are described in four sections. This introduction is followed by a second section that focuses on methodology. It includes a description of the industries included in the FOCAL definition of the broader automotive industry and then provides an outline of the Statistics Canada Interprovincial IO Model.

A third section sets out the details of a simulation of the effects of adding 20% (\$12.0 billion) to production levels. The fourth section describes a simulation of a 20% (\$4.0 billion) increase in exports of manufactured parts.

A fifth section digs deeper into the IO model results; looking at the geographic and technological impacts and at more detailed occupational analysis. A sixth, concluding section, draws out the key finding that manufacturers across the FOCAL Automotive Production Sector are a critical source of national activity and wealth.

## METHODOLOGY

Each year Statistics Canada updates Input-Output Tables that measure the patterns of purchases and sales that connect industries with each other and with final demand and incomes. The result is a matrix or table that lists industries, final demand and income categories across the columns and rows. Industries in the tables are defined by the North American Industrial Classification System (NAICS) and final demand and income measures are taken from the System of National Accounts. Tables are created for each province and both interprovincial and international trade activity are included. Input-output tables are converted into computer models that can be used to simulate the impact of economic changes across industries and employment<sup>3</sup>.

The Statistics Canada Interprovincial Input-Output table is the best starting point for analysis of supply chains and economic links across a complex group of industries. These tables are built up from a wide range of Statistics Canada surveys and analysis including the National Accounts and detailed industry and employer surveys. The detailed version of the IO Table identifies 230 industries, each defined at the 4- or 5-digit North American Industry Classification System (NAICS) levels. This level of detail recognizes the individual automotive industries set out in Figure 1. Industry linkages measured in the IO table are the basis for the simulations provided in this paper and in the FOCAL production and labour force models<sup>4</sup>. There are delays in the release of IO tables and the most recent release, available for FOCAL analysis, was 2015. Readers will notice that exhibits tracking the structure of the economy use data for 2015 taken from the IO tables<sup>5</sup>.

Each simulation of the Statistics Canada Interprovincial IO Model calculates direct, indirect, and induced changes across the economy. These changes are called “impacts” and each impact is uniquely determined by the assumed change to production and demand.

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<sup>3</sup> Statistics Canada maintains the Interprovincial Input-Output models and offers users access to model simulations. FOCAL requested two simulations and the results received from Statistics Canada serve as the basis for most of this report.

<sup>4</sup> FOCAL has created economic models of the broader automotive industry and used these to prepare base case and alternative simulations. Model results are reported in a series of FOCAL reports <https://www.futureautolabourforce.ca/labour-market-forecasts/>

<sup>5</sup> Readers can refer to Appendix 1 for a glossary of terms and definitions

*Direct impacts* measure the first-round labour requirements and purchases from supplying industries needed to produce the needed output of a given industry.

*Indirect impacts* measure the changes due to inter-industry purchases among successive suppliers as they respond to the new demands.

*Induced impacts* measure the changes in the production of goods and services in response to consumer expenditures induced by the households' jobs and incomes (i.e., wages) generated by the production of the direct and indirect requirements.

*Total impact* is equal to the sum of the direct, indirect and induced impacts.<sup>6</sup>

The IO table measures these changes for 230 industries and 44 components of final demand. The next section summarizes the impacts and focuses on the change in output and employment and the distribution of change among industries and final demand. The IO model includes trade flows, and this links Canadian activity to the supply chain in other countries. This is important as there are large changes to imports in industries across the automotive production sector. Impacts are spread across all provinces and territories tracking interprovincial exports and imports and the final change in output.

## **The Automotive Production Industry as Defined by FOCAL**

The automotive industry is a complex and dynamic network of connected businesses.

Figure 1 defines the FOCAL Automotive Production industry in three parts:

- Vehicle Assembly
- Vehicle Parts Manufacturing
- Other Primary Automotive Suppliers

Vehicle Assembly and Parts Manufacturing together were often understood to be the entire industry. But research shows that other industries and key firms have a very close association with assembly and parts and these industries are included as Other Primary Automotive

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<sup>6</sup> Source; Explanatory Notes, Statistics Canada Interprovincial Input-Output Model, 2015, Macroeconomics Accounts Branch, Industry Accounts Division.

Suppliers in the FOCAL definitions<sup>7</sup>. Figure 1 sets out these industries and their links<sup>8</sup>. Vehicle assembly is defined to include both light vehicles and heavy truck and bus manufacturing. Eight parts manufacturing industries sell to each other and to the assemblers and are included in the traditional definition. Both assemblers and parts manufacturers export a very large portion of their output and are often linked to a North American supply chain. The Other Primary Automotive Suppliers were chosen based on:

- their reliance on the assembly and parts industries as major customers **or**
- their strategic importance.

Figure 1 includes, for each of the Other Primary Automotive Supplier industries, the proportion of their sales to the core Assembly and Parts industries.

FOCAL's definition of the automotive production industry was based on a combination of both "top-down" and "bottom-up" industry analysis. The Statistics Canada IO tables are applied to get a "top-down" perspective, whereas the unique APRC database<sup>9</sup> of automotive manufacturing establishments and businesses was used for the "bottom-up" approach.

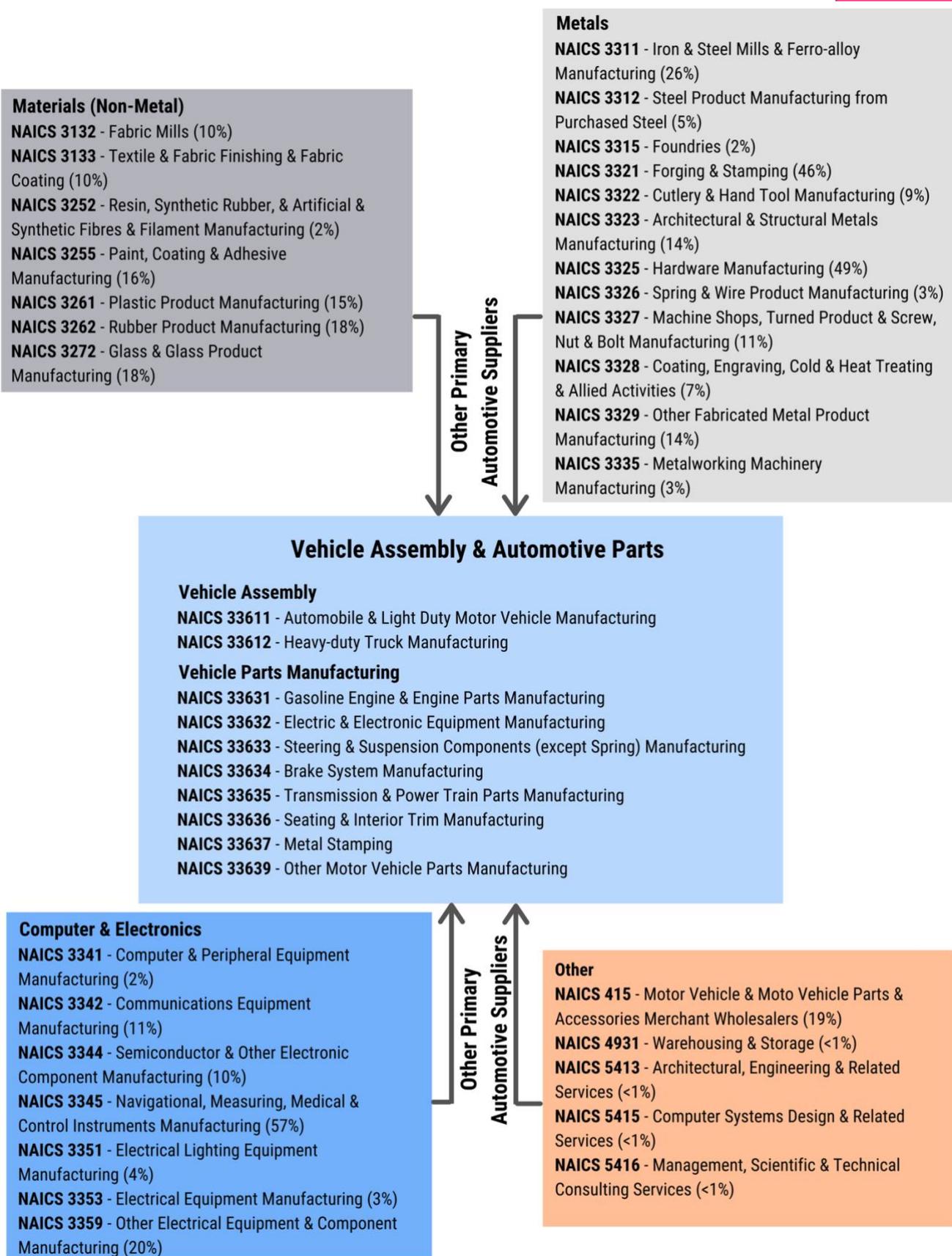
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<sup>7</sup> Defining the Broader Automotive Sector, Future of Canadian Automotive Labourforce Initiative (FOCAL), 2019.

<sup>8</sup> The Statistics Canada Interprovincial Input-Output table is the best starting point for analysis of supply chains and economic links across a complex group of industries. Industry linkages measured in the IO Table are the basis for the impact analysis provided in this paper and in the FOCAL production and labour force models. References to "industries" correspond to NAICS definitions. A major drawback to the use of the IO tables is that the most recent release is for 2015. Readers will notice that Exhibits tracking the structure of the economy use data for 2015 taken from the IO Tables.

<sup>9</sup> The Automotive Policy Research Centre (APRC) Database comprises a list of more than 1,400 automotive manufacturing and automotive technologies companies and organizations across Canada, with details on products, processes, employment, and numerous other indicators.

**Figure 1. FOCAL-defined Automotive Production Industry**



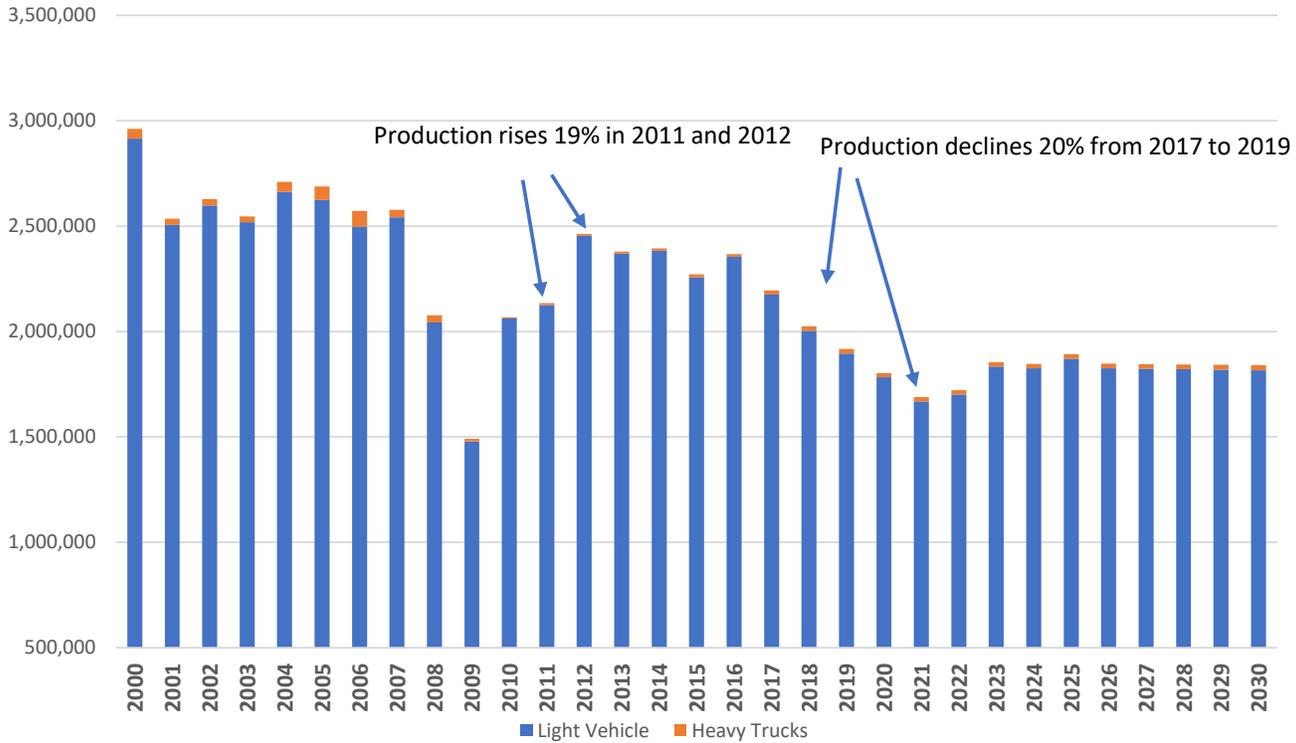
## SIMULATION #1 - A 20% INCREASE IN THE ASSEMBLY INDUSTRY

Canada's vehicle, heavy truck and bus assembly industry produced \$61.4 billion in output in 2015. Vehicle production was concentrated in nine major assembly plants owned by five OEMs, and 85% of assembly output is exported. Vehicle assembly is the largest of 72 manufacturing industries. A major change in activity in a single assembly plant sends a huge shock wave across the economy.

FOCAL tested the impact of a 20% change in the output of the assembly industry. A change of this magnitude is certainly possible as cycles, between 2008 and 2019, in overall activity, included both gains and losses of this size. Indeed, assembly gained 19% from 2011 to 2012 and then dropped 20% from 2017 to 2019. Figure 2 tracks these year-to-year changes. These changes were roughly the equivalent of the addition of two assembly plants operating at capacity.

The assumed 20% change is also consistent with overall industry capacity. For example, the Bank of Canada measures of industrial capacity utilization rates for vehicle assembly to have been between 80% and 90% from 2010 to 2019 and to have been 83% at the end of the study period.

**Figure 2. Change in Vehicle Assembly, 2008 – 2019 (CVMA)**



**Source:** International Organization of Motor Vehicle Manufacturers (2000 – 2019); LMC Automotive (2022 – 2030).

Table 1 summarizes the impacts of a 20% increase in assembly activity across the entire national economy, as measured by the IO Model. Each row in the table distributes the total national impacts across **Vehicle Assembly**, **Vehicle Parts Manufacturing**, the **Other Primary Automotive Suppliers**, and all other industries. Each column allocates the total national impacts to direct plus indirect impacts and total impacts for output and jobs.

**Table 1. National Economic Impact of a 20% (\$12 billion) Increase in Assembly**

	Industry Output		Jobs (FTE) #	
	Direct + Indirect	Total	Direct + Indirect	Total
Vehicle Assembly	\$12,881,353	\$12,903,319	7,803	7,816
Vehicle Parts Manufacturing	\$1,547,609	\$1,552,179	3,688	3,699
<b>Total Vehicle Assembly + Parts Manufacturing</b>	<b>\$14,428,962</b>	<b>\$14,455,498</b>	<b>11,491</b>	<b>11,515</b>
Materials, Non-metals	\$718,342	\$729,102	2,331	2,366
Metals	\$362,353	\$369,511	1,152	1,178
Computer & Electronics	\$32,738	\$34,905	110	117
Distribution, Engineering & Management	\$713,770	\$1,889,952	2,127	2,314
<b>Total Other Primary Automotive Suppliers</b>	<b>\$1,827,203</b>	<b>\$1,889,952</b>	<b>5,720</b>	<b>5,974</b>
<b>Total All Other Automotive Suppliers</b>	<b>\$2,442,683</b>	<b>\$4,099,700</b>	<b>10,384</b>	<b>17,445</b>
<b>Total Impact</b>	<b>\$18,699,849</b>	<b>\$20,445,151</b>	<b>27,595</b>	<b>34,934</b>

Source: Statistics Canada

Focusing first on the direct plus indirect impacts, it is important to note that more than half of the initial \$12 billion increase in assembly is supplied by the Vehicle Parts Manufacturing industry (about \$7.1 billion). But \$5.5 billion of these parts are *imported*, leaving an impact of \$1.6 billion on domestic parts production. Impacts in the parts manufacturing industries are limited by direct imports. Indeed, parts production in Canada is tightly linked to both exports and imports. This dynamic is further analyzed in the second simulation.

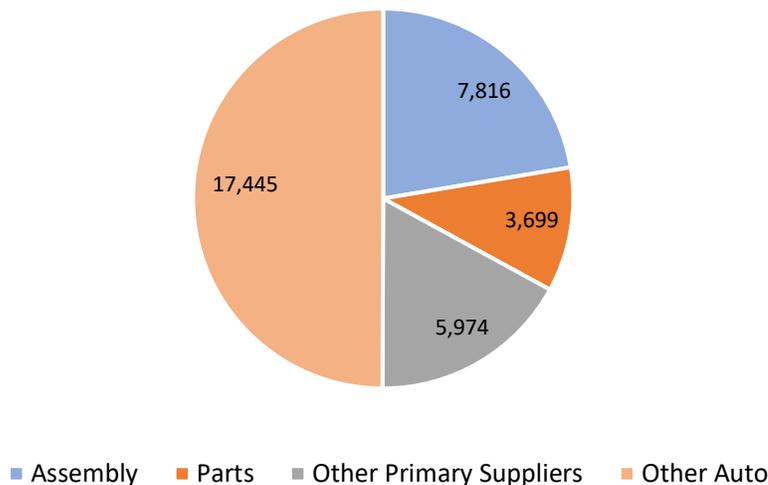
Notice that the industries tracked in the Other Primary Automotive Suppliers create a *larger* direct plus indirect impact (\$1.8 billion) than the parts sector (\$1.6 billion). Specifically, large indirect impacts are concentrated in plastics (included in non-metal materials) and wholesale, transportation, and other processing work (included in all other automotive suppliers)<sup>10</sup>.

<sup>10</sup> The FOCAL report “Defining the Broader Automotive Sector” highlighted the importance of links to the plastics industry is one example of how the NAICS classification allocates activity dedicated to automotive production to outside industries and the FOCAL definition of other primary industries is designed to correct this misrepresentation.

Looking at *total* impacts, employment impacts are particularly large (7,816 jobs) of the assembly industry. However, there are also significant total labour requirements in Parts (3,699 jobs). As noted, more jobs are added through the total impact in Other Primary Automotive Suppliers (5,974 jobs) than in Parts manufacturing. Indeed, these large impacts across the Other Primary Parts Suppliers are the main reason for adding these employers to the expanded definition of the industry. Their role in the supply chain is at least as important as the companies that self-identify as Vehicle Parts Manufacturers.

The total employment impacts across the Other Primary Suppliers span a wide range of activity. One large component is added activity in wholesale and distribution activity dedicated to the automotive sector. Often these jobs are added in logistics operations attached to OEM Assembly Plants. These job gains form the largest part (1,577) of the 2,314 total job gains reported for Distribution, Engineering and Management.

**Figure 3. Total Impact of a 20% (\$12 billion) Increase in Production**



**\*Total Impact = Direct + Indirect + Induced**

**Source:** Statistics Canada Interprovincial Input-Output Model (2015)

Jobs created in the remaining Engineering and Management positions as well as jobs added in the Computer and Electronics were separated out in the FOCAL analysis to highlight technological change and the key occupations that will be impacted in the simulations. Just over 600 jobs would be added in engineering, management, design and other tech industries supplying the assembly plants.

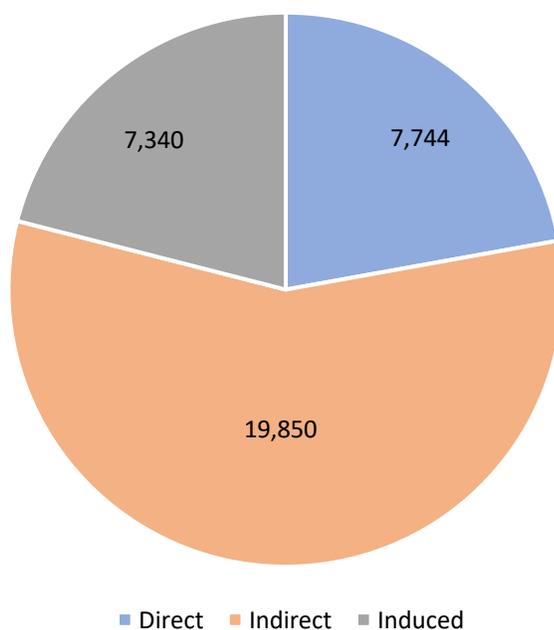
There is a large total employment effect spread across the other automotive suppliers in the rest of the economy. Overall, 17,445 jobs are added to meet the total impacts on new demand for goods and services. This includes work in areas like electricity generation, truck and rail transportation, finance and other services. The FOCAL labour market models assess the challenges in each industry and across 49 occupations in adapting to these needs.

Finally, there are the widely dispersed induced effects that capture the increased purchasing power that spread out from rising employment and consumer spending. There impacts are measured as total impacts (i.e., 34,935 jobs) less direct plus indirect impacts (i.e., 27,535 jobs). These create another \$1.75 billion in spending and 7,340 jobs. The distribution of total impacts across employment in the major industry groups is set out in Figure 3

Impacts reported here cover the combined activity of two assembly industries: vehicles and heavy truck and bus. Vehicle assembly at \$61.4 billion dominates the overall effects. Heavy truck and bus assembly at \$2.9 billion has a distinct supply chain and related links to both domestic suppliers and international trade. The final section of this report considers these impacts in more detail.

The distribution across direct, indirect and induced impacts is set out in Figure 4. Almost all of the induced impacts are in Other Auto Suppliers.

**Figure 4. The Impact of a 20% Increase in Vehicle Assembly**



**Source:** Statistics Canada Interprovincial Input-Output Model (2015).

## SIMULATON #2 - A 20% INCREASE IN PARTS EXPORTS

The Vehicle Parts Manufacturing industry is structurally distinct from assembly in at least two important ways. First, parts production in Canada is spread across eight very different industries<sup>11</sup>:

1. Engines
2. Electrical and Electronic Parts
3. Steering and Suspension
4. Brake
5. Transmissions and Power trains
6. Seating and Interior Trim
7. Metal Stamping
8. Other parts

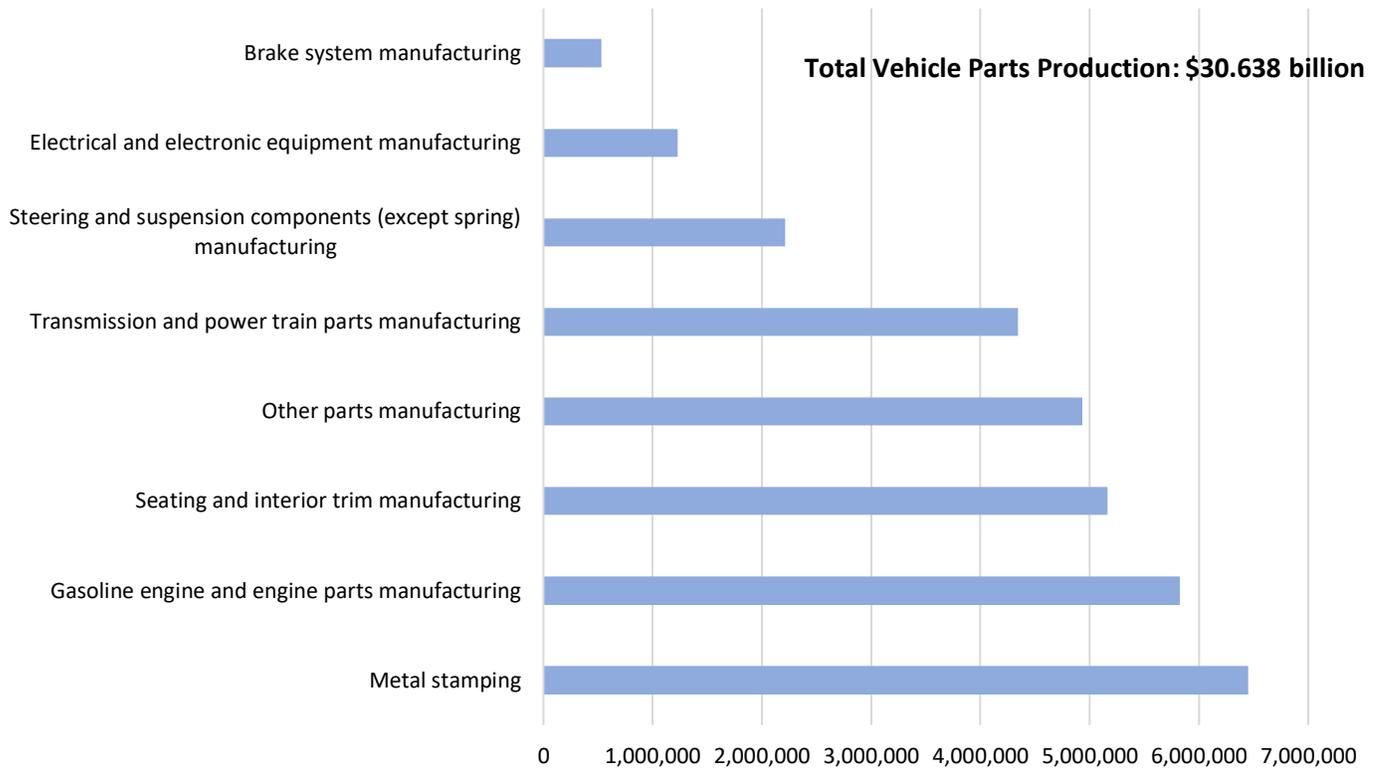
Each industry has a unique profile in terms of size, ownership, and the distribution of customers. Total production, at \$30.6 billion in 2015, makes Vehicle Parts Manufacturing the second largest among Canada's 73 manufacturing industries<sup>12</sup>. There are important differences in size with Metal Stamping production twelve times larger than Brake Systems. Figure 5 sets out production levels in 2015.

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<sup>11</sup> In the NAICS industry classification Vehicle Parts Manufacturing (3363) is a four-digit industry comprised of the eight five-digit industries (33631, 33632, 33633, 33634, 33635, 33636, 33637, 33639)

<sup>12</sup> Industry comparisons in the report are all based on the detailed level industry definition in the 2015 Statistics Canada Input -Output Model. These industry definitions are equivalent to four- and five-digit NAICS classifications.

Figure 5. Vehicle Parts Production, Canada (2015)

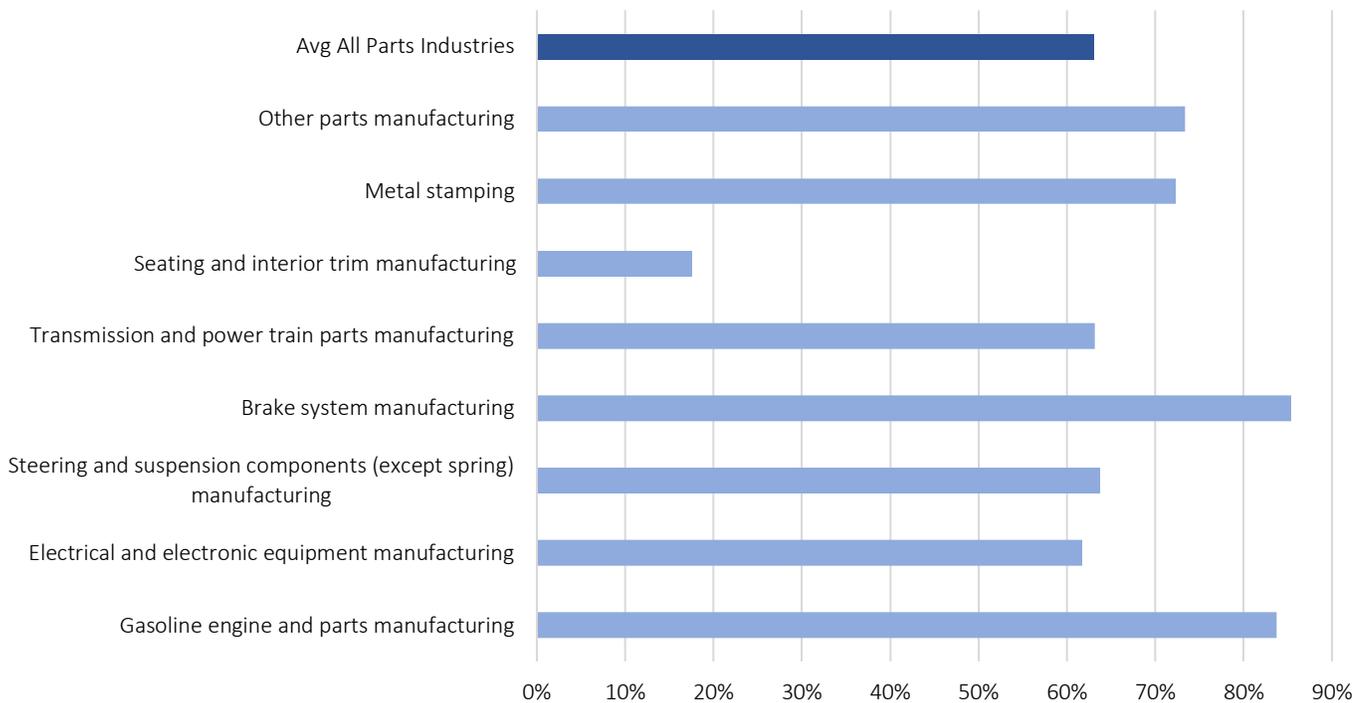


**Source:** Statistics Canada Interprovincial Input-Output Model, 2015 - IOTs symmetric D 2015 by province.

Seven of the eight parts industries export more than half of their output to assembly and related customers *outside Canada*. There are wide variations in export markets, with engines and brake systems tied almost completely to US and international assembly while seating and interiors are linked to Canadian assembly. There is an equivalent trade structure in Canada with, for example, extensive reliance on imported engines.

Figure 6 tracks exports as a percentage of output. On average over 60% of production across all eight parts industries is exported.

**Figure 6. Automotive Parts Industries - Exports as a Share of Output**



**Source:** Statistics Canada Interprovincial Input-Output Model, 2015 - IOTs symmetric D 2015 by province.

The second simulation of the Statistics Canada Interprovincial IO Model is designed to trace the impact of these export relationships. A 20% increase (\$4.2 billion) in exports of manufactured parts is introduced to the IO Model. Higher exports increased activity across direct and indirect suppliers. Table 2 provides the results of the Interprovincial I-O simulation. Each row in the table distributes the total national impacts across the vehicle assembly, vehicle parts, Other Primary Automotive Suppliers and other automotive supplier groups. Each column allocates the total national impacts to direct plus indirect impacts and total impacts for output and jobs.

The export shock totals \$4.21 billion, or 20% of a total of \$20.0 in parts exports, on a commodity basis in 2015.<sup>13</sup> To meet these higher production levels, these eight parts industries need to draw on \$789 million in international imports and this reduces the overall indirect gains. The total impact on employment in the parts industries is 8,489 jobs – about

<sup>13</sup> Export and import values are measured on a commodity basis and then converted into industry totals in the IO Model system. Total exports by the Parts Industry, on a commodity basis, is \$21.065 billion, differing slightly from the industry basis total of \$19.430 billion.

10% of the starting workforce. Note that the impacts are distributed across the eight industries according to both their overall size and export markets.

Reviewing impacts reported in Table 2 shows a small change in the Assembly industry as the industry is downstream from the parts industries and its suppliers. The limited impacts are linked to the induced gains in consumer spending for new vehicles.

The distribution of the Direct and Indirect impacts across the eight industries reflects both their relative size and export dependence. For example, even though the brake system industry has the highest export orientation, the small impact reflects its relatively small size.

**Table 2. National Economic Impact of a 20% Increase in Vehicle Parts Exports**

	Industry Output (\$, thousands)		Jobs (FTE) #		
	Direct + Indirect	Total	Direct	Direct + Indirect	Total
<b>Vehicle Assembly</b>	\$20,996	\$34,149	13	15	22
<b>Vehicle Parts Manufacturing</b>					
Gasoline Engine & Engine Parts Manufacturing	\$979,515	\$979,727	1,386	1,424	1,425
Electrical & Electronic Equipment Manufacturing	\$156,813	\$156,933	432	448	449
Steering & Suspension Components (except Spring) Manufacturing	\$251,399	\$251,584	505	552	553
Brake System Manufacturing	\$77,944	\$77,958	238	239	239
Transmission & Powertrain Parts Manufacturing	\$558,433	\$558,830	1,420	1,490	1,491
Seating & Interior Trim Manufacturing	\$250,038	\$251,108	493	630	632
Metal Stamping	\$877,858	\$878,283	1,975	2,044	2,045
Other Parts Manufacturing	\$603,301	\$608,618	1,621	1,661	1,662
<b>Total Vehicle Parts Manufacturing</b>	<b>\$3,760,301</b>	<b>\$3,763,042</b>	<b>8,069</b>	<b>8,489</b>	<b>8,496</b>
<b>Total Vehicle Assembly + Parts Manufacturing</b>	<b>\$3,781,296</b>	<b>\$3,797,191</b>	<b>8,082</b>	<b>8,504</b>	<b>8,518</b>
<b>Other Primary Automotive Suppliers</b>					
Materials, Non-metals	\$143,307	\$149,818	71	458	479
Metals	\$650,652	\$655,003	428	1,986	2,001
Computer & Electronics	\$35,191	\$36,509	87	123	127
Distribution, Engineering & Management	\$339,576	\$365,491	598	1,109	1,223
<b>Total Other Primary Automotive Suppliers</b>	<b>\$1,168,726</b>	<b>\$1,206,821</b>	<b>1,184</b>	<b>3,675</b>	<b>3,830</b>
<b>Other Automotive Suppliers</b>	<b>\$1,533,614</b>	<b>\$2,539,699</b>	<b>967</b>	<b>6,158</b>	<b>10,445</b>
<b>Total Impact</b>	<b>\$6,483,637</b>	<b>\$7,542,711</b>	<b>10,233</b>	<b>18,337</b>	<b>22,793</b>

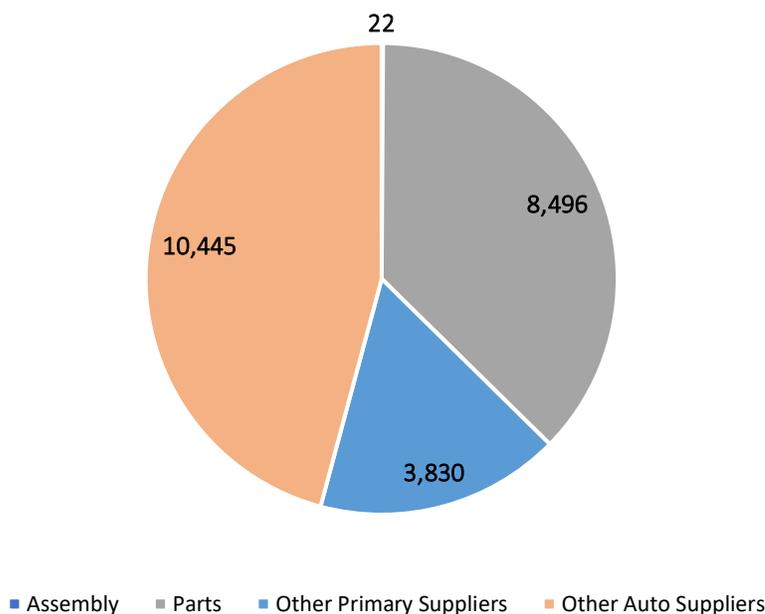
Source: Statistics Canada

Total impacts across industries are reported in Figure 7. This shows a total impact in the Other Primary Automotive Suppliers of \$1.2 billion and employment by 3,830 jobs. The largest impacts in the other primary industries are concentrated in Metals Suppliers and in service-related gains in Distribution, Engineering and Management.

The total impact in the Other Primary Automotive Supplier group is distributed across metals, other materials, computers and electronics and distribution, engineering and management services. These changes are concentrated in metals and distribution. One measure of strategic technology impacts in the simulation are changes in the Computer and Electronics manufacturing industries as well as in Engineering, Design and Management. Over 300 jobs are concentrated in key occupations linked to new technologies.

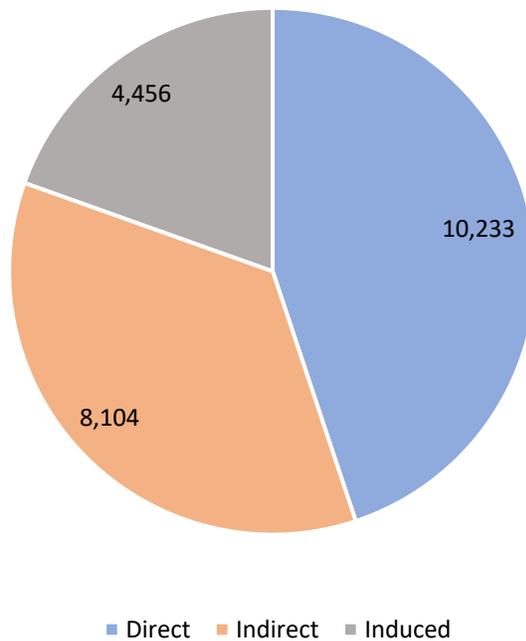
In the Other Automotive Suppliers, the impacts are concentrated in energy, finance, truck and rail transportation and other transportation services. This segment also represents all the other industries in the economy and the bulk of the induced impacts are focused here. These induced impacts, the difference between total and direct and indirect impacts, are the most dispersed effects as they capture the total increase in incomes across the entire workforce.

**Figure 7. Total Impact of a 20% (\$4 billion) Increase in Parts Exports, Jobs Created = 22,793**



**Source:** Statistics Canada Interprovincial Input-Output Model (2015).

**Figure 8. Total Impact of a 20% (\$4 billion) Increase in Parts Exports, Jobs Created = 22,752**



**Source:** Statistics Canada Interprovincial Input-Output Model (2015).

The distribution across direct, indirect, and induced is set out in Figure 9. Induced impacts are concentrates in **Other Automotive Suppliers**.

## TRADE, STRATEGIC TECHNOLOGY LINKS AND REGIONAL DISTRIBUTION

This section compares and contrasts the two IO Model simulations to reveal three key themes;

- the importance of international trade,
- strategically important technologies and
- regional concentrations.

### International Trade

An initial comparison of the Assembly Simulation (Table 1) with the Vehicle Parts Manufacturing Simulation (Table 2) highlights very different employment impacts. While the assembly simulation increase (\$12 billion) is three times larger than the parts export

simulation increase (\$4.0 billion), the total employment impacts in assembly (34,934 jobs) are just 50% higher than in the parts export total impact (22,753 jobs). The relatively low labour intensity in the assembly simulation reflects the very large role of imports of parts as assembly activity increases. In contrast, the much higher job intensity of the second, parts export, simulation highlights the job creation potential of export growth that is independent of assembly. Further, these differences are very distinct across the eight parts manufacturing industries. For instance, the change in seat and interior assembly is more than twice as large in the assembly shock, while all other parts industries show stronger impacts from rising exports.

Imports and exports are a critical component of activity at every point in the supply chain. For example, in many industries imports are a larger component of total inputs than domestic sourced supplies. At the same time, for most industries, exports are the dominant market for production. Trade conditions and related flows are a major determinant of outcomes for production and employment.

## Strategic Technology Links

There is a different and strategically important technological change associated with the expansion of automotive production. New technologies are extensively associated with increasing production at several points in the supply change. As activity increases technological improvements are required in Industry 4.0, connected, autonomous, shared and electrified vehicle technologies. These IO simulations identify industries that provide specialized technology products and services to the automotive production supply chain. Specifically, the other primary supplier group includes computer and electronics manufacturers and engineering, design, computer and management services.

Total employment change in Computer and Electronics Manufacturing and in Engineering, Design and Management Services are larger in the assembly simulation where over 600 strategic jobs are added. This compares with over 300 jobs added among strategic suppliers in the Parts simulation. These purchases by automotive assembly and parts manufacturers are just one component of a broader flow of new technology. The IO tables capture only a small part of the production and employment impacts in these industries.

These findings understate the impact of rising automotive production on the development of technology across the economy. This is another example of industry classifications and statistical sources missing critical features of the industry. FOCAL research on technology

clusters demonstrates the much larger employment and job creation in skilled occupations that are tied to the industry. FOCAL research looks into the connection revealed in the IO supply chain included here and then more deeply into specialized research centers, technology companies and regional clusters of activity<sup>14</sup>.

## Regional Distribution

The third comparison looks at the geographic perspective. Tables 3 and 4 show the distribution of the total impacts across the provinces. Almost all of the impacts occur in Ontario. The Interprovincial IO Model identifies exports and imports among provinces that are related to the shocks. These links are limited. Seen, for example, from the perspective of impacts in Ontario, total interprovincial imports in the Vehicle Parts Manufacturing industries, in 2015, are just \$148 million versus \$30 billion in international parts imports. Similarly, interprovincial vehicle parts exports from Ontario to the other provinces total just \$446 million compared to total international exports the \$20 billion. Large international trade connections combine with limited interprovincial trade to define the impact.

**Table 3. 20% Increase in Assembly – Distribution of Total Impact (\$, thousands) by Region**

Territories & Atlantic Canada	\$82,893	0.4%
Quebec	\$997,053	4.9%
Ontario	\$18,583,672	90.9%
Manitoba & Saskatchewan	\$343,415	1.7%
Alberta	\$276,497	1.4%
British Columbia	\$161,621	0.8%
<b>Total Canada</b>	<b>\$20,445,151</b>	<b>100.0%</b>

Source: Statistics Canada

<sup>14</sup> See “Canada’s Automotive Technology Clusters: Labour Market Characteristics and Regional Specializations” <https://www.futureautolabourforce.ca/wp-content/uploads/2020/12/Canadas-Automotive-Technology-Clusters.pdf>

**Table 4. Exports of Parts – Distribution of Total Impact (\$, thousands) by Region**

Territories & Atlantic Canada	\$41,828	0.6%
Quebec	\$550,025	7.3%
Ontario	\$6,471,905	85.8%
Manitoba & Saskatchewan	\$102,133	1.4%
Alberta	\$173,172	2.3%
British Columbia	\$204,648	2.7%
<b>Total Canada</b>	<b>\$7,543,711</b>	<b>100.0%</b>

**Source:** Statistics Canada

Perhaps the most important strategic linkage considered in the FOCAL work is the connection to labour markets and key occupations. FOCAL seeks to provide industry and government leaders with details and insights into the challenges and solutions for human resource issues including recruiting, training, mobility and skill shortages. Industry employment impacts are assessed across forty-nine selected occupations. Detailed analysis for labour market conditions in each occupation is the ultimate intention of FOCAL’s research. Findings reported here highlight how activity and employment is impacted across the FOCAL Automotive Production Sector and the industries that supply it.

## CONCLUSIONS

This paper describes how the national economy is impacted by rising automotive production. Findings here confirm and expand on FOCAL Trend Reports, Regional Profiles and Labour Market Forecasts. The Automotive Production industry, as defined by FOCAL, describes a complex network of industries that are among Canada’s largest exporters and importers. In addition to the core Assembly and Parts industries, FOCAL analysis adds in “Other Primary Suppliers” to properly assess the size and impact of automotive production.

Two IO model simulations discussed here point to the large magnitude of changes that result from an increase in automotive production. All of Canada’s industries are implicated in the change and results differ by industry and region. Changes in employment linked to rising automotive productions are:

- Large relative to total employment in other industries and employment,
- Variable depending on changes to imports and exports,
- Spread far into industries outside the core assembly and parts industries, **and**

- Critical determinants for the supply and demand for occupations.

Effective responses to changes must take account of all the industries included in the FOCAL Automotive Production industry and, in particular, employment in key occupations.

Canada's success, for example, in attracting new OEM assembly plants will create 35,000 new jobs that are spread across industries, regions and occupations. An increase in parts exports is more labour intensive than assembly with 22,000 new jobs added by a 20% increase in activity or by attracting additional production of vehicle parts. FOCAL highlights the additional labour requirements that emerge from the Other Primary Automotive Suppliers that are closely associated with the core industries. The FOCAL analysis has included, among the Other Primary Suppliers, both material suppliers like plastics processing and links to engineering, electronics and computer suppliers. In a simulation of rising automotive assembly activity, employment impacts acting through the other primary suppliers can be larger than impacts through the parts industry. These employers face the same labour market challenges as their customers in assembly and parts and they are major participants in the challenge of skill shortages and recruiting.

It is important to recognize the broader scale and scope of the Automotive Production industry when it is defined in this way. This change acknowledges the full role that the industry plays and more accurately identifies the labour market and occupational implications of change.

## APPENDIX A – GLOSSARY OF TERMS AND DEFINITIONS

Key terminology

Impacts

Final Demand

Income

North American Industrial Classification System

Commodity Definitions

Trade Definitions

IO table Input-Output Table

*Direct impacts* measure the initial requirements to add an extra dollar's worth of output of a given industry. The direct impact on the output of an industry is a one dollar change in output to meet the change of one dollar in final demand. Associated with this change, there will also be direct impacts on GDP, jobs, and imports.

*Indirect impacts* measure the changes due to inter-industry purchases as they respond to the new demands of the directly affected, supplier industries. This includes all the chain reaction of output up the production stream since each of the products purchased will require, in turn, the production of various inputs.

*Induced impacts* measure the changes in the production of goods and services in response to consumer expenditures induced by households' incomes (i.e., wages) generated by the production of the direct and indirect requirements.

*Total impact* is equal to the sum of the direct, indirect and induced impacts.<sup>15</sup>

IO Model

Simulations

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<sup>15</sup> Source; Explanatory Notes, Statistics Canada Interprovincial Input-Output Model, 2015, Macroeconomics Accounts Branch, Industry Accounts Division.

## FOCAL Industry Definitions

1. Vehicle Assembly (NAICS 3361)
2. Vehicle Parts Manufacturing (NAICS 3363)
3. Vehicle Assembly and Parts Manufacturing (1 plus 2)
4. Other Primary Automotive Suppliers<sup>16</sup> (See Figure 1)
5. Primary Automotive Suppliers (2 plus 4)
6. Automotive Production (1 plus 2 plus 4)
7. Automotive Technology<sup>17</sup>
8. Automotive Production and Technology (6 plus 7)
9. Other Automotive Suppliers (these are all suppliers to 3363 and 3361 not included in 4, i.e., banking, accounting, security, transport)

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<sup>16</sup> The term “Other Primary Automotive Suppliers” identifies 36 industries that are closely associated with the core industry – which is in turn made up of assembly and parts. Research reported in the technology studies in this project also identify “automotive technology clusters” that are also associated with the core industry but consist of private and public establishments providing research and innovation.

<sup>17</sup> This sector is defined in the FOCAL’s research report “Defining the Broader Automotive Sector”