

U.S. Consumer & Economic Impacts of U.S. Automotive Trade Policies



CENTER FOR
AUTOMOTIVE
RESEARCH

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CAR's mission is to conduct independent research and analysis to educate, inform and advise stakeholders, policymakers, and the general public on critical issues facing the automotive industry, and the industry's impact on the U.S. economy and society.

Executive Summary

A decision to impose tariffs on U.S. imports of autos and auto parts under Section 232 of the Trade Expansion Act of 1962, as amended (hereafter, “Section 232 autos and auto parts tariffs”), could far outweigh the impact of any previous trade action on the U.S. automotive industry, and on related U.S. consumer prices, sales, and employment. Moreover, this is true even though the implementation of the new United States Mexico Canada Agreement (USMCA) and other trade agreements will partially mitigate the effects of these tariffs.

The Center for Automotive Research (CAR) looked at ten different policy scenarios, projecting different combinations of policies and U.S. trade deals including: Section 232 autos and auto parts tariffs; the USMCA; the current (as of January 21, 2019) Section 301 tariffs on Chinese imports; and the current Section 232 steel and aluminum tariffs. Across all these policy scenarios, the impact on the U.S. new vehicle market and the broader U.S. economy is (1) substantial and (2) nearly entirely determined by the severity of the potential Section 232 tariffs on imported autos and auto parts.

Worst-case scenario

Under the scenario where (1) the USMCA is implemented in its current form, (2) other tariffs continue unmodified, and (3) the Section 232 auto and auto parts tariffs are imposed except on Canada, Mexico, and South Korea, the following will likely occur:

- A total of 366,900 U.S. jobs will be lost;
- U.S. light-duty vehicle prices will increase by USD 2,750 on average;
- U.S. new light-duty vehicle sales will drop by 1,319,700 units per year; and
- Many consumers will be forced into the used car market.

Importantly, in this worst-case scenario, the broad-based Section 232 autos and auto parts tariffs will be responsible for over **90 percent** of the total economic harm.

Other scenarios

A range of current and potential U.S. trade actions will impact the U.S. automotive industry going forward – from the new USMCA, to current tariffs on imports from China and imported steel and aluminum products from a wide range of trading partners, to the potential for new tariffs on imported automobiles and auto parts. No matter how these policies are combined, they operate to raise consumer prices for new vehicles, while lowering U.S. light vehicle sales, U.S. Gross Domestic Product (GDP), and total and new vehicle dealership employment.

In every scenario considered new vehicle dealership revenue and employment fall. Dealerships are likely to experience a decline in revenue totaling between USD 6.1 billion and USD 43.6 billion, with associated employment losses of between 10,700 and 77,000 employees. For the average dealership, these losses correspond to a fall in revenue ranging from USD 362,000 to USD 2.6 million, with corresponding employment losses of 0.6 to 4.6 employees. In the broader economy, U.S. GDP is projected to fall between USD 6.0 billion and USD 30.4 billion and total economy-wide employment would decline by between 71,200 and 366,900 jobs. In addition, higher prices for new vehicles will impact the market for used vehicles as well as raise the price of repair and maintenance parts – thereby raising the overall cost of vehicle ownership for consumers.

While there are many moving pieces in U.S. trade policy, the range of likely outcomes from (1) the implementation of the USMCA, (2) continuation of Section 301 China tariffs, (3) the Section 232 steel and aluminum tariffs, and (4) a range of possible Section 232 auto and auto parts tariffs are all profoundly negative for consumers, for new vehicle dealership revenue and employment, and for overall U.S. economic output and employment levels.

Introduction

Since the early days of the 2016 U.S. presidential campaign, President Trump pledged to revamp U.S. trade policy. The first two years of the Trump Administration have seen dramatic and, at times, rapid changes as the President seeks to prioritize U.S. manufacturing employment and investment. Many of the enacted or proposed policy changes have profound impacts on the U.S. and North American automotive industry, consumer prices for autos and auto parts, and the broader economy.

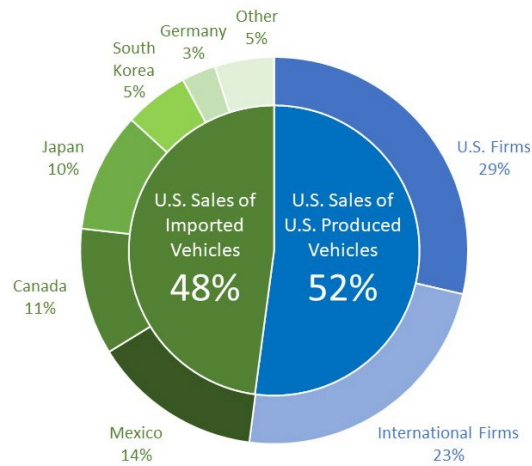
This briefing provides a quantitative analysis of current and proposed trade policy impacts on the U.S. automotive industry and updates CAR's *Trade Briefing: Consumer Impact of Potential U.S. Section 232 Tariffs and Quotas on Imported Automobiles & Automotive Parts* that was released in July 2018 (Schultz, Dzikczek, Swiecki, & Chen, 2018). This briefing expands on the July report and considers four specific policies: The United States-Mexico-Canada Agreement (USMCA), Section 232 national security tariffs on imported steel and aluminum, Section 301 tariffs implemented against imports from China, and the potential for Section 232 national security tariffs on imported autos and auto parts. The Center for Automotive Research (CAR) evaluated ten policy scenarios to estimate the combined effect of adopting each of these four policies. The scenarios differ by which countries are assumed to be subject to the potential auto and auto parts tariffs, and whether Canada and Mexico win exemptions from U.S. tariffs on imported steel and aluminum.

Trade and the U.S. Automotive Industry

The U.S. market relies on imported light vehicles and automotive parts to meet consumer demand. While the United States produced over 11 million light vehicles in 2018, light vehicle sales were 17.3 million. (IHS, 2018). In 2017, the dollar value of imported light vehicles and parts totaled over USD 340 billion (U.S.A. Trade Online, 2018). That year, 48 percent of all vehicles sold in the United States were imported – with 25 percent imported from NAFTA partners: Canada (11 percent) and Mexico (14 percent) (IHS Markit).

NAFTA ranks third globally in terms of light- and medium-duty vehicle production and is the second largest auto parts production region in the world. The North American light- and medium-duty motor vehicle market is estimated to be worth USD 728 billion annually, which together represents roughly 28 percent of the global market for new vehicles (Ward's World Motor Vehicle Data, 2017).

Figure 1: Sourcing of U.S. Light Vehicle Sales, 2017



Source: CAR; U.S. International Trade Administration

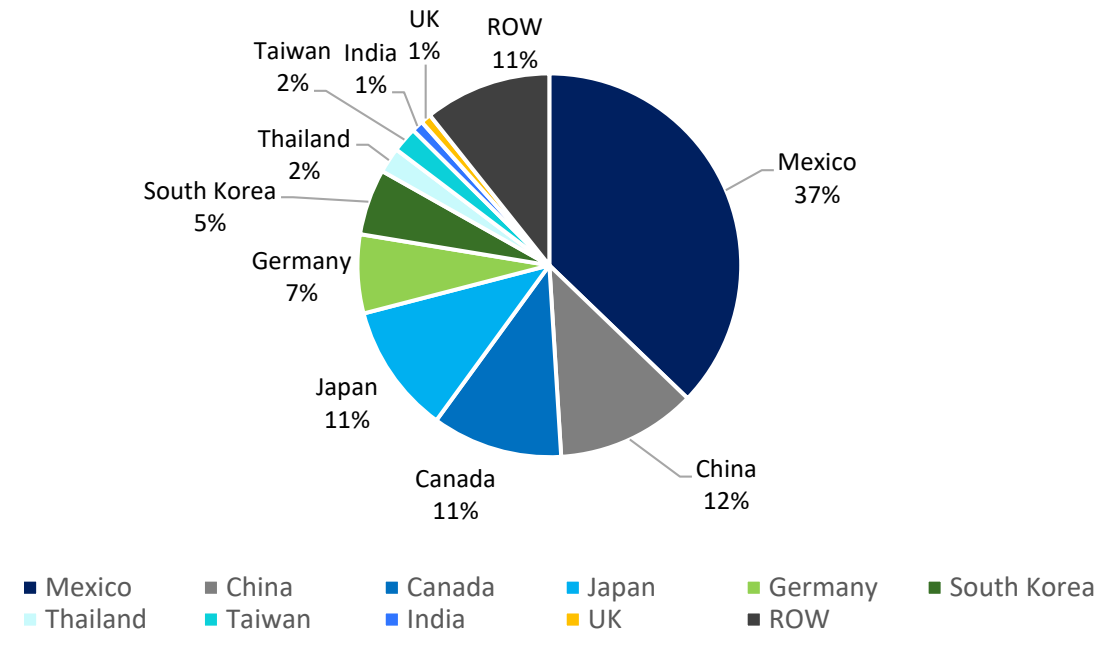
Automakers and their suppliers throughout the NAFTA region are very interconnected. No vehicle assembled in the United States is 100 percent U.S.-made; the average vehicle produced in the United States relies on 40 to 50 percent imported parts and component content (National Highway Traffic Safety Administration, 2018).

The share of non-U.S. parts content ranges widely across vehicles – and does not fall neatly across companies or vehicle brands. Some vehicles assembled in the United States have low North American and U.S. content, while certain models assembled outside the United States have high U.S. content. Consider two generalized examples: A vehicle selling for USD 35,000 contains approximately USD 26,000 in value from materials, parts, and components. At 80 percent U.S. content for these inputs, a 25 percent tariff applied to all imported auto parts would add USD 1,300 to the vehicle’s price. For a U.S. content level of 30 percent, the price increase would surpass USD 4,500. At the vehicle model level, consumers are very sensitive to relative prices compared to other vehicles within the same class or segment. Thus, even the relatively small price change experienced by the 80 percent U.S. content vehicle could drive significant sales losses for a dealership.

The U.S. imported USD 148.8 billion in auto parts in 2017 with NAFTA partners accounting for nearly half of all parts imports: 11 percent of all U.S. parts imports were from Canada and 37 percent from Mexico (U.S.A. Trade Online). Canada and Mexico are also the destinations for 62 percent of U.S. motor vehicle and parts exports (U.S. International Trade Administration, 2017).

Even for vehicles not assembled in the United States, automakers’ decisions on where to build their products impact U.S. jobs and the economy. Imports from Canada and Mexico support many U.S. jobs since there is a greater share of U.S. content in the average Canadian- or Mexican-built vehicle than there is in any vehicle assembled in a non-NAFTA country. According to CAR’s estimates of NAFTA content in vehicles sold in the United States, the typical Mexican-assembled vehicle includes between 20 and 30 percent U.S. and Canadian content. In contrast, the average vehicle imported from outside the region has North American content of just 3.5 percent.

Figure 2: Sourcing of U.S. Motor Vehicle Parts Imports, 2017



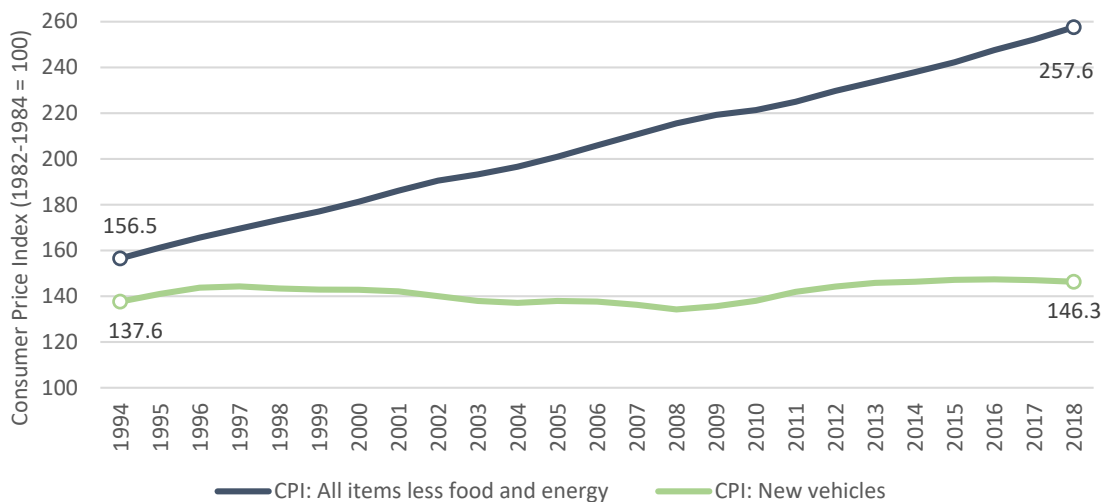
Source: CAR; U.S. International Trade Administration

Due to the automotive industry’s reliance on complex cross-border supply chains, any new barriers to trade will have a significant impact on the U.S. automotive industry, consumer prices, and U.S. sales, employment, and economic output. Trade enables the U.S. automotive and parts industries to be globally competitive. Because of international commerce, the U.S. industry can specialize in areas where it has a comparative advantage and achieve greater economies of scale.

U.S. consumers benefit from trade both because there is a greater selection of models in the market, and because trade helps to keep new vehicles affordable. While only 117 vehicle models were produced in the United States in 2017, 354 models were available for U.S. consumers to choose from (IHS, 2018). Among the 237 vehicle models without U.S. production, some models have sales that are just too low to support local production: 49 of these models see fewer than 1,000 annual U.S. sales, and 95 less than 5,000 (IHS, 2018). U.S. consumers additionally benefit from improved affordability as trade increases competition between automakers encourages specialization and improves economies of scale.

Figure 3 shows that while consumer prices have risen 86 percent since NAFTA came into being in 1994, new vehicle prices have only gone up by 7 percent over the same period.

Figure 3: U.S. Consumer Price Indices for All Items-Except Food & Energy, and New Vehicles, 1994-2018



Source: U.S. Bureau of Labor Statistics, 2018

Policy Specifics

Section 232 Tariffs on Imported Light Vehicles & Vehicle Parts

In May 2018, at the direction of President Trump, the U.S. Department of Commerce (DOC) opened an investigation into whether U.S. light vehicle and parts imports are a threat to U.S. national security, again using the authority granted Section 232 of the Trade Expansion Act of 1962. The DOC was expected to issue findings and recommendations in February 2019,¹ after which the President has 90 days to decide whether to impose tariffs or quotas (or both) to adjust imports. President Trump has frequently mentioned imposing new auto and auto parts tariffs of as high as 25 to 30 percent using Section 232 as the tool to do so.

As part of the USMCA negotiations, both Canada and Mexico gained commitments from the United States, which effectively exempt them from any Section 232 tariffs on vehicles or vehicle parts.

USMCA

The renegotiation of NAFTA began in August 2017, and the parties released the draft text of the USMCA on September 30, 2018. President Trump, Canadian Prime Minister Trudeau, and Mexican President Peña Nieto signed the agreement on November 30, 2018. Pending approval by each party's national legislatures, USMCA is projected to enter into force on January 1, 2020.

Alterations to the rules governing automotive trade are among the most significant changes in the move from NAFTA to USMCA. The USMCA heavily modifies the automotive Regional Value Content (RVC) requirement and introduces a North American steel and aluminum purchase requirement and a Labor

¹ The report is due within 270 days of opening the investigation.

Value Content (LVC) requirement, both of which finished vehicles must additionally comply with to receive tariff-free access to each country.

Under NAFTA, a 62.5 percent RVC was the only requirement necessary for vehicles and vehicle parts to receive tariff-free market access. Before the USMCA, NAFTA automotive rules provided the strictest rules of origin of any U.S. trade agreement. NAFTA includes extensive rules for calculating content, provisions to prevent the use of roll-ups,² and the use of a tracing list – where the origin of items on the list had to be traced back often to the raw materials used in their manufacture.

Under USMCA, the content requirement threshold for finished vehicles increases to 75 percent of the net cost. However, this higher requirement is counterbalanced by provisions which explicitly permit the use of roll-ups in the calculation of originating content and the abolishment of the tracing list.

The USMCA also extends the requirements for vehicle parts content. Whereas NAFTA had one content requirement level, the USMCA creates three bins for vehicle parts, each with a different threshold. The “Core Parts” bin has an RVC of 75 percent, the “Principal Parts” bin has an RVC of 70 percent, and the “Complimentary Parts” bin has an RVC of 65 percent.

Table 1: USMCA Regional Value Content Requirements

RVC Category	Required Content	Description of Category and Phase-In Period
Light Vehicles	75%	3-year transition, but automakers can appeal for a 2-year extension for a limited amount of production (~10%) if they have a “credible plan” to meet the new ROO
Core Parts	75%	Includes engine, transmission, body & chassis, axle, suspension, steering (all 3-year transition), and advanced batteries (5-year transition). Must be originating for the vehicle to be originating.
Principal Parts	70%	Includes tires, glass, pumps & compressors, A/C, bearings & bearing housings, electric motors used as primary source of propulsion, electric motors for electrical variable transmission, electromagnets, starter motors & generators, bumpers, safety belts, brakes, road wheels, radiators, mufflers, clutches, airbags, seats, and parts of seats.
Complimentary Parts	65%	Includes dies, locks, catalytic converters, valves, taps & cocks, electric motors & universal AC/DC motors not exceeding 37.5W, DC motors & generators not exceeding 750W, other batteries, distributors & ignition coils, electrical lighting, windshield wipers/defrosters, sound recording/reproducing apparatus, switches, insulating wiring sets, headlamps, electronic instruments & measurement equipment.
Steel & Aluminum	70%	Day 1 rule, no transition.

Source: CAR summary of [USMCA provisions on the USTR website](#)

USMCA additionally requires that items in the “Core Parts” bin must be originating content for a finished vehicle to meet the RVC. To comply with the core parts requirement, either each core part must

² When roll-ups are employed, any item which meets the relevant content requirement threshold is counted as wholly originating. For example, consider a car which uses an engine with 75 percent North American content, facing an RVC threshold of 75 percent. On average, engines account for 11.5 percent of total car content. Without roll-up, this engine would contribute 8.6 percent (75 percent x 11.5 percent) towards the content requirement. If roll-up is permitted, however, the full value of the engine is counted as originating content, so it adds 11.5 percent towards the RVC requirement.

individually meet the 75 percent content threshold or 75 percent of the total content of core parts value must be originating. Under this second option, which is called the “Super-Core” provision, a vehicle may contain some non-originating core parts, such as a transmission, and still comply with the core parts requirement. However, under either option, if a very high-value core part is non-originating, the vehicle will fail the core parts requirement. For example, if a vehicle is entirely made of North American content except for its engine (or battery in the case of an EV), the vehicle would fail the core parts requirement (because the engine is such a large share of core parts content), and therefore the vehicle would fail the RVC requirement and be subject to tariff.

In addition to the RVC requirements for vehicles and vehicle parts, the USMCA includes a mandate for North American sourcing of metals used in vehicle manufacturing. For a vehicle to comply, at least 70 percent of an automaker’s expenditures on steel and aluminum purchased to produce vehicles in North America must be attributable to steel and aluminum products originating in North America.

The USMCA also introduces an innovation in trade policy – the LVC requirement. Under the USMCA, for tariff-free market access, a minimum portion of the direct manufacturing labor incorporated into the production of the vehicle must involve a base wage rate of at least USD 16 per hour. For cars, the minimum is 40 percent, and for light trucks, the minimum is 45 percent. A credit of up to 10 percentage points towards the 40 or 45 percent LVC requirement is available through the employment of highly-compensated salaried workers in research & development or information technology. An additional credit of 5 percentage points applies to vehicles which use an engine, transmission, or battery sourced from a manufacturing facility with average direct manufacturing pay exceeding USD 16 per hour. In practice, the LVC is a mandate for U.S. or Canadian manufacturing employment, with additional incentives for locating salaried workers in the United States or Canada.

Section 301 Tariffs on Imports from China

In August 2017, the United States initiated an investigation into China’s acts, policies, and practices related to technology transfer, intellectual property, and innovation under Section 301 of the Trade Act of 1974. The United States Trade Representative (USTR) issued a report in March 2018 and found that China’s technology-transfer policies, licensing restrictions, outbound investments, and cybercrimes constitute unfair trading practices. The USTR points to China’s National Medium- and Long-Term Science and Technology Development Plan, the State Council Decision on Accelerating and Cultivating the Development of Strategic Emerging Industries, and the Made in China 2025 Notice as evidence of their claim. The finding enables the United States to pursue trade remedies through bilateral negotiations, filing disputes at the World Trade Organization (WTO), or initiating additional Section 301 investigations.

The United States published a list of USD 50 billion in Chinese goods that it would target for tariffs, and China also released a list of USD 50 billion in U.S. goods on which it would impose additional tariffs if the United States went forward with its tariffs. In July 2018, the United States imposed 10 percent additional tariffs on the first tranche of USD 34 billion in Chinese imports; China quickly retaliated with tariffs on USD 34 billion in U.S. imports to China. Also in July 2018, China lowered its bound rate for light vehicle imports from 25 percent to 15 percent, and then quickly added a 25 percent tariff on U.S. light vehicle imports only – taking the duty for U.S. autos to 40 percent while the rest of the world pays 15 percent. In response to China’s retaliatory moves, the United States published a list in July 2018 of USD 200 billion of Chinese imports that it would target for additional tariffs, and China published a list of USD 60

billion in U.S. goods on which it would raise duties in response. The second tranche of U.S. tariffs on USD 16 billion in Chinese imports went into effect in August 2018, and China quickly followed with tariffs on USD 16 billion of U.S. imports to China. The third tranche of U.S. tariffs on Chinese goods, which took effect in September 2018, included substantially all light vehicle parts and components as well as automotive tooling and molds. The United States set the tariff rate on Chinese imports in the third tranche at 10 percent, with a threat that the rate would increase to 25 percent if China did not act to resolve the dispute. In November 2018, the United States and China agreed to a tariff truce and initiated a series of bilateral talks aimed at addressing the trade dispute. The United States has said it would automatically raise the third tranche tariff rate to 25 percent if the parties do not make progress in talks before the end of March 2019. If this comes to pass, the impacts of Section 301 will be far more significant than CAR has modeled, as this briefing is based on tariff rates in effect as of January 2019.

Section 232 Tariffs on Imported Steel & Aluminum

In January 2018, the DOC completed its investigation into whether imports of steel and aluminum products constitute a national security threat under Section 232 of the Trade Expansion Act of 1962. As a result, the United States imposed a 25 percent tariff on steel imports and 10 percent tariff on aluminum imports on 1 June 2018 (U.S. Customs and Border Protection, 2018). The additional duty applies to all affected steel and aluminum products from countries except for those the United States agreed to grant an exemption, including Argentina, Australia, Brazil, and South Korea. As of December 20, 2018, the DOC has issued some 14,301 steel product exclusions out of 44,389 requests filed and 917 aluminum product exclusions out of 6,013 petitions filed (McDaniel & Parks, 2019).

As a result of the tariffs, prices for imported steel and aluminum increased, as did prices for U.S.-produced metals due to increased demand. U.S. steel and aluminum price increases have increased the costs of U.S. motor vehicle and parts output due to the usage of steel and aluminum as inputs in the manufacturing process. The U.S. tariffs have made reportedly made U.S. steel the most expensive, globally (Naughton & Deaux, 2018). Both Ford and General Motors disclosed in late 2018 that these tariffs had cost them USD 1 billion each – approximately USD 700 for each vehicle they produced in North America. Ford and GM's input costs rose despite already predominantly using U.S.-sourced metals (Carey & Klayman, 2018) (Carey & Shepardson, 2018).

The steel and aluminum tariffs have also increased the costs of vehicle and parts production in Canada and Mexico. Due to the integration of the North American market, vehicle parts produced in one country are often used for vehicle assembly occurring in another. As a result, broad-based cost increases in one country, such as due to the U.S. tariffs on imported steel and aluminum, and retaliatory measures enacted by Canada and Mexico, have increased metals prices in all three NAFTA countries.

Summary of Methods

Simulation Model

CAR developed a simulation model of trade in the U.S. automotive industry to evaluate the impact of imposing additional tariffs on imported autos and auto parts. The analysis examines the substitution away from imported autos and auto parts as a result of the potential trade action and assumes unitary demand elasticity (i.e., changes in price yield proportionate changes in sales volumes and the total dollar

value of the market remains unchanged). The analysis also assumes that producers will fully pass cost increases along into consumer prices. The simulation provides direct estimates of the impacts on vehicle prices, sales, dealership revenue, and motor vehicle and parts manufacturing. The direct effects are used as input values to determine the economy-wide impacts using the Regional Input-Output Modeling System (RIMS II) – a commercially-available model of the U.S. economy. The appendix presents additional information on the modeling process.

Simulation Inputs

The impacts of each policy action are required inputs to the simulation model. The potential costs of each policy were estimated using publicly available data. Where assumptions were required, CAR utilized best-case scenarios for CAR’s modeling to avoid overstating and compounding potential negative impacts. A brief discussion of the procedures for estimating changes in trade costs follow, with additional information available in the methodology appendix.

Section 232 Tariffs on Imported Light Vehicles & Vehicle Parts

While intuitive to assign the tariffs imposed on imported vehicles and vehicle parts as costs to vehicle sales or vehicle assembly, doing so would overstate the impacts of these tariffs. The reason is that it would fail to differentiate between original equipment – the production of new vehicles or creation of vehicle parts – and aftermarket use, such as a consumer purchasing a new muffler from a parts store. Additionally, many of the goods subject to tariffs are used by multiple industries. CAR researchers pursued numerous avenues of research to adequately adjust import figures to reflect only the costs these tariffs would impose on the manufacture and sale of new vehicles.

For imported parts that are specific to light vehicles, an estimated 75 percent of imports (by value) are destined for original equipment use (Automotive Aftermarket Suppliers Association, 2012) (International Trade Administration, 2011) (International Trade Administration, 2009) (International Trade Administration, 2007). Thus, when estimating the impact on the costs of U.S.-assembled vehicles, CAR considered trade impacts upon 75 percent of imported vehicle parts by value. The total tariff-caused increase in OEM parts cost is assigned to all vehicles assembled in the United States, with the effects on the prices of vehicles both assembled and sold in the United States presented in our results. Cost increases raise the price of U.S. vehicle exports, as well, but this briefing only presents effects on U.S. consumers. For vehicles assembled outside of the United States, and imported from countries which are subject to the tariff, the assumed tariff rate of 25 percent is applied to these vehicles as a consumer price increase.

USMCA

Evaluating the impacts of the new rules of origin requirements present in USMCA requires first estimating the North American content and the U.S. and Canadian labor content of all vehicles assembled and sold in North America. While NAFTA content certification data exists, it is not available for public or research use. CAR developed a method for estimating the required vehicle-model level content figures using the model year 2018 the American Automobile Labeling Act data, and industry-level government data available through the U.S. Census Bureau, Statistics Canada, and Instituto Nacional de Estadística y Geografía. These estimates were cross-checked using trade data and

proprietary databases. Additionally, one automaker provided limited feedback on the accuracy of CAR's estimates for their products.

CAR estimates that 47 vehicle models which are produced and sold in North America do not meet the USMCA rules of origin requirements. Of these, 20 vehicle models are assembled in the United States, and the remaining 27 vehicle models are assembled in either Canada or Mexico. Nearly all of the models assembled outside of the United States met the NAFTA requirements – 24 of the 27 which would not comply with USMCA do meet NAFTA requirements. Under USMCA, these 24 vehicle models would be newly exposed to import tariffs assessed by each country. Passenger vehicles entering the United States would be assessed at the most-favored-nation (MFN) tariff rate of 2.5 percent and cargo vehicles, including light-duty pickup trucks and vans, are assessed a 25 percent tariff. Across these 24 vehicle models, the average potential tariff cost for units complying with NAFTA but not USMCA would be USD 635. However, it is unlikely that many of these models will be brought into compliance with USMCA rules. All non-conforming vehicles fail multiple criteria within the USMCA rules of origin, with the LVC requirement particularly challenging to meet through supply chain alteration. Instead, the sale of these vehicles in the U.S. market is likely to cease. Manufacturers have already announced plans to end either North American production or U.S. sales for 12 of these vehicles.

Although the cost increase for these individual models which could lose tariff-free access is substantial on a model-by-model basis, weighed against the total volume of vehicles imported from Canada or Mexico, the average per vehicle imported cost would be far smaller. As a simulation input, the shift from NAFTA to USMCA is incorporated as a slight increase in the U.S. consumer prices of vehicles assembled in Canada or Mexico.

Section 301 Tariffs on Imports from China

As previously stated, approximately 25 percent of the value of imported vehicle parts is destined for aftermarket applications. However, available data suggest that for vehicle parts imported from China, far more than the typical 25 percent are destined for aftermarket use. To properly incorporate Section 301 tariffs against imports from China, CAR conducted additional research and meticulously reviewed the most detailed data available. Following this review, where used, remanufactured, and non-automotive vehicle parts were removed from consideration.

CAR researchers developed boundary conditions, where the full value of those imports which could not be reliably categorized as relevant or irrelevant to the U.S. light vehicle production were wholly assigned to use in U.S. light vehicle production or were considered to be entirely unrelated to U.S. vehicle production. This exercise suggests that between 1 and 3 percent of the value of U.S.-assembled vehicles is made up of vehicle parts imported from China. To evaluate the impacts of Section 301 tariffs, CAR used the midpoint of this range – an assumption that 2 percent of the value of U.S.-assembled vehicles stems from parts imported from China.

Section 232 Tariffs on Imported Steel & Aluminum

For the tariffs in effect against U.S. imports of steel and aluminum, CAR researched the consumption patterns for steel and aluminum by U.S. industry. The U.S. vehicle and vehicle parts manufacturing industries account for 26 percent of U.S. steel consumption and 31 percent of U.S. aluminum consumption (statista) (Bray, 2018) (U.S. Census Bureau, 2015). Using full-year 2017 trade data (the

latest available), with the exemptions granted to imports from Argentina, Australia, Brazil, and South Korea, the steel and aluminum tariffs apply to USD 27.8 billion of steel and aluminum imports (U.S.A. Trade Online). Given current consumption and import patterns and the exemptions granted to imports from Argentina, Australia, Brazil, and South Korea, the steel and aluminum tariffs represent an indirect tax of USD 1.4 billion on U.S. light vehicle and vehicle parts manufacturing, increasing costs of U.S. vehicle assembly by 0.43 percent. Were Canada and Mexico also exempted from the steel and aluminum tariff, the cost increase for U.S. light vehicle manufacturing would instead be 0.28 percent.

U.S. Light Vehicle Production Capacity

As the U.S. automotive industry does not have sufficient capacity to meet all U.S. consumer demand for new vehicles, constraints are imposed upon the simulation's predicted changes to total U.S. light vehicle production. Open (underutilized) vehicle assembly capacity in the United States currently, as of January 2019, sits at 2.8 million units (Center for Automotive Research, 2018). This open capacity is not evenly distributed across automakers or regions, does not align with historical production patterns, and mainly is free due to a mismatch between the products these factories can produce, and those which U.S. consumers are purchasing.

The simulation model enforces capacity constraints on a regional basis, using data on current open capacity at each U.S. vehicle assembly plant and recent historical data on each region's share of the nation's light vehicle manufacturing output. The simulation does not attempt to impose constraints according to vehicle model, class, brand, or any other criteria beyond the production region's current and recent output level. This approach provides a generous accounting of open capacity, such that any open unit could be used to produce any product regardless of vehicle architecture, the manufacturing process, or facility ownership. The actual effects of capacity constraints would be more severe, and the employment and economic outcomes more dramatic than what is shown in these scenarios.

Uncertain Impacts on Used Vehicles Prices, Repair, & Maintenance Costs

Tariffs on new automobiles and automotive parts will impact the market for used vehicles, as well as increase the price consumers pay to repair and maintain their existing vehicle due to higher parts prices. Higher costs for vehicle purchases result in higher valuations of existing vehicles and longer service lives, yet higher operating costs lower the value of existing vehicles and shorten their service lives. The dearth of literature presently available makes it impossible to determine which of these effects is likely to dominate. As an attempt at modeling these effects would rely upon assumed parameters, with little guidance as to their appropriate values, we exclude the impacts on used vehicles and vehicle repair and maintenance from our analysis.

Used vehicle prices typically follow a well-behaved and consistent depreciation pattern, with a given vehicle's value declining approximately 20 percent per year. Deviations from this generalized depreciation curve result from macro-level shocks in the economy, such as substantial changes in fuel prices, or shocks to used vehicle supplies, such as widespread destruction of vehicles due to a natural disaster (Center for Automotive Research) (Yerger, 2010).

The relative value of new and used vehicles is influenced by the relationship between used and new vehicle purchases. The supply of used vehicles is highly inelastic, as additional supply primarily results from either current vehicle owners bringing in-use vehicles onto the market to reduce their vehicle holdings or to replace them with newly-manufactured vehicles, thereby expanding the in-use fleet. Absent a dramatic change to household transportation needs or planned vehicle-ownership downsizing, sold vehicles must be replaced.

A secondary effect of increasing vehicle prices is an extension of vehicle service lives. Multiple studies indicate that the typical response to increasing vehicle prices – both for new vehicles, and for used vehicles – is to extend the length of ownership for currently-held vehicles, resulting in fewer sales of both new and used vehicles (Copeland, 2013) (Alberini, Bareit, & Martinez-Cruz, 2016) (Bento, Roth, & Zuo, 2016). However, this effect is offset by the increase in vehicle repair and maintenance costs which a tariff on imported vehicle parts will cause. Increases in vehicle operating costs have been conclusively tied to shorter periods of ownership and lower vehicle valuations (Hamilton & Macauley, 1999).

A 25 percent tariff applied to all imports of automotive parts will increase the cost of aftermarket parts by 8.3 percent. If an exemption were granted to Canada, Mexico, and South Korea, the impact would instead be a 3.4 percent price increase. Should Canada, Mexico, South Korea, Japan, the United Kingdom, and the post-BREXIT European Union all receive exemptions, this increase in aftermarket parts prices declines to 1.7 percent. It is difficult to determine the impact these costs would have on the providers of automotive repair and maintenance services. Parts and materials account for 100 percent of the cost of DIY repair and maintenance, and, on average, 33 percent for commercial vehicle repair and maintenance work. This result suggests that, as the relative cost of DIY would increase against commercial providers, more consumers would opt for commercial vehicle repair and maintenance services. However, budget tightening, whether due to price increases or falling incomes, has historically resulted in a shift towards DIY work. With currently available information, no reliable conclusion can be drawn as to the impacts of higher parts prices across DIY and “Do It For Me” repair and maintenance (Automotive Aftermarket Suppliers Association, 2012) (U.S. Bureau of Economic Analysis, 2018) (U.S. Census Bureau, 2018).

Policy Scenarios

To evaluate the effects of current and potential trade policy, the Center for Automotive Research developed ten policy scenarios from the four trade policies considered (USMCA, Section 301 China tariffs, Section 232 steel and aluminum tariffs, and Section 232 auto & auto parts tariffs). In all scenarios, CAR assumes that the USMCA is ratified and enters into force and that Section 301 tariffs against imports from China remain unchanged from their January 2019, product coverage and rates. The Section 232 tariffs on imported steel and aluminum are evaluated in either their current form, where Argentina, Australia, Brazil, and South Korea are exempt or in an alternate form which also provides exemptions for steel and aluminum imports from Canada and Mexico. This alternative is considered as both countries had indicated that removal of the steel and aluminum tariffs as a pre-requisite for proceeding with USMCA, and negotiations towards ending these tariffs or transitioning to a quota system for imports from Canada and Mexico appear to be ongoing (Rappeport & Thrush, 2018).

CAR considered five versions of Section 232 tariffs on autos and parts:

1. A broad-based tariff, where exemptions are granted only to Canada and Mexico, by the existing and already in-force side letters to the USMCA, and South Korea, because that country has successfully negotiated exemptions to prior protectionist trade measures;
2. A narrowly-focused tariff that applies only to vehicles and parts imported from the (post BREXIT) European Union;
3. A narrowly-focused tariff that applies only to vehicles and parts imported from the United Kingdom;
4. A narrowly-focused tariff that applies only to vehicles and parts imported from Japan; or
5. A broad-based tariff, but with exemptions for Canada, Mexico, South Korea, the EU, the UK, and Japan.

Section 232 vehicle and parts Scenarios 2 through 5 are in keeping with the Trump administration’s history of using tariffs – or the threat of tariffs – as a form of leverage in trade negotiations. Aside from Canada and Mexico, which have broad exemptions to Section 232 auto and parts tariffs via the USMCA, and South Korea, which has negotiated exemptions to other U.S. tariffs, the Administration is negotiating new trade agreements with the E.U., with the U.K., and with Japan.

The ten policy scenarios which result from the combination of the five possible Section 232 auto and auto parts tariffs, the USMCA, the Section 301 tariffs, and the two scenarios for the Section 232 steel and aluminum tariffs are summarized in Table 2.

Table 2: Overview of U.S. Automotive Trade Scenarios Analyzed

	USMCA	Section 301 China Tariffs	Section 232 Steel & Alum. Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%					
				Canada & Mexico	South Korea	EU	UK	Japan	All other countries
1	Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Exempt	Exempt	✓	✓	✓	✓
2				Exempt	Exempt	✓	Exempt	Exempt	Exempt
3				Exempt	Exempt	Exempt	✓	Exempt	Exempt
4				Exempt	Exempt	Exempt	Exempt	✓	Exempt
5				Exempt	Exempt	Exempt	Exempt	Exempt	✓
6			Exclude Canada & Mexico	Exempt	Exempt	✓	✓	✓	✓
7				Exempt	Exempt	✓	Exempt	Exempt	Exempt
8				Exempt	Exempt	Exempt	✓	Exempt	Exempt
9				Exempt	Exempt	Exempt	Exempt	✓	Exempt
10				Exempt	Exempt	Exempt	Exempt	Exempt	✓

Results

Across all ten scenarios, average vehicle prices rise and sales fall. New vehicle dealerships – and likewise, the entire U.S. economy – are always, unambiguously harmed. Of note, the potential Section 232 tariffs on imported light vehicles and vehicle parts are the single-largest factor in determining the magnitude of adverse effects. In the worst-case scenario, where a broad-based Section 232 is adopted against imported light vehicles and vehicle parts, exempting only Canada, Mexico, and South Korea, 90.5 percent of the total economic harm results from this single action. Under the scenario of least-harm, wherein exemptions to the existent Section 232 steel and aluminum tariffs are expanded to additionally exempt Canada and Mexico, and Section 232 tariffs on autos and auto parts only affect imports from the

United Kingdom, the vehicle and parts tariffs remain 42.8 percent of the total impact. The source of impacts, by specific trade policy and scenario, are presented in Table 3.

Table 3: Source of Impacts, by Specific Policy, by Scenario

U S M C A	Section 301 China Tariffs	Section 232 Steel & Aluminum Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%	Percent of Total Impact Due to Each Policy, by Policy Scenario			
				232 Light Vehicles & Parts	USMCA	301 China	232 Steel and Aluminum
Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Canada, Mexico, & South Korea Exempt	90.5%	2.2%	3.1%	4.1%
			Only applies to EU	74.2%	6.1%	8.5%	11.2%
			Only applies to UK	38.9%	14.5%	20.2%	26.5%
			Only applies to Japan	76.8%	5.5%	7.7%	10.1%
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	73.1%	6.4%	8.9%	11.7%
		Exclude Canada & Mexico	Canada, Mexico, & South Korea Exempt	91.8%	2.3%	3.2%	2.7%
			Only applies to EU	77.2%	6.4%	8.9%	7.6%
			Only applies to UK	42.8%	15.9%	22.2%	19.1%
			Only applies to Japan	79.5%	5.7%	7.9%	6.8%
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	76.1%	6.6%	9.3%	8.0%

Source: Center for Automotive Research estimates

Across the ten policy scenarios, the magnitude of trade policy impacts varies meaningfully. The price of the average vehicle sold in the United States could rise as much as USD 2,750 or by slightly more than USD 350, depending upon which policies are enacted. These price effects correspond to vehicle sales losses from 183,000 to 1.3 million. These outcomes are summarized in Table 4.

Table 4: Change in U.S. Light Vehicle Sales and Prices Under Various U.S. Automotive Trade Policies

USMCA	Section 301 China Tariffs	Section 232 Steel & Alum. Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%	U.S. Sales (units)	Overall Change in Price/Unit (\$) (dollars)	Change in Price/Unit Imported Vehicles (\$ dollars)	Change in Price/Unit Domestic Vehicles (\$ dollars)
Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Canada, Mexico, & South Korea Exempt	(1,319,700)	\$2,750	\$3,700	\$1,900
			Only applies to EU	(494,000)	\$1,000	\$1,400	\$650
			Only applies to UK	(197,600)	\$400	\$450	\$300
			Only applies to Japan	(548,700)	\$1,100	\$1,550	\$700
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(425,400)	\$850	\$850	\$850
		Exclude Canada & Mexico	Canada, Mexico, & South Korea Exempt	(1,315,100)	\$2,750	\$3,700	\$1,900
			Only applies to EU	(482,100)	\$950	\$1,400	\$600
			Only applies to UK	(183,800)	\$350	\$450	\$300
			Only applies to Japan	(536,900)	\$1,050	\$1,550	\$700
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(408,800)	\$800	\$850	\$800

Source: Center for Automotive Research estimates

In every scenario, new vehicle dealership revenue and employment falls, as does U.S. GDP and overall U.S. employment. Dealerships are likely to experience a decline in revenue totaling between USD 6.1 billion and USD 43.6 billion, with associated employment losses between 10,700 and 77,000 employees. For the average dealership, these losses correspond to a fall in revenue ranging from USD 362 thousand to USD 2.6 million, with corresponding employment losses of 0.6 to 4.6 employees. In the broader economy, U.S. GDP is projected to fall between USD 6.0 billion and USD 30.4 billion and total economy-wide employment would drop between 71,200 and 366,900 jobs (see Table 5).

Table 5: Change in Dealership Revenue, Employment, U.S. GDP, and Overall U.S. Employment Under Various U.S. Automotive Trade Scenarios

USMCA	Section 301 China Tariffs	Section 232 Steel & Aluminum Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%	Dealership Revenue		Change in U.S. Dealership Employment Level		U.S. GDP (\$ Billions)	Change in Overall U.S. Employment Level
				Total (\$ Billions)	Per Dealership (\$1,000s)	Total	Per Dealership		
Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Canada, Mexico, & South Korea Exempt	(\$43.62)	(\$2,596)	(77,000)	(4.6)	(\$30.40)	(366,900)
			Only applies to EU	(\$16.33)	(\$972)	(28,800)	(1.7)	(\$10.80)	(131,100)
			Only applies to UK	(\$6.53)	(\$389)	(11,500)	(0.7)	(\$7.10)	(83,900)
			Only applies to Japan	(\$18.14)	(\$1,079)	(32,000)	(1.9)	(\$12.00)	(145,800)
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(\$14.06)	(\$837)	(24,800)	(1.5)	(\$18.00)	(207,800)
		Exclude Canada & Mexico	Canada, Mexico, & South Korea Exempt	(\$43.47)	(\$2,587)	(76,700)	(4.6)	(\$29.80)	(360,500)
			Only applies to EU	(\$15.93)	(\$948)	(28,100)	(1.7)	(\$9.80)	(119,600)
			Only applies to UK	(\$6.08)	(\$362)	(10,700)	(0.6)	(\$6.00)	(71,200)
			Only applies to Japan	(\$17.75)	(\$1,052)	(31,300)	(1.9)	(\$11.00)	(134,300)
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(\$13.51)	(\$804)	(23,900)	(1.4)	(\$16.70)	(193,000)

Source: Center for Automotive Research estimates

Conclusions

CAR expanded its past research into the effects of potential U.S. trade policy actions to consider ten policy scenarios that combine trade policies implemented as of January 2019 and potential near-term U.S. trade policy changes. Across these policy scenarios, the variation in impacts on the U.S. new vehicle market and the broader U.S. economy is substantial, but near wholly determined by the severity of potential Section 232 tariffs on imported autos and auto parts.

In the worst-case scenario, the price of the average vehicle sold in the U.S. would increase by USD 2,750. In the least severe case, this average price increase would be a comparatively small USD 350. The difference between these extremes is almost solely determined by whether automotive Section 232 tariffs are broad-based or highly targeted to only a few countries. Broad-based automotive tariffs threaten more than 366,000 jobs. While the trade restrictions adopted or under consideration are intended to assist U.S. workers, these policies are likely to be extremely disruptive to and negative for the U.S. economy.

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Methodology Appendix

The Simulation Model

To evaluate the potential economic impacts of trade barriers being imposed upon auto and auto parts trade, CAR developed a simulation model of the U.S. light vehicle industry. A critical assumption of the model is that the new vehicle market has a unitary demand elasticity – changes in prices yield proportionate, opposite changes in sales volumes such that the total dollar value of the market is unchanged. Additionally, when calculating the effects of tariffs, CAR assumes that these costs are fully passed along into consumer prices. As not all information required for CAR’s modeling exercise has been updated through calendar year 2018, CAR’s estimates rely upon 2017 data for vehicle production, vehicle sales, and trade in vehicles and vehicle parts.

CAR’s model provides direct estimates of the output changes for light vehicle sales and manufacturing. The model explicitly incorporates trade across ten blocks which define U.S. new light vehicle sales by country of assembly: 1) total U.S. light vehicle sales, 2) U.S. sales of U.S.-assembled vehicles, and U.S. sales of vehicles assembled in 3) Canada, 4) Mexico, 5) China, 6) South Korea, 7) the United Kingdom, 8) the Post-BREXIT European Union, 9) Japan, or 10) the remainder of the world.

Application of the simulation model yields the direct impacts of automotive tariffs on three industries: U.S. motor vehicle dealerships, U.S. light vehicle manufacturing, and U.S. motor vehicle parts manufacturing. These direct impacts are translated into nationwide economic impacts using the Regional Input-Output Modeling System (“RIMS II”) available from the U.S. Bureau of Economic Analysis.

The direct impact on dealerships is defined as the change in dealership revenue which results from changes in the level of new vehicle sales. The direct impact on U.S. light vehicle manufacturing is defined as the change in the value of U.S. sales of U.S.-assembled vehicles, due to the changes in relative prices between U.S.-assembled and foreign-assembled vehicles which result from the imposition of tariffs. The impact on U.S. motor vehicle parts manufacturing is comprised of two, offsetting effects: parts manufacturing gains from increased U.S. vehicle manufacturing but declines from lowered foreign vehicle assembly activity. U.S. motor vehicle parts are used in both the production of U.S.- and foreign-assembled vehicles which are sold in the U.S., particularly those vehicles assembled in Canada and Mexico. The gain to motor vehicle parts manufacturing from increased U.S.-assembly is encapsulated in the economy-wide effects estimated from the application of the RIMS II model to the direct impacts on light vehicle manufacturing. The effects on vehicle parts manufacturing from decreased imports of vehicles with U.S.-content is incorporated via a combination of the estimated value of U.S.-content in Canadian and Mexican vehicles with the estimated declines in U.S. imports of vehicles from these countries.

As the RIMS multipliers are single-region, these estimates do not account for feedback across regional boundaries, let alone national borders. Instead, CAR explicitly modeled the relationship between U.S. vehicle parts manufacturing and Canadian and Mexican vehicle manufacturing. This relationship was evaluated similarly to the “Trade Data Approach” used to estimate foreign content in U.S.-assembled vehicles, discussed in the section on tariff cost estimates. Vehicles assembled in Canada and Mexico contain a high degree of U.S. parts content; the value of OEM-destined U.S. vehicle parts exports to Canada and Mexico are assigned to the value of vehicle production occurring in each country.

Finally, CAR's simulation model needed to properly incorporate market share shifts across the origins of vehicles and vehicle parts. As the price of imported goods increase, the amount sourced either domestically or from an unaffected foreign market increases. Estimated "Armington" trade elasticities represent this effect. However, estimates of trade elasticities vary wildly. For example, a review of the literature on U.S. Armington elasticities finds values for automobiles which range from near 1 – indicating a 1 percent cost increase for imported vehicles results in 1 percent decrease in vehicle imports, to values greater than 9. Estimates of bilateral trade elasticity values are less consistent, even when considered for the same country pair. The average of values found for U.S. imports of vehicles is just below 5 (Donnelly, Johnson, Tsigas, & Ingersoll, Revised Armington Elasticities of Substitution for the USITC Model and the Concordance for Constructing a Consistent Set for the GTAP Model, 2004) (Zhang & Verikios, 2006) (Gallaway, McDaniel, & Rivera, 2003). A separate review of the pattern of vehicle imports by vehicle segment, combined with estimates of cross-price elasticities finds, on a sales-weighted basis, imported vehicles belong to a segment with an elasticity value of 6, based upon 2017 sales and import segmentation. With this finding and considering the Armington elasticity literature, CAR modeled the sales response of imports and domestic (U.S.-assembled) vehicles to a change in relative prices such that a 1 percent increase in imported vehicle prices, relative to the prices of domestic vehicles, results in a market share shift of 5 percent away from imported vehicles and towards domestic vehicles.

Compliance with USMCA Rules of Origin

To evaluate the potential for USMCA to disrupt existing North American vehicle production, CAR developed estimates of total North American content, and Canadian and U.S. labor content, for model year 2018 vehicles assembled in North America. To evaluate the ability of each vehicle to comply with the other requirements of USMCA rules of origin, CAR additionally cataloged the sources of each vehicle's engine, transmission, and for electric vehicles, propulsion battery. Data on the sourcing of steel and aluminum used in vehicle manufacturing are unavailable, so CAR's estimates assume all North American vehicles comply with this requirement.

To develop these estimates, CAR relied upon data from vehicle model-specific data from the American Automobile Labeling Act (AALA) and industry-wide data for materials and parts purchases, gross output, and value-added from the U.S. 2012 Economic Census, the U.S. Annual Survey of Manufacturers, Statistics Canada, and Instituto Nacional de Estadística y Geografía. In calculating NAFTA content, CAR applied industry-wide averages to individual vehicle models in conjunction with the AALA data. CAR also relied on trade flow data to contextualize CAR's content estimates and cross-checked the vehicle, engine, and transmission sourcing with two commercially-available datasets.³ Additionally, one automaker provided limited feedback on the accuracy of CAR's estimates for their products. CAR acknowledges the existence of several shortcomings in the use of AALA data for this purpose, but the AALA data is only publicly-available dataset for analyzing light vehicle content.⁴ Due to limitations in these publicly available data sources, CAR's content share estimates are imprecise but directionally correct.

³ LMC Automotive and IHS|Markit

⁴ NHTSA regulation Part 583 ([49 CFR 583](#))—*Automobile Parts Content Labeling*.

Depending upon the assumptions made, between 47 and 120 vehicle models do not comply with USMCA rules of origin, representing the best and worst cases for compliance, respectively. Considering only models which are assembled outside of the United States, the most generous assumption set suggests 27 vehicle models fail to meet USMCA requirements, while under the worst-case scenario for compliance, 32 models assembled in Canada or Mexico fail to meet USMCA. To avoid overstating the disruption which USMCA may cause, CAR utilizes the best-case compliance scenario – that only 27 models assembled in Canada or Mexico fail to comply – to estimate impacts of each trade policy scenario. Additional guidance is provided by a timely statement issued by Mexico – that 32 percent of 2018 vehicle output would not meet USMCA rules of origin requirements (Morales, 2018). This share of Mexican production failing to meet USMCA is almost perfectly matched by the share indicated under the “best-case” assumption set.

For the 27 vehicle models which are assembled in either Canada or Mexico and fail to comply under the most-generous assumption set, 24 met the NAFTA requirements. Adoption of USMCA would see these models newly exposed to import tariffs – for passenger cars imported into the United States, a 2.5 percent tariff would be assessed, and for cargo vehicles such as pickup trucks and cargo vans, the MFN tariff rate is 25 percent. Across these 24 models, the average potential tariff is USD 635, but ranges from USD 321 to USD 7,900. Despite these potentially large tariff costs, automakers are unlikely to bring production of these models into compliance with USMCA, as each of these models fails to comply with multiple criteria in the USMCA rules of origin.

For the 24 models assembled in either Canada or Mexico that do not appear to meet USMCA but do conform with NAFTA rules of origin, CAR estimates that 8 will fail the USMCA core parts requirement. All 8 use an engine imported from outside North America, and 1 uses both an engine and transmission from outside North America. These 8 vehicle models span 5 manufacturers, and even those models from the same manufacturer are significantly different in their specifications that the models cannot share a powertrain. Further, total U.S. sales volumes across these 8 models are just 225,000 units. Even if all of these 8 models across the 5 manufacturers could hypothetically share a single engine, a volume of 225,000 units is far too small to support regional engine production at scale.

Even the lowest volume engine and transmission plants must produce several hundred thousand units per year to operate efficiently. The average North American engine plant produces over half a million units a year and the average North American transmission plant produces over 600,000 units annually. Although there are a total of 29 vehicle models that are assembled in North America that appear to not meet the USMCA core parts requirement, most cannot even hypothetically share a powertrain due to specification differences and the fact that these products span 11 different manufacturers. Without both significant redesign and multi-company powertrain joint ventures, it may be less costly for manufacturers to pay tariffs rather than invest in additional powertrain capacity in North America to support regionalizing production. This is especially true given the advancement of vehicle electrification that could render traditional powertrain production facilities obsolete within the next few decades.

Although the increase in costs for these specific models is significant, contextualized against total imports from Canada or Mexico, these costs are relatively small. As a simulation input, the shift from NAFTA to USMCA is incorporated as a slight increase in the U.S. consumer prices of vehicles assembled in Canada – 0.22 percent – and a 1.70 percent increase in the prices of vehicles imported from Mexico.

Section 232 and Section 301 Tariffs

While intuitive to simply assign the tariff rates imposed on imported vehicles and vehicle parts to the value of imports, such an approach fails to consider the presence of re-exports and imports destined for aftermarket use, such as vehicle parts used by a consumer, a dealership, or an independent repair shop for vehicle maintenance and repair activities. Multiple avenues of research were pursued to adequately adjust import figures to reflect only the costs these tariffs would impose on the manufacture and sales of new vehicles.

Evaluating the impact of restrictions on automotive parts imports on U.S.-assembled vehicles additionally requires knowledge of the amount of imported content in U.S. vehicles. There are two methods to arrive at this figure which were applied in this analysis. While the two methods differ dramatically, with no common sources or required assumptions, both arrive at the same levels of foreign (non-U.S. or non-NAFTA) content in the average U.S.-assembled vehicle.

The first is the “Trade Data Approach,” wherein the value of imported original equipment parts are applied equally to all vehicles assembled in the United States. The value of imports is adjusted to remove aftermarket parts, and this original equipment parts value is divided by the total number of vehicles produced in the United States to establish an average value of foreign content per vehicle.

To avoid overstating the impacts of tariffs on imports of automotive parts on U.S.-assembled vehicles, CAR researched the division between original equipment and aftermarket parts and found that, in a typical year, aftermarket parts constitute 25 percent of the total value of automotive parts. Thus, when estimating the impact on the costs of U.S.-assembled vehicles, CAR considered trade impacts upon 75 percent of imported vehicle parts, by value (Automotive Aftermarket Suppliers Association, 2012) (International Trade Administration, 2011) (International Trade Administration, 2009) (International Trade Administration, 2007).

The second method is the “Foreign/Domestic Content Approach,” centers around estimates of the U.S.- and NAFTA-content of the typical U.S.-assembled vehicle. These estimates are formed from a multitude of data points and sources: the American Automobile Labeling Act⁵ (AALA) U.S. and Canadian parts content values; engine, transmission, and vehicle sourcing data from LMC Automotive and IHS|Market; and data from the U.S. Census Bureau, Statistics Canada, and Mexico’s Instituto Nacional de Estadística y Geografía.

Across both the “Trade Data Approach” and the “Foreign/Domestic Content Approach,” similar figures resulted for average non-U.S. content in U.S.-assembled vehicles. As the data required for the “Trade Data Approach” is far more readily available, our estimates rely primarily upon this method.

Section 232 Tariffs on Imported Steel & Aluminum

For the tariffs in effect against U.S. imports of steel and aluminum, CAR researched the consumption patterns for steel and aluminum, by U.S. industry. Of total consumption of these metals, 32 percent of steel consumed in the United States is imported, and 80 percent of aluminum is imported (International Trade Administration, 2018) (Bureau of Industry and Security Office of Technology Evaluation, 2018). The U.S. vehicle and vehicle parts manufacturing industries account for 26 percent of U.S. steel

⁵ NHTSA regulation Part 583 (49 CFR 583), Automobile Parts Content Labeling

consumption and 31 percent of U.S. aluminum consumption (statista) (Bray, 2018) (U.S. Census Bureau, 2015).

In 2017, the U.S. imported USD 27.7 billion of iron and steel products and USD 22.2 billion of aluminum products. With the exemptions granted to imports from Argentina, Australia, Brazil, and South Korea, the steel and aluminum tariffs apply to USD 27.8 billion of steel and aluminum imports (U.S.A. Trade Online). If consumption by industry does not differ across imported and U.S.-sourced steel, and aluminum, 26 percent of the tariff applied to imported steel and 31 percent of the tariff applied to imported aluminum becomes a cost increase for the by vehicle and vehicle parts industries. This approach yields an indirect tax on U.S. auto and auto parts manufacturing equal to USD 1.4 billion. As higher material costs increase the costs of U.S. manufactured automotive parts, which are used in vehicles assembled throughout North America, the U.S. tariffs on steel and aluminum impact vehicle manufacturing in the U.S., Canada, and Mexico. Accounting for North American vehicle parts trade, this implies a cost increase of 0.43 percent for vehicles assembled in the United States, 0.28 percent for vehicles assembled in Canada, and 0.15 percent for vehicles assembled in Mexico. Note that these estimates do not account for retaliatory measures, such as Canada's tariffs on U.S. steel and aluminum, nor does CAR consider opportunistic pricing actions taken by U.S. producers of steel and aluminum. As a result, while CAR's estimates suggest the steel and aluminum tariffs have added approximately USD 130 per vehicle assembled in North America, Ford and General Motors have each announced \$1 billion in additional costs due to the steel and aluminum tariffs – USD 700 per vehicle produced in North America (Carey & Shepardson, 2018) (Carey & Klayman, 2018). In announcing 2018 year-end financial results, Ford's CFO attributed USD 750 million in increased costs due to tariffs (Klayman, 2019).

Section 301 Tariffs on Imports from China

Review of additional data specific to imported vehicle parts arriving from China suggests that, specifically for imports from China, far more than this 25 percent share is destined for aftermarket use. Estimates of the value of Chinese materials used in the production of new vehicles in the United States were developed, primarily following the "Trade Data Approach." While total imports of automotive parts and tooling were valued at USD 15 billion in 2017, many of these items are destined for aftermarket use (U.S.A. Trade Online). At the 10-digit HS code level, certain products are differentiated by whether they are new, used, or remanufactured items. Once imports of used or remanufactured vehicle parts have been removed, the total import value falls below USD 12 billion (U.S.A. Trade Online). For many of the remaining imports – for example, "wiring sets for vehicles, aircraft, or ships" – use is split across light vehicle manufacturing, the light aftermarket, and several other industries. For these items where it is not possible to both identify the appropriate value of content imported for light vehicles and differentiate between original equipment and aftermarket use, CAR researchers developed boundary scenarios, considering either the full value of these imports to be used in U.S. light vehicle production, or all of these imports to be destined for either the aftermarket or non-light vehicle use. The results of this exercise suggest that between 1 percent and 3 percent of the value of U.S.-assembled light vehicles stems from parts imported from China. For the evaluation of the potential impacts of Section 301 tariffs, CAR used the mid-point of this range, 2 percent, as the share of Chinese content in U.S.-assembled vehicles. With items covered by the first and second tranches of tariffs against imports from China assessed a 25 percent tariff, and the items covered by third tranche subject to a tariff rate of 10 percent tariff, the cost increase experienced by U.S. vehicle manufacturing due to higher costs on

imported parts and tooling is 0.24 percent, and finished vehicles imported from China increase in cost by 25 percent.

Section 232 Tariffs on Light Vehicles & Vehicle Parts

To evaluate the impacts of a potential Section 232 tariff on automobiles and auto parts, CAR evaluated vehicle imports and parts imports separately. Imports of complete vehicles are assessed the 25 percent tariff rate, which is assumed to pass fully along into consumer prices. For vehicle parts, the estimated value of OEM-use parts imports is assigned as a cost increase to the total number of light vehicles assembled in the United States. Consequently, at 2017 import and U.S. production levels, a 25 percent additional tariff levied on imported vehicles and vehicle parts would raise the cost of U.S. vehicle assembly by 6 percent if no countries were exempted. With USMCA side letters that largely exempt Canada and Mexico from potential Section 232 tariffs on autos and auto parts, and assuming that South Korea gains an exemption from any auto tariffs as it did with steel and aluminum, the increase to U.S. vehicle manufacturing cost is significantly reduced to just 2.69 percent. The more tightly targeted a potential auto and auto parts 232 tariff action, the less the impact on U.S. consumer prices. Against only the (post-BREXIT) European Union, U.S. vehicle production costs would increase 0.46 percent, while against only the UK or only against Japan, costs would rise by 0.08 percent or 0.60 percent, respectively. If a Section 232 tariff on autos and auto parts were adopted that exempted parts from Canada, Mexico, South Korea, the UK, the EU, and Japan, the cost increase to U.S. light vehicle manufacturing would be only 1.55 percent compared to the 6 percent cost increase seen when applied globally to all countries.

Known Biases

For several reasons, CAR's estimated impacts understate the effects tariffs would have on the U.S. automotive industry and the U.S. economy. Most significantly, while CAR's simulation model does respect the limited capacity available for U.S. production, the model does not differentiate open capacity according to the vehicle model, vehicle segment, or the manufacturer to which the capacity is tied. Thus, the results are biased towards positive outcomes for the U.S. economy. Many of the factories operating below 100 percent capacity utilization are tooled for the production of passenger cars, the sales of which have collapsed in recent years as consumer preferences have shifted to crossover utility vehicles (CUVs). CUVs now comprise 40 percent of U.S. light vehicle sales, and these vehicles have similar fuel economy as passenger cars, but far more interior space for passengers and cargo. The process of converting an under-utilized factory from passenger car to CUV production is costly and time-consuming, with each retooled factory entailing costs near, if not exceeding, USD 1 billion, and requiring, on average, one year to complete. Where CAR's simulation model suggests that U.S. production of vehicles will increase dramatically, that expansion of domestic manufacturing is unlikely to occur quickly – and potentially may not occur at all.

Other sources of bias towards positive outcomes include:

- RIMS is not capable of estimating cross-region feedback effects, and national multipliers are not available through RIMS. CAR relies upon regional multipliers and uses the sum of regional effects for CAR's nationwide impact estimates. Where supply chains may tie a company in one region to another company located in a separate region, RIMS has no mechanism which can link impacts experienced by one of these companies to the other, so a loss (or gain) in sales and

production for a company located in region A is not reflected in a loss (or gain) in orders for its supplier located in region B.

- CAR's estimates of tariff impacts assume that automotive parts cross the border into the United States only one time before being installed into the U.S.-assembled vehicle. In reality, the existence of cross-border supply chains results in continuous movement of parts back and forth between Canada, Mexico, and the United States: Any tariff imposed would be applied at each entry, and its effects thereby amplified.
- CAR does not attempt to incorporate the effects of increased new vehicle prices and imported vehicle parts prices on the used vehicle market or cost of ownership.
- CAR's estimates do not include the effects of implemented or potential retaliatory actions from the United States' trading partners.
- CAR's modeling assumes that companies do not remove low-volume products or products which could no longer be sold profitably from the U.S. market. Such a reduction in product choice is both a likely and significant source of lost consumer welfare.

Scenario Results Without Capacity Constraints

The scenario results presented in the main body of this briefing assume that U.S. light vehicle production capacity is constrained to the output levels that can be sustainably achieved in two-shift, straight-time utilization of plants and equipment in existence as of January 2019. Plants can, and do, exceed 100 percent utilization for relatively short durations, and over a period of a few years, automakers and suppliers could respond to policy changes by investing in new or expanded productive capacity. A new automotive assembly plant generally costs USD 1-1.6 billion, takes about three years from when the investment is announced to when the first vehicle rolls off the line and lasts 40 or more years.⁶ These are not decisions that automakers and their suppliers take lightly and would only be made in response to what is seen as a permanent shift in the market or trade policy changes.

CAR ran the ten scenarios without constraining output to the industry's plant and equipment footprint as of 2019. The results shown in Tables 6 and 7 show that U.S. light vehicle sales would still decline, and consumer prices would still rise under every scenario. The results remain negative for dealership revenue, dealership employment, U.S. GDP, and overall U.S. employment, as well.

Even in the case where automakers and suppliers can expand capacity to meet consumer demand with more domestically-built vehicles, the combination of trade actions the United States has enacted or is considering enacting is a net negative for automotive sales, dealership revenues, and overall U.S. economic output and employment and would raise prices on imported and domestically-produced vehicles.

⁶ Source: CAR Book of Deals database.

Table 6: Change in U.S. Light Vehicle Sales and Prices Under Various U.S. Automotive Trade Policies -- Capacity Unconstrained

USMCA	Section 301 China Tariffs	Section 232 Steel & Alum. Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%	U.S. Sales (units)	Overall Change in Price/Unit (\$ dollars)	Change in Price/Unit Imported Vehicles (\$ dollars)	Change in Price/Unit Domestic Vehicles (\$ dollars)
Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Canada, Mexico, & South Korea Exempt	(1,153,500)	\$2,400	\$3,700	\$1,250
			Only applies to EU	(443,200)	\$900	\$1,400	\$450
			Only applies to UK	(190,000)	\$350	\$450	\$300
			Only applies to Japan	(491,200)	\$1,000	\$1,550	\$500
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(425,400)	\$850	\$850	\$850
		Exclude Canada & Mexico	Canada, Mexico, & South Korea Exempt	(1,138,200)	\$2,350	\$3,650	\$1,200
			Only applies to EU	(426,600)	\$850	\$1,400	\$350
			Only applies to UK	(172,900)	\$350	\$450	\$250
			Only applies to Japan	(474,700)	\$950	\$1,550	\$400
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(408,800)	\$800	\$850	\$800

Source: Center for Automotive Research estimates

Table 7: Change in Dealership Revenue, Employment, U.S. GDP, and Overall U.S. Employment Under Various U.S. Automotive Trade Scenarios – Capacity Unconstrained

USMCA	Section 301 China Tariffs	Section 232 Steel & Aluminum Tariffs	Potential Section 232 Auto & Parts Tariffs @ 25%	Dealership Revenue		Change in U.S. Dealership Employment Level		U.S. GDP (\$ Billions)	Change in Overall U.S. Employment Level
				Total (\$ Billions)	Per Dealership (\$1,000s)	Total	Per Dealership		
Implemented in Current Form	In place as of 11 January 2019	Include Canada & Mexico	Canada, Mexico, & South Korea Exempt	(\$38.13)	(\$2,269)	(67,300)	(4.0)	(\$19.98)	(248,000)
			Only applies to EU	(\$14.65)	(\$872)	(25,900)	(1.5)	(\$7.58)	(94,800)
			Only applies to UK	(\$6.28)	(\$374)	(11,100)	(0.7)	(\$6.67)	(78,500)
			Only applies to Japan	(\$16.24)	(\$966)	(28,700)	(1.7)	(\$8.38)	(104,700)
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(\$14.06)	(\$837)	(24,800)	(1.5)	(\$17.97)	(207,800)
		Exclude Canada & Mexico	Canada, Mexico, & South Korea Exempt	(\$37.62)	(\$2,239)	(66,400)	(4.0)	(\$18.73)	(234,000)
			Only applies to EU	(\$14.10)	(\$839)	(24,900)	(1.5)	(\$6.27)	(80,000)
			Only applies to UK	(\$5.71)	(\$340)	(10,100)	(0.6)	(\$5.33)	(63,400)
			Only applies to Japan	(\$15.69)	(\$934)	(27,700)	(1.6)	(\$7.06)	(89,900)
			Canada, Mexico, South Korea, EU, UK, & Japan Exempt	(\$13.51)	(\$804)	(23,900)	(1.4)	(\$16.66)	(193,000)

Source: Center for Automotive Research estimates