New trade rules, technological disruption and COVID-19: prospects for Ontario in the cross-border Great Lakes automotive industry

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Abstract: Canada has been characterised as a 'semi-peripheral' automotive-producing nation. This paper argues that to frame Canada only as a singular 'national' automotive industry is ill-conceived. Overwhelmingly concentrated in Ontario, Canadian automotive production forms an integral and important part of the cross-border Great Lakes automotive production region. The fortunes of automotive production in Canada are reliant, therefore, not only on 'national' policies but also on the continued vitality of the industry in this broader region and must be analysed as such. An analysis of the state of the industry in Canada stressing its integration within the Great Lakes automotive region is followed by an assessment of how the industry in the region, and especially in Ontario, might be impacted by impending challenges. These include supply chain weaknesses exposed by COVID-19, the more complex and stringent USMCA automotive rules of origin, and technological disruption associated with the transition to electric vehicles.

Keywords: Canadian automotive industry; Great Lakes Region; USMCA rules of origin; electric vehicle technological disruption; pandemic disruption.

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1 Introduction

In late November 2018, as the USA, Mexico and Canada reached final agreement on a successor to the 1994 North American Free Trade Agreement (NAFTA)[1], the Canadian auto industry faced an uncertain future. Since producing a record 3.1 million vehicles in

1999, Canada had suffered a net loss of five assembly plants and annual vehicle production now stood at just under 2.0 million. Under NAFTA, Canada's share of North American vehicle production had fallen from 16.7% in 1994 to 11.4% in 2019 while Mexico's share had risen from 9.7% to 23.5%. The very same month, General Motors (GM) announced an end to vehicle production at its Oshawa, Ontario plant in 2019 and Fiat Chrysler Automobiles (FCA) announced it would be eliminating the third shift at its Windsor Assembly Plant.[2] These announcements sent a shock wave through the industry, even leading some to question whether Canada would continue to be a globally significant vehicle manufacturer.

Beyond this latest reduction in assembly capacity, the Canadian auto industry, together with its counterparts in the USA and Mexico, faced several impending challenges. With Canada-United States-Mexico Agreement (CUSMA) implementation set to begin in 2020, the agreement's complex automotive rules of origin (ROO) and regional value content (RVC) requirements, which are more stringent than the former NAFTA rules, were expected to reshape the geography of automotive production in North America. Although less immediate, the technological transition from internal combustion engine vehicle (ICEV) to electric vehicle (EV) production was gathering momentum in North America and likely would disrupt the industry over the coming decades. Then, without warning in early 2020, the global COVID-19 pandemic struck, exposing the vulnerability of global and continental automotive supply chains and bringing vehicle production to a halt across the continent.

This paper explores how the responses to these challenges might reshape automotive production in North America and what this might portend for the industry in Canada. Crucial to our analysis is an often-understated aspect of Canada's role within the organisational structure of the North American automotive industry. Numerous writers acknowledge the progressive continental integration of automotive production across North America from the 1965 Canada-USA Auto Pact to NAFTA (Holmes, 1993; Brid, 1996; Weintraub and Sands, 1998; Carrillo, 2004; Covarrubias Valdenebro, 2011; Brincks et al., 2018). Many, however, approach their analysis from a strictly national standpoint, focusing on the consequences of continental integration for the industry within just one of the three countries [see, for example, Kumar and Holmes (1998) and other chapters in Weintraub and Sands (1998)]. Consequently, the interdependent nature and scale of automotive production integration between the three countries is underplayed. This issue is especially germane in the case of Canada. Since it is highly concentrated in southern Ontario and fully integrated into the cross-border Great Lakes automotive production region (GLR)[3], and while not denying that national policies play a role in shaping the industry, it is ill-conceived to analyse Canadian automotive production only from the perspective of a singular 'national' industry.

Our analysis suggests the need to modify recent interpretations that have characterised Canada as a strictly 'semi-peripheral' automotive-producing nation (Pavlínek, 2018; Mordue and Sweeney, 2020; Klier and Rubenstein, 2020). Pavlínek (2018, 2021) developed an analytical procedure to determine the relative hierarchical position of countries in the core, semi-periphery, or periphery of the European automotive industry. His semi-periphery category applies to wealthier automotive producing countries such as Spain. Austria and Belgium that, compared to 'core' countries such as Germany, lack a domestically headquartered automaker, exhibit a high degree of foreign control and less strength in automotive innovation activities (Pavlínek, 2021). Drawing on Pavlínek's typology, Mordue and Sweeney (2020) portray Canada as a 'proto-typical semi-peripheral automotive-producing country'.[4] As evidence, they stress the absence of a domestic automaker and low levels of Canadian automotive R&D spending and outputs represented by patents. Their subsequent discussion of the prospects for the future of automotive production in Canada is framed entirely in the context of a stand-alone national automotive industry and fails to consider the consequences of its extraordinarily tight cross-border integration into the heartland of North American automotive production.

The central premise guiding this paper is that automotive production in Canada is an integral part of the broader Great Lakes cross-border automotive producing region, rather than a stand-alone national industry, and any analysis of the future prospects for automotive production in Canada (and in the Great Lakes Region as a whole) must acknowledge this reality.

Our analysis and argument develops as follows. Section 2 provides an overview of the current state of the auto industry in Canada underscoring its incorporation into the cross-border Great Lakes automotive region. Section 3 addresses the challenges faced by the North American automotive industry due to supply chain weaknesses exposed by COVID-19, the more stringent CUSMA automotive ROO and technological disruption associated with the transition to EVs. How automotive manufacturing in the Great Lakes Region, and especially in Ontario, will be impacted by these challenges, is the focus of Section 4. The paper concludes by suggesting in Section 5 the need to consider how 'national' policies and programs can help secure a continued role for Canada in Great Lakes automotive manufacturing.

The evidence to support our argument is derived from analysis of various trade and employment statistical series produced by Canadian and US government agencies, automotive facility data extracted from specialised commercial automotive databases, and information contained in automotive reports produced by both governmental and non-governmental organisations. Unlike most 'nationally' framed analyses, our in-depth analysis of trade data at the five-digit NAICS industry level provides insight into the functional integration and relational interdependence of the automotive industry *between and across* jurisdictions within the GLR.

2 Canadian automotive production and the cross-border Great Lakes automotive region

As the name suggests, cross-border regions, such as the GLR, are territorial units comprised of contiguous sub-national units from two or more nation-states. Several writers (e.g., Brenner, 2004; Perkmann and Sum, 2002) argue that as globalisation challenged the primacy of the national scale of political-economic organisation and regulation, new forms of sub-national governance, including cross-border regions, became important in positioning "urban and regional economies optimally within global and supranational circuits of capital" [Brenner, (2004), p.3]. The development and importance of Canada-US cross-border regions is well recognised in both government policy documents (Policy Research Initiative, 2008; Andrea and Smith, 2002) and academic research (Courchene, 2001; Blatter, 2004; Brunet-Jailly, 2004; Sweeney, 2010). The Great Lakes Region encompassing Ontario and neighbouring US states is one such region, and one in which automotive manufacturing is of prime importance (Courchene, 2001; Rutherford and Holmes, 2013).

2.1 Automotive production in Canada

Despite the steady loss of assembly capacity over the last 20 years, automotive manufacturing remains a major Canadian industry. In 2019, it contributed $16 billion to GDP, $80 billion in exports, and directly employed over 118,500 people, roughly one-third in vehicle manufacturing and two-thirds in motor vehicle parts manufacturing (Unifor, 2020).[5] All Canadian light vehicle manufacturing and around 90% of parts production is located in a narrow corridor in southwestern Ontario, stretching from Windsor, on the border across from Detroit, to just east of Toronto. Hence, the Ontario automotive industry essentially *is* the Canadian auto industry. In 2019, 86% of the almost 2.0 million vehicles built in Ontario by five automakers (Toyota, FCA, Honda, GM and Ford) were exported for sale in the USA. More than 700 plants are operated by parts suppliers, including many large global suppliers, and around 50% of Canadian-made automotive parts by value were exported in 2019, overwhelmingly to the USA and Mexico (89.3% and 7.3% of total parts exports, respectively).

2.2 Ontario: an integral part of the GLR

For purposes of our analysis, we identify four distinct automotive production regions within North America: the historic heartland GLR; the US Mid-South region, the US South and Mexico.[6] Two-thirds of the $20.1 billion of automotive parts exported from Canada in 2019 went to states within the GLR, predominantly Michigan, Ohio and Indiana, with much smaller volumes going to the other two US regions and Mexico (Table 1).[7] Thus, Ontario automotive parts production is dependent not just on assembly capacity within Ontario but also importantly on levels of vehicle production across the GLR. Engines, engine parts, transmissions, transmission parts, other drivetrain parts, and metal stampings are prominent among Ontario exports to GLR states, accounting for over 50% of the auto part exports by value (Table 1). The GLR states are the source for almost 45% of the $43.9 billion in parts imported for assembly into Canadian-built vehicles and powertrain components again account for a significant share of the value (Table 2). The dominance of powertrain components is not surprising given the high level of production integration within the GLR and the fact that an individual engine or transmission manufacturing plant will supply multiple assembly plants due to lower minimum efficient scales of production in final assembly compared to powertrain plants [see Klier and Rubenstein (2020) for an insightful analysis of powertrain sourcing patterns in North America and Europe].

Table 1 Canadian automotive parts total exports: percentage shares by sub-industry and region: 2019

Automotive parts industry		*Total value ($C million)*	*Great Lakes (%)*	*US Mid-South (%)*	*US South (%)*	*US other states (%)*	*Mexico (%)*	*Outside NAFTA (%)*
NAICS 33631	Motor vehicle gasoline engine and engine parts manufacturing	4,317.8	75.8	12.7	3.3	3.5	4.4	3.9
NAICS 33632	Motor vehicle electrical and electronic equipment manufacturing	763.9	50.3	5.3	5.8	11.6	15.4	11.7
NAICS 33633	Motor vehicle steering and suspension components (except spring) manufacturing	1,614.1	57.4	9.3	10.3	11.2	9.0	2.8
NAICS 33634	Motor vehicle brake system manufacturing	489.3	45.6	18.1	23.0	7.4	1.9	4.1
NAICS 33635	Motor vehicle transmission and powertrain parts manufacturing	3,581.1	74.7	2.0	4.1	3.3	12.0	3.9
NAICS 33636	Motor vehicle seating and interior trim manufacturing	1,390.5	64.3	11.3	10.7	6.9	4.7	2.0
NAICS 33637	Motor vehicle metal stamping	2,747.6	65.1	9.9	9.2	8.2	5.2	2.4
NAICS 33639	Other motor vehicle parts manufacturing	2,757.3	49.1	8.2	12.6	15.3	8.5	6.3
NAICS 326193	Motor vehicle plastic parts manufacturing	2,414.1	66.1	11.1	8.9	7.1	5.1	8.8
Total ($C million)		20,075.58 100.0%	13,171.17 65.6%	1,829.01 9.1%	1,578.86 7.9%	1,346.36 6.7%	1,455.38 7.3%	694.80 3.5%

Notes: Great Lakes: MI, OH, IN, IL, NY, PA and WI.
Mid-South: KY, TN, MO and WV.
South: TX, AL, NC, SC, GA, MS and LA.
Source: Trade Data Online (accessed 23 October 2020)

Table 2 Canadian automotive parts total imports: percentage shares by sub-industry and region: 2019

Automotive parts industry		*Total value ($C million)*	*Great Lakes (%)*	*U.S. Mid-South (%)*	*US South (%)*	*U.S. other states (%)*	*Mexico (%)*	*Outside NAFTA (%)*
NAICS 33631	Motor vehicle gasoline engine and engine parts manufacturing	9,558.6	44.5	12.3	9.2	1.6	14.5	18.0
NAICS 33632	Motor vehicle electrical and electronic equipment manufacturing	4,942.1	22.0	5.1	5.3	4.0	31.0	32.7
NAICS 33633	Motor vehicle steering and suspension components (except spring) manufacturing	3,061.9	44.3	12.7	3.8	5.9	14.4	19.0
NAICS 33634	Motor vehicle brake system manufacturing	2,312.1	32.3	6.8	12.7	5.4	11.5	31.3
NAICS 33635	Motor vehicle transmission and powertrain parts manufacturing	6,426.1	53.1	8.3	5.7	2.6	14.7	15.6
NAICS 33636	Motor vehicle seating and interior trim manufacturing	978.1	32.4	5.7	8.8	7.5	30.2	15.4
NAICS 33637	Motor vehicle metal stamping	831.5	81.5	4.3	0.7	2.1	6.1	7.6
NAICS 33639	Other motor vehicle parts manufacturing	15,572.8	48.7	10.2	3.5	7.3	9.5	20.9
NAICS 326193	Motor vehicle plastic parts manufacturing	245.0	34.3	8.6	10.1	6.6	5.7	34.9
Total ($C million)		43,927.33 100.00%	19,520.26 44.4%	4,199.71 9.6%	2,578.42 5.9%	2,060.36 4.7%	6,400.77 14.6%	9,167.81 20.9%

Notes: Great Lakes: MI, OH, IN, IL, NY, PA and WI.
Mid-South: KY, TN, MO and WV.
South: TX, AL, NC, SC, GA, MS and LA.
Source: Trade Data Online (accessed 23 October 2020)

Interlocking supply chains facilitate this large two-way flow of automotive parts between Ontario and neighbouring US states and bind these jurisdictions together into the GLR. Any analysis of the automotive industry in either Canada or the Great Lakes states must recognise the significance of this symbiotic relationship. The fortunes of the industry in Canada are reliant on the vitality of the industry across the broader region including the ability of the GLR to secure new automotive productive investment in competition with other North American automotive producing regions.

Within the GLR, Ontario must compete for a share of regional investment with states such as Michigan, Ohio and Indiana and economic and social policy tools that are 'national' or 'Ontarian' in scope and effect are important in this regard.[8] Factors such as labour costs including the cost of healthcare benefits, energy costs and the currency exchange rate have worked, at different times, both to and against Ontario's competitive advantage within the broader region. During the 1990s, for example, Canadian plants enjoyed a significant all-in labour cost advantage over neighbouring US plants and automotive employment in Ontario grew by nearly 24%, compared to just 9.6% in the US portion of the GLR (Andrea and Smith, 2002).

At the peak of automotive manufacturing in 2000, Michigan, Ohio, Indiana and Ontario together employed 730,800 workers but as D-3 automakers (GM, Ford and FCA) lost market share to Asian and European automakers with newly built assembly plants in the southern US, the GLR, so heavily dependent on the D-3, steadily shed assembly capacity and employment. Witherspoon and Brown (2018) reported that automotive employment in the US Midwest region fell by 29% between 2001 and 2018 compared with a rise of 17% in the US South. At the same time, Ontario's competitive position within the GLR weakened due to a rapidly appreciating Canadian dollar and transformational labour agreements in the USA that combined to erode its prior labour cost advantage (Holmes, 2015).[9]

Following the 2008–2009 global financial crisis that saw the bankruptcy-forced restructuring of GM and Chrysler, and consolidation within the supplier base (Stanford, 2010), output and employment recovered more quickly in the US portion of the GLR than in Ontario (Rutherford and Holmes, 2014). Furthermore, the GLR faced additional competitive pressure as newly opened Mexican assembly plants captured an increasing share of the North American market at the expense of both the USA and Canada (Covarrubias Valdenebro, 2020).

Although it must compete with the lower-cost US South and Mexico to secure new automotive investment, the GLR remains North America's dominant automotive production region. The GLR received 58% of the almost US$148 billion in North American investment announced by automakers in the ten years following the end of the 2009 recession, whilst the US South and Mexico each received just 16% (Swiecki, 2020). The regional distribution of automotive employment (Table 3) and OEM assembly and powertrain manufacturing (Table 4) underscore not only the GLR's continued dominance but also the importance of Ontario within the region. The concentration of powertrain plants in the region particularly is striking.

The most salient measure of continued GLR dominance, however, and one that sharply differentiates it from other North American automotive producing regions, is the concentration of automotive R&D and engineering activity within the region. The tendency for OEM vehicle design, R&D, and product engineering activities to cluster to OEM headquarters is well documented. Furthermore, as OEMs ask their global suppliers to share more of the responsibility and costs associated with new vehicle development, the R&D and production engineering facilities of global suppliers locate in close proximity to those of the OEMs. This leads such activities to cluster in just a few key locations around the globe. Michigan fulfils this role for North America (Hannigan et al., 2015; Klier et al., 2014; O'Huallachain et al., 2018; Mordue and Karmally, 2020). In 2019, 21 OEMs had headquarters or technology centres in Michigan and 96 of the top 100 automotive suppliers to North America had a presence in Michigan, with 60 being headquartered there (Detroit Regional Chamber, 2020). With automotive manufacturing spread across the entire cross-border region and R&D and product engineering tightly clustered in south-eastern Michigan, the GLR is a classic example of what Clark (2013) describes as a 'working region' – a region in which design, R&D and engineering functions co-exist with manufacturing and where their outputs are mutually reinforcing.

Table 3 Regional distribution of automotive employment: 2019

Automotive producing region	*Employment motor vehicle manufacturing (NAICS 3661)*	*Employment motor vehicle parts manufacturing (NAICS 3363)*	*Total*
Great Lakes			
Ontario	37,658	66,416	104,074
Michigan	38,974	132,800	171,774
Ohio	22,241	75,340	97,581
Indiana	18,879	65,060	83,939
Other GLR states	20,312	51,805	72,117
Great Lakes total	138,064	391,421	529,485
US Mid-South	53,215	95,767	148,982
US South	53,658	109,451	163,109
Mexico	100,170	867,000	967,170

Source: QCEW Data Files: U.S. Bureau of Labor Statistics (http://bls.gov) and Statistics Canada. Table 14-10-0202-01 Employment by Industry, Annual (https://www.statista.com/statistics/1053310/mexico-automotive-industry-employment-by-sector/)

Recognising Ontario's inclusion and role within the GLR offers insight into recent debates regarding the future of the auto industry in Canada. Levels of automotive R&D and product engineering historically have been low in Canada (Tanguay, 2018; Mordue, 2020). This should not be a surprise, given the Ontario industry's integration into the Great Lakes automotive region with its cluster of research and development activity just across the border in Michigan.[10] Nevertheless, influential industry voices such as CAPC (2016, p.2) suggest that "[I]n this period of rapid industry transformation and adoption of new technologies, Canada needs to now invent products others will manufacture – not just manufacture products others have invented." For some policy advocates, this means transitioning to a more knowledge-intensive innovation profile for the industry focused on technologies linked to the development of autonomous, connected, electric and shared vehicles (ACESs) (Goracinova and Wolfe, 2019; Trippl et al., 2021). They point to Ontario's strength in both digital ICT technologies and cutting-edge artificial intelligence research and recent Ontario investments in ACES software development by both traditional OEMs and global digital platform companies such as Google and Uber. However, based on their analysis of patent data, Mordue and Karmally (2020) conclude that the preponderance of AV-related R&D is converging in core automotive locations such as Michigan with only 'mediocre' outcomes in Ontario. We shall return to this issue in the concluding section.

Table 4 Regional distribution of OEM vehicle assembly and powertrain plants: 2019

Automotive producing region	*Vehicle assembly plants*	*Engine plants*	*Transmission plants*
Great Lakes			
Michigan	11	7	4
Ontario	10	5	1
Ohio	6	5	4
Indiana	4	2	5
Illinois	2	1	1
Great Lakes total	33	20	15
Mid-South	9	3	1
US South	12	3	1
Mexico	24	12	6
Total	78	38	22

Source: https://www.marklines.com/portal_top_en.html and various others

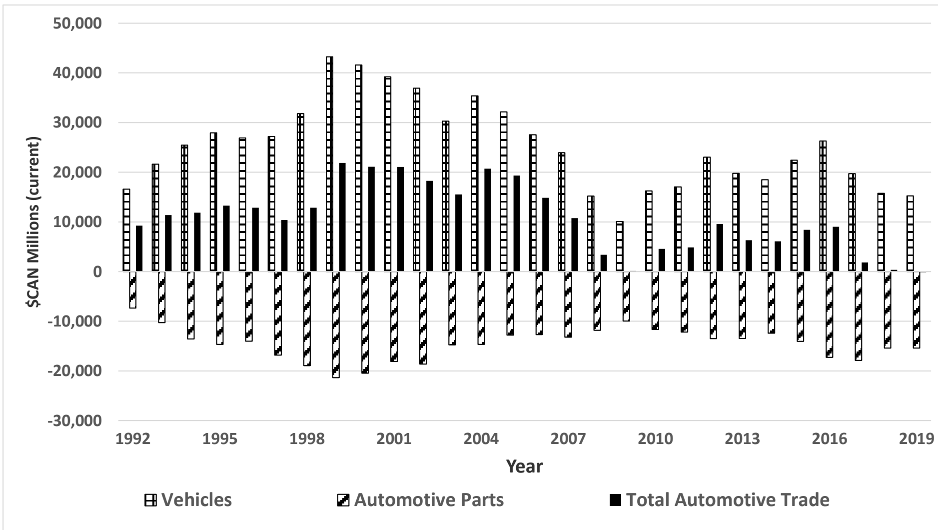
2.3 Automotive trade under NAFTA

Combined, the USA and Mexico accounted for over 84% of Canada's total worldwide automotive trade in 2019, 96.5% of exports and 79.1% of imports. Notwithstanding the highly integrated nature of the North American auto industry, the continent's geography results in an asymmetric trilateral pattern of automotive trade between the three NAFTA partners (Table 5). Large volumes of manufactured vehicles and parts flow in both directions across the US-Canada border and the US imports even larger volumes from Mexico. In sharp contrast, the volume of automotive trade between Canada and Mexico remains relatively small – just 9.7% of Canada's total North American automotive trade – and mostly flows from Mexico to Canada. Virtually all finished vehicles traded between Canada, the USA and Mexico enjoyed preferential zero tariff treatment under NAFTA. Although the majority of Canadian automotive parts exports entered the US duty free under NAFTA [81% in 2016 according to Dziczek at al. (2018)], some importers simply elected to pay the most-favoured-nation (MFN) tariff (on average 3.2%) to avoid the administrative burden and cost of complying with the NAFTA ROO.

Although Canada's share of North American vehicle production has contracted, it was able to maintain an overall positive annual North American automotive trade balance from 1965 (the advent of the US-Canada Auto Pact) through to 2019 (Figures 1 and 2).[11] Over this long period, a large positive balance derived from assembled vehicles exported to the USA was always more than sufficient to offset a large negative trade balance in automotive parts with the USA and smaller negative balances with Mexico for both vehicles and parts. Following the 2008–2009 crisis, a growing negative trade balance with Mexico steadily eroded the continued but diminishing positive balance with the USA. By 2019, the last full year under NAFTA trade rules, Canada's overall North American automotive trade (almost $145 billion in total) was virtually in balance;

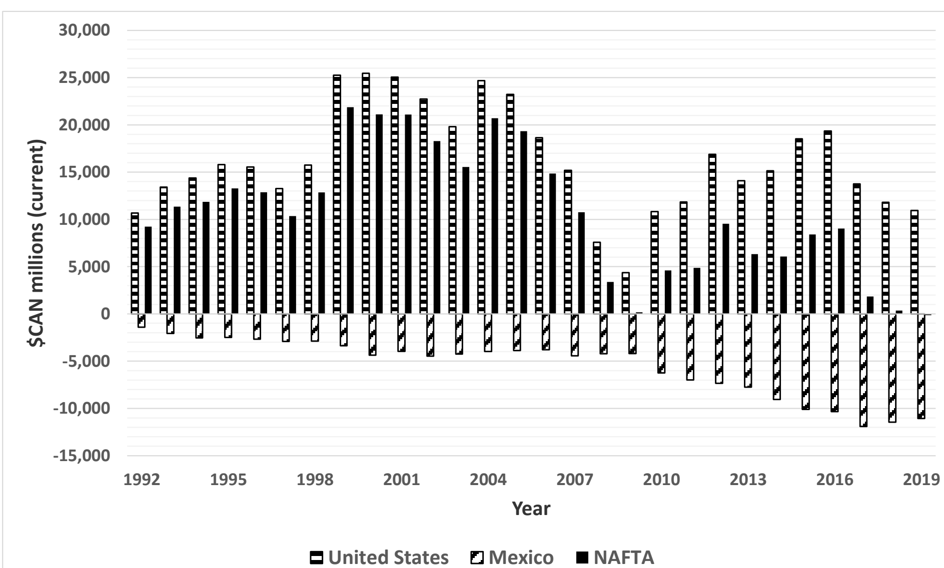
a roughly $11 billion surplus with the USA offsetting a similarly sized deficit with Mexico and a roughly $15 billion trade surplus in motor vehicles offset by a $15 billion deficit in automotive parts.

Figure 1 Canada automotive trade balances within NAFTA by industry: 1992–2019



Source: Strategis Online Trade Data

Figure 2 Canadian automotive trade balances within NAFTA by country: 1992–2019



Source: Strategis Online Trade Data

Table 5 Flows of motor vehicles (units) and motor vehicle parts (US$ millions) between Canada, the USA and Mexico: 2019

Vehicle production	*To: From:*	*Motor vehicles (units)*			*Motor vehicle parts ($US millions)*		
		Canada	*USA*	*Mexico*	*Canada*	*USA*	*Mexico*
1,916,585	Canada		1,616,880	1,055[a]		11,814.4	1,003.2
10,880,019	USA	884,989		126,052	21,261.4		20,724.6
3,986,794	Mexico	183,800	2,799,410		4,813.2	50,493.6	

Note: [a]Author estimate.

Source: http://www.trade.gov/td/otm/autostats.asp; Strategis Online Trade Data

3 Challenges confronting the automotive industry in the Great Lakes Region

The North American automotive industry faces both immediate and longer-term challenges. How it responds to these challenges will have repercussions for the industry in the broader Great Lakes Region, including in Ontario. It is important to retain perspective on the different time horizons associated with such changes. The most immediate and pressing challenge is for the industry to address supply chain vulnerabilities exposed by the global COVID-19 pandemic and more fully recover from the severe production disruption caused by the pandemic. Over the short to medium-term (five years), companies must adjust supply chains in order to conform to the complex and more stringent automotive ROO and RVC requirements in CUSMA. The new rules began to be phased-in in 2020 and initially were scheduled to be fully implemented by July 1, 2023. However, at least 13 automakers applied for an 'alternative staging regime' that allows them up to five years to comply fully with the new requirements. In the longer-term, the transition away from internal combustion engine powered vehicles to battery EVs will affect both OEMs and suppliers, especially those manufacturing powertrain components. Although this major shift in automotive technology is gathering momentum in North America, forecasts suggest that BEV sales will not exceed ICEV sales until at least 2040 (KPMG, 2020).[12]

3.1 The COVID-19 pandemic

The rapid onset of the coronavirus in early 2020 led to a sharp drop in North American vehicle sales and brought automotive production across the continent to a jarring halt. The pandemic exposed the fragility of highly synchronised and geographically stretched automotive supply chains. This manifested first in shortages of parts sourced from Asian plants that were among the first to experience COVID-related shutdowns. As the pandemic spread, supplier and OEM plants in North America shutdown. The assembly-line nature of many labour processes in the automotive industry requires people to work in close physical proximity. An initial shortage of personal protective equipment for workers led to rapid viral spread within workplaces and shutdowns. Canada experienced much lower rates of COVID infection both in the general population and in auto manufacturing plants compared to the USA and Mexico. Nevertheless, Ontario auto production was idled due to the integrated nature of supply chains across the GLR.[13]

Resuming vehicle production in North America was far from smooth given the complexity of supply chains and the uneven global spread of the virus. North American vehicle assembly plants haltingly began to reopen in late May 2020 after the USA pressured the Mexican Government to prioritise the reopening of supplier plants. However, the industry continued to experience disruptions due to fresh outbreaks of the virus in key plants in the supply chain and shortages of available workers willing to return to work. Workers in several unionised GLR assembly plants engaged in work refusals and wildcat stoppages to highlight inadequate in-plant health and safety protocols. The need for frequent cleaning and sanitising of workstations impaired the ability of many plants to regain pre-COVID levels of productivity.

Furthermore, an unanticipated shortage of semiconductor computer chips used in a growing range of vehicle parts from engine control systems to infotainment systems produced a new wave of auto plant extended shutdowns in the GLR (and elsewhere in North America) in 2021. Industry officials attribute the shortage to semiconductor companies first reducing production as vehicle sales and production fell sharply in the early months of the pandemic and then diverting production to meet a surge in demand for laptop computers and other consumer electronics from households forced by COVID-19 to isolate and work from home.

COVID-related disruptions have forced automakers and suppliers to review and adjust sourcing and inventory management practices to improve the resilience of their broader production system. The industry could well witness the reshoring to North America of some critical component production and increased sourcing from within the region.

3.2 CUSMA automotive ROO and RVC requirements

For goods to qualify for preferential tariff-free treatment under trade agreements such as NAFTA and CUSMA, they must meet certain criteria set out in ROO and RVC requirements. These rules strongly influence how companies organise their global production networks and are especially important in the automotive industry given the vast number of components and complexity of supply chains involved in vehicle production (Yates and Holmes, 2019). Automotive ROOs and RVC requirements became a contentious issue during CUSMA negotiations with the USA seeking to shape them to encourage increased US jobs and production in both vehicle and parts manufacturing and channel investment away from low cost jurisdictions (primarily Mexico). Canadian negotiators and stakeholders such as the Canadian Automotive Parts Manufacturers' Association (APMA) and Unifor supported the US general push to increase North American RVC on the grounds that it would likely generate additional sourcing opportunities for Canadian parts producers. Whilst Canadian and Mexican negotiators successfully opposed a USA proposal for a 50% US value content requirement, Mexico later accused Canada of being the architect of CUSMA's labour value content (LVC) requirement that works to Mexico's disadvantage.

The CUSMA automotive rules are far more restrictive and complex than the equivalent NAFTA rules (Table 6). RVC thresholds for passenger vehicles and light trucks will increase in stages from 62.5% (the NAFTA RVC) to 75%. CUSMA divides parts for these vehicles into three categories: core, principal and complementary parts.[14] The RVC threshold in the first year (2020) for each category was set at 66%, 62.5% and 62%, respectively, and will then increase in stages over the following three years to 75%, 70% and 65%. Vehicles only qualify as originating if 'super core' parts used in their production are also originating. Such parts include engines, transmissions, body and chassis, axles, steering and suspension system, steering system and advanced batteries. The inclusion of batteries, including battery cells, is significant given the impending shift to EVs.

Table 6 NAFTA and CUSMA requirements for passenger vehicles and light trucks to qualify for preferential tariff treatment

Requirement to qualify for preferential tariff treatment	*CUSMA*	*NAFTA*
Regional value content (RVC) thresholds (net cost method)		
Passenger vehicles and light trucks	75% after phase-in over 3 years: 66%, 69%, 72%, 75%	62.5%
Core parts (e.g., engine, transmission, body, chassis with engine, drive axles, steering and suspension systems and advanced batteries)	75% after phase-in over 3 years: 66%, 69%, 72%, 75% and must be originating	62.5% on engines and transmissions, 60% on other parts; no requirement that such parts be originating
Principal parts (e.g., brake system, ball bearings, tyres and wheels, seats, fuel systems, safety glass, pumps and compressors)	70% after phase-in over 3 years: 62.5%, 65%, 67.5%, 70%	60%
Complementary parts (e.g., plastic interior panels, instrument panels, audio equipment, lighting, catalytic converters, etc.)	65% after phase-in over 3 years: 62%, 63%, 64%, 65%	60% or less
'Alternative staging regime' available for qualifying passenger vehicle OEMs providing longer period to meet RVC thresholds		
Labour value content (LVC): for a vehicle to be originating, the threshold percentage of a vehicle's content produced by workers in North American factories earning on average US$16.00 (CA$20.88 in Canada, MXN$294.22 in Mexico) per hour		
Passenger vehicles	40% after phase-in over 3 years: 30%, 33%, 36%, 40%	No such requirement
Light and heavy trucks	45%	No such requirement
Steel and aluminium		
Passenger vehicle and light truck producers	70% of steel and 70% of aluminium purchases in previous year sourced in North America	No such requirement

Source: Author derived from NAFTA and CUSMA Agreements (https://ustr.gov/sites/default/files/files/agreements/FTA/USMCA/Text/UniformRegulationsRulesofOrigin.pdf)

In addition to increasing previous NAFTA RVC thresholds, CUSMA contains two novel features applicable to motor vehicle producers. To qualify as originating, vehicles must meet a complicated LVC requirement that, when fully phased-in, requires that at least 40% of the content value of the car (45% for pickup trucks with no phase-in) must originate from North American plants with a wage rate that on average is at least US$16/hour. The second novel feature is that an OEM's vehicles will only be deemed originating if the vehicle producer in the previous year purchased at least 70% of its steel and aluminium requirements from within North America.

Whilst CUSMA negotiations were underway, the protectionist Trump Administration threatened to place tariffs, similar to those already imposed on imported aluminium and steel, on automotive products, including those imported from Mexico and Canada. CUSMA Annex 2-C and separate side letters serve to protect Canadian and Mexican automotive production in the event that the USA imposes such tariffs [see Yates and Holmes (2019) for details].

3.3 Technological disruption

A technologically-driven transformation that promises to disrupt the North American auto industry is gathering momentum. Pressure to reduce greenhouse gas emissions to slow the rate of climate warming is pushing OEMs to shift production away from vehicles powered solely by internal combustion engine powertrains towards EVs. Currently, there are two principal types of EVs: plug-in hybrids (PHEVs), which use an electric motor in concert with an internal combustion engine, and BEVs using only an electric motor powered by batteries.

Sales of EVs represented less than 3% of the North American vehicle market in 2018 but are widely expected steadily to increase over the next two decades (UAW, 2020). Competition from EV manufacturers such as Tesla, Lucid Motors and Rivian has heightened competition and produced a flurry of planned North American EV production announcements from established OEMs. Coincident with the November 2018 announcement that it planned to shutter five plants, including four in the GLR, GM pledged to introduce 20 new BEVs by 2023. Ford plans to produce 16 EVs by 2022, whilst Volkswagen is expanding its Tennessee assembly plant to make EVs and battery packs starting in 2022. During the 2020 round of labour contract negotiations in Canada, Ford, FCA and GM committed almost $6 billion to retool manufacturing plants in Ontario to produce EVs starting in the early-to-mid 2020s.

The shift away from vehicles powered solely by internal combustion engines to ones powered by batteries and electric motors will have a transformational impact on the North American auto industry; especially in the GLR with its present concentration of ICEV powertrain manufacturing. The ICEV powertrain includes the engine, drivetrain, and associated components, such as transmission, fuel system, and engine cooling, exhaust and emissions control systems (see Küpper et al., 2020). While OEMs tend to produce engines and transmissions in-house, they source many of the myriad of discrete engine and transmission parts from independent suppliers. The BEV powertrain differs significantly from that in a gasoline or diesel powered vehicle with far fewer moving parts in its electric motor and single or two-speed transmission – Tesla, for example, claims that its drivetrain has only 17 moving parts and its motor just 2! The key components in a battery-powered vehicle are a very large lithium-ion battery pack; a controller to govern speed and acceleration; and a converter to distribute power to vehicle accessories (Küpper et al., 2020; UAW, 2020). The battery pack consists of battery cell modules packed into a housing together with a battery management system and thermal management system to cool the battery; critical tasks in lithium-ion batteries that can cause fires if not properly monitored and controlled.

As BEV production expands, OEMs will configure their EV production footprint and supply chains based on labour costs, cost and time constraints associated with logistics and trade regulations. The relative mechanical simplicity of BEV powertrains reduces the amount of labour required in vehicle assembly. The switch to BEV production will reduce employment in the manufacture of ICE engines, transmissions, exhaust systems, and fuel systems but create employment in batteries, electric motors, electronics, thermal systems and semiconductors (UAW, 2020; Küpper et al., 2020). Traditional OEMs currently lack battery technology expertise and generally source the cells that go into battery modules from Asian suppliers with lithium-ion battery expertise acquired by supplying the consumer electronics industry. OEMs, however, tend to manufacture electric motors and assemble battery packs in-house. Battery packs are designed and customised for each specific vehicle model and are assembled close to vehicle manufacturing, since transporting heavy and potentially hazardous batteries is costly (Harrison, 2021). Therefore, OEM's decisions about where to produce EVs (and in what quantities) are likely to be the primary determinants in the location of lithium-ion battery pack production in North America [Coffin and Horowitz, (2018), p.16].

4 Prospects for automotive manufacturing in Ontario and the broader Great Lakes Region

Earlier, we argued that the fortunes of the Canadian auto industry are intertwined with those of the Great Lakes automotive region as a whole. How might the sweeping changes identified in the previous section affect automotive manufacturing in the Great Lakes automotive region, and in particular, how might the Ontario segment of the region fare? The CUSMA rules governing automotive trade within North America, efforts to improve the resilience of supply chains in the wake of the coronavirus pandemic and the 'Made in America' policies of the current US administration all point to increased auto manufacturing in North America, and in particular, in the Great Lakes Region. On the other hand, and further out in time, the transition to EVs will likely lead to a net loss of employment in the GLR, especially in the segments of the industry engaged in manufacturing ICE powertrain components.

In reshaping the geography of auto production in North America, the CUSMA automotive rules will produce both winners and losers. To qualify for continued tariff-free preferential treatment, vehicles currently produced in North America will require more parts and materials sourced from within the continent than was the case under NAFTA. The introduction of the LVC requirement, and the stipulation that 'super core' parts such as engines and transmissions must be originating, favour the USA (and Canada) at the expense of Mexico (USTR, 2019). Some US and Canadian manufacturing facilities in the GLR could see increases in production and employment, as they become suppliers to more OEM vehicle programs. Conversely, some of those operating in Mexico may lose supply contracts over time and the growth of automotive manufacturing in Mexico in general may slow.

The US International Trade Commission (USITC) forecast that CUSMA would result in a 'modest' increase of 76,000 automotive jobs for the USA (USTR, 2019). Canada's

APMA suggests that CUSMA may increase Canadian auto parts sector production volumes by 25%, especially with the coronavirus pandemic pushing automakers to question the wisdom of extended supply chains and look to more localised regional sourcing (Nuthall, 2020). At the same time, there is a consensus that, by increasing the cost of producing vehicles in North America, the CUSMA content rules will raise the price of vehicles for North American consumers and reduce the global competitiveness of the North American industry (USTR, 2019; High, 2019; Dziczek et al., 2018).

Since CUSMA makes provision for an extended five-year phase-in period, automakers currently building vehicles within the GLR should experience little difficulty in meeting the higher RVC and the new LVC and steel and aluminium requirements. Many D-3 vehicles produced in the region already exceed NAFTA RVC thresholds and other automakers in the region – Honda, Toyota and Subaru – source the majority of major components including engines and transmissions in North America. The LVC requirement strongly favours assembly and powertrain plants in the GLR, since they already pay above the specified LVC average wage level, whereas those in Mexico (and in some instances in the southern US) do not (Klier and Rubenstein, 2020; Covarrubias Valdenebro, 2020). A number of vehicles currently built by European and Asian-owned OEMs in the southern US and Mexico use imported engines and/or transmissions from overseas. The CUSMA requirement that 'super core' components must be originating for the vehicle to qualify for preferential tariff treatment will likely force these automakers to move some powertrain production to North America.

In summary, the GLR appears well positioned to capture a substantial share of increased production resulting from the application of CUSMA automotive rules. There are, however, two possible caveats. The expected positive benefit to GLR will be dampened if, instead of meeting the complex and administratively costly new RVC and LVC rules, companies simply opt to pay the relatively low MFN tariffs on non-originating automotive products imported to the USA and Canada from Mexico or overseas.[15] Recent reports suggest that whilst some Japanese OEMs operating in Mexico are prepared to pay the 2.5% US tariff imposed on vehicles not meeting the CUSMA LVC requirement, others are considering raising wages to meet the requirement and increasing automation to offset the higher labour costs (Asayama and Sotaro, 2020).

The second caveat is that Canadian and Mexican vehicle and parts manufacturers do have the option of seeking preferential treatment for vehicles and parts shipped between them under either CUSMA or the Comprehensive and Progressive Trans Pacific Partnership (CPTPP) Agreement (Holmes and Carey, 2016). If a vehicle imported from Mexico to Canada, for example, fails to meet the CUSMA RVC threshold but satisfies the much lower CPTPP requirement, Canadian importers can claim preferential treatment under the CPTPP and avoid the otherwise applicable tariff of 6.1% on imported passenger vehicles. This underscores that CUSMA implementation is likely to produce complex, and in some instances, unanticipated outcomes and it may be several years before a clear picture emerges of the full consequences of the new agreement for automotive production in the GLR.

The overall outcome for the GLR of the transition to EVs is less clear. The start-up North American manufacturers of BEVs – Tesla and Lucid Motors – are located in California and Arizona and Nevada is home to Tesla'a large-scale battery plant. Current production of EVs (mainly PHEVs), electric motors and battery packs in the GLR is limited. However, this will change in light of the flurry of OEM announcements regarding planned North American EV production and Biden's executive order aimed at making half of all vehicles sold in the USA in 2030 electric. The D-3 each plan to start building PHEVs and BEVs in the GLR within the next five years, especially in Michigan and Ontario. Rivian, a Michigan-based EV start-up, is reopening part of the former Mitsubishi assembly plant in Normal, Illinois to manufacture BEVs, and with financial backing from GM, Lordstown Motors plans to produce electric pick-ups and work trucks in GM's former Lordstown, Ohio assembly plant. Early indications suggest that OEMs favour pursuing a vertical integration strategy of producing battery modules, battery packs, and electric motors in-house while outsourcing battery cells and power electronics from Asia. Ultium Cells LLC, a partnership between GM and South Korea's LG Energy Solutions, is constructing a $US2.3 billion EV battery plant in Ohio and has announced a second battery plant to be built in Tennessee to supply BEV production at GM's Spring Hill, TN assembly facility.

The USA Government is intent on developing secure supplies of materials and components used in battery pack production. The manufacture of cells for lithium-ion batteries requires substantially transforming and increasing value along the supply chain of four key raw materials – lithium, cobalt, nickel and graphite (Scott and Ireland, 2020). Currently, China dominates the processing of these raw materials and their manufacture into battery cells and accounts for nearly 70% of global EV lithium-ion battery manufacturing capacity while the USA has less than 10% (Harrison, 2021). This poses a strategic threat to the USA as the demand for batteries to power BEVs accelerates. While the USA has limited domestic supplies of the key raw materials, Ontario has ample reserves of all four. The 2020 Canada-US Joint Action Plan for Critical Minerals Collaboration seeks to build downstream value and enhance North American capacity to refine and process critical mineral inputs for batteries. Government support for renewed mining and processing activity in Ontario linked to the development of battery cell manufacturing capacity in the GLR would further strengthen the automotive supply chains binding Ontario into the region.

The GLR may well secure a significant share of PHEV and BEV vehicle production and some electric motor and battery pack manufacturing. The full transition to BEV or hydrogen fuel cell vehicles, however, represents a serious long-term threat to jobs in companies manufacturing ICE engines, transmissions, exhaust systems and fuel systems (UAW, 2020). While some workers may retrain to make parts for EV motors and lithium-ion battery packs, the likelihood is that there will be far fewer such jobs than exist in automotive drive-train supply chains today. The GLR is home to a large number of plants manufacturing internal combustion engines and transmissions (Table 4) as well as a large number of suppliers to those plants. Approximately one-quarter of US motor vehicle parts manufacturing workers make components for internal combustion powertrains (UAW, 2020). Engine and transmission manufacturing combined account for close to 40% of total automotive parts exports by value and 26% of auto parts employment in Ontario. The new manufacturing investments required to retool plants for BEV production provide an opportunity to integrate advanced manufacturing technologies, including increased use of automation and artificial intelligence, and this may further reduce the number of workers needed for BEV production (Küpper et al., 2020). Overall, the phasing out of ICE powered vehicle manufacturing will undoubtedly result in a net negative reduction in GLR automotive parts manufacturing employment.

5 Conclusions

Analyses of automotive production in Canada are framed most often in the context of a singular stand-alone ‘national’ industry. It is undeniable that ‘national’ (both federal and provincial) policies have been, and continue to be, influential in shaping the industry (Mordue, 2020). However, the overwhelming majority of the Canadian industry lies in southern Ontario and forms a prominent and integral part of the cross-border Great Lakes Region that continues to dominate North American automotive production. Consequently, the fortunes of the Canadian automotive industry are shaped not only by Canadian ‘national’ policies but also are highly dependent on the ability of the broader GLR to attract and retain automotive investment.

In all likelihood, the phasing-in over the next five years of the CUSMA rules governing automotive trade will lead to increased levels of automotive production and employment in the GLR. In the wake of the coronavirus pandemic, adjustments to avoid future production and supply chain disruptions may result in more localised sourcing that would also benefit the region. The transition to battery EVs, which is gathering momentum under the current US administration, will have a major impact on the industry. The GLR is well-positioned to capture both EV and battery production, but will likely experience a net loss of parts sector jobs as internal combustion engines are phased-out.

How Ontario fares within the GLR will depend on whether it can remain cost competitive with states on the US-side of the border and on how well it is able to position itself to play a growing role in the transition to the production of electric, autonomous, and connected vehicles. In both instances, federal and provincial policies and programs will be of prime importance. Given the most recent outcomes from automotive labour contract bargaining in the USA and Canada, and with the Canadian dollar trading in a range around US$0.79, automotive production in Ontario currently is cost competitive within the GLR. Like its predecessor, the Biden administration in Washington publically champions a ‘Buy American’ policy. There are indications, however, that it pragmatically recognises the economic advantages of maintaining an integrated North American automotive industry.

‘National’ (i.e., federal and provincial) policies are required to ensure that Ontario not only remains cost competitive but will play a role, as a part of the GLR, in the ongoing technological transformation of the auto industry. Such policies include programs to support the extraction and processing of Canadian minerals needed for electric battery production, the building of EV infrastructure, support for producers of innovative parts for EVs and AVs, and direct support to OEM plants to secure mandates to produce BEVs and batteries in Canada.

On balance, our analysis suggests there are grounds to be cautiously optimistic with regard to Canada’s ability to retain an automotive manufacturing role within the Great Lakes Region.

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Notes

1 The new agreement took effect July 1, 2020. The USA refers to the agreement as the United States-Mexico-Canada Agreement (USMCA). In Mexico, it is the Tratado entre México, Estados Unidos y Canadá (T-MEC), and in Canada, the CUSMA. Given the Canadian focus of this paper, CUSMA is used throughout.

2 FCA merged with the French-based PSA group in January 2021 to form a new company, Stellantis. Our analysis predates the merger and so retains FCA.

3 In this paper, the GLR, which spans the US-Canada border, comprises Michigan, Ohio, Ontario, Indiana, Illinois, Wisconsin, Pennsylvania and New York.

4 Pavlínek (2018) also suggests Canada as an example of a semi-peripheral automotive industry.

5 The COVID-19 pandemic resulted in extreme dips in output, employment and trade in 2020 and so only data to 2019 are used. Monetary values expressed in Canadian dollars, unless stated otherwise.

6 The US Mid-South consists of Kentucky, Tennessee, Missouri and West Virginia. The US South of North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana and Texas. Although there are at least two automotive sub-regions – Northern and Central – in Mexico, we treat Mexico as a single region due to data limitations.

7 In contrast to Canada's heavy reliance on parts exports to the GLR, Mexico's are directed to both the GLR (44%) and the US South (36%).

8 From the 1878 National Tariff Policy through the 1965 Canada-US Auto Pact, the 1988 Canada-US Free Trade Agreement, and the 1994 NAFTA to CUSMA, national political agendas have shaped the development of automotive production in Canada.

9 In 2007, the UAW agreed to the formation of a voluntary employees' beneficiary association – the UAW Retiree Medical Benefits Trust – for US workers at D-3 plants. This relieved the D-3 from carrying the liability for retiree health plans on their books and narrowed the production cost differential between Canadian and US plants.

10 Even Canadian-owned and headquartered global suppliers such as Magna International and Linamar situate their primary North American R&D and product engineering facilities in Michigan close to their OEM customers' headquarters.

11 Canada also ran a positive balance on its automotive trade with all countries until 2007 when the balance turned negative. Since then, its overall automotive trade deficit has steadily grown and stood at $20.89 billion in 2019.

12 The development of autonomous vehicles represents a second source of technological disruption that will affect vehicle manufacturing and potentially transform patterns of future vehicle ownership and use. Given the enormous amounts of capital required for vehicle technology development and heightened awareness of the climate crisis due to severe weather events, the current top priority for automakers is the development of BEVs and the timeline for autonomous vehicles is pushed further into the future.

13 The Canada-US border was closed to non-essential travel. Automotive shipments were deemed 'essential' but border delays and disruptions still occurred. With vehicle production at a standstill, a number of suppliers in the GLR quickly pivoted from producing automotive parts to manufacturing PPE. This demonstrated the ability of manufacturing enterprises rapidly to convert production in times of crisis and lent support to the feasibility of converting to green technologies to address the climate crisis.

14 See CUSMA Part VI Tables A, B and C for detailed lists of parts in each category.

15 OEMs and large global suppliers have in-house expertise to navigate successfully the complex and potentially costly CUSMA administrative process and qualify for preferential treatment, but many smaller companies do not. Vehicles imported into Canada incur a non-preferential tariff of 6.1% and parts destined for Canadian assembly plants already enter duty free. Corresponding US non-preferential tariffs are 2.5% for cars, 25% for pickup trucks and an average of 3.1% for parts. Mexico levies a non-preferential tariff of 20% on vehicles and a minimum 5% on automotive parts.