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# The Future of the Canadian Auto Industry

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# Introduction

GENERAL MOTORS' (GM) stunning announcement in November that it would permanently close its Oshawa, Ontario assembly plant by the end of 2019 sent shudders through the country. Immediate concerns over the loss of jobs and the impact on the Oshawa community quickly turned to questions about GM's overall commitment to Canada and the fate of the Canadian automotive industry writ large.

The company claimed it had to close the plant and several others in the United States because of reduced consumer demand for the vehicles the workers in those plants were making. GM managers further proposed that the closures would allow the corporation to position itself for a future of electrification, environmental sustainability and connected and autonomous vehicles (CAVs). Some analysts, however, stressed that the company and its Oshawa plant were highly profitable; the move most likely stemmed from GM's desire to reduce capacity, shift production to lower-wage plants in Mexico, and respond favourably to pressure for more cash payouts to shareholders, they argued.[1]

No matter the ultimate reasons for GM's shocking announcement, all agree that it points to significant change in an industry of critical importance to the Canadian economy. This study unpacks some of the challenges facing the Canadian automotive industry—before and after GM's announcement—and offers an informed assessment of possible scenarios for its future.

Accelerated technological change alongside shifting consumer demographics and demand for vehicles promise seismic impacts on the automotive

industry, and on automobility itself.[2] Recent free trade agreements, including the renegotiated North American Free Trade Agreement (NAFTA),[3] the Trump administration's imposition of tariffs on steel and aluminum imports and the threat of possible tariffs on automotive imports to the United States create additional uncertainty. So too do continuing shifts in the geography of automotive production and trade, both globally and within North America.

The precise nature of the impact these developments will have on the Canadian automotive industry is unclear. Yet it is important for governments, companies, communities and unions to consider the likely outcomes so they can better prepare themselves for this future, and, where necessary, attempt to mitigate some of the worst risks associated with these disruptive changes.

Manufacturing, and automotive manufacturing in particular, remains important to the Canadian economy. The automotive industry contributes significantly to Canada's economic prosperity through investment, employment and technological innovation. Currently, it is Canada's second largest manufacturing industry, adding $18.28 billion a year to GDP, $86.58 billion a year to Canadian exports (17% of total merchandise exports), and employing over 126,000 people directly and half a million people indirectly.[4]

Beyond these immediate economic benefits, the automotive industry drives technological innovation in robotics, artificial intelligence, sensors, telecommunications, new materials and advanced manufacturing processes.[5] Canada has benefited from breakthroughs by startup technology companies, the ready supply of a well-trained engineering and technical workforce, and consolidation in the auto parts supply chain that has boosted several Canadian-based firms to become leading global parts suppliers. For all of these reasons, Canada continues to need and want an automotive industry.

Canadian vehicle assembly plants have long enjoyed a reputation for the highest levels of product quality and being among the most productive operations in North America. When awarding some of their high-end flagship models for final assembly in Canada, automakers point to the highly skilled workforce and the superior ability to launch new vehicle models. But tethering this industry to Canadian soil is increasingly difficult. Canada's relative position in the global automotive industry is in decline. In 1999, Canada was the fifth largest producer of motor vehicles in the world; by 2017, it had fallen to 11th place.[6]

Within North America the rapid expansion of assembly capacity in Mexico has eclipsed Canadian vehicle production. Since producing over three million vehicles at its high point in 1999, output has shrunk to around 2.3 million vehicles annually, largely the result of a net loss of five assembly

plants. In the late 1990s, Canada produced roughly two vehicles for every one sold domestically; by 2017, that ratio was down to 1.1:1. Since 2004, Canada has received only $1 billion of investment in greenfield vehicle assembly operations compared to $15 billion in Mexico.

Between 2010 and 2017, the vehicle assembly sector in Canada annually averaged just $1.2 billion in new capital investments, down from an annual average of $2.3 billion for 2000–2009. Over the same period, average new capital expenditures in the parts sector dropped to $565.9 million from $887.7 million. Besides GM's announcement that it would not be allocating product to its Oshawa assembly plant beyond December 2019, with the market for mid-sized cars declining rapidly the midterm future of the Fiat Chrysler Automobiles (FCA) Brampton assembly plant is also uncertain unless new vehicles in growing segments are allocated to it.[7] If these two assembly plants do close, no doubt followed by the parts network that depends on them, the damage to Canada's auto industry will be severe.

Between 2010 and 2017, the vehicle assembly sector in Canada annually averaged just $1.2 billion in new capital investments.

To understand the impact of changing rules of trade, rapid advances in technology and shifts in consumer patterns on the future of the industry and future policy choices, it is important to recognize several key aspects of the structure and organization of the automotive industry in Canada.

Automotive production is highly integrated between Canada and the United States and has been for a half-century. Currently five global automakers (OEMs)—Toyota, FCA, GM, Honda and Ford—build around 2.3 million vehicles in Canada.[8] In 2016, Canada exported almost two million vehicles, representing close to 85% of Canadian production, to the United States. With a domestic market of almost two million vehicles, Canada imported over 900,000 vehicles from the U.S. and over 246,000 from Mexico.

There are several distinct groups of automotive parts suppliers that together operate more than 700 manufacturing plants in Canada. First, there are a few large Canadian Tier 1 suppliers that operate globally (e.g., Magna International, Linamar, Martinrea, Woodbridge). Then there are the Canadian subsidiaries of large Japanese, European and American global suppliers, medium-sized Canadian suppliers with multiple manufacturing footprints, and small single-establishment Canadian suppliers.[9] The latter group includes technology startups that supply emergent demand for parts associated with CAVs.

Like with fully assembled vehicles, Canada exports large volumes of parts to the U.S., but also imports large volumes from the U.S. (and, to a much lesser extent, from Mexico) for assembly into Canadian-built vehicles. Canada enjoys a very modest automotive trade surplus within the NAFTA region—the net result of a positive balance with the U.S. generated by vehicle exports outweighing smaller (but growing) negative balances with Mexico in both vehicles and parts.[10]

Within OEMs and most global suppliers there are two distinct areas of focus: automotive manufacturing; and automotive engineering and research and development (R&D), or the process of inventing, testing, integrating and optimizing new automotive products and services.[11] While interdependent, distinctly different factors influence investments in each of these activities.

Regional competitiveness factors such as the relative cost and quality of labour, energy, logistics and other input costs, trade agreements and government financial incentives influence the location of manufacturing investment.[12] This is true for both vehicle assembly and automotive parts manufacturing. Because of the organizational structure of the industry and the strong multiplier effects associated with vehicle assembly, the capture and retention of OEM investment is crucial to maintaining a manufacturing footprint.

On the other hand, product engineering and R&D investment is more dependent upon factors such as engineering talent, alliances with academic institutions, intellectual property policy, effective financial supports for company-based innovation and a range of other innovation policy enablers.[13] There is a long-running debate over the interconnection between product manufacturing and R&D.[14] Most recent studies point to a critical link between growth in R&D and geographic proximity to manufacturing production: once a region loses manufacturing, R&D in related sectors also tends to decline.[15]

While Canada remains an important site for automotive manufacturing, levels of automotive R&D and product engineering remain relatively low, despite Canada scoring well on a number of CAPC's list of factors influencing such investment.[16] Why is this? OEMs seek to spread the extremely high costs associated with new vehicle product development across multiple end markets by developing global vehicle platforms. Consequently, major vehicle design, R&D and product engineering tend to be geographically close to OEM headquarters.

Furthermore, as OEMs shift some of the burden posed by the high costs of R&D and product engineering to their Tier 1 suppliers, co-operation is easier to achieve if suppliers locate their own R&D and design engineering

facilities close to the R&D facilities of lead OEMs. Thus, R&D and product engineering facilities operated by OEMs and their major suppliers are highly concentrated in just a handful of locations around the world: in North America, this means Michigan.[17]

The design requirements and specifications for parts tend still to come from the top down and many smaller suppliers simply bid for production of a part designed and fully specified by the OEM or Tier 1 customer.[18] Contracts to supply parts usually are multi-year with the customer expecting the supplier to reduce annually the price of the part. Thus, there is little room or incentive for smaller suppliers to engage in R&D to develop their own unique products and technologies. There is a strong incentive, however, for them to engage in plant-level incremental process innovation to increase production efficiency and reduce costs.

Once a region loses manufacturing, R&D in related sectors also tends to decline.

The paucity of investment in automotive R&D and product engineering in Canada is therefore not surprising given the absence of a domestically owned OEM, the large number of Canadian parts plants operated by subsidiaries of global suppliers and Ontario's close proximity to Michigan. Although foreign-owned OEMs and Tier 1 global suppliers undertake manufacturing in Canada, their R&D and product engineering activities primarily take place elsewhere in their corporate network. Even the handful of Canadian-owned global suppliers listed above locate their principal North American R&D and product engineering facilities close to their OEM customer's headquarters in Michigan.

In developing automotive policy instruments, or assessing their efficacy, it is crucial to bear in mind this distinction between *automotive manufacturing* and *automotive engineering and R&D*, and to recognize that each require different policy levers. The distinction guides our analysis throughout the rest of this paper.

# The changing geography of automotive production

THE LAST TWO decades witnessed dramatic shifts in the location of automotive production both globally and within North America, shifts that are likely to continue in the near term and pose challenges to automotive manufacturing in Canada. It is helpful to break these up into shifts in the global industry and those affecting North American production specifically.

## Global industry

The global automotive industry is not as "fully globalized" as industries such as electronics and textiles.[19] A handful of global original equipment makers (OEMs) dominate the industry and each produces and sells vehicles in all of the global regional market blocs: NAFTA, the EU and East Asia. Global automotive parts suppliers "follow" as their OEM customers open new assembly plants around the world.

Despite the importance of automotive trade flows between blocs,[20] the industry still exhibits a significant regionalization of production and investment. The OEMs plan their product development, production and marketing operations at a global level, but tend to locate production close to final markets due both to political pressures and the high transportation costs

incurred in shipping finished vehicles.[21] North American facilities assemble around 80% of vehicles purchased in the NAFTA bloc, and 75% of all auto parts in North American–built vehicles are sourced from within NAFTA.

The most dramatic shift in the geography of global auto production has been the rise of China and India as significant automotive powerhouses in terms of both market size and production. There has been a tenfold increase in vehicle production in China since 2000 and a fivefold increase in India. China is now both the largest market for new vehicles (29.12 million in 2017 compared to 17.58 million for the second-place United States) and the largest producer (29.02 million compared to 11.19 million for the U.S.).[22] Established American-, European- and Japanese-based OEMs and many global parts producers have sought to secure a share of these burgeoning new markets by building manufacturing capacity there, often in partnership with Chinese and Indian companies.

The most dramatic shift in the geography of global auto production has been the rise of China and India as significant automotive powerhouses.

As noted earlier, Canada has no domestically owned OEM, but a number of Canadian-owned suppliers are major global players and active in virtually every major automotive-producing region in the world. They have the capital and the technical and managerial expertise to succeed in a rapidly changing global automotive environment and are likely to thrive as they adapt to these new markets. Though these suppliers may well continue to grow and prosper financially, growth in their manufacturing activities is more likely to occur outside of Canada than at home.

## NAFTA region

Today there are four broad automotive producing regions within the area covered by NAFTA: the historic heartland of the Great Lakes region (GLR), the southern United States, northern Mexico, and central Mexico. The Canadian automotive industry is an integral part of the highly integrated GLR that straddles the Canada-U.S. border.

Vehicles assembled in Canada contain a substantial proportion of parts and components sourced out of Great Lakes states, especially from supplier plants in Michigan, Ohio and Indiana. Conversely, 65% of the $91 billion of automotive parts exported from Canada in 2017 were destined for those same states, in which GM, Ford and FCA (the D-3) dominate assembly operations.

Hence, independent Canadian-based parts suppliers are heavily reliant on D-3 customers across the GLR.

For some time, the centre of gravity of assembly capacity has been shifting southward within the NAFTA region. Since 2000, only one new plant opened in Canada while six D-3 assembly plants have closed.[23] The restructuring of the D-3 in the wake of the 2008–09 financial crisis continues with GM's announced closure in 2019 of its Oshawa, Detroit-Hamtramck and Lordstown, Ohio assembly plants. This trend has reduced assembly capacity in the Great Lakes region, eroding the market for Ontario-produced automotive parts.

At the same time, Asian and European OEMs have continued to build new assembly capacity in Mexico and in a broad swath of the southeastern United States stretching from South Carolina in the east to Texas in the west. Of the 17 new North American assembly plants announced since 2006, 10 have gone to Mexico, seven to the southern United States and none to the Great Lakes region.[24]

Supplying a new assembly plant in Alabama or central Mexico from a parts manufacturing plant in Ontario poses serious logistical challenges related to both transport costs and meeting tight delivery schedules. Many suppliers have responded to the challenge by establishing manufacturing plants in the southern U.S. and Mexico to supply the new assembly plants.[25] Canadian-owned suppliers who follow this strategy may continue to prosper, but at the expense of production and employment in Canada.

Policy-makers realize that the future of automotive production in Canada is tied inextricably to the fortunes of the industry in the broader Great Lakes region, which in turn depends on the GLR's competitiveness relative to the auto-producing regions in the southern U.S. and Mexico. Without the retention of existing assembly capacity and the attraction of new investment in the GLR, the locus of North American automotive production will continue to shift southward. Thus, many policy advocates urge closer policy co-ordination and co-operation between Ontario and the Great Lakes states.

Over the last decade, differences in automotive labour costs across the GLR have narrowed due to the cost-cutting conditions attached to the 2009 bailout money for GM and Chrysler and the outcomes of subsequent rounds of collective bargaining on both sides of the border. At present within the GLR, with the Canadian dollar trading in the mid US$0.70 range, automotive production in Ontario is cost competitive with U.S. production. However, the Trump administration's desire to repatriate the U.S. auto industry and demands for a "Buy American and Hire American" policy cast a shadow over the ability of the Canadian auto industry to retain its place and manufacturing role within the Great Lakes region.

# Trade agreements and the auto sector

RECENTLY, CHANGES TO automotive trade policy have represented the greatest short-term threat to automotive manufacturing in Canada. In addition to the negotiation of the United States–Mexico–Canada Agreement (USMCA, or CUSMA as the Canadian government calls it) to supersede NAFTA, Canada has recently concluded free trade agreements including significant auto concessions with South Korea (CKFTA), the European Union (CETA) and 10 other Pacific Rim countries involved in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), which came into force on December 30, 2018. The Trump administration's imposition of tariffs on steel and aluminum imports, and Trump's continued threat to impose tariffs on imported automotive products, have only served to ratchet up uncertainty in the Canadian auto sector.

Historically, trade and tariff policy played a crucial role in establishing a vibrant automotive industry in Canada.[26] Since 1965, and subject to certain conditions, vehicles and automotive parts manufactured in Canada have enjoyed preferential tariff access to the all-important U.S. market. First secured under the 1965 Canada–U.S. Auto Pact, and later by the 1988 Canada–U.S. Free Trade Agreement (CUSFTA), tariff-free access since 1994 has been governed by NAFTA.

Under NAFTA, automakers constructed the most highly integrated supply chain of any North American manufacturing industry, with high levels of

regional specialization, intra-industry and intra-corporate automotive trade between the United States, Canada and Mexico. Both Canada and Mexico are heavily dependent on preferential access to the U.S. market for exports of both assembled vehicles and automotive parts, but both also import large volumes of automotive products from the United States.[27]

By improving productivity and efficiency, the continental integration of automotive production enables the North American auto industry to remain globally competitive. It has benefited carmakers, lowered vehicle prices for consumers and attracted billions of dollars of new investment. On the other hand, autoworker unions—Unifor and the UAW—point to the loss of automotive manufacturing jobs in both Canada and the U.S. resulting from continental integration under NAFTA.

During the recent NAFTA renegotiation, automakers and many commentators argued that significant changes to the rules governing automotive trade within North America would disrupt the highly integrated system of supply chains, increase the price of automotive products for consumers and reduce the overall competitiveness of North American–produced vehicles in both domestic and export markets. Unifor has long argued that a significant adjustment to existing automotive trade rules, especially between NAFTA and other auto producing countries, is exactly what is required to secure the long-term vitality of the auto industry in Canada.[28]

## CKFTA and CETA

Phasing out the 6.1% tariff previously levied on Korean- and European-built vehicles imported into Canada under the CKFTA and CETA will make such vehicles more price-competitive in the Canadian market and potentially displace some North American vehicle production.[29] In 2017, only 3% of Canadian vehicle exports by value went to countries other than the United States and Mexico. This suggests a very low probability that we will see a large increase in exports of Canadian-built vehicles to Europe and Korea.

The CKFTA and CETA are less likely to disrupt supply chains feeding Canadian vehicle assembly plants. Since the late 1990s there has been no tariff on automotive parts imported by OEMs for assembly into Canadian-built vehicles, including imported parts from Korea and the EU. In contrast, the rules governing automotive trade contained in the USMCA and the CPTPP could each have a larger impact on North American supply chains and future levels of automotive production in Canada.

## From NAFTA to the USMCA

Rules of origin (ROO) and regional value content (RVC) requirements, which define whether goods are "originating" and hence qualify for tariff preferences, are key features of any liberalized trade agreement. They are especially important for the automotive industry given the complexity of supply chains involved in vehicle production.[30] These rules shape firm strategies by strongly influencing *what, where* and *how* companies produce automotive goods within the area covered by a regional trade agreement.

Remember, however, that the only reason for a manufacturer to comply with such trade rules is to secure preferential tariff treatment for their product. If, as with the current U.S. tariff of 2.5% on cars, the non-preferential tariff is already low and the trade rules too onerous, then some manufacturers will opt to ignore the rules and simply pay the tariff.

Currently, for a vehicle or component to qualify for preferential tariff treatment under NAFTA it must "originate" in the U.S., Canada or Mexico and contain a specified minimum level of RVC. Furthermore, and uniquely within NAFTA, the automotive industry is subject to what Canadian Foreign Affairs Minister Chrystia Freeland has referred to as "fiendishly complex" rules related to the calculation of RVC. The most significant are "tracing" rules that require tracking the value of a list of specified automotive components and subassemblies imported from outside the NAFTA region, so that their non-originating value can be accurately reflected in the final RVC calculation of the vehicle or component into which they are incorporated.[31]

These rules shape firm strategies by strongly influencing what, where and how companies produce automotive goods.

Measured on a net cost basis, the NAFTA RVC requirement for vehicles, engines and transmissions is set at 62.5% and at 60% for automotive parts on the tracing list—levels much higher than for most other goods under NAFTA.[32] In the years since NAFTA came into force, the evolution of vehicle technology, including the incorporation of an increasing range of electronic parts not included in the NAFTA tracing list, has steadily eroded the 62.5% RVC for vehicles.[33]

Vehicles built in the U.S. and Mexico that fail to meet the NAFTA RVC, as well as vehicles built outside the NAFTA bloc, incur a non-preferential tariff of 6.1% when imported into Canada. As noted earlier, automotive parts destined for assembly plants in Canada enter duty free. Corresponding non-

preferential tariffs levied on automotive imports by the United States are 2.5% for cars, 25% for pickup trucks and an average of 3.1% for automotive parts. Mexico levies a non-preferential tariff of 20% on cars and, at a minimum, 5% on automotive parts.

Changes to the automotive rules of origin became a contentious and core issue during the renegotiation of NAFTA. In November 2017, during a fourth round of trilateral talks, the United States demanded tighter rules of origin on automotive products.[34] The U.S. wanted the minimum NAFTA RVC requirement for vehicles, engines, transmissions *and* for parts on the tracing list raised to 85%. In addition, the U.S. demanded that for duty-free entry to the U.S. market, 50% of the value of vehicles built in Canada or Mexico must be generated in the U.S. (i.e., an "85/50 rule of origin").[35]

The Canadian and Mexican governments together with Unifor, the union representing Canadian autoworkers, and many vehicle manufacturers steadfastly opposed the 50% U.S. domestic content rule, arguing that it would lead to a major disruption of supply chains, raise costs and render North American–built vehicles less competitive against global competitors. Furthermore, Unifor argued that the U.S. content rule would disproportionately and negatively affect Canada.

The U.S. abandoned its proposal for 50% U.S content after Canada at the January 2018 round of negotiations in Montreal proposed incorporating into the automotive RVC framework additional requirements tied to wages, and counting value created by R&D and technology-related activities.[36] The United States and Mexico then reached a tentative agreement in August 2018, leading to a further month of intense negotiation between the U.S. and Canada. The tripartite USMCA was announced on September 30, 2018 and officially signed by the three parties on November 30, 2018 during a G20 meeting in Argentina.

The USMCA rules governing automotive trade between the three countries are much more restrictive and complex than the current NAFTA rules. They are set out in three different sections of the agreement as summarized here and explained in more detail below:

- Chapter 4, specifically the Appendix to Annex 4-B (Product Specific Rules of Origin), spells out the rules of origin and regional value content required for vehicles and parts to qualify for duty-free preferential tariff treatment.

- Chapter 2, Annex 2-C covers the rules governing the tariff treatment of automotive products imported into the U.S. from Mexico that *do not* qualify as originating.
- U.S.–Mexico and U.S.–Canada 232 side-letters provide exemptions for specified levels of Mexican and Canadian automotive imports to the U.S. should the U.S. impose so-called national security tariffs under Section 232 of the U.S. 1962 Trade Expansion Act.[37]

### i. USMCA automotive ROOs and RVC requirements

The USMCA raises regional content requirements for vehicles and parts as follows:[38]

- The NAFTA RVC for cars and light trucks will increase to 75%.
- Automotive parts are divided into three categories, with RVC levels ranging from 75% for "core parts" through 70% for "principal parts" to 65% for "complementary parts."[39] The USMCA changes significantly the tracing requirements to address the gaps that existed in the NAFTA tracing system.
- Vehicles will only qualify as originating if core parts used in their production are originating.[40]
- A vehicle is only originating if during the previous year 70% of the vehicle producer's purchases of steel and aluminum originated from within North America.[41]
- A vehicle is originating only if the vehicle producer certifies that its production meets a Labour Value Content (LVC). The calculation of LVC is complicated, but in broad terms requires that, when fully phased-in, at least 40% of the content value of the car (45% for pickup trucks) must originate from plants located in North America with a production wage rate that is at least US$16/hour.[42]

How will these changes to the rules of origin governing automotive trade within North America affect Canada? Canadian-based assemblers, including Honda and Toyota, will likely be able to adjust to the new USMCA ROO without undue challenges. Scotiabank estimates that the North American RVC in Canadian auto production is already around 71% and the extended phase-in for both RVC and LVC provides time to adjust supply chains.[43] It

is conceivable that Canadian production of parts could increase if Canada captures a portion of the overall rise in required regional content value as OEMs move to substitute North American content for non-originating content in vehicles and components in order to secure preferential tariff treatment.[44]

This will especially be an issue for some European and Asian-owned OEMs that currently source a significant number of core parts, including high-value engines and transmissions, from overseas and will therefore likely be at risk of non-compliance under the new rules for certain vehicles they assemble in North America.[45] How much additional business this will actually generate in Canada is unclear. The only non–D-3 assemblers in Canada—Honda and Toyota—already source most of their major components from within North America and the D-3 do not expect to be impacted significantly by the new rules.[46]

Potentially more significant is the new LVC rule that may well shift some parts production from Mexico to the United States and Canada. The inclusion of advanced technology applications in regional content compliance requirements for vehicle assembly also offers opportunities for Canadian firms. The impact of changes to rules of origin may be muted, however, if companies, instead of meeting the new RVC and LCV rules, simply opt to pay the relatively low most-favoured-nation (MFN) tariffs on non-originating automotive products. Annex 2-C attempts to forestall companies operating in Mexico from adopting this strategy and further increasing non-originating content in their automotive products.

### ii. USMCA Annex 2-C

This annex applies to automotive products imported to the United States from Mexico that *do not* qualify as originating under the rules of origin set out in Chapter 4 of the USMCA and would thus be subject to import tariffs. It states that if the U.S. raises the MFN tariff on imported automotive products above the current levels, the latter will still apply to vehicles and parts imported from Mexico as long as they qualify under the "old" NAFTA (1994) rules.[47] The annex also states that the U.S. may limit this treatment of non-conforming automotive products to 1.6 million passenger vehicles a year and to parts valued at US$108 billion in any year. There appears to be no such limit on light trucks, presumably because the current MFN tariff on pickup trucks is already 25%.

What is the relevance of this provision? The USMCA rules of origin make it more costly for Mexican-built passenger vehicles and parts to qualify for

preferential tariff treatment and some companies may opt not to comply and just pay the MFN tariff instead.[48] Annex 2-C dissuades automakers in Mexico from adopting this strategy and further lowering their costs by buying more parts from outside North America, since they would then likely no longer satisfy the original NAFTA ROOs and, hence, be subject to tariffs potentially higher than the currently low MFN tariffs.[49]

### iii. U.S.–Mexico and U.S.–Canada 232 side-letters

These letters state that in the event the United States invokes Section 232 of the 1962 Trade Expansion Act to impose tariffs on automotive products, the following products would be excluded: 2.6 million passenger vehicles annually from each of Mexico and Canada, and US$108 billion and US$32.4 billion in automotive parts from Mexico and Canada respectively. Light truck exports from both countries are also excluded. These "caps" are well in excess of current levels of U.S. automotive imports from both Mexico and Canada and provide some measure of insurance and comfort should the Trump administration move to impose Section 232 tariffs on imported automotive products.[50]

If the U.S. were to impose Section 232 tariffs on imported vehicles and parts the Canadian automotive industry could well benefit from an increase in the production of North American–built vehicles and parts for the U.S. market.

With these side letters in place, if the U.S. were to impose Section 232 tariffs on imported vehicles and parts, the major impact would be to make vehicles and parts imported from Europe and Asia less competitive in the U.S. market. As a result, the Canadian automotive industry could well benefit from an increase in the production of North American–built vehicles and parts for the U.S. market.

Overall, Unifor, the Automotive Parts Manufacturers Association (APMA) and industry commentators reacted to the automotive sections of the USMCA with relief and guarded optimism. There is a consensus that the outcome could have been much worse, especially if the U.S. had walked away from the negotiations, prevailed with its tough initial demands or imposed tariffs on vehicles and parts imported from Canada and Mexico. Any of these outcomes would have been catastrophic for the North American auto industry.

Fortunately, the U.S. backed off, although the new rules of origin in the final agreement are certainly more restrictive and cumbersome than under

the original NAFTA. As such, they will likely reduce the regional and global competitiveness of the North American automotive industry and raise the price of automobiles for North American consumers.

Canada, however, may benefit from a modest increase in automotive manufacturing due to the possible movement of parts production from Mexico to the United States and Canada, forced by the new LVC requirement, and from foreign automakers being forced by the USMCA automotive rules of origin (and the possible future imposition of Section 232 tariffs by the U.S.) to move more of their manufacturing to North America.

## From TPP to CPTPP

Following Donald Trump's January 2017 announcement of the U.S. withdrawal from the Trans-Pacific Partnership (TPP), the TPP re-emerged as the CPTPP—the words "Comprehensive and Progressive" tacked on at Canada's urging.[51] Canadian interests in the CPTPP were always going to be dependent on the outcome of the NAFTA renegotiation. This was especially so in the case of automotive trade.

The rules for automotive products in the CPTPP are essentially unchanged from the original TPP and were negotiated with the U.S. at the table. Duty-free movement of vehicles requires at least 45% of value-content to come from member countries, and 30–45% minimum regional content for auto parts.[52] The CPTPP, however, also contains Canadian side-letters with both Australia and Malaysia that provide for a lower RVC (40%) for cars.[53]

Concerns expressed by automotive industry stakeholders in Canada about the original TPP resurfaced with the signing of the CPTPP.[54] The CPTPP removes the 6.1% tariff on Japanese-built vehicles imported into Canada, vehicles that potentially could contain high levels of content sourced from low-cost countries. On the other hand, the prospect for increased exports of Canadian-built vehicles within the CPTPP region is limited. The APMA argued that the TPP/CPTPP rules clearly favour the sourcing and multi-tiered supply chain realities of the Japan-based vehicle assembly industry and do not reflect the dynamics of Canada's industry.

While large Canadian-owned Tier 1 suppliers will be largely unaffected by the reduction in tariffs, and could well benefit from potential access to new markets, small and medium-sized suppliers will be vulnerable to a possible dramatic shift in sourcing dynamics to low-cost Asian countries like China and Thailand.[55] Advantage accrues to Asian-based assemblers

(i.e., Japanese OEMs under the CPTPP, and Korean OEMs under CKFTA), since volume access to the low-cost Asian supply chains is structurally out of reach for many Canadian manufacturers.[56]

Although concerns remain regarding the impact of the CPTPP on the Canadian automotive industry, they are less than when the U.S. was a party to the TPP. Canada will still enjoy preferential access to the U.S. market for automotive products that meet USMCA rules of origin, i.e., the overwhelming bulk of Canadian automotive exports. Before the U.S. withdrew, other signatories to the TPP, including Japan, would also have gained preferential access to the U.S. market and this would have had a negative indirect impact on Canada.[57]

With the U.S. outside the CPTPP, arguably there was an incentive for Canada and Mexico in the NAFTA renegotiation to avoid higher RVC rules of origin for vehicles and parts. But even with the relatively low CPTPP RVC of 45%, the USMCA rules requiring higher levels of North American (including U.S.) parts reduces the likelihood of Canadian- and Mexican-built vehicles qualifying for tariff-free access to CPTPP countries, since U.S. content is classed as non-originating under CPTPP ROOs. For various reasons, therefore, the growth potential for Canadian automotive exports to most CPTPP partners is low and continued preferential access to the U.S. market remains the overriding concern for automotive manufacturers in Canada.[58]

Continued preferential access to the U.S. market remains the overriding concern for automotive manufacturers in Canada.

In summary, and although the USMCA is still to be ratified, the conclusion of the NAFTA renegotiation has removed one major source of uncertainty for the auto sector. Automakers and suppliers had been reluctant to make future investment and production commitments, especially for their Canadian and Mexican operations, while the NAFTA renegotiation was still underway. But the ongoing uncertainty regarding the U.S. imposition of Section 232 tariffs on European- and Japanese-built vehicles imported to the U.S. raises questions regarding how such tariffs would affect existing trade agreements that both Canada and Mexico have with the EU and Asian countries, including through the CPTPP.

Given the large number of interrelated moving parts and the continued unpredictability of the Trump administration, some uncertainty remains regarding the overall impact of changes in automotive trade rules on the future of automotive manufacturing in Canada.

# Technological change: disruption and opportunity

TECHNOLOGICAL CHANGE IN vehicle design and engineering as well as in automotive production has accelerated over the last 10 years, affecting R&D activities and automotive manufacturing. This section explores how two disruptive and ongoing technological transformations—efforts to lower vehicle greenhouse gas emissions and the shift to connected and autonomous vehicles—are expected to reshape the automotive industry in Canada.

## Fuel efficiency

Canadian policy-makers have tended to mimic U.S. vehicle standards in recognition of the tightly integrated automotive markets between the two countries and the inefficiencies that would arise from divergent national regulations governing fuel economy and emissions. Such regulations are the primary force behind technological innovations by automakers and parts producers aimed at improving fuel efficiency across their vehicle fleet.[59]

These fuel efficiency innovations include the move to alternative propulsion systems, whether fully electric vehicles, hybrids or those powered by hydrogen fuel cells;[60] optimizing engine efficiency in internal combustion

engines (ICEs); and light weighting through the use of "new" materials such as aluminum, magnesium, high-strength steels and carbon fibre, which reduce the weight of the vehicle and thereby also fuel consumption.[61] Light weighting is also achieved by replacing mechanical components with electronics in systems such as steering and brakes. New entrants to the auto market such as Tesla have heightened the competition between companies in their race to reduce the carbon footprint of vehicles.

To encourage the development of these technologies and their application in automotive production, Canadian governments have invested directly in R&D, used tax credits, offered grants and loans and implemented elements of green "industrial" policy.[62] Policy programs include the federal government's Automotive Innovation Fund (AIF) and Automotive Supplier Innovation Program (ASIP),[63] the Scientific Research and Experimental Development Tax Incentive Program (SR&ED), the Canada Research Excellence program and Automotive Partnership Canada. There have also been several provincial programs such as the Ontario and Quebec governments' tax incentives to encourage consumers to buy electric vehicles, Ontario's Green Energy Act (2009) and Smart Grid Fund (2011),[64] and Quebec's Transportation Electrification Strategy and related technological development programs.

OEMs remain committed to ongoing technological investments to reduce GHGs, in order to satisfy other world markets where fuel efficiency requirements are and will be more stringent.

Most of these programs explicitly tied funding of company projects and advancement of the country's science, technology and innovation agenda to "green" innovation. The AIF, for example, stated that it would "support Canada's environmental agenda in advancing Canadian capabilities in fuel-efficient automotive technologies, greenhouse gas reduction and clean technologies," by focusing on energy-efficient engines, light weighting and other related technologies.[65] These programs supported OEM investment in the R&D and *production* of alternative propulsion vehicles in Canada, such as Toyota's 2015 investment in light weighting of the Lexus, and Ford's 2017 investment in connectivity R&D, light weighting and a new mandate for the Windsor engine plant.[66]

Yet these government programs did not significantly increase OEM R&D investment in Canada. Where Canadian government policies have fostered R&D is in the automotive parts sector and in universities, often partnered with OEMs and automotive parts suppliers. Government investment has occasionally resulted in Canada establishing an early competitive advantage

in emerging technologies, as was the case with Ballard in the development and application of fuel cells for clean energy, and with Multimatic, which has become a global leader in light weighting.

The greening policy and social landscape that pushed auto companies and their suppliers to become environmental technology innovators has shifted with the current U.S. president's repudiation of global warming, and steps to roll back the stringent fuel-economy standards adopted by the Obama administration in 2012.[67] Although major automakers have expressed relief with regard to the easing of the 2025 standards, it is unlikely that OEMs will abandon their significant sunk investment in the development and commercialization of more fuel-efficient vehicles.

Moreover, OEMs remain committed to ongoing technological investments to reduce GHGs, in order to satisfy other world markets where fuel efficiency requirements are and will be more stringent. Within the U.S. itself, California has vowed that it remains committed to higher emissions standards, a position that the other 12 states that use California emissions standards will likely adopt.[68]

The recently elected Ontario Conservative government has rolled back the cap-and-trade carbon pricing system introduced as part of the Climate Change Mitigation and Low-carbon Economy Act of 2016, along with the Green Energy and Economy Act of 2009, which included consumer incentives for buying electric and hydrogen vehicles. Given the small share of the vehicle market driven by demand for electric and hydrogen vehicles, and the continued intent of the Canadian national government to introduce a carbon tax, the Ontario policy change is not likely to have a significant impact in its own right.

What does the U.S. policy shift mean for Canada and our auto industry? As long as California and other states continue to uphold the tighter emissions standards it is likely that Canada can follow suit with little penalty, therefore also meeting its own environmental commitments arising from the signing of the Paris Agreement. The promised federal establishment of carbon tax regimes in provinces that do not develop their own policies will add further incentives for investments in fuel-efficient vehicles.

## Connected and autonomous vehicles (CAVs): possible missed Canadian opportunities

Embedding integrated circuits, software, sensors and artificial intelligence (AI) within automobiles to develop advanced connectivity between drivers, the vehicle and their environment promises to transform the automobile and automobility, disrupt the automotive supply chain and result in massive change to public mobility infrastructure. In addition to the infotainment and enhanced safety aspects of improved vehicle connectivity found in in-vehicle Wi-Fi, blind-spot warning systems, pedestrian warnings, emergency breaking and so on, rapid and continuous improvements in connectivity and ultimately the integration of AI in vehicles is leading to a future of driverless vehicles.[69]

Canada aspires to be a leader in emerging connective automotive technologies, including sensors, cybersecurity, digitization and AI. Ontario, with expertise in the design of electrical, computer and electronics parts and software suitable for inclusion in intelligent vehicles, boasts that it is home to hundreds of companies invested in "teaching cars to think."[70] According to the Ontario government, over $1 billion was invested in the development of connected and autonomous vehicles in Ontario in a single year by Uber, FCA, Ford, GM, Apple, Google, and Blackberry QNX.[71]

These vehicles need to be produced somewhere; Canada could position itself to attract such investment in assembly.

The development of connected and autonomous vehicles is spurring the entry into the Canadian industry of nontraditional automotive suppliers such as software and electronic component manufacturers, many of which are Canadian-owned startups.[72] This cluster of companies feeds off Canada's information technology cluster in the Toronto-Kitchener-Waterloo area that is second in size only to Silicon Valley in North America.

The dense population of well-trained engineers in this region and targeted government investment in these technologies combines with the robust auto supply chain in southern Ontario to create the conditions for Canada to claim a globally competitive place in the development of connected and autonomous vehicles. These measures may well improve Ontario's role in the research and development of automotive-related digital technologies, but they are unlikely to increase our manufacturing footprint as the components within these innovations tend to be produced elsewhere.

The opportunities as well as the risks associated with this technological shift toward autonomous connected vehicles highlight the interconnectedness between Canada's desire to increase R&D and become a leader in connectivity and AI technologies, and the public policy goal of attracting foreign investment to expand the country's assembly and manufacturing footprint.[73] As OEMs accelerate demand for specific parts associated with the shift to alternative propulsion systems, lightweight materials and software-driven features, "including mobility services, advanced safety, location-based services, in-vehicle content, and remote analytics," the Canadian automotive supply chain undoubtedly will be disrupted.[74]

On one hand, the parts sector in Canada currently has strength in the manufacture of components for internal combustion engines and drive trains. A switch to vehicles powered by electric battery or fuel cells requires a very different set of components that will negatively affect the sector unless parts makers can adjust to the transition in propulsion technology. Conversely, the development of CAVs opens up opportunities for Canadian startups and larger technology companies such as Blackberry QNX and OpenText, and will likely lead to new OEM partnerships with technology giants such as Apple and Google.

For these economic opportunities to be sustained in Canada, governments need to continue to invest in R&D, including the training of the next generation of researchers and inventors. They need to ensure smaller startup companies have access to capital,[75] support for commercialization and, perhaps most importantly, network opportunities with OEMs and government officials. Interviews with companies involved in the APMA's connected car project identified their lack of contact with OEMs as a hindrance to being able to bring their innovations to market.[76]

As technology giants such as Google and Apple and new automotive companies such as Tesla become more important in the development and production of electric and autonomous vehicles, new opportunities may emerge.[77] These vehicles need to be produced somewhere; Canada could position itself to attract such investment in assembly.

The Canadian-owned global auto parts company Magna has the demonstrated technical capacity to assemble vehicles in Europe but has never been able to break into the North American market as a producer.[78] Tesla's recent musings that it might buy some of GM's North American plants should they become idle, to expand its production capacity, suggest that other companies may be interested in locating production on existing sites.[79]

The acquisition of such domestic production capabilities in alternative propulsion vehicles could open further commercialization opportunities for would-be auto parts suppliers specializing in new technologies. Moreover, it could begin to establish Canada as a hub for production of the cars for the future. Specific policy measures would be needed to make this shift, something discussed in our concluding section.

Notwithstanding Canada's strength in some areas of emerging automotive technology, there are several risks to Canada maintaining this competitive advantage. As explained earlier, exceedingly low rates of investment in automotive R&D characterize the Canadian automotive industry.[80] Further, Canada has a weak track record of commercializing innovations. These characteristics flow from a historical tendency for Canadian companies to be bought by foreign multinational corporations before the full benefits of global growth and commercialization of innovation can be realized. Canadian companies that become global players in alternative propulsion systems and connectivity, such as Ballard, often relocate their operations, including R&D centres, to the U.S. to be closer to OEM headquarters and the large American market.

Exceedingly low rates of investment in automotive R&D characterize the Canadian automotive industry.

Recent moves by AI researchers from Canadian universities to foreign-owned private companies highlight concerns that the benefits of commercialization and economic growth from government-funded research and associated intellectual property may be lost to Canada.[81] These trends pose potential obstacles to securing Canada's place as a leader in autonomous and connected vehicle technologies and the ability to reap production-related benefits accruing from domestic R&D.

## Employment consequences of automotive technological transformation

In order to compete with low-cost jurisdictions such as China and Mexico, companies have accelerated and expanded their application of advanced technologies to their production, logistics and distribution systems. These technologies include autonomous robotics, data analysis systems, additive manufacturing, cloud-based software, augmented reality, cybersecurity and the so-called internet of things (IoT). Taken together these technolo-

gies are often referred to as Industry 4.0. Combined with the changes in vehicle design, these trends have shifted labour demand from semi-skilled labour—whether drivers, assembly line or retail workers—to more technically skilled employees with a heavy emphasis on engineering, computer science and data analytics skills.

According to several recent reports on the future of Canada's labour market, routinized work is most likely to be automated first.[82] Matthew Lo and Creig Lamb's Brookfield study of the estimated impact of industrial robotics on employment in highly concentrated manufacturing towns noted that, "In Canada, it took 20 jobs to generate $1 million in manufacturing output in 1980. By 2013, this number had been cut in half."[83] This trend suggests that Canada will experience significant negative employment effects, especially for production workers, as investments in smart technologies increase. The same report estimates that 61% of work activities in manufacturing and transportation and warehousing could be lost to automation in the near term.

The automotive manufacturing industry in Canada has been an early and extensive adopter of robotic technology and so some of the employment effects of automation have already been felt. Communities such as Windsor, Oshawa, Woodstock and Ingersoll that are heavily dependent on single industries, especially manufacturing, are particularly vulnerable to these effects as there will be few alternative work opportunities for laid-off employees.[84] Yet, and perhaps paradoxically, reports on Industry 4.0 suggest that countries and industries that do not invest in such integrated communication-based technologies will be left behind in terms of productivity, investment and, ultimately, jobs.

Technological change in the automotive industry is changing the skills demanded by employers. Demand is growing for a more highly technically skilled workforce including engineers, computer scientists, media communications and data analysts. This shift affects the automotive industry in Canada in three distinct ways.

The skill sets of automotive companies' current aging workforce (the average age of an autoworker in Canada is 48) often do not match the emerging skills needs. This necessitates either that workers get retrained with the technical skills needed, whether through government programs such as Second Career Ontario or company training programs, or, as has happened in a number of companies, they are induced into retirement and replaced with younger, more technically skilled employees.

The second challenge confronting automakers is that, notwithstanding the heavy investment by Canadian governments in the training of engineer-

ing and other technical skills, the automotive industry has had difficulty recruiting adequate numbers of highly skilled workers. This is in part the result of high competing demand for engineers, data scientists and other technologists by technology and data analytics companies.

The recognized high quality of Canadian-trained engineers has resulted in a steady drain of workers from Canada to the U.S.[85] Companies such as Google, Facebook and others are seen as the cool employers with better pay and opportunities; this contrasts to the image of the automotive industry as a dated industrial sector. Automakers such as GM have engaged in concerted campaigns to change this image, especially as they sought to hire 1,000 engineers in Canada to support their investment in environmental sustainability and their Canadian-based global centre for CAV-related software development.

Technological change in the automotive industry is changing the skills demanded by employers.

Finally, the skill sets required for servicing and repairing vehicles are shifting dramatically with the increase in vehicle electronics, changes in engine and drivetrain technologies and the use of new materials for vehicle bodies.

Canada is well placed to reap some benefits of this shift to a much more highly skilled workforce given its significant public investments into educating a technically sophisticated workforce and its approach to recruiting highly skilled immigrants. Moreover, Canada's celebration of its diversity and culture of inclusion has become a competitive advantage to some companies in the aftermath of the election of Donald Trump.

Yet many people are left behind by the disruptions caused by rapid technological change. Supporting and preparing workers and their families for this disruption requires active labour market policy coincident with industry policies.

# Changing consumer patterns

GENERATION Y CONSUMERS, born during the 1980s and 1990s, "are less loyal, more skeptical, and more demanding than buyers from previous generations, and their focus on new technology, social connectivity, and nontraditional shopping methods are changing the way automakers and dealers must operate to attract these buyers."[86] These expectations are part of the driving force behind increased vehicle connectivity, making our vehicles entertainment and business hubs.

Notwithstanding the recent uptick in sales of automobiles to gen-Yers, who in 2014 made up 26% of the U.S. car market,[87] these younger consumers are highly urbanized, live in smaller spaces and are more sustainability-conscious than previous generations. These characteristics are stimulating a radical shift in vehicle use and ownership. Large cities are expensive and travel is time-consuming, resulting in a shift in mobility expectations.

Gen-Yers are therefore more likely to adopt lower cost, "pay per use mobility" methods that include ride- and car-sharing, ride-hailing and public transit.[88] They expect these different forms of mobility to be teleconnected through smart apps to reduce travel times. These demands alongside the development of autonomous vehicles promise disruptive change in the vehicle consumer market. These changes will in turn require significant investment by governments in new mobility infrastructure.

It remains uncertain if more radical shifts in consumer patterns away from individually owned automobiles will occur as quickly as some futurists predict. North American markets for vehicles are showing signs of shrinking, and these trends could accelerate this decline. For Canada, such a shift in consumer demand means either finding new export markets or, more likely, a smaller vehicle-manufacturing footprint.

Yet new mobility patterns could have a positive side for advanced manufacturing in Canada. Canada has significant manufacturing and R&D capacity in the production of mass transit, including trains, subway cars, buses and aircraft. Mass transit tends to be a global market, thus increasing the international growth potential of such firms as Bombardier and Grande West Transportation.

The broader mobility industry should be seen as a potential focus of investment, innovation and efficiency. Although the manufacturing and employment footprints of this industry are unlikely to be as great as the automotive sector, the economic benefits to the Canadian economy could be proportionally greater as these companies are Canadian-owned, with their headquarters and R&D activity concentrated in Canada.[89]

# Conclusion

FOR WELL OVER half a century, the automotive industry has been the mainstay of manufacturing and prosperity in southern Ontario. In this report we have highlighted several transformational developments that, if left unaddressed, could undercut the future vitality of the industry. In closing, we return to the distinction we made between automotive manufacturing and automotive engineering and R&D, and we raise some important policy considerations for the future of the Canadian automotive industry. This concluding policy discussion is neither exhaustive nor detailed but is meant to point to some of the areas needing greater consideration and analysis.

Although product and process innovation (R&D) are intimately linked to the actual making of "things," very different factors influence investments in each of these activities.[90] It is crucial to bear this in mind when developing, or assessing the efficacy of, automotive policy instruments. Moreover, for automotive policy instruments to be effective they need to be integrated into a broader Canadian industrial policy aimed at sustaining manufacturing activities, and hence employment, *as well as* R&D/product engineering in advanced manufacturing more broadly.

Industrial policy must be approached in an integrated fashion and build on the capacity of Canadian industry to respond to global competition, shifts in consumer choices and patterns of mobility while supporting innovation in areas in which Canada could become globally competitive. For policy supports to have the greatest impact on the automotive industry the Canadian and Ontario governments need to foster deep collaboration

across multiple levels of government while reducing bureaucratic obstacles and jurisdictional squabbles.[91]

The continued viability and vitality of automotive product manufacturing in Canada depends crucially on maintaining the current OEM assembly footprint and the concurrent demand for automotive parts. GM's announcement of its intention to reduce its assembly footprint in Canada with the likely closure of Oshawa is a step in the wrong direction. Auto parts suppliers that feed into this facility are already announcing their intention to shut plants, thus producing a negative ripple effect. Canadian governments, both federal and Ontario, should join with their counterparts in the United States to actively pressure GM to maintain its manufacturing footprint in Canada and the U.S.[92]

Although factors such as the cost and quality of labour, logistics, trade barriers and government financial incentives shape Canada's ability to attract automotive investment, the GM announcement has reminded us that these actions are not enough. What kind of industrial policy can maintain our competitiveness without pushing us toward a low-labour-cost option?

Unifor along with many automotive companies and, most recently, Ray Tanguay's "Drive to Win" report all argue that a first step in such an industrial policy involves the clear articulation of Canada's value proposition that reinforces the competitive value of a highly productive, skilled workforce producing top-quality products.[93] To sustain Canada's reputation for a highly skilled workforce and address emerging skills gaps, Canadian governments need to develop a workforce development plan with investments focused on the development of engineering, technical and data analytic skills, including trades and apprenticeships, as well as skills in marketing and commercialization. Using labour market analytics, this workforce development plan needs to anticipate generational changes taking place in skills development and employment, and offer income supports for skills retraining for those interested and able to be re-skilled as well as those made redundant by technological change.

A high-skill labour strategy only works if we have cars to build.

To ensure continued increases in productivity while also promoting safe and healthy work, an industrial policy could use tax credit incentives to encourage acquisition of new capital goods alongside other policy levers to incent companies to accelerate the adoption of Industry 4.0. Multi-stakeholder policy structures such as CAPC could be tasked with negotiating union- and employer-supported plans for a managed and just transition for workers

and those firms unable to keep pace with technological change and global competition.

A high-skill labour strategy only works if we have cars to build. Government financial incentives are required but won't be enough to attract new automotive assembly investment.[94] Rather, Canadian governments need to adopt a targeted policy approach that zeroes in on supporting investment from companies that will allocate product lines to Canada that are high-value with strong return on investment and have long-term market viability. In the short run, this may well involve conventional but more fuel-efficient ICE vehicles.

However, with consumer demand expected to continue its shift toward electric and autonomous vehicles, we argue that government incentives and government industrial strategy should be articulated as a green industrial policy with targeted supports for companies that commit to build green vehicles (hybrid and electric) and use environmentally sustainable production processes. Government investments could incent partnerships between companies such as Magna, Google, Tesla and small Canadian startups in the design and production of such vehicles and the technology infrastructure to drive integrated mobility across multiple transportation platforms. Industrial policy would then become national rather than regional and support the revitalization of the automotive industry through the interconnected growth of the automotive, aerospace, public transportation and communication industries.

Such an approach to incenting a larger automotive production footprint in Canada can support the goal of improving Canada's record on automotive R&D and product innovation. A green industrial policy could support the growth of our engineering talent pipeline, the development of partnerships between universities, colleges and businesses, and incent industry to adopt Industry 4.0. Canada has demonstrated strength in AI, mechatronics, data analytics and light-weighting—all areas that are crucial to the future of the automotive industry. Canada needs to focus its R&D investments on specific centres of excellence rather than R&D more broadly, thus building our capabilities in areas where we have proven strengths.

Many of the technical advances to date have been driven by Canadian-owned technology startups and universities. Whereas investment in universities is relatively secure, technology startups face a number of barriers to commercializing their inventions and scaling up production. These smaller Canadian companies could become bigger and more globally competitive through tax

credits and grants, easier access to capital and the use of procurement policy to build a test market for Canadian-made innovations.

There need to be incentives for these companies to grow while remaining Canadian-owned, rather than becoming the food for growth of large foreign-owned corporations that then use Canadian innovations and IP for value and wealth creation in other countries. Max Blouw, former president of Wilfrid Laurier University and chair of the Canadian Council of Academies, warned that "much of the intellectual property originating in Canada is now sold or licensed to firms abroad, and many Canadian entrepreneurs and firms are unprepared or underprepared to compete in the intensely competitive global IP landscape."[95]

Canada's anchor policy in support of R&D is the Scientific Research and Experimental Development program (SR&ED). Although this program is criticized for being bureaucratic, small to medium-sized companies see it as invaluable support for their innovation strategies. To complement SR&ED, government needs to design a R&D policy that would support product and process innovation, offer grants for companies investing in disruptive innovation and tie into support for the adoption and spread of Industry 4.0.

Lastly, but perhaps most importantly, though Canada should seek secure and easy access to international markets for the export of assembled vehicles and parts, government policy needs to prioritize the North American automotive platform centred on the Great Lakes. Canada–U.S. auto production and trade could be further integrated to create even greater competitive advantages of efficiency associated with a larger regional production footprint. Canada continues to need preferential tariff access to the American market for finished goods for this model to succeed.

Nevertheless, recent events remind us of the attempts of Pierre Trudeau in the 1970s to diversify and deepen Canada's export opportunities to reduce our dependence on a single market. However, Canada's most recent free trade agreements, such as the CPTPP, Canada–Korea and CETA, have made Canada's auto sector more vulnerable to tariff-free foreign competition without substantially opening new markets abroad for Canadian-made automobiles and parts. Such entry into new markets will be eased only if Canada can position itself as a source of high-quality, green vehicles designed and built for the future.

# Notes

**1** For example, CBC Radio, "GM cuts an 'old-style, greed-driven' decision, argues former Unifor economist," CBC, November 30, 2018; and Ed Broadbent, "Is shutting the Oshawa GM plant inevitable? No," *Toronto Star*, December 4, 2018.

**2** The dictionary defines "automobility" as the use of automobiles as the major means of transportation. In the social sciences, automobility is a concept used to describe how cars serve not just as a means of transportation, but as a technology deeply embedded within our everyday lives.

**3** The media commonly refer to the new agreement as the United States–Mexico–Canada Agreement (USMCA), the title given it by the United States. Officially, Canada names it the Canada–United States–Mexico Agreement (CUSMA) and in Mexico it is the Tratado entre México, Estados Unidos y Canadá (T-MEC). Throughout this paper we use USMCA since it is widely used in common parlance.

**4** Réal Tanguay, *Drive to Win: Automotive Advisor Report*, Ottawa: Canadian Automotive Partnership Council, January 2018.

**5** Today, automotive manufacturing is at the forefront of advanced manufacturing processes utilizing sophisticated robotics, computer systems, complex sequencing and logistics to produce finished vehicles and automotive components.

**6** OICA (International Organization of Motor Vehicle Manufacturers) 2017 production statistics retrieved from: http://www.oica.net/category/production-statistics/2017-statistics/.

**7** Both these plants currently build mainly mid-size cars for a market that has swooned in favour of SUVs, CUVs and pickup trucks. The other eight Canadian assembly plants have a mix of in-demand vehicles and appear secure.

**8** OEMs listed in descending order of vehicle output in 2016 with Toyota and Honda now accounting for 46% of Canadian vehicle production. The fact that there is no domestically owned OEM is critical to understanding certain aspects of the Canadian auto industry.

**9** It is important to recognize the heterogeneous composition of the auto parts sector, since responses to the challenges posed by changing trade rules and technological change will likely differentially affect each group.

**10** John Holmes, "NAFTA and the Automotive Industry," Presentation to the 61st Annual EDCO Conference, Toronto, February 7, 2018.

**11** Canadian Automotive Partnership Council (CAPC), "CAPC Submission on a Canada Innovation Strategy," August 31, 2016. Retrieved from: http://capcinfo.ca/en/CAPC-Innovation-en.html.

**12** Ibid. See also: Charlotte Yates and Wayne Lewchuk, "What Shapes Automotive Investment Decisions in a Contemporary Global Economy?," *Canadian Public Policy*, Vol. 43, Issue S1 (January 2017): S16-S29.

**13** CAPC (2016—Note 11). See also: Elena Goracinova and David Wolfe, "Regional Resilience and Ontario's Automotive Cluster: Its Future in the Digital Age," Paper prepared for the Annual CDO Partnership Network Conference, Montreal, May 1–3, 2017.

**14** Stephen S. Cohen and John Zysman, *Manufacturing Matters: the Myth of the Post-industrial Economy* (New York: Basic Books, 1987). See also: Suzanne Berger, *Making in America: From Innovation to Market* (Boston: MIT Press, 2013); and Susan Helper, Timothy Krueger and Howard Wial, *Why does manufacturing matter? Which manufacturing matters? A policy framework*, Washington, D.C.: Brookings Institution Metropolitan Policy Program, February 2012.

**15** Jennifer Clark, *Working regions: Reconnecting Innovation and Production in the Knowledge Economy* (London: Routledge, 2013).

**16** CAPC, in its 2016 submission to the federal Innovation Agenda review process (see Note 11), stated that "innovation must become THE pathway to automotive industry growth in Canada [but] we have not historically focused on Canada as a growth location for invention, research & development (R&D) and engineering of new automotive products and technologies."

**17** MichAuto reports that 16 OEMs have headquarters or technology centers in Michigan, and of the top 100 automotive suppliers to North America, 92 have a presence in Michigan and 60 are headquartered in the state. MichAuto report retrieved from: http://1419891vq14j2fapah1bpghjzyq.wpengine.netdna-cdn.com/wp-content/uploads/2017/05/Michigan-is-Auto-Mobility_COMBINED.pdf.

**18** Timothy Sturgeon, Olga Memedovic, Johannes Van Biesebroeck and Gary Gereffi, G., "Globalisation of the automotive industry: main features and trends," *Int. J. Technological Learning, Innovation and Development*, Vol. 2, Nos. 1/2 (2009): 7–24.

**19** Ibid.

**20** The most significant between-bloc flows of vehicles are from Japan and Korea to Europe and North America, and from Europe to North America.

**21** Jim Stanford, "The geography of auto globalization and the politics of auto bailouts," *Cambridge Journal of Regions, Economy and Society*, Vol. 3, No. 3 (November 2010): 383–405.

**22** OICA 2017 production statistics (see Note 6).

**23** One result is that there has been a relative shift in vehicle production in Canada from the D-3 to Honda and Toyota. By 2017, the Japanese OEMs accounted for 46% of total Canadian vehicle production, compared to less than 17% at the peak of Canadian vehicle production in 1999. This shift has negatively affected independent parts suppliers in Canada that historically have been disproportionately reliant on D-3 customers.

**24** However, there has been substantial investment into modernizing and upgrading the D-3 assembly plants that survived the 2008-09 restructuring. Toyota recently announced a significant investment to upgrade its Ontario assembly plants.

**25** In 2017, the APMA reported that, by employment, "Canada's supplier footprint is larger south of the 49th parallel than it is in Canada." It estimated that 64 Canadian-owned companies now operate 120 manufacturing facilities and employ over 43,000 workers in Mexico. In the U.S. 33 Canadian companies operate 150 plants and employ close to 43,000 direct workers. See the

APMA's 2017 "Canadian Supplier Footprint, USA/Mexico," retrieved from: https://apma.ca/canadian-supplier-footprint-usamexico/.

**26** For example, the first assembly plants in Canada date from the very early 1900s and resulted from American OEMs' desire to avoid the then 35% National Policy tariff on cars entering Canada. Furthermore, since Canada was part of the British Empire, Canadian-made goods could be shipped to many countries in the Empire (later, the British Commonwealth) at a lower preferential tariff rate than from the United States. By 1923, Canada had the world's second largest automotive industry. Later, the 1965 managed trade agreement between the United States and Canada, known as the Auto Pact, proved pivotal to the success of the Canadian auto industry in the period 1965–2000. See Dimitry Anastakis, *Auto Pact: Creating a Borderless North American Auto Industry, 1960–1971* (Toronto: University of Toronto Press, 2005).

**27** See: Holmes (2018—Note 10); and Thomas H. Klier and James Rubenstein, "Mexico's growing role in the auto industry under NAFTA: Who makes what and what goes where," *Economic Perspectives*, Federal Reserve Bank of Chicago, Vol. 41, No. 6 (2017).

**28** Current trade rules limit overseas market access for North American–built vehicles while low U.S. and Canada tariffs leave the domestic market open to vehicles imported from Europe and Asia. See: Bill Murnighan, "Five Inconvenient Truths About Auto Trade Policy…some labour observations," Presentation to the APRC International Workshop, Toronto, April 5–6, 2018. Unifor has long argued for tying access to the Canadian automotive market to commitments to produce in Canada and for greater reciprocity in automotive trade volumes with Asia and Europe. See, for example, CAW *Rethinking Canada's Auto Industry: A Policy Vision to Escape the Race to the Bottom*, Willowdale: Canadian Autoworkers Union, April 2012.

**29** With over 80% of vehicles built in Canada exported south and a very large proportion of the vehicles sold in Canada built in the U.S., removing the 6.1% tariff likely has a greater impact on U.S. than Canadian production.

**30** Reflecting the complexity of supply chains, the USMCA rules of origin for automotive goods require their own 48-page Appendix in the agreement—text retrieved from: https://international.gc.ca/trade-commerce/assets/pdfs/agreements-accords/cusma-aceum/cusma-04.pdf.

**31** For the 29 categories of parts on the NAFTA tracing list, any non-originating (i.e., non-NAFTA) value remains non-originating through all stages of assembly and must be included in the final calculation of the RVC of the vehicle or component. For example, if a seating manufacturer uses a non-originating electric motor (say, from China) in the production of a seat it sells to a vehicle manufacturer, the non-originating value of the assembled vehicle must include the value of the non-originating motor.

**32** For some parts such as bearings, parts of bumpers and certain other body parts, parts of wheels and parts of clutches the NAFTA RVC is 50%.

**33** During the TPP negotiations the Office of the U.S. Trade Representative said that, using the normal approach for counting the value of non-originating materials, a number in the low 50% range was comparable to the 62.5% RVC threshold for vehicles under the NAFTA using tracing (U.S. House of Representatives, Committee on Ways and Means, *TPP Issue Analysis: Trade in the Automotive Manufacturing Supply Chain*, 114th Congress Minority Staff Report, January 8, 2016). Consequently, during the USMCA negotiations the U.S. pressed for major changes in tracing and the calculation of non-originating content.

**34** Scotiabank, "NAFTA: Data at Odds with Proposed Changes to Auto Rules of Origin," *Global Economics: Insights & Views*, December 19, 2017.

**35** It is important to remember that content levels only matter if your product has to cross a border to reach a customer. The demand for a U.S. content requirement for Canadian and Mexican

vehicles exported to the United States was ironic given that an OEM could build vehicles in the U.S. for the domestic market using cheaper parts sourced from anywhere in the world without any consideration for U.S. content! See Kelsey Johnson, "Canadian NAFTA auto rules of origin idea 'opposite' of U.S. goals: Lighthizer," *iPolitics*, January 29, 2018.

**36** The Canadian proposal included granting automakers extra credit for electric and autonomous vehicles (Anne Riley Moffat, "Canada Wants Electric, Driverless Cars to Factor in Nafta," *Bloomberg*, January 31, 2018), but this was not included in the final agreement.

**37** The Trump administration directed the U.S. Commerce Department to undertake an investigation under the little-used Section 232 of the Trade Expansion Act of 1962 to assess whether national security concerns warrant the imposition of tariffs on imported vehicles and parts. Earlier, the Trump administration used Section 232 to justify tariffs on steel (25%) and aluminum (10%) imports that are still in force and negatively affect the automotive industry.

**38** The increased RVC levels begin at a level higher than the current NAFTA RVC and then increase in three further steps to become fully phased-in by January 1, 2023 (or three years after the agreement comes into force, whichever is later).

**39** For a list of parts which fall into each of the three categories see: *Meet the New NAFTA*, Ann Arbor: Center for Automotive Research, October 2018.

**40** These are engines, transmissions, body and chassis, axles, suspension system, steering system and advanced batteries.

**41** The U.S. tariffs imposed in July 2018 on steel (25%) and aluminum (10%) imported from Canada and Mexico remain in force. Unless the tariffs are rescinded, commentators question how the USMCA steel and aluminum ROO can possibly be met.

**42** The agreement defines the production wage rate as "the average hourly base wage rate, not including benefits, of employees directly involved in the production of the part or component used to calculate the LVC" (USMA, Article 4-B.7 footnote 104). High-wage technology expenditures (including for research and development and software) and high-wage assembly expenditures can be applied to meet up to 10 and 5 percentage points of the threshold respectively (USMCA Article 4-B.7).

**43** Scotiabank, "NAFTA: USMCA Preserves Open Trade in North America," *Global Economics: Insights and Views*, October 1, 2018. Since OEMs do not publicly release RVC data for their vehicles, estimates by third parties should be treated with caution. Estimates of RVC in North American vehicles differ widely—see, for example, Scotiabank (2017—Note 34); and Anne Flatness and Chris Rasmussen, "U.S.-Produced Value in U.S. Imports from NAFTA," Department of Commerce, International Trade Administration, Office of Trade and Economic Analysis, September 22, 2017. Government monitoring of the more complex and stringent USMCA automotive rules of origin to ensure OEM compliance will likely prove formidable.

**44** The APMA optimistically suggests that the USMCA will increase Canadian auto parts sector volumes by 25%.

**45** For example, the subcompact and compact cars built in Mexico by Honda, Mazda, Nissan, Fiat and Volkswagen. Automakers are likely to look first at moving engine and transmission production to North America, since under the USMCA these key components must themselves be "originating" in order for the vehicle to be originating. They also represent approximately 30% of a vehicles value and hence represent a major step towards meeting the stricter USMCA regional content thresholds.

**46** Chester Dawson and William Boston, "Auto Makers Consider Shifting More Manufacturing to North America: trade pact is prompting foreign automakers to rethink supply chains to meet potential restrictions," *Wall Street Journal*, October 5, 2018.

**47** The current MFN tariffs for imports to the U.S. are 2.5% on passenger vehicles, 25% on light trucks and an average of 3.2% on automotive parts. These are now much lower than when NAFTA came into force in 1994. Note that Annex 2-C does not refer to imports from Canada that do not qualify as originating, but only those from Mexico.

**48** Already under NAFTA some automotive parts companies simply elect to pay the MFN tariff to avoid the administrative burden and cost of complying with the rules of origin. The Center for Automotive Research (CAR) estimates that only 76.5% of Mexican parts exports to the U.S. entered duty free under NAFTA in 2016; the corresponding figure for Canada was 81%. See: Kristin Dziczek, Michael Schultz, Bernard Swiecki and Yen Chen, *NAFTA Briefing: Review of current NAFTA proposals and potential impacts on the North American automotive industry*, Ann Arbor: Center for Automotive Research, April 2018.

**49** By providing this protection to non-qualifying imports from Mexico, this seems to indicate that the U.S. still contemplates using GATT Article XXVIII to impose higher import tariffs on automotive products imported from outside North America.

**50** The side-letters containing exemptions from possible Section 232 automotive tariffs came in to force with the signing of the USMCA and do not require actual ratification of the USMCA.

**51** The remaining 11 countries, including Canada, Mexico and Japan, concluded CPTPP discussions on January 23, 2018 and signed the agreement in early March 2018.

**52** Jeffrey Carey and John Holmes, "What Does the Trans-Pacific Partnership Agreement Portend for the Canadian Automotive Industry?," *Canadian Public Policy*, Vol. 43, No. S1 (January 2017): S30-S42.

**53** According to Global Affairs Canada: "Based on current sourcing and production patterns, and without the ability to accumulate U.S. materials under the CPTPP, Canadian vehicles cannot meet the CPTPP regional value content requirement (45%). However, except for Australia, Malaysia and Vietnam, Canada has duty-free access to all CPTPP countries, either on a MFN basis or through FTAs already in force." Thus, the need for the side-letters. See: Government of Canada. Global Affairs Canada. "Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)," retrieved from: http://international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cptpp-ptpgp/text-texte/index.aspx?lang=eng; and Global Affairs Canada. "Economic impact of Canada's participation in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership," retrieved from: http://international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cptpp-ptpgp/impact-repercussions.aspx?lang=eng.

**54** Flavio Volpe, "The Trans Pacific Partnership: TPP, TPP11, CPTPP and the Case for Further Negotiations," APMA, December 2017, retrieved from: https://apma.ca/wp-content/uploads/2017/12/The-Case-for-Further-Negotiations-CPTPP.pdf. See also: Unifor, "Presentation to Standing Senate Committee on Foreign Affairs and International Trade re: Bill C-79," October 23, 2018, retrieved from: https://sencanada.ca/en/Content/Sen/Committee/421/AEFA/54312-e; and Unifor, "The Trans-Pacific Partnership and Canada's Auto Industry," not dated, retrieved from: https://www.unifor.org/sites/default/files/attachments/959-tpp_brief-auto.pdf.

**55** John Holmes and Jeffrey Carey, *The Devil is in the Details: The TPP's Impact on the Canadian Automotive Industry*, Ottawa: Canadian Centre for Policy Alternatives, July 2016.

**56** Japan pushed hard for the TPP rules since Japanese automakers desire duty-free access to the U.S. (and Canadian) market for vehicles imported directly from Japan, especially given the duty-free access secured under recent free trade agreements for European and Korean automakers.

Japanese-built vehicles contain significant levels of parts sourced from China, Thailand and Indonesia (i.e., non-CPTPP countries). See Carey and Holmes (2017—Note 51), and Volpe (2017—Note 53).

**57** Carey and Holmes (2017—Note 51).

**58** Canadian automotive products must continue to adhere to NAFTA rules of origin in order to continue to enjoy duty-free access to the U.S. (and Mexican) market. Thus, the CPTPP rules of origin are not expected to have a significant direct effect on Canadian automakers' production patterns and sourcing decisions. See Global Affairs Canada (2018—Note 52) and Unifor (2018—Note 53).

**59** International Energy Agency, *Global EV Outlook 2018: Towards cross-modal electrification*, Paris: IEA, June 2018. See also: McKinsey & Co., "Automotive Revolution — Perspective Towards 2030," January 2016.

**60** Josifa G. Petrunić, *Advanced Automotive Systems, Electrification, and an Overview of Relevant Policy Concerns*, Hamilton, ON: Automotive Policy Research Centre, November 2014.

**61** Peter J. Warrian and Mike Smitka, "The Changing Dynamics of Innovation in the Auto Supply Chain," *Journal of Business and Economics*, Vol. 6, No. 4 (April 2015): 799–821.

**62** Stephanie Tombari, *Towards sustainable automobility? Green industrial policy in Ontario and Michigan*, Hamilton, ON: Automotive Policy Research Centre presentation, November 2017. Retrieved from https://aprc.mcmaster.ca/sites/default/files/pubs/towards-sustainable-automobility-tombari.pdf.

**63** The Automotive Innovation Fund (AIF) and Automotive Supplier Innovation Program (ASIP) were recently simplified and consolidated into the Strategic Initiative Fund (SIF) along with the Strategic Aerospace and Defence Initiative and Technology Demonstration Program. The SIF has a budget of $1.26 billion over five years.

**64** Petrunić (2014—Note 59).

**65** Government of Canada. "Archived—Automotive Innovation Fund—projects funded to date," Industry Canada, not dated. Retrieved from: https://www.ic.gc.ca/eic/site/auto-auto.nsf/eng/am02366.html.

**66** Ibid. Canadian government incentives through AIF also have increased production of "greener" vehicles, in part by linking the latter to government support for investment in advanced manufacturing technologies to upgrade assembly plants. For example, Canada produces the only hybrid Lexus outside of Japan and Honda plans to produce for export to Europe the next generation of more fuel-efficient CR-Vs in its Canadian plant.

**67** These standards, introduced to speed up the development of hybrid and electric vehicles, would require automakers to nearly double the average fuel economy of new cars and trucks by 2025, to 54.5 miles per gallon. Meeting these stringent standards poses a significant technological challenge to automakers.

**68** These 13 states constitute a third of the American market for vehicles and so have significant impact on the production decisions and practices of automakers. See: Hiroko Tabuchi, "California Upholds Auto Emissions Standards, Setting Up Face-Off With Trump," *New York Times*, March 24, 2017.

**69** EV and CAV technologies are attracting major investments of capital. Recently, however, more sober assessments have surfaced regarding the length of time required for both EVs and CAVs to account for a significant proportion of the North American total vehicle fleet. Currently, EV sales account for only 1% of the North American market, an insufficient volume to justify a full-scale D-3 assembly plant devoted exclusively to building them. Thus it is likely that there will continue to be a mix of vehicle types for at least the next two decades.

**70** Government of Ontario, "Invest in Ontario," video retrieved from: https://www.investinontario.com/videos/teaching-cars-think.

**71** Ibid.

**72** Ata-ul Munim and Charlotte A.B. Yates, *The APMA's Connected Car Project: Innovation Through Collaboration*, Hamilton, ON: Automotive Policy Research Centre, February 2015.

**73** Tanguay (2018—Note 4).

**74** McKinsey & Co. (2016—Note 58).

**75** Tom Jenkins et. al, *Innovation Canada: A Call to Action, Report of the Independent Panel on Federal Support to Research and Development*. Ottawa: Government of Canada, 2011.

**76** Munim and Yates (2015—Note 71).

**77** McKinsey & Co. (2016—Note 58).

**78** Greg Keenan, "How Magna almost snapped up GM-owned auto maker Opel," *Globe and Mail*, March 6, 2017.

**79** David Welch, "Elon Musk says Tesla may consider buying idle General Motors plants," *Bloomberg News* (*Financial Post*), December 10, 2018.

**80** Government of Canada. *Compete to Win* (the Red Wilson Report), Ottawa: Industry Canada, June 2008. See also: Council of Academies, *Paradox Lost: Explaining Canada's Research Strength and Innovation Weakness*, Ottawa: Advisory Group, Council of Canadian Academies, 2013.

**81** Jim Balsillie, "Empty talk on innovation is killing Canada's economic prosperity," *Globe and Mail*, March 17, 2017.

**82** McKinsey & Co. (2016—Note 58); See also: Matthew Lo and Creig Lamb, "Mapping Automation: How will advancing technology impact cities and towns across Canada?" Toronto: Brookfield Institute, June 2017.

**83** Lo and Lamb (2017—Note 81).

**84** Creig Lamb, *The Talented Mr. Robot: The impact of automation on Canada's workforce*, Toronto: Brookfield Institute, June 2016.

**85** Sean Silcoff, "Canada facing 'brain drain' as young tech talent leaves for Silicon Valley," *Globe and Mail*, May 3, 2018.

**86** Ratings Direct, "Will Generation Y Change How The U.S. Auto Industry Does Business?," Standard and Poor's Rating Services, retrieved from: https://www.jdpower.com/sites/default/files/Will%20Generation%20Y%20Change%20the%20Auto%20Industry%20Business%20September%202014.pdf

**87** Ibid.

**88** Tanguay (2018—Note 4).

**89** Research InfoSource Inc, "Canada's Top 100 Corporate R&D Spenders," November 16, 2017, retrieved from: https://researchinfosource.com/pdf/CIL2017-Top%20100%20RandD%20List.pdf

**90** The scale and nature of the jobs associated with each of these activities also differ significantly. Automotive manufacturing provides decent employment for a significant number of working people. Engineering and R&D activity generates fewer but more highly trained engineering and professional jobs.

**91** CAPC (2016—Note 11); See also: Yates and Lewchuk (2017—Note 12).

**92** GM says it is closing Oshawa Assembly, which it acknowledges is productive and internationally competitive, because it is producing cars in a market demanding SUVs and pickup trucks. This rationale disregards that the facility has a state-of-the-art flexible production line and a highly experienced, skilled and productive workforce. The plant has previously produced other types of vehicles including small trucks, and with retooling is capable of producing electric or autonomous vehicles. Failing to reverse GM's decision, the Canadian government should seek to induce or partner with other companies to take over the Oshawa facility.

**93** Tanguay (2018—Note 4).

**94** Yates and Lewchuk (2017—Note 12).

**95** Max Blouw, "Will Canada keep up globally on R&D?," *Policy Options*, April 19, 2018.

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