Impact of a Pandemic on the Automotive Industry: Analysis of the Effect of Covid-19 on the Sector

Manuel Neves Sena Alçada Ribeiro

Department of Engineering and Management, Instituto Superior Técnico

Abstract

The year of 2020 started in an unexpected way: the Covid-19 caused an unprecedented global impact. As the virus spread the automotive sector was no exception. As part of the lockdown measures imposed in several countries in order to contain the virus, many workers were forced to remain in confinement, which caused production to slow down and led to the temporary closure of several car plants, contributing to disruptions in the supply chain.

This dissertation aims to analyze the impact of Covid-19 on the automotive industry, in order to anticipate the evolution of the sector ensuring its sustainability. Hence, this work contextualizes the problem from a literature review on the 2008-2009 financial crisis, establishing a parallel with the current one. A qualitative content methodology is used to analyze the effects of Covid-19 on the automotive industry and mobility, followed by a prospective analysis to predict the evolution of the sector.

Through the qualitative analysis it was found that the automotive market was in decline at the beginning of 2019 and that the Covid-19, only accentuated it, particularly in the supply chain, in production, sales and employment. The prospective analysis that followed indicated that the sector has a probability of recovery that can be defined within three scenarios "V", "U" and "L". These are dependent on the timing of the vaccine discovery or treatment of Covid-19. However, the "U" scenario is the most likely, consisting of a forecast of economic recovery on the automotive sector by the end of 2021

Keywords: Financial Crisis, Automobile, Automotive Industry, Covid-19, Coronavirus

Introduction

In early 2020 the world faced the Covid-19 disease pandemic that originated in Wuhan, Hubei province, China with overwhelming economically, politically and social impact that spanned across several industries, mostly negative. The automotive sector was no exception, with the blockade measures imposed in several countries in order to contain the virus, many workers were forced to remain in quarantine at home, which caused slowdowns in production and led to the temporary closure of several factories and businesses, contributing to disruptions in the supply chain. In addition, this pandemic has highlighted the supply dependence of several automotive factories throughout Europe and the US on China (Statista, 2020). On the other hand, this pandemic has increased the pressure already felt in the slowdown of global demand in the sector (World Economic Forum, 2020)

In this work, we use the learning experience of the financial crisis of 2008-2009 to address the potential impact of the current crisis in the automotive sector. The financial crisis of 2008-2009 literature was analysed in order to understand the impact of this crisis on the automotive sector and how the same mistakes made can be reflected in the current Covid-19 crisis.

The financial crisis that started in 2008 in the USA, hit the international car markets in October of that year and led to a global financial crisis that deepened the recession of the world economy. Apart from the housing, financial and banking market, one of the sectors most affected by this crisis was the automotive

industry, which led to government intervention worldwide (UNIDO, 2009).

The two main reasons for the severity of the impact of the 2008-2009 Financial Crisis on the automotive sector, was the financial degradation of the three largest automotive companies of the time, General Motors, Ford and Chrysler, and the high cost of automobiles and their increasing longevity. Many consumers postponed the purchase of vehicles due to the difficulty of obtaining loans given the uncertainty caused by the crisis and the fear of job loss. For the reasons mentioned, the sector was pushed into the biggest crisis since the Great Depression.

According to (OICA, 2020) in the period of 1 year, from the end of 2008 to 2009, the global production of vehicles fell by around 10 million units, showing that it is sensitive to business cycles. Although not all regions of the world have been affected in the same way, the most affected markets were NAFTA (North American Free Trade Agreement), Europe and Africa. The reason that NAFTA and Europe are the regions most affected is due to the difficult access to credit for new vehicles by consumers(Klier and Rubenstein, 2010). On the other hand, the situation in the Asian emerging market was quite different, registering an increase of 0.8% from 2008 to 2009 in vehicle production. The reason behind Asia's immunity from the crisis has to do with the fact that the region's financial institutions, unlike their European counterparts, have had limited exposure to subprime and toxic assets.

The 2008-2009 Financial Crisis led several countries to take measures to support the sector under pressure due to the existence of strong

unions and the geographical concentration of this industry. On the other hand, the sector is characterised by a small number of large companies, which employ a large number of workers, leading to a more attentive political intervention in order to guarantee the continuity of these companies. Consequently, its financial rescue also makes the sector's financing institutions viable, thus avoiding a chain shock (Oh, 2014). In the USA and Europe during the 2008-2009 Crisis, governments played a key role in safeguarding these companies, having adopted measures such as the granting of tax benefits, subsidies and direct involvement in company restructuring plans (Sturgeon, 2010).

The automotive industry had already been experiencing a slowdown in sales before the pandemic began. In 2017 there was a first drop in sales in the sector since the Great Recession period 2008-2009. Since then, the number of vehicles sold has been decreasing. Coronavirus and its spread have increased the pressure on the automotive industry. Due to this circumstance, several countries have adopted drastic confinement measures in order to reduce infection rates. The main European economies, such as Germany, France, Italy and Spain, adopted partial or complete lockdown measures, implying the closure of factories in the automotive and other sectors, which contributed to the international trade crisis and a reduction in global GDP (Gross Domestic Product).

Compared to the 2008-2009 Financial Crisis, the crisis caused by the Covid-19 pandemic is much more profound. According to the European Commission, in the report "European Economic Forecast / Spring 2020", the economic impact of the coronavirus led the European Union to enter the deepest economic recession in its history. The European economy is expected to contract at a record 7.4% this year, more than in the 2008-2009 financial crisis, in which the contraction was around 4.5% in 2009 (European Commission, 2020).

The purpose of this study is to analyse the present and to forecast the future of the automotive industry taking into account the impact of the Covid-19 pandemic on the sector.

In this context, we address the following research question: to what extent a pandemic such as Covid-19 affects the automotive industry and how can the sector guarantee its sustainability in the future?

Methodology and Procedural Guidelines

To answer the research question, two approaches were adopted.

- The first is a qualitative content analysis as it is a process in constant evolution and development, involving the analysis of online news in relation to the impact of the Covid-19 disease pandemic on the automotive industry. The resulting information is compiled into a table in which the collected articles are processed, organised and coded by under different categories. After preparing the table, the collected code are validated.
- The second is based on a prospective analysis to envision future trends in the sector.

There is no specific format for developing a qualitative content analysis (Creswell, 2007).

However, there are several general steps that should be included in the article. The steps to be developed are based on the framework of(Flick, 2014) although the procedure has been adapted in order to better fit the study of the problem:

1. Specify the objectives and research question.

2. Collect the research material, analysing it and removing unnecessary material.

3. Build a code framework / table in which the unit of unitization will be represented, the source from which the material was collected and the date.

4. Codification, in which categories will be assigned to the units of unitization.

5. Evaluate and modify the code table.

6. Main analysis, where all the material is already encoded.

7. Presentation and interpretation of results.

Data Collection

The selection of the most appropriate method for data collection is essential to ensure the credibility of the content analysis. The strategy to guarantee the credibility of the content analysis begins precisely with the way in which the best method of data collection was chosen in order to respond to the research question (Elo and Kyngäs, 2008). There is no ideal sample size for qualitative studies, as this sample depends on the objective of the project, the research questions, and the wealth of data (Burmeister and Aitken, 2012).

Qualitative research involves large amounts of material, but only part is used to build the code framework. Therefore, it is important to select relevant information that reflects the diversity of data sources. If the collection of material consists of analysing articles from online newspapers, as is the case with this project, it is necessary to define a period in which the news will be collected and what are its sources (Flick, 2014)

While searching for online news can increase the scope of the sample collected, since Big Data can handle millions of items, it can also have some implications. The way in which the categorisation schemes are developed requires a clear understanding of the synthesis, semantics and logic of the articles being collected. In the case of this project, in which articles are accessed online, it is important to make a decision about the starting date of the collected article, whether it is linked to the date of publication or the date of updating, as many journalists sometimes update published texts (Karlsson and Sjøvaag, 2016). As news can be constantly updated, the most sensible way is to use the original date of publication of the article.

Regarding data collection, we started by choosing the most appropriate keywords to start the search. The chosen keywords were as follows:

"automotive+automobile+covid19+coronavirus"

The reason why these keywords were chosen has to do with the fact that they are entirely framed with the theme of this project, which is why we chose to use Anglo-Saxon terms since the automotive industry has an international dimension.

The search engine used was Google News, which is an online news aggregator and uses specific technologies to discover relevant and authorized news from various internet sources.

On the other hand, Google News was also chosen because the content policies used by this service, include transparency and accountability requirements, which is essential to help fight Fake News (Google, 2020).

The time window was defined from January 1st, 2020 to April 30th, 2020, that is, from the announcement of the proliferation of the outbreak in China (WHO, 2020) until the end of April. In total, 148 articles were collected from 19 sources.

The collected articles were coded and assigned several categories according to the theme, or themes, covered in each news item. In total, 16 categories were assigned, each of which can be assigned to more than one article.

Data Validation

One way to demonstrate the reliability of the project is to describe the way the categories were created. Often the description and definition of the categories can become a challenge. A large number of concepts or categories mean that it was not possible to group the data and that the categories can overlap. In this case, the grouping of categories should continue to be carried out in order to identify any similarities or differences between them (Elo *et al.*, 2014).

The fifth step of the procedure is to evaluate and modify the code table. From a more careful analysis of the code table, it was possible to simplify and group the number of main categories. The code framework will consist of a two-level hierarchy, where the main categories and subcategories are found. The main categories represent information about a

chosen aspect, while the subcategories identify relevant information in relation to that aspect (Flick, 2014).

The main categories and subcategories were chosen taking into account the objectives of the project, allowing to find standards according to the content of each news item, analyzing the effects of the Covid-19 pandemic disease on the automotive industry and what the responses given by the various stakeholders to the sector. In total, the code framework consists of 6 main categories and 23 subcategories as shown in Table 1, with the subcategories being mutually exclusive of each other (Flick, 2014). After identifying the categories, definitions were given about them.

Data Analysis

During the term under review, the impact of the pandemic on the automotive sector worsened through the monthly quantification of the data collected, with a parallel between the growing number of published articles, motivated by the evolution of Covid-19 disease, and the worsening of its effects on the automotive industry over this period. Figure 1 represents the number of articles collected per month.
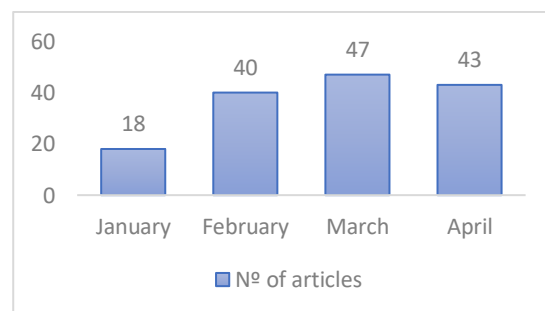

Figure 1 - Number of articles collected per month

Table 1 – Code Framework

Main Categories	Subcategories
Economic Impact	Financial Losses
	Financial Gains
	Impact on R&D
	Fall in oil and raw materials price
	Potential Economic Impact
Supply Chain Impact	Closure of Suppliers' Factories
	Impact on Freight Transport
	Possible Impact on the Supply Chain
Production Impact	Production Reduction
	Production Stoppages
	Possible Impact on Production
Sales Impact	Losses on Sales
	Possible Sales Impact
Employment Impact	Reduction in the Number of Workstations
Crisis Response	Adapting Industry to Market Needs
	Reopening of closed factories
	Bet on Electric Vehicles
	Online Car Sales
	M&A
	Diversify suppliers geographic origin
	Economic Restructuring Plan
	Consumer Financing / Support Plan
	China Travel Restrictions

Subsequently, a qualitative analysis of the collected data is performed, describing the main categories and respective subcategories. In this section, the last two steps of the procedure will be completed, which consist of the main analysis, where all the material is already coded, and the presentation and interpretation of results. In this way, the results of this section are presented directly from the final code table, and the code table itself represents the main result of the analysis under study. After this description, the first objective of this project is concluded, which consists of analyzing the effects of the Covid-19 pandemic on the automotive sector.

Comparison with the 2008 Financial Crisis

While the 2008-2009 Financial Crisis started with the fall in the US housing and financial markets and only after spread to the rest of the world, the crisis caused by the Covid-19 pandemic disease had an immediate, abrupt and absolutely overwhelming effect in the world economy. The closure of factories in China promptly disrupted supply chains that are globally interconnected. Unemployment caused by the closure of factories and car dealers due to containment measures has led to a decrease in vehicle purchases. As in 2008-2009, governments intervened with monetary and fiscal policy in order to counter the recession and provide temporary income support for businesses and households. Measures taken to contain the spread of the virus, such as confinement, restrictions on circulation and social distancing, affected the transport of people and goods, which was not seen in the Financial Crisis of 2008-2009. The crisis caused by Covid-19 had a greater economic, financial

and social impact than the Financial Crisis of 2008-2009 due to unemployment and company closures. In the USA, in March 2020, sales of passenger cars and light trucks fell by 34% and the unemployment rate rose to 14.7%, the highest recorded since 1940 (ING, 2020).

Prospective Analysis

The prospective analysis is presented through roadmaps, which consider several alternative scenarios for the evolution of the Covid-19 pandemic and their impacts on the automotive sector. Three scenarios were projected: "Optimistic", "Pessimistic" and "Probable" which are based on the forecasts of the various scenarios of the evolution of the world GDP (World Bank, 2020), of (OICA, 2020) in relation to car sales since 2007 to 2019 and the BCG report on the projection of vehicle sales for 2020 and 2021. The "Optimistic" scenario is based on the discovery of the vaccine or treatment of Covid-19 disease by the end of 2020. This scenario considers the recovery of the global economy in "V" in 2021 and its impact on the automotive industry. In a "Probabilistic" scenario, the vaccine or treatment for Covid-19 disease is expected to be discovered within 18 months from the start of the pandemic announcement date, which will correspond to a global economic U-shaped recession with the resumption of economic activity in the automotive sector towards the end of 2021 (Figure 2).

It is concluded that the recovery of the automotive sector is dependent on the timing of the discovery of the vaccine or the treatment of Covid-19. On the other hand, world GDP projections allow the sector to foresee future scenarios regarding world sales of automobiles.
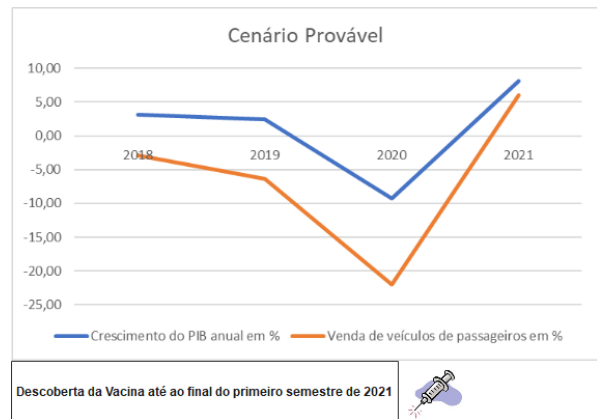

Figure 2 - Probabilistic Scenario

In this regard, it should be noted that it was found that there is an anticipated and more than proportional correlation between the sales of motor vehicles in relation to the fluctuations in GDP. An increase in sales in the automotive sector has, in the short term, a leveraging effect on GDP and contributes to the growth of the economy, just as the opposite is also true, that is, a decrease in car sales, anticipates a decrease in the pace of GDP growth. This phenomenon can be seen from the Financial Crisis of 2008-2009 until 2019, which means that this situation may occur in the future.

Future of Mobility

Major changes in mobility and in the automotive sector are approaching as a result of environmental awareness and the crisis generated by the Covid-19 pandemic that caused profound changes in the habits of society worldwide. New market trends have led to an increase in demand for electric vehicles, hydrogen, digitalization and autonomous mobility.

Most European Union member states, prepared to meet environmental targets, announced tax incentives and benefits for the purchase of electric cars (ACEA, 2020) China has also

7

extended tax exemptions and subsidies beyond 2020 and promoted new investments in order to further boost the market for clean energy vehicles. In addition, China is building electrical supply infrastructures in order to benefit companies producing this type of vehicles and entice consumers to buy electric cars (China Briefing, 2020).

In 2019, several European cities imposed restrictions on the circulation of combustion vehicles and in some cases with total interdiction in urban centers (Business Insider, 2019). In 2020, many European cities imposed temporary restrictions on the frequency and occupation of public transport and are developing policies to improve the use of urban space and promoting walking and cycling, with a special focus on promoting clean transport. In Rome, 150 kilometers of cycle paths were implemented, and in Paris by 2024 all streets will become suitable for cycling and about 72% of parking spaces will be removed, with the construction of permanent cycle paths being accelerated in response to the crisis (BBC, 2020). These measures may remain beyond the Covid-19 crisis and cities may decide to make them permanent as they promote improvements such as fewer accidents and less pollution (Mckinsey, 2020).

According to the report (Mckinsey, 2020), the Covid-19 crisis will have long-term effects on mobility as it will lead to changes in the macroeconomic environment, legislation, technology and consumer behaviour.

In the US, the electric vehicle market is dependent on environmental regulatory agencies and oil price fluctuations. Electric vehicle sales are expected to return to pre-pandemic levels, but oil prices need to follow the same trend and there must be an increase in the number of states that adopt California emissions regulations. As for technological innovation, some delay is expected, however investment is expected to recover. In Europe, car sales are expected to decline except for electric vehicles. These vehicles and shared mobility will be more widely accepted during and after the pandemic, and the electric market may also benefit from incentives for green mobility.

The impact of the Covid-19 crisis will vary by region. As for the electric market, sales of this type of vehicles are expected to recover quickly in China, also in Europe the same trajectory is expected, however in the USA the electric market may come to a standstill if governors do not make decisions regarding the legislation of CO_2 emissions limits and if oil prices remain low. Mobility will always be a factor with a large social dimension so it is necessary that the main "players" of the mobility industry immediately adjust their strategies to face the current crisis and to prepare for the "new normal" future.

One of the effects of the Covid-19 crisis was the increase in environmental awareness that will lead to sustainable zero-emission mobility, which will be based on electric and autonomous vehicles with a tendency to have zero accidents, that will lead to a faster change from combustion engines to electric or hydrogen. This situation proves the data from the qualitative analysis in relation to the main category "Crisis Response".

Conclusions

This paper aimed to analyse the effects of the Covid-19 pandemic on the automotive sector and to anticipate its evolution after that impact.

To answer the research question, the extent to which a pandemic like Covid-19 affects the automotive industry and how the future of the sector can be envisaged in order to guarantee its sustainability was analysed.

In this context and through the results of the qualitative analysis it was found that the automotive market was already in decline in early 2019 and that Covid-19, although not being at its origin, accentuated it, namely at an economic level, in the supply chain, production, sales, and employment. On the other hand, being a situation to some extent unprecedented, it originated several ad-hoc responses to the crisis by the governments and the different "players" of the automotive industry.

The prospective analysis that followed allowed to verify that any of the three recovery scenarios in the sector, "Optimistic", "Pessimistic" and "Probable", respectively, "V", "L" and "U", are dependent on the timing of the discovery of the vaccine or treatment for Covid-19 disease. However, the "U" scenario was considered the most likely and consists of a forecast of the economic recovery of the automotive sector within 18 months from the start of the date of the announcement of the pandemic, which will lead to the resumption of economic activity in the automotive sector towards the end of 2021. This analysis was based on the current indicators, which, being relatively volatile, do not allow to predict with more determination the exact moment of the recovery.

These three scenarios were constructed based on information collected in the World Bank report, with regard to the different scenarios for the evolution of global GDP, which allow foreseeing future scenarios for OICA's global car sales, regarding car sales since 2007 to 2019 and the BCG report on the projection of vehicle sales for 2020 and 2021.

The Covid-19 crisis caused a profound change in mobility with the increase of environmental awareness and with the objective of leading to a sustainable mobility of emissions with a tendency towards zero. Mobility will always be a factor with a large social dimension, it is up to governments and the main "players" in the mobility industry to immediately adjust their strategies to face the current crisis and to prepare for the "new normal" future. As mentioned in the dissertation, the "new normal" will be based on electric, autonomous and digitized vehicles where accidents and CO_2 emissions will tend to disappear.

For future work, the monitoring of some parameters, such as the evolution of world GDP and vehicle sales, may predict the future of the automotive sector.

References

ACEA (2020) Overview - Electric vehicles: Tax benefits & purchase incentives in the European Union | ACEA - European Automobile Manufacturers' Association. Available at: https://www.acea.be/publications/article/overview-of-incentives-for-buying-electric-vehicles (Accessed: 30 August 2020).

BBC (2020) How cities are clamping down on cars - BBC Future. Available at: https://www.bbc.com/future/article/20200429-are-we-witnessing-the-death-of-the-car (Accessed: 30 August 2020).

Burmeister, E. and Aitken, L. M. (2012) 'Sample size: How many is enough?', Australian Critical Care, Volume 22, pp. 271–274. doi: 10.1016/j.aucc.2012.07.002.

Business Insider (2019) Cities are banning cars around the world - Business Insider. Available at: https://www.businessinsider.com/cities-going-car-free-ban-2018-12#madrid-banned-older-cars-

from-its-city-center-1 (Accessed: 12 July 2020).

China Briefing (2020) Incentives Extended for China's Electric Vehicles, Hybrid Vehicles Industry. Available at: https://www.china-briefing.com/news/china-electric-vehicles-hybrid-vehicles-industry-incentives-extended-investment-new-infrastructure/ (Accessed: 12 July 2020).

Creswell, J. W. (2007) 'Qualitative Inquiry & Research Design', in Sage Publications, Inc., pp. 35–52. doi: 10.1111/1467-9299.00177.
Elo, S. et al. (2014) 'Qualitative Content Analysis: A Focus on Trustworthiness', SAGE Open, Volume 4, pp. 1–10. doi: 10.1177/2158244014522633.

Elo, S. and Kyngäs, H. (2008) 'The qualitative content analysis process', Journal of Advanced Nursing, Volume 62, pp. 107–115. doi: 10.1111/j.1365-2648.2007.04569.x.
European Commission (2020) 'Spring 2020 Economic Forecast : A deep and uneven recession , an uncertain', (May 2020), pp. 1–3.
Flick, U. (2014) 'The SAGE Handbook of Qualitative Data Analysis', in The SAGE Handbook of Qualitative Data Analysis, pp. 170–184. doi: 10.4135/9781446282243.

Google (2020) Organizing news from around the web – How News Works. Available at: https://newsinitiative.withgoogle.com/hownewsworks/approach/organizing-news-from-around-the-web/ (Accessed: 5 May 2020).

ING (2020) 'Covid 19's long-term effects on the industry', (May), pp. 1–13.
Karlsson, M. and Sjøvaag, H. (2016) 'Content analysis and online news: Epistemologies of analysing the ephemeral web', Digital Journalism, Volume 4, pp. 177–192. doi: 10.1080/21670811.2015.1096619.

Klier, T. H. and Rubenstein, J. M. (2010) 'The changing geography of North American motor vehicle production', Cambridge Journal of Regions, Economy and Society, Volume 3, pp. 335–347. doi: 10.1093/cjres/rsq024.

Mckinsey (2020) The new normal: Impact of COVID-19 on mobility solutions | McKinsey. Available at: https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-impact-of-covid-19-on-future-mobility-solutions (Accessed: 9 September 2020).

Oh, S. Y. (2014) 'Shifting gears: Industrial policy and automotive industry after the 2008 financial crisis', Business and Politics, Volume 16, pp. 7–13. doi: 10.1515/bap-2014-0015.

OICA (2020) Sales Statistics | OICA. Available at: http://www.oica.net/category/sales-statistics/ (Accessed: 23 April 2020).

Statista (2020) • Chart: U.S. Car Industry Most Reliant on Chinese Parts | Statista. Available at: https://www.statista.com/chart/20913/chinese-exports-of-motor-vehicle-parts-and-accessories/ (Accessed: 22 April 2020).

Sturgeon, T. J. J. V. B. (2010) Effects of the Crisis on the Automotive Industry in Developing Countries -- A Global Value Chain Perspective, Policy Research Working Paper. doi: 10.1073/pnas.1411798111.
UNIDO (2009) Impact of the Global Economic and Financial Crisis over the Automotive Industry in Developing Countries, Fuel Processing Technology. doi: 10.1016/j.fuproc.2006.05.007.

WHO (2020) World Health Organization (WHO) no Twitter: '#China has reported to WHO a cluster of #pneumonia cases —with no deaths— in Wuhan, Hubei Province ?? . Investigations are underway to identify the cause of this illness.' / Twitter. Available at:https://twitter.com/WHO/status/1213523866703814656?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1213523866703814656&ref_url=https%3A%2F%2Fwww.who.int%2Femergencies%2Fdiseases%2Fnovel-coronavirus-2019%2Fevents-as-they-happen (Accessed: 5 May 2020).

World Bank (2020) GDP growth (annual %) | Data. Available at: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2019&start=2007 (Accessed: 10 July 2020).
World Economic Forum (2020) How the global car industry is changing gears after coronavirus, from Wuhan to Detroit | World Economic Forum. Available at: https://www.weforum.org/agenda/2020/02/coronavirus-china-automotive-industry/ (Accessed: 22 April 2020).