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# Uncertainty and Risk in the Global Automotive Industry

Changing Behaviors and Growing Disruption





REUTERS/Carlos Barria

# Changing Behaviors and Growing Disruption

The automotive industry faces uncertain times as the specter of a trade war between countries crucial to the global car market looms. Recent developments such as the maturation of the sharing economy, advent of connected cars, artificial intelligence, and automation in manufacturing and driving are fostering an evolution.

Changing geopolitical circumstances and faltering trade regimes will also present

many difficult challenges and risks for automobile manufacturers and related businesses. Illustrative of this seismic shift is the recent transformation of one of the oldest transportation professions, taxi driving, which has undergone a disruption by new market participants, such as Uber and car2go, and the concurrent arrival and mass adoption of the sharing economy by consumers.

## Ditch the Car and Share a Ride?

New transportation companies intend to make travel by car inexpensive enough to remove the necessity of car ownership. They pose a threat to jobs in the long-established transportation services sector, such as taxi drivers, and the traditional business model the world's largest automakers depend on.

Today's model relies on individual car consumption to drive growth and profitability. As a consequence, the largest companies could shift their focus to developing after-sales services and ancillary businesses, rather than relying heavily on car sales. This scenario is especially likely if consumers continue to eschew car ownership and opt for new services such as Uber and Zipcar. Other possibilities like person-to-person markets enabled by technological developments such as the Internet of Things (IoT) and artificial intelligence may also prove consequential.

## The Autonomous Auto

Tesla's 2015 models are already 90% self-drivable according to founder and CEO Elon Musk, and Google® believes that by 2020, cars will be fully autonomous, a scenario which could destroy almost 10 million jobs.<sup>1</sup> How likely is that to occur? In a recent statement, Uber's CEO, Travis Kalanick, said he envisions eventually replacing all Uber drivers with self-driving cars.

The effects of these changes on industry and society are difficult to predict. Some observers believe the loss of jobs will be offset by gains in productivity in other sectors. Initial estimates suggest the average commuter will save close to 50 minutes a day. Those foregoing buying a car altogether may save on average \$9,000-\$10,000. In addition, these changes will lead to new jobs in other areas of the economy, including computer science, data analysis, and marketing. There will be marked growth in opportunities for after-purchase services and software development, as a new ecosystem of applications and entertainment for increasingly connected vehicles will become commonplace.

## Clear and Present Disruption or Change on the Horizon?

Many industry analysts do not believe the adoption of autonomous vehicles will reach critical mass before 2020, and point to 2030 for mainstream status. Although these predictions may well prove accurate, the opposite may also be true: the industry could transition to fully autonomous vehicles much earlier.

Automakers and original equipment manufacturers (OEM) should anticipate and prepare for this possibility to mitigate their exposure to risk and market volatility. In fact, several trends point to the possibility of a short term disruption being more likely, including:

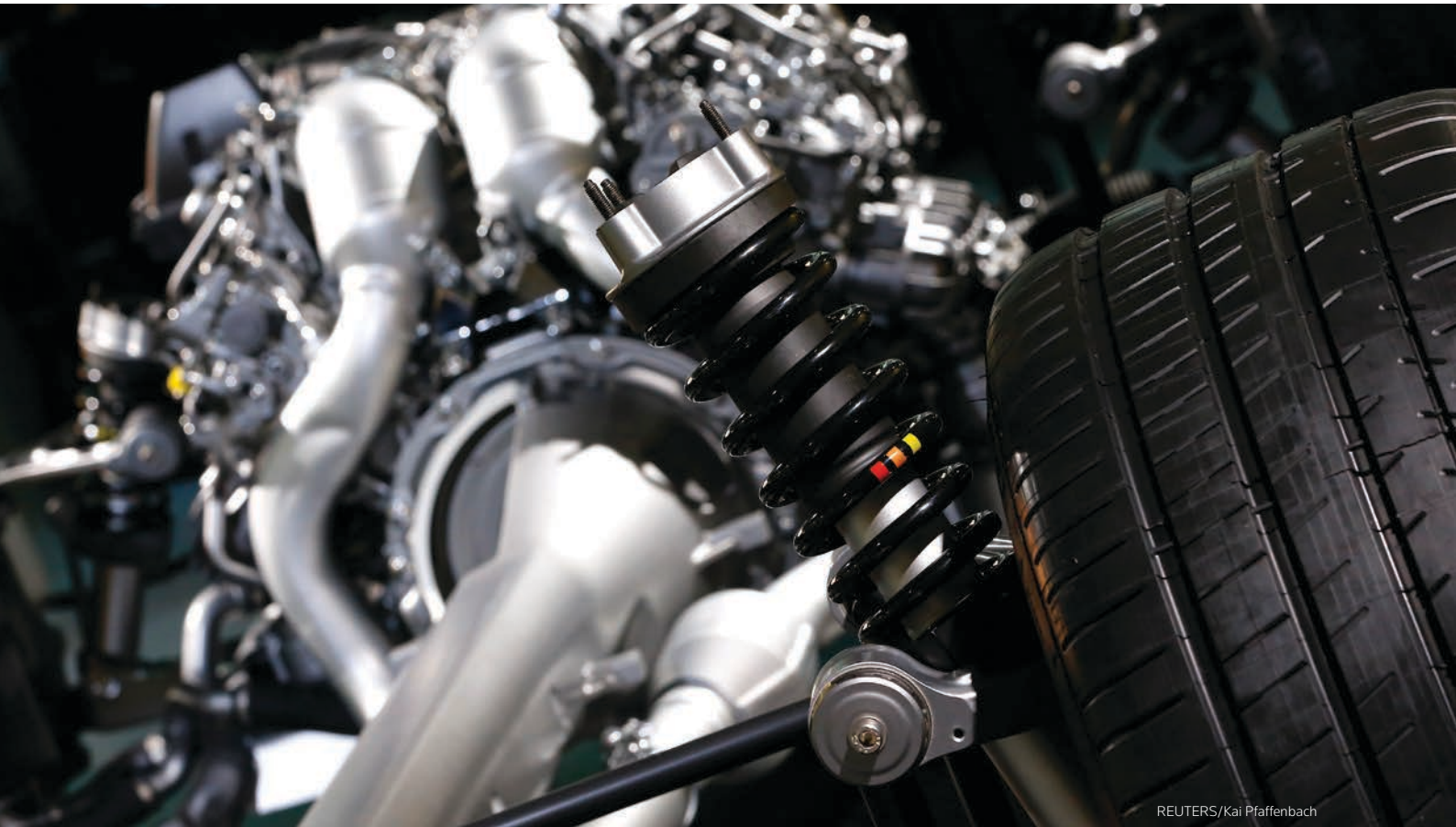
1. The use of car sharing services is now considered more economical than owning a car in many cities
2. Studies suggest car ownership drops by half for car sharing users in certain areas
3. Poll results show an increasing acceptance to the idea of driverless vehicles, with up to 60% of one poll stating they would ride in an autonomous vehicle, and 32% saying they would stop driving altogether.

Consumers show an increasing acceptance of these new technologies and service models, and point to the possibility of a world where car ownership is no longer seen as a sacred right or absolute necessity for life in the 21<sup>st</sup> century.

The very idea of driving a car to work or for leisure may seem quaint by 2030, if not sooner. Currently there is a technological arms race amongst the world's automakers who are vying to become the first to offer the fully connected and autonomous car experience, and first to enjoy huge gains in share price and profits.<sup>[1]</sup>

<sup>1</sup> <http://sanfrancisco.cbslocal.com/2015/01/27/how-ubers-autonomous-cars-will-destroy-10-million-jobs-and-reshape-the-economy-by-2025-lyft-google-zack-kanter/>

[1] <https://forbes.com/sites/zacharyhamed/2015/01/21/driverless-stocks/#425624fe6a5f>



REUTERS/Kai Pfaffenbach

## Investing in the Future of Driving

Consequently, Ford, BMW, and other major automakers have made massive investments in acquiring specific technologies and rapidly developing them internally. Even traditional software companies such as Google and Uber have made huge investments to win this race. Every automaker wants to compete in a future where cars are increasingly autonomous and connected. As a result, these technologies have developed rapidly from early driver assistance systems to the significantly advanced partial and conditional automation we see today.<sup>2</sup>

Ford recently tripled its investment in autonomous vehicle (AV) technology, and is testing a fleet of AVs in California and elsewhere.<sup>[2]</sup> BMW, meanwhile, has partnered with advanced driver assistance technology firm Mobileye and Intel's autonomous vehicle technology brand "Go," aiming to have

40 AVs on the road by the end of 2017.<sup>[3]</sup> Google has created its own driverless technology company called Waymo, which creates software and sensor technology for the industry.<sup>3</sup> Waymo not only develops AV solutions for Google, it has also equipped several major automakers with its driverless technologies, including Audi, Lexus, and Toyota.

Notably, Google's AV fleet has already logged over two million miles, much of it done on roads. Finally, in 2015 a Google prototype with no pedals, steering wheel, or driver, made the first entirely autonomous trip on public roads. This marked a milestone in the development of these technologies, while also drawing a line in the sand between a past where drivers were in full control, to a future where there will only be passengers.

<sup>2</sup> <https://wired.com/brandlab/2016/03/a-brief-history-of-autonomous-vehicle-technology/>

[2] Ibid

[3] <http://techworld.com/picture-gallery/big-data/-companies-working-on-driverless-cars-3641537/>

<sup>3</sup> <https://waymo.com/>



REUTERS/Jason Lee

## Car Trade Tectonics

The rise of populist sentiment embodied by the recent events in Europe and the United States signals the beginning of a period of turbulence for the automotive industry. The Trump administration has made it clear that regulations and trade policies are now open to renegotiation and even removal.

Protectionism is on the rise, especially regarding automobile companies and their manufacturing bases, as populist leaders declare their intent to return jobs and operations back to their

countries, largely at the expense of foreign competitors and long-standing trade agreements between historic trading partners.

Emblematic of this current trend is the effort by many world leaders, including Prime Minister Trudeau, Prime Minister May, and Chancellor Merkel, to renegotiate trade agreements and change regulatory policies governing the automotive industry to protect their national interests.<sup>4</sup>

<sup>4</sup> <http://reuters.com/article/us-usa-trade-nafta-idUSKBN1581QF>, <http://reuters.com/article/us-usa-nafta-canada-mexico-idUSKBN1582MV?il=0>

## In Canada

Justin Trudeau has carefully kept Canada away from the contentious debate between the U.S. and Mexico regarding changes to NAFTA, although he has pledged his support for the free trade agreement. Furthermore, Canada does not have a trade surplus with the U.S., which has been the metric used by the Trump administration for deciding which countries to renegotiate trade policies with.

## In Europe

Prime Minister May is dealing with the fallout from the United Kingdom's Brexit, which has put British car manufacturing plants in danger of being shuttered, especially with Peugeot's agreed deal with General Motors to buy its European business. This would be problematic for May, as her economic strategy is predicated on growing British manufacturing jobs, not losing them.

Britain's car manufacturing industry reached a 17-year high in 2016, producing 1.72 million cars, and a post-Brexit slump in manufacturing jobs would cast doubt on her government's economic strategies.<sup>5</sup> Consequently, she has been vocal about protecting the 30,000 car manufacturing jobs at Vauxhall, which is part of General Motors-European operations, especially now that Ford cut 1,000 jobs in one of their Welsh plants.<sup>6</sup>

Peugeot's acquisition of Opel could also affect thousands of German car manufacturing jobs due to the presence of several Opel manufacturing plants in Germany. This has led Chancellor Merkel to engage the French government to try and protect German workers from any potential losses as a result of this deal. Finally, it remains to be seen how Britain's automotive industry will be affected as Brexit goes through, although British industry leaders have warned against instituting tariffs and stressed the importance in establishing a trade deal with Europe that would maintain the benefits of the single market and customs union.<sup>7</sup>

<sup>5</sup> <https://theguardian.com/business/2017/jan/26/uk-car-industry-tariffs-red-line-issue-jobs-brexit-smmt>

<sup>6</sup> <http://reuters.com/article/us-ford-britain-idUSKBN1683YD>

<sup>7</sup> <https://theguardian.com/business/2017/jan/26/uk-car-industry-tariffs-red-line-issue-jobs-brexit-smmt>

# The Great Deregulation, Dodd-Frank, and Conflict Minerals

President Trump's executive order terminating the proposed Trans-Pacific Partnership (TPP) on his first day in power shows the new administration's stance on trade agreements it finds harmful to U.S. economic interests. It also highlights more broadly its goal to review and change existing trade and regulatory policies to fit its strategic economic goals. Industry experts believe the administration's emphasis on reviving manufacturing jobs, once written off as dead, while also promising to ease the overall regulatory burden on business, may benefit certain U.S. automakers.

## Conflict Minerals

Revealingly, the Trump administration has taken aim at several rules within the Dodd-Frank Act it finds unduly burdensome on corporations.<sup>8</sup> One of the primary targets for suspension is the Section 1502 rule, which requires companies to disclose to the Securities and Exchange Commission (SEC) whether products they manufacture contain conflict minerals – tin, tantalum, tungsten, and gold (3TG) – from specific African countries.<sup>9</sup>

Congress first passed laws against 3TG in 2010, and reporting on conflict minerals to the SEC began in 2014.<sup>10</sup> The rule aims to prevent conflict minerals being purchased from armed groups or warlords in Africa. Companies are required to tell investors if they have conflict minerals in their supply chains.<sup>11</sup>

Companies dependent on these minerals have become wary of supply chain risk, which can lead to public consumer protests, damaging both reputation and revenue. According to industry reports, the cost of screening supply chains for conflict minerals was "\$3 billion to \$4 billion billion in 2014, and would be hundreds of millions of dollars thereafter.<sup>12</sup> Although these figures are disputed, the magnitude and cost to automakers and their supply chain partners remains.<sup>13</sup> In addition, the global supply chain for these minerals is complex and interconnected, cutting across many industries, including the automotive, aerospace, heavy equipment, electronics, and more.



8 <http://reuters.com/article/us-usa-trump-conflictminerals-idUSKBN15N06N>

9 <https://sec.gov/spotlight/dodd-frank/speccorpdisclosure.shtml>

10 <http://conflictminerals.aiag.org/>

11 Ibid

12 <http://clsbluesky.law.columbia.edu/2016/03/15/cost-benefit-analysis-and-the-conflict-minerals-rule/>

13 Ibid

## Will the Rule Remain?

Many believe a suspension of this rule is imminent. This may ease the burden on Original Equipment Manufacturers (OEMs) with high exposure to supply chain risk, but broader underlying market uncertainty means they should still invest in risk management solutions to mitigate unforeseen changes. There is a global push for greater supply chain transparency driven by changes in consumer behavior. Consumers want to ensure their consumption has not contributed to environmental or human rights abuses.

This trend increases the likelihood of similar rules on conflict minerals being adopted in other key car markets, a process which has already begun in Europe and Japan. Even if national-level regulations are suspended, automakers must still account for state-driven initiatives to combat human rights abuses in supply chains, such as California’s Transparency in Supply Chains Act (TISCA).<sup>14</sup>

## OECD Guidance

The Organization for Economic Co-Operation and Development (OECD) issued guidance for corporates in 2010 on how to properly source minerals from high-risk areas in Africa. These guidelines are meant to help European companies avoid doing business with, and by extension supporting, human rights abusers in source countries.<sup>15</sup>

The European Union continues to develop the framework surrounding the OECD guidelines on conflict minerals, to better regulate trade amongst EU members. Even with the potential absence of national regulations, some companies are proactively addressing the issue.

Toyota has created its own corporate conflict minerals policy even though Japan does not have national disclosure laws.<sup>16</sup> Additionally, because Toyota exports over a million cars to the U.S., accounting for roughly half of its global exports, it has also filed with the SEC under the conflict minerals rule. As a result, automakers must ensure they can identify and mitigate possible reputational damage from their supply chains, which necessitates deploying strong risk intelligence solutions.

Conflict Mineral <sup>17</sup>	Usage
Tantalum	Audio Equipment, Climate Control, Sensors, Wiper System, Seat Belts, and Fuel Pump, etc.
Tin	Fuel Tank, Sealants, Wiring, Radiator, Seat Cushions
Gold	Onboard electronics and fuel cells
Tungsten	Circuits, Gear Teeth, and Bearing Components

<sup>14</sup> <https://oag.ca.gov/sites/all/files/agweb/pdfs/sb657/resource-guide.pdf>

<sup>15</sup> Ibid

<sup>16</sup> [http://toyota-global.com/sustainability/society/human\\_rights/conflict-minerals-issues/](http://toyota-global.com/sustainability/society/human_rights/conflict-minerals-issues/)

<sup>17</sup> <http://conflictminerals.aiag.org/>



## Environmental Regulations in the Crosshairs

U.S. environmental regulations, particularly fuel efficiency standards, are being targeted by the new administration. In a meeting between White House officials and national automakers, the administration made clear its intention to modify car efficiency standards mandated by the previous administration to reduce the perceived regulatory burden. One automaker in attendance suggested that the current efficiency rules threaten one million jobs in the industry, although he would not say what study supports these claims.<sup>18</sup> Certain industry analysts believe lowering emission targets may benefit national automakers by helping them sell more light trucks, which make up the bulk of domestic car sales for U.S. manufacturers. These changes, however, will add to the increasingly complex and uncertain regulatory environment automakers must navigate, which may lead to additional operation costs.

## California's Prominent Role

The push to amend these laws has put the new administration at loggerheads with important state institutions, especially the California Air Resource Board (CARB), which sets its own fuel efficiency standards.<sup>19</sup> California exercises great influence over policy-making regarding regulations, and often exceeds the federal standards set by the Environmental Protection Agency (EPA) when issuing new mandates. California is the largest car market in the U.S. and largest importer of cars in the world. Adding to California's leverage is its influence over a dozen additional states which have adopted its regulations as their own.<sup>20</sup>

Any effort to change the existing regulatory framework and pull back efficiency targets will require the acquiescence of CARB and similar institutions in order to succeed.<sup>21</sup> Automakers rely on a uniform set of standards to sell cars and trucks across the U.S., which would be difficult if emissions targets and other relevant standards differed between states and regions.

As Ford's CEO recently noted, it's "really important" for there to be one national standard for automakers to follow. This is clearly where the goals of the administration and automakers align, although they will have to bring California on board in order to achieve them.

Globally, navigating the changing regulatory landscape will continue to be challenging as new cars built to meet lower U.S. fuel efficiency standards may not meet the requirements of other key global markets. These nontariff barriers may also become more commonplace as a means of retaliation by other countries against what they see as protectionist policies in Washington.

18 <https://bloomberg.com/news/articles/2017-01-26/trump-revives-auto-efficiency-debate-with-pledge-to-slash-rules>

19 [https://washingtonpost.com/news/innovations/wp/2017/02/23/even-in-trumps-america-california-could-decide-how-clean-your-car-runs/?hpid=hp\\_hp-more-top-stories\\_innovations-calif-420am%3Ahomepage%2Fstory&utm\\_term=.e692eab6c953](https://washingtonpost.com/news/innovations/wp/2017/02/23/even-in-trumps-america-california-could-decide-how-clean-your-car-runs/?hpid=hp_hp-more-top-stories_innovations-calif-420am%3Ahomepage%2Fstory&utm_term=.e692eab6c953)

20 Ibid

21 Ibid

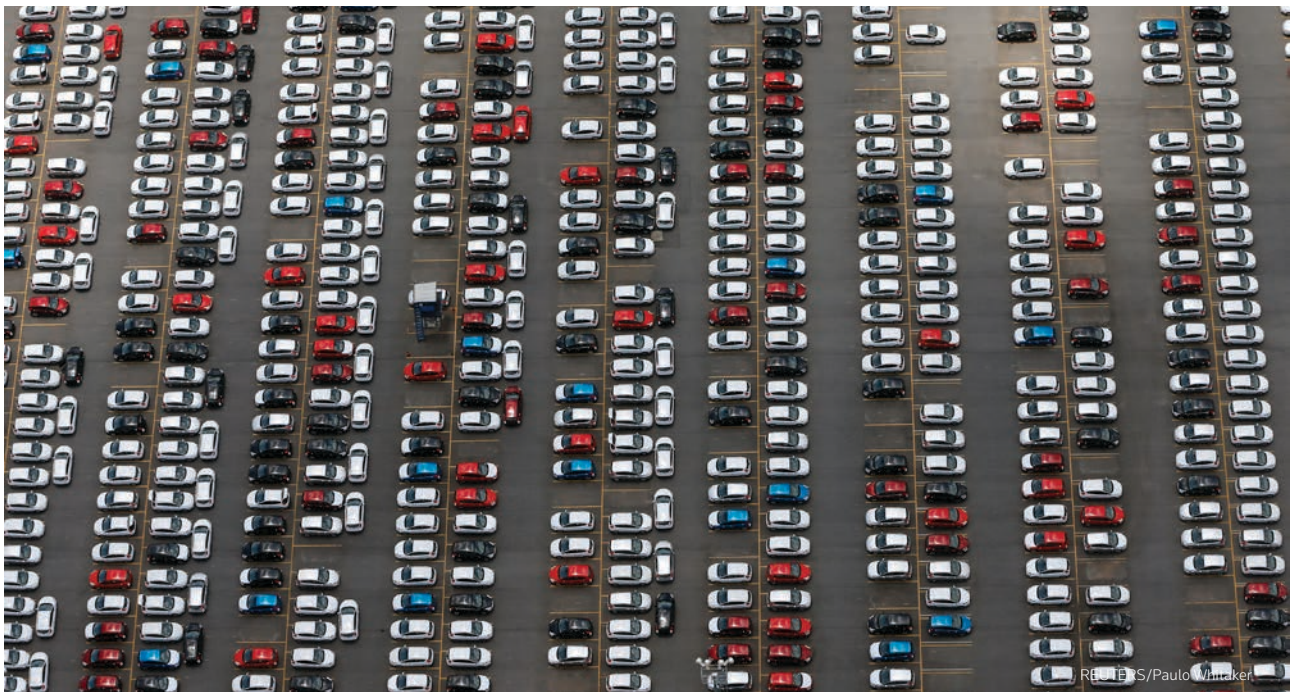
## Changes to Tax Policy May Benefit North American Automakers

U.S. car manufacturers may also enjoy other benefits, including favorable new tax policies that lower corporate taxes and provide incentives to ensure large investments do not move offshore to competitor markets. The current administration has been vocal in its intention to bring car manufacturing jobs back to the U.S., and to ensure large investments are made within its borders, even threatening those who do not comply.

Consequently, General Motors will now reconsider a proposed \$5 billion investment to double production capacity in Mexico, and Ford has jettisoned plans to build a \$1 billion factory in Mexico, opting to invest \$700 million in a Michigan facility instead. U.S. automakers may find the new administration's position encouraging, or at the very least view it as a possible strategic opportunity.

## Cars, Tariffs, and Trade Wars – the World Reacts to a New President

Despite those potentially positive developments, U.S. automakers are still forecast to cut production of small cars this year, costing 2,000 jobs in Ohio and Michigan. The job losses also go against the new administration's strategy to bring car manufacturing jobs back to the U.S. from other countries, where some officials believe they have moved as a result of NAFTA. President Trump has even labeled NAFTA the worst trade agreement in U.S. history, making clear his unfavorable view of it. He has threatened Mexico and many other countries with increased tariffs on imports, and indicated a desire to change existing trade policies and agreements.





REUTERS/Jim Young

## The Start of a Trade War?

International media, in turn, has interpreted Trump's rhetoric on trade as the beginning of a series of trade wars, particularly with countries that have trade surpluses with the U.S. Industry experts point out the many adverse impacts that would result from a trade war between the world's largest economies, including the damaging effects it would have on automakers, such as increased production costs and less competitiveness.

This rhetoric has contributed to the already high level of uncertainty within the global business climate, especially regarding concerns over how countries will react to new tariffs or protectionist policies. Questions abound, such as how these changes will affect global markets and long-standing trade frameworks. As a result, companies must be prepared to adapt to changes in regulatory and trade policies, which may benefit some while harming others.

Trump's proposed border tax, for example, would harm automakers that do not use a majority of U.S.-sourced auto parts or build vehicles within the U.S. Mazda and Volkswagen would be especially hurt by this change because they import the majority of their vehicles from overseas. Ford, Honda, and General Motors would be least affected because they produce the majority of their vehicles within the U.S. It is also important to note that hurting European and Asian car companies may end up costing a significant amount of jobs in North America, as these companies employ tens of thousands of people in their dealerships, from Canada to Mexico. To put this into perspective, Mazda has over 600 U.S. dealerships and Toyota employs over 90,000 people throughout its dealerships in the U.S.

## A Coming Clash?

Economists and trade specialists are afraid that the proposed measures to aid domestic companies at the expense of foreign producers will lead to a clash between important global economies.<sup>22</sup> Countries may decide to retaliate against new barriers to entry by preemptively leaving trade agreements, as Mexico has threatened to do with NAFTA, or by levying their own tariffs on imports from the U.S., which China has threatened to do.<sup>23</sup>

If China retaliates by imposing tariffs or boycotting U.S. products, it would be particularly harmful for General Motors and Ford, as both companies are large exporters to China. A boycott of Ford or General Motors would boost demand for cars from competing automakers. The Peterson Institute for International Economics studied the possible effects of a full trade war between the U.S., China, and Mexico, and predicted it would generate a recession and cost millions of U.S. jobs.

The automotive industry would be especially affected because it is one of the most segmented industries. Supply chains play a critical role in the manufacturing process. Another retaliatory measure from China could be to bar critical components of automotive supply chains where they hold a competitive edge. This would force U.S. companies to find alternatives for these components, which could increase delays and costs. Such an incident is not without precedent. China stopped all exports of rare earth metals to Japan in 2010 in reaction to perceived provocations in the East China Sea.

Finally, the Peterson Institute found it unlikely that higher tariffs on competing countries would return certain manufacturing jobs to the U.S., as this activity would relocate to countries with fewer trade restrictions.<sup>24</sup>

## NAFTA – A Changing Trade Regime

Most of the largest global automakers – General Motors, Ford, Volkswagen, Nissan, Honda, Toyota – make cars in Mexico to take advantage of the tariff-free common market under NAFTA and its cheap labor. Mexico is particularly exposed to changes in NAFTA. Car manufacturing and related businesses account for 18.5% of manufacturing GDP in Mexico compared to 3% in the U.S., and the sector employs tens of thousands of people. This increases Mexico's vulnerability to significant job losses and economic damage if automakers were to move their operations north as a result of changes to NAFTA.

Moreover, the political rhetoric of the last election on returning manufacturing jobs back to the U.S. from Mexico is being tested, with the Trump administration detailing plans to begin this process. This includes the possibility of a 35% tax on certain products made in Mexico by foreign competitors, principally Japan and China.

22 <https://piie.com/system/files/documents/piieb16-6.pdf>

23 <https://bloomberg.com/politics/articles/2017-01-24/trump-s-nafta-revamp-may-hinge-on-partners-willingness-to-talk>  
<https://piie.com/system/files/documents/piieb16-6.pdf>

24 <https://piie.com/system/files/documents/piieb16-6.pdf>

## A Game-Changing Tax

A tax this large would wreak havoc on a decades-old ecosystem of business agreements and complex supply chains that stretch across the common market, employing 1.5 million people. Industry experts point out the danger of imposing higher tariffs, which will increase certain car prices by \$2,300. This would also raise the cost of manufacturing in the U.S. and Mexico by lowering competitiveness in both countries and damaging NAFTA and WTO trade norms.<sup>25</sup>

Ultimately this would result in higher costs for consumers and job losses in the industry. For example, the proposed cross-border tax may increase the price of Jaguar's cars as much as \$17,000, and up to \$6,000 to \$7,000 for Volvos and Volkswagens. Tesla, on the other hand, would benefit at the expense of these automakers as it would see no increase in the price of their cars because they are all manufactured in the United States.

This illustrates how costs and benefits will be highly variable across the industry depending on changes made to specific regulations and trade policies. It may take years for the effects to crystalize, as many of the proposed changes require negotiations between different entities, each with competing interests.

Plenty of uncertainty remains, and negotiations over these changes may become drawn out and challenging. This was recently exemplified by the Mexican government's recent decision to cancel a trip to Washington to discuss NAFTA changes with President Trump. The exact effects of deregulation and changes made to NAFTA remain to be seen, although they will undoubtedly have large consequences for key producing, exporting, and importing countries.

U.S. automakers today rely on seamless borders and a multitiered distributed network of parts manufacturers enabled by NAFTA to produce goods at competitive cost. A capacitor installed in a car seat's control unit may cross the borders of the U.S., Mexico, and Canada four times before rolling off an assembly line in a finished automobile. Erecting trade barriers would impede the easy flow of cheap components, which may help workers in some domestic industries but would cause immediate ripples across entire supply chains. This would raise consumer prices and cost as many as 30,000 jobs in the United States.

Finally, shifting auto manufacturing jobs to the U.S. will face further hurdles from future sales projections and start-up costs. U.S. car manufacturing currently runs close to capacity.<sup>26</sup> Adjusting rules of origin to require more domestically sourced parts and production would require investment in new factories. It may be risky for some automakers, especially with potential stagnation of future car sales.<sup>27</sup> Stagnation could even lead to a period of decline in demand if consumer behavior towards car ownership changes and greater geopolitical disruption occurs.

<sup>25</sup> <http://freep.com/story/money/cars/2017/01/26/trump-mexican-border-auto-industry/97105754/>

<sup>26</sup> <http://forbes.com/sites/joannmuller/2017/01/20/how-trumps-protectionism-would-destroy-auto-industry-jobs-not-create-them/#4f57a2503e3e>

<sup>27</sup> <http://money.cnn.com/2017/01/03/news/companies/car-sales/>

## Mexico – A Key Gateway for Trade

Mexico is a key car producer for several important reasons, including cheap labor and NAFTA membership, which allows it to export tariff-free to the U.S. The world's largest automakers build factories and assembly plants in Mexico to take advantage of this competitive edge.

An important factor, however, is Mexico's many bilateral trade agreements specific to the automotive industry, which dwarf the number of bilateral trade deals the U.S. has for the same industry. These agreements give Mexico access to half the global car market tariff-free, whereas the U.S. only has access to 9% tariff-free. It highlights the importance of Mexico as a global entry point to the U.S. car market for major European and Asian automakers.

Any disruption to Mexico's ability to export goods tariff-free to the U.S. will have repercussions on automakers and related businesses. Conversely, it will also make it more difficult for U.S. automakers to use Mexico as a bridge for tariff-free entry into the 44 partner countries. Furthermore, using this gateway to export cars globally helped U.S. automakers avoid \$770 million in tariffs in 2014. This is a crucial reason why Mexico plays such a pivotal role in the global car market, why its benefits go beyond cheap labor, and why NAFTA is crucial to the automotive industry in its member states.

## Leaving NAFTA?

To leave NAFTA, the U.S. simply needs to invoke Article 2205 and give Canada and Mexico six months written notice. This would return the U.S. trade relationships with Canada and Mexico to their pre-NAFTA position.

For Mexico, tariff levels would return to those dictated by the World Trade Organization's (WTO) most-favored-nation status, a small enough change in tariffs for Mexico to absorb through the depreciation of the peso. Canada would return to levels agreed upon by a bilateral trade agreement from 1989.

Finally, if the Trump administration decides to withdraw from the WTO, it would create serious disruptions to deeply integrated supply chains in North America. It would result in significant job losses and higher costs for consumers, which is contrary to the administration's stated aims. President Nieto has said Mexico would leave NAFTA if U.S. demands make it no longer economically worth staying, stating it wouldn't make sense to remain in an agreement where they benefit less than they do now.<sup>28</sup>



28 <http://reuters.com/article/us-usa-trade-nafta-idUSKBN1581QF>

# Information Sovereignty and Firewalls to Data Flow

Surging nationalism and reinvigorated national borders will disrupt a critical piece of the autonomous car: the easy flow of data. The modern knowledge economy is a product of a borderless Internet that moves information without respect to sovereignty. Automakers will rely on access to data generated by vehicles to gather precise information on speed limits, street conditions, and other features of the road. By compiling and pushing this data out to other autonomous cars, companies who manufacture and maintain driverless cars will improve the vehicle's "knowledge" of permanent features on any stretch of road, freeing up more software for dealing with collision detection and sensing pedestrians.<sup>29</sup>

Autonomous cars' onboard AI will also require large amounts of data to improve the algorithms they use, enhancing vehicle safety and efficiency. The value of data created by autonomous car's users will also create new revenue flows for data brokers. Some forecast that future automakers can make more money selling vehicle user data than from selling vehicles.<sup>30</sup> For example, a wearable biometric tracker used by a future passenger may notify the vehicle that the wearer is hungry. By knowing the passenger's favorite meals and preferred routes, the vehicle will be able to make an informed suggestion on nearby restaurants.

Moves by national governments to restrict the flow of data and popular opinions regarding data use and collection threaten to prevent these industries from enjoying the same privileges the e-commerce and related data-driven industries enjoyed at the turn of the millennium.

Barriers to the flow of data are a product of changing public attitudes regarding privacy and the Internet. Following the disclosures about the U.S. government's bulk collection programs, popular opinion in some countries has shifted away from movement of data toward a model where user data remains within defined national borders.<sup>31</sup>

Brazil has already started to build its own separate data infrastructure.<sup>32</sup> These same concerns prompted a lawsuit against Facebook® in Europe, resulting in the Court of Justice of the European Union overturning the Safe Harbor Agreement between the U.S. and EU. The resulting Privacy Shield Agreement more tightly regulates what U.S. companies can do with EU citizen data.<sup>33</sup>

Meanwhile, repressive states continue to exercise greater control over data movement across and within their borders, as well as establishing requirements for moving their citizens' data to other countries or disclosing software's source code for security measures.<sup>34</sup> Although states' motivations on information sovereignty differ, they could contribute to a future dilemma where user data is subject to conflicting legal requirements, hampering the seamless movement of data. This may create a substantial hurdle for auto manufacturers and data brokers.

If the Internet fractures along national lines and a labyrinth of new privacy and data regulations emerge, providers of autonomous vehicle services will be hampered. A large pool of user data is essential for machine learning. Without the ability to aggregate user data, service providers will not be able to provide after-purchase services in entertainment, lifestyle, and marketing.

It is not inconceivable that U.S. auto manufacturers may face high barriers to accessing and using user data in the European Union. In such a scenario, their ability to integrate more data into their vehicle's navigation and control systems will be diminished. Consequently, U.S. automobiles may be less competitive in comparison to European-based service providers. This is not without precedent. Some analysts believe European technology firms seek to use EU privacy laws as a form of protectionism.<sup>35</sup> It is not a stretch to imagine that the future of the AV industry may be beset by these challenges. Divergent national regulations regarding data access will hamper the deployment of autonomous vehicles and new segments in the information economy.

29 <https://wired.com/2014/05/google-self-driving-car-maps/>

30 <http://money.cnn.com/2017/02/07/technology/car-data-value/index.html>

31 [https://washingtonpost.com/world/europe/germany-looks-at-keeping-its-internet-e-mail-traffic-inside-its-borders/2013/10/31/981104fe-424f-11e3-a751-f032898f2dbc\\_story.html?utm\\_term=.ca950c63d9e6](https://washingtonpost.com/world/europe/germany-looks-at-keeping-its-internet-e-mail-traffic-inside-its-borders/2013/10/31/981104fe-424f-11e3-a751-f032898f2dbc_story.html?utm_term=.ca950c63d9e6)

32 <http://wired.co.uk/article/brazilian-sea-spanner>

33 [http://ec.europa.eu/justice/data-protection/files/factsheets/factsheet\\_eu-us\\_privacy\\_shield\\_en.pdf](http://ec.europa.eu/justice/data-protection/files/factsheets/factsheet_eu-us_privacy_shield_en.pdf)

34 <http://csmonitor.com/World/Passcode/Passcode-Voices/2015/1005/Opinion-The-troubling-rise-of-Internet-borders>

35 <http://gadgetsnow.com/tech-news/US-tech-giants-concerned-over-digital-protectionism-in-EU/articleshow/49516349.cms>

## Counterfeit Parts Potential

OEMs, suppliers, and companies providing onboarding services will have access to more information about drivers and passengers. By leveraging this information, they can effectively target consumers, contributing to growth in the automotive aftermarket.<sup>36</sup> There will be further growth in the aftermarket as goods and services are also offered online.<sup>37</sup> This will create a market for after-sale upgrades and services, similar to the market for mobile applications and accessories for smartphones, allowing consumers more customization options for their vehicles.

A sizable market for retrofitting existing vehicles with driverless technology will further bolster the automotive aftermarket.<sup>38</sup> These increased points of contact between consumers and upgrades for driverless cars could create new opportunities for fraud. This will likely take two forms: goods produced that are not up to specifications and goods that are intentionally flawed.

Bearing the marks of legitimate brands, counterfeit components are typically not made to the specifications of original equipment manufacturers. Counterfeit parts can result in poor performance and even catastrophic failure. According to estimates from the Federal Trade Commission, the current market for counterfeit parts is approximately \$12 billion annually.<sup>39</sup> China produces a large share of counterfeit parts, alongside Taiwan, Hong Kong, Russia, India, Pakistan, and Uruguay. This may not pose a problem for most consumers who utilize the manufacturer's service centers, but can be problematic for consumers who elect to use independently owned and operated automotive repair shops.

## Vulnerable Software and Users

The fact that driverless cars will rely on a bank of software applications further opens the possibility of new vulnerabilities to counterfeit and fraudulent parts. An organized criminal syndicate may seek to create counterfeit parts with preinstalled backdoors or vulnerabilities and sell them to consumers.

There is already a precedent for this: An organization in Russia created a replica of a Taiwanese company's industrial automation solutions.<sup>40</sup> Among other parts, the counterfeit company sold programmable logic controllers with embedded malware. This possibility opens up new dangers to consumers beyond faulty airbags or subpar brake pads. Organized criminals or governments can exploit backdoors to access user location history, intercept communications, or gather other personally identifiable information.

36 <http://strategyand.pwc.com/media/file/Connected-car-report-2016.pdf>

37 <https://forbes.com/sites/sarwantsingh/2016/10/19/the-five-pillars-of-digitisation-that-will-transform-the-automotive-industry/#27fc6f118f2>

38 <http://mashable.com/2014/08/05/aftermarket-driverless-car-technology/#HDYr5zSDomqX>

39 <http://assemblymag.com/articles/93460-cracking-down-on-counterfeit-parts>

40 <https://treadstone7llc.files.wordpress.com/2016/04/delta-elektroniks.pdf>



## Connected Cars May Hold the Answer

The solution to the counterfeit parts challenge may be found in the economic model of connected cars. The safety-critical nature of autonomous vehicle technology and costly nature of autonomous vehicle maintenance systems may push consumers away from independent car services and towards the OEMs themselves.<sup>41</sup> In addition, OEMs can use the car's ability to make recommendations to consumers to nudge them to OEM-approved service centers and replacement parts. A process for certifying equipment and service providers by evaluating their supply chains and pushing these services online may further assist consumers looking to save money by buying third-party components.

## Information Security

The prospect of preinstalled malware in counterfeit parts illuminates a challenge facing driverless cars: information security. As cars transition into becoming both a computer on wheels and a means of transportation, they will eventually integrate seamlessly into our lives. Cars will join a complicated and growing universe of connected devices. This means traditional physical safety challenges posed by vehicles will be joined by new challenges to data security and user privacy.

Auto manufacturers will need to balance consumer desire for privacy with the potential benefits gained from aggregating huge amounts of data on user behavior. Cars synced with their owner's lives will collect large amounts of information and be in a position to make recommendations based on this, such as restaurants or other consumer goods.<sup>42</sup>

Data on preferred routes taken by certain users will enable advertisers to precisely target ads and other services along known routes. Users of driverless vehicles will no longer have their eyes on the road, giving them more time to consume media, news, entertainment, and other content during trips.<sup>43</sup>



REUTERS/Siu Chiu

41 <http://mckinsey.com/industries/automotive-and-assembly/our-insights/ten-ways-autonomous-driving-could-redefine-the-automotive-world>

42 <https://theatlantic.com/technology/archive/2016/03/self-driving-car-makers-on-privacy-just-trust-us/474903/>

43 <http://connectedcar-news.com/news/2016/jul/04/how-rise-driverless-cars-will-transform-advertising-industry/>



## Balancing Privacy Needs

The potential for advertising firms and tech firms to partner with auto manufacturers in this space is enormous. To capture this and maintain credibility, however, auto manufacturers will have to address and respond to consumer concerns about privacy. At the moment, companies engaging with connected cars have not established clear guidelines for consent, privacy safeguards, and data retention.<sup>44</sup> It is possible that these standards will emerge organically as early adopters establish best practices. If consumers do not trust these standards, however, and consumer behavior in this space becomes more conservative in regards to privacy, manufacturers run the risk of diminishing trust in connected cars.

Users of connected vehicles must also now contend with cybercriminals in addition to the physical safety risks of driving. Hackers may manipulate a vehicle's operation, whether disabling a vehicle's brake system or tampering with the steering during a commute. Even though today's vehicles are not fully autonomous, the growing presence of computerized components and automation features has created a raft of vulnerabilities that security researchers have begun to exploit.

The most high-profile of car hacking culminated in a major auto manufacturer recalling 1.4 million vehicles after security researchers demonstrated it was possible to hijack its computer systems over the Internet.<sup>45</sup> As more auto components are connected to the Web, whether to facilitate route navigation or entertainment, these risks will increase. They will be further complicated by the tangled web of connections between auto components: a security failure in one could filter into other devices, creating a larger risk.

44 <http://gao.gov/assets/660/659509.pdf>

45 <https://wired.com/2016/08/jEEP-hackers-return-high-speed-steering-acceleration-hacks/>

## The Criminal Angle

The digital risk to connected vehicles extends beyond the immediate damage to life and limb posed by manipulating the controls. Connected vehicles and the data centers where a large amount of user information is held will become targets for actors interested in stealing pattern-of-life data to help exploit it.

The proliferation of Internet-connected appliances, such as refrigerators and security cameras, has enabled some cybercriminals to build larger botnets for committing denial of service attacks or distributing spam messages.<sup>46</sup> The largest denial of service attack in history deployed an army of hijacked security cameras to knock websites offline.

The possibilities for malicious actors grow with the addition of millions of Internet-connected devices on future roads. In the not so distant future, your car's onboard navigation might recommend you visit a certain pharmacy while simultaneously sending thousands of unsolicited advertisements for unregulated pharmaceuticals.

Ultimately, cars will not be exempt from the current ransomware-heavy environment. Given a user's potential reliance on their vehicle, these will make desirable targets for cybercriminals looking to extort money from hapless drivers.<sup>47</sup> A future scenario could involve a hacker encrypting or altering a car's control system, demanding a ransom before unlocking the doors or releasing their grip on the vehicle's safety controls.

A final challenge car manufacturers must consider is the end-of-life cycle for their vehicle's software. Outdated products are more likely to be vulnerable to security flaws, and therefore hackers, because the process of identifying and patching software defects will have ceased.

These challenges have not been properly addressed for the current Internet of Things, and long-term risks in using a product past its life expectancy will remain unresolved.<sup>48</sup> In addition, consumers today plan on keeping their cars for longer periods of time, leaving auto manufacturers performing maintenance and updates for cars longer.<sup>49</sup> Insurance companies can help mitigate some of these challenges by adjusting incentives for consumers related to vehicle ownership and technology. A first step could be adjusting premium rates so users of conventional transportation are penalized, followed by policies that offer discounts for investing in more sophisticated driverless technology.<sup>50</sup> From this standpoint, drivers could be offered savings to ensure they have secure, up-to-date software installed in their vehicle.

Some of these changes are manifesting today. Tesla Motors anticipated the shift in liability from driver to company, bundling the cost of maintenance and insurance into the price of the vehicle itself.<sup>51</sup> Consumer behavior is further at play: a pair of class-action lawsuits filed in 2015 targeted major automakers and parts manufacturers for selling systems that were "exceedingly hackable."<sup>52</sup>



46 [www.infosecurity-magazine.com/news/leet-iot-botnet-bursts-on-the-scene/](http://www.infosecurity-magazine.com/news/leet-iot-botnet-bursts-on-the-scene/)

47 <http://tomsguide.com/us/iot-ransomware-attacks,news-24505.html>

48 <http://natlawreview.com/article/ftc-urges-prescient-end-life-strategy-internet-things-products>

49 <http://business.time.com/2012/07/27/driver-consensus-its-silly-to-upgrade-cars-every-couple-of-years/>

50 <http://www.propertycasualty360.com/2016/06/21/driverless-cars-what-are-the-insurance-implication>

51 <http://businessinsider.com/tesla-cars-could-come-with-insurance-maintenance-included-2017-2>

52 <https://law360.com/articles/846901/a-look-at-manufacturer-liability-for-the-internet-of-things>



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