

THE INFLUENCE OF FINANCIAL CRISES ON THE AMERICAN AUTO INDUSTRY

Anamaria-Geanina MACOVEI

Stefan cel Mare University of Suceava, 720229, Romania
anamaria.macovei@usm.ro

Abstract

The automotive industry has historically faced new challenges and technological changes that will continue to shape its evolution in the future. Annual sales of traditional automobiles in the US have had a significant impact on the American economy, but also on the global economy and numerous changes due to government policies and economic improvements. The purpose of this paper is to analyze the evolution of annual car sales in the US after World War II. The proposed objectives to achieve this goal are: O1: Analysis of the impact of crises on the auto industry, O2: Analysis of the impact of crises on annual car sales from 1951 to 2022, and O3: Evolution over time of annual car sales after World War II in the US. To achieve the proposed goal, analytical and forecasting methods are applied using statistical data on annual car sales in the US for the period 1951-2022. The results of the study consist of a microeconomic model for the analysis of the evolution over time of annual car sales after World War II in the US, with a focus on the economic crises that occurred during the period under analysis.

Keywords: trend; auto industry; model cubic; economic crisis.

JEL Classification: C22, H21, O23

I. INTRODUCTION

The automotive industry has a remarkable and fascinating history of innovation and technological developments that have led to the way we travel today, long before 1860, and has played an important role in transforming society and the global economy. Before the outbreak of the First World War and during the war (1914-1918), the automotive industry was booming, leading to significant changes. Many car factories were converted for the production of military vehicles such as trucks, ambulances and armoured vehicles. This rapid transition was essential to support the war effort as vehicles became essential for transporting troops and equipment to the front. The automotive industry was also involved in the production of aircraft and aircraft engines, contributing to the development of the aviation industry.

In the interwar period (1918-1939), through the three major US automakers (Ford, General Motors and Chrysler), the American auto industry began to diversify its product lines, offering a wider variety of models and options to consumers. This diversification, due to inventions and technological developments, led to market growth and increased demand for cars. Thus, the US auto industry was moving towards a mass market, like the auto industry in Europe, due to declining living standards and purchasing power, shrinking domestic markets, tax restrictions and stricter tariff policies. During the inter-war period there were countries that erected certain trade barriers so that car manufacturers could operate in other markets and production, which led to an upward trend of cars in Europe. Cars were widely used for transport and supply.

The US auto industry played a key role during World War II, contributing significantly to the country's war effort. During World War II, production of automobiles for civilian use was virtually discontinued, and factories were reconfigured to produce military vehicles such as trucks, jeeps, ambulances and armored vehicles, and most cars and trucks not made in the US were produced in Europe, although European production was a fraction of American production. These vehicles were essential for transporting troops, equipment and supplies to battle fronts around the world.

After World War II, the US auto industry experienced unprecedented expansion and had a profound impact on the American economy, society and culture. This period, known as the "post-war boom", was marked by a massive demand for cars amidst a return to normalcy and economic prosperity (Elhefnawy, 2022). Americans wanted to buy homes in the growing suburbs and cars to commute to work.

This study aims to analyse the development of annual car sales in the US after World War II. The aim is addressed through the following objectives:

O1: Investigate the impact of economic crises on the traditional automotive industry throughout automotive history.

O2: Investigate the impact of economic crises on annual sales of traditional passenger cars from 1951-2022.

O3: Analyze the growth trend of annual sales of traditional passenger cars in the US in the post-World War II period.

Analytical and forecasting methods are applied to achieve the proposed goal, using statistical data on annual car sales in the US for the period 1951-2022. The results of this research include the development of a micro-econometric model that allows the analysis of the evolution of annual sales of traditional passenger cars in the US after World War II, with a focus on the periods of economic crisis during the analysis period.

II. LITERATURE REVIEW

In the run-up to the First World War, the car industry was booming, with companies like Ford, Mercedes-Benz, and Rolls-Royce producing ever more affordable and efficient cars (Rosegger, 1096). The advent of mass production revolutionised the way cars were made, allowing ordinary people to own their own cars. This innovation had a major impact on society, paving the way for greater and more affordable mobility for people. During the First World War, cars played a crucial role in facilitating communications and military mobility, contributing significantly to the evolution of warfare. After the end of the conflict in 1918, the car industry returned to the production of vehicles for civilian use, but with considerable experience and technology gained during the war, and continued to grow rapidly (Olney, 1989). Henry Ford was one of those who significantly influenced this growth, as his mass production and the concept of the 'car for every family' became a reality (Watts, 2005). Thus the affordability of cars for the broad masses increased significantly. After the First World War, the car industry expanded and began to consolidate in global markets (Solvell, 2013). American, European and Japanese car companies became major international players and competition became increasingly intense. The styling evolution of cars was also an important issue after the war. Car design became more streamlined and modern, reflecting changes in consumer tastes and preferences (Bloch, 1995).

The authors E. Eckermann, (2001), G.N. Georgano (1990), D.A. Hounshell (1984) and R.A. Kamal (2005) also noted the significant impact of automobiles on society and culture after World War I. Automobiles contributed to the suburbanization of cities, the change in the way people travelled and the development of car-related consumer culture.

The World War II period brought with it technological innovations in the automotive industry (Flink, 1985; Ayres, 1990), such as the development of more powerful and durable engines for military vehicles, as well as more efficient production and assembly technologies. As many men served in the military, women played a significant role in the auto industry, taking jobs in factories and contributing to the war effort through the production of military vehicles and equipment. After the end of the war in 1945, the American auto industry quickly adapted to return to civilian vehicle production (Flink, 1985). This was an important moment for the industry, mass production resumed and cars became available to consumers again. American car companies introduced new models and innovative technologies to appeal to consumers. Thus, technology has had a significant impact on life over the past decade, influencing everyday life as well as work life and transforming the automotive industry. Cars have become not just a mode of transport, but also a safe and efficient mode of mobility, as they are no longer designed to carry someone, but to offer unique experiences to customers, from sports cars to 'odd' shaped and sized cars, leading to an increase in car sales.

Despite continued growth, the US auto industry has had to weather periods of crisis. External crises can be conceptualized as "occasional events" that occur in a company by interrupting periods of stability and are key mechanisms that lead to instability in current practices (Van de Hoed, 2007). During crises uncertainty arises, traditional practices are reviewed and new opportunities are created for development and innovation.

The oil crisis of the 1970s had a significant impact on the American auto industry and accentuated the need for more fuel-efficient cars. This led to a sharp rise in fuel prices (Macovei, 2023), which made consumers more conscious of the fuel consumption of their vehicles, and forced American automakers to develop and produce fuel-efficient vehicles to meet market demands. In response to the oil crisis (Mitchell, 2015), the US government has imposed stricter fuel economy standards on US-made vehicles. These rules have put additional pressure on automakers to develop more fuel-efficient technologies and meet compliance requirements. The oil crisis has spawned other global crises.

The increase in the number of cars with internal combustion engines has led to higher carbon dioxide emissions. Experts in the field had to find solutions to lower emissions. By 1990, the best solution was to improve the internal combustion engine. Between 1990 and 2003 there were two crises that significantly influenced the development of the car industry. The first crisis, in 1990 when the California Air Resources Board's zero-emission car regulation came into force, changed the evolution of the car industry. According to the regulation, the only solution to achieve sustainable mobility is "zero emission cars" (Verleger, 1990). Enforcement of the regulation has been cumbersome, due to the impossibility of switching internal combustion engine emissions to zero emissions. To implement the regulation, car manufacturers are investing in technologies applied to fuel cell cars, battery electric cars and hybrid cars and in patenting the results (Fogelberg, 1998).

The second crisis was in 2001, after the terrorist attack on the World Trade Center in New York, when there was a desire to improve fuel cell technology by an "independent" hydrogen society (Van de Hoed, 2007). The socio-political turmoil in the Middle East and the oil dependence of Western countries requires decisions to be made regarding energy security and the reduction of oil imports from the Middle East. Government policies and automotive companies in the US, Europe and Japan are investing in new hydrogen technologies. Carbon dioxide (CO₂) emission standards and environmental regulations have become increasingly stringent in many countries since 2000. These regulations have prompted car manufacturers to invest in cleaner technologies and develop low- or zero-emission vehicles, such as electric vehicles (Chau, 2016), leading to a decline in sales of traditional cars.

The global financial crisis of 2008-2009 was one of the most devastating economic crises in the world, and the automotive industry was one of the hardest hit (Claessens & Kose, 2010). This financial crisis was triggered by a number of factors, including the collapse of the US housing market and the banking system crisis that followed. As a result of the financial crisis, many people became uncertain about their financial future and began to spend less. Declining demand for cars led to a slump in sales, and automakers had to face the new economic realities. Many car companies have had to reorganise or close plants, make massive job cuts, cut costs to strengthen their financial position and receive government assistance, and some companies have had to seek partnerships or mergers to survive (Bowman, 2010). The COVID-19 pandemic in 2020 caused a steep drop in demand for cars and disrupted production and supply chains. Car manufacturers faced significant challenges in adapting to this unforeseen situation.

III. THE IMPACT OF FINANCIAL CRISES ANNUAL CAR SALES

The American car industry became a dominant force in the world, but also began to compete with foreign manufacturers, especially Japanese and European, in later decades. Technological advances, including the development of autonomous vehicles and connectivity technologies, have presented challenges and opportunities for the auto industry. Automakers have had to invest heavily in developing and integrating these technologies to remain competitive in the global market. From 1951 to 2022, the traditional automotive industry underwent many changes and evolutions due to innovations and new technologies, as well as many significant economic crises, and annual sales trends of traditional passenger cars were fluctuating and dependent on market requirements.

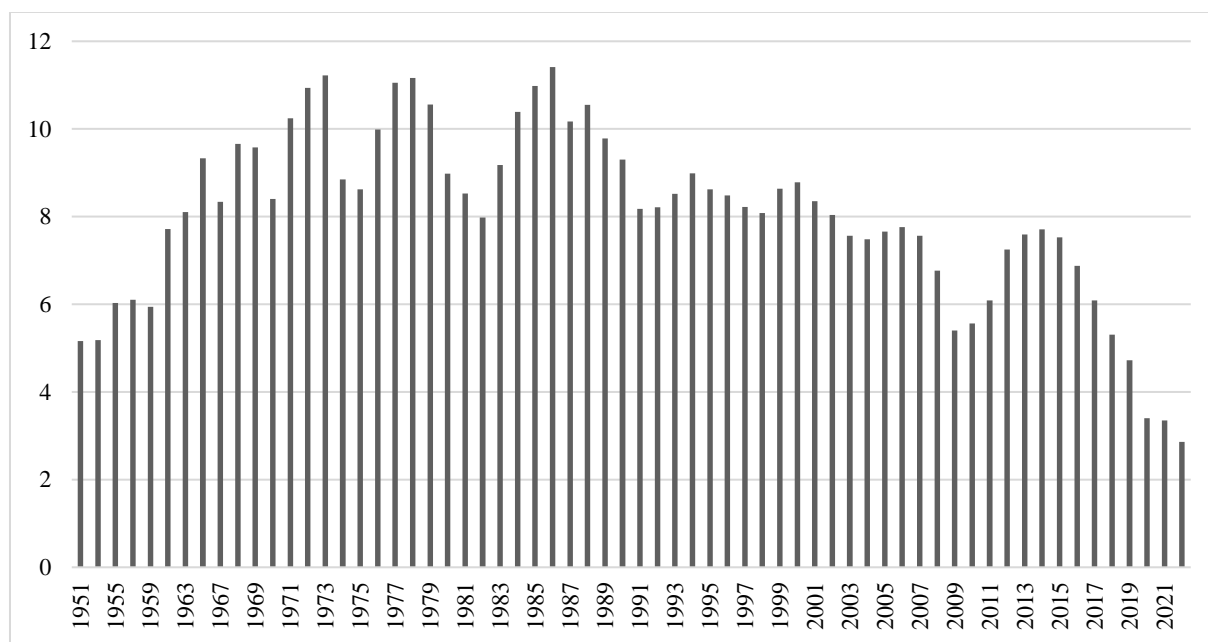


Figure 1. Annual passenger car sales in the United States from 1951 to 2022 (in million units)
Source: author elaboration (Statista)

Between 1951 and 1973, the development of sales of traditional passenger cars fluctuates, but shows an upward trend with a growth rate of 54.01%. The oil crisis of the 1970s began in 1973, when member states of the Organisation of Petroleum Exporting Countries (OPEC) imposed an embargo on oil exports to countries supporting Israel in the Yom Kippur War. This led to a significant increase in oil prices and an energy crisis in consuming countries, which had a negative impact on global economies (Macovei, 2023). This crisis led to a decrease in the sales of traditional cars by 40.60% by 1982, after which a recovery of the American industry, including the car industry, follows and the sales of traditional cars increase by 30.06% by 1986. In 1987, the stock

market crisis in the US causes a steep fall in stock prices. Even though the market recovered relatively quickly, the event raised fears about the volatility of financial markets. Trade tensions between the United States and other countries impacted the auto industry, affecting supply chains and creating uncertainty for manufacturers, and sales of traditional cars suffered in 1988-1991, declining 28.97%. During this period, the California Air Resources Board's zero-emission car regulation goes into effect.

After 1992, there have been significant fluctuations in traditional car sales due to fuel prices, with considerable increases in times of crisis or geopolitical conflict. This has influenced consumer preferences, leading to greater demand for fuel-efficient cars and electric vehicles.

The sharp drop in car sales in 2006-2008 was one of the harbingers of the US financial crisis. This period was characterised by a number of factors that had a significant impact on the automotive industry and contributed to the onset of the global financial crisis in 2008. Car manufacturers experienced a significant drop in sales of 43.70%. This drop in sales led to overproduction and the need to cut production and lay-offs in the automotive industry. After the global crisis of 2008-2009, due to government policies adopted in the US, the automotive industry recovered and the number of car sales increased significantly by 29.96% in 2014. In 2009, the US federal government introduced the "Cash for Clunkers" program, which provided financial incentives to consumers to replace their old and less efficient vehicles with newer and more fuel-efficient cars. This programme stimulated demand for new cars and supported car manufacturers.

During the period 2014-2022, the US auto industry went through several significant changes and developments. The annual sales trend of traditional passenger cars in the US during the period under review is downward with an impressive 168.58% decrease. This decrease in passenger car sales is due to the popularity of SUVs and trucks. This has led to a shift in consumer preferences and production adjustments to meet the increased demand for larger and more robust vehicles. Another factor in the decline in annual sales of traditional passenger cars is the rise in popularity of electric vehicles. Companies such as Tesla, Chevrolet, Ford and others have launched electric models and plug-in hybrids, and the charging infrastructure has grown to support this transition to greener vehicles.

IV. MODEL ANALYSIS. EMPIRICAL DATA AND RESULTS

This study uses empirical and analytical approaches to investigate the sales trends of traditional passenger cars in the US over an extended time frame from 1951 to 2022. To achieve this, a cubic regression equation fitted to the variables of interest was used, based on the cubic regression model (Macovei, 2021), of the theoretical form:

$$Y_t = \alpha + \beta \cdot t + \gamma \cdot t^2 + \mu \cdot t^3 + \varepsilon ,$$

where Y_t represents the annual sales of traditional passenger cars in the US and t represents the time variable, i.e. period rank. The variables of the model analysed are shown in Table 1:

Table 1. Model Description

Model Name		MOD_1
Dependent Variable	1	Annual passenger car sales in the United States from 1951 to 2022 (in million units)
Equation	1	Cubic
Independent Variable		Case sequence
Constant		Included
Variable Whose Values Label Observations in Plots		Unspecified
Tolerance for Entering Terms in Equations		.0001

Source: Authors Computation with the aid of IBM SPSS Statistics, version 26

Analyzing Figure 1 shows that the annual sales of traditional passenger cars in the U.S. is fluctuating and its evolution over time is realized using a cubic model.

Table 2. Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.872	.760	.749	.999

Source: Authors Computation with the aid of IBM SPSS Statistics, version 26

According to Table 2 there is a strong relationship between the model variables because the correlation ratio is 0.872. The determination ratio is 0.760, so 76% of the variation in the annual sales of traditional cars in the

US is explained by the variation in the period due to the innovations of new technologies as well as the crises that occurred during the period under analysis.

Table 3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	189.993	3	63.331	63.501	.000
Residual	59.840	60	.997		
Total	249.833	63			

Source: Authors Computation with the aid of IBM SPSS Statistics, version 26

According to Table 3, the cubic model obtained for our study is validated, therefore, evaluating and testing the accuracy and usefulness of the obtained model we can make relevant predictions or analysis.

Table 4. Table Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Case Sequence	.468	.070	4.371	6.672	.000
Case Sequence ** 2	-.013	.002	-8.061	-5.153	.000
Case Sequence ** 3	8.445E-5	.000	3.253	3.346	.001
(Constant)	5.109	.530		9.638	.000

Source: Authors Computation with the aid of IBM SPSS Statistics, version 26

According to Table 4 the cubic model equation for the evolution of annual sales of traditional passenger cars in the US is:

$$ASC = 5.109 + 0.468 \cdot t - 0.013 \cdot t^2 + (8.445E - 5) \cdot t^3$$

The value of annual sales of traditional passenger cars in the US at time 0 is 5,109 (in million units). According to the model obtained the annual sales of traditional passenger cars in the US has two inflection points. Analyzing the data and the equation of the obtained model it can be seen that the annual sales of traditional passenger cars in the US has an increasing trend, after which follows a decrease which was due to multiple crises and trade tensions between the US and other countries. The graph of the cubic model equation is shown in Figure 2:

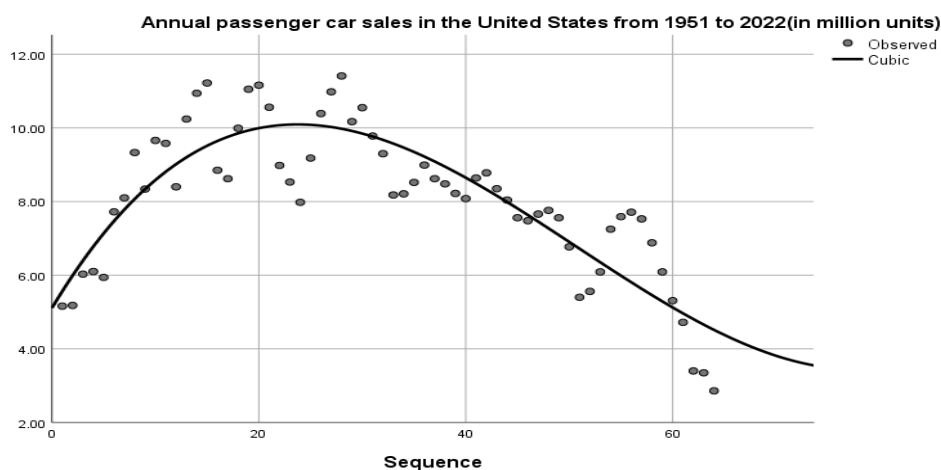


Figure 2. Trend annual sales of traditional cars in the US

Source: Authors Computation with the aid of IBM SPSS Statistics, version 26

Analyzing the graph of the evolution of annual sales of traditional cars in the US over the next period shows a downward trend as traditional cars are replaced by electric vehicles and more recently autonomous vehicles. Companies like Tesla, Chevrolet, Ford and others have launched electric models and plug-in hybrids, and charging infrastructure has grown to support this transition to greener vehicles. The development of autonomous vehicles

has been a major focus for the US auto industry. Many technology companies and automakers have invested heavily in research and development to bring safe and efficient autonomous vehicles to market.

V. CONCLUSION

The evolution of annual traditional car sales in the US has gone through periods of significant change over the past two decades. The oil crises of the 1970s had a profound impact on the US auto industry, leading to significant changes in consumer preferences, vehicle technology and government fuel economy regulations. These changes influenced the way US automakers developed and marketed vehicles and had a long-term impact on the industry. This crisis has led to a decline in annual sales of traditional passenger cars. After a steady increase until the 1980s in annual sales of traditional cars in the US, there followed a period of massive fluctuations. The global financial crisis of 2008-2009 had a significant impact on the auto industry, and some of the changes and adjustments made during that period have continued to affect the auto industry in the years since, and in particular annual sales of traditional cars in the US have been on a downward trend. However, the auto industry has adapted to major changes in the U.S. and global markets as economies have recovered and adjusted to consumer demands.

Throughout this evolution, several factors have influenced the car market, including technological innovations in fuel efficiency and the environment, changes in consumer preferences, and government interventions to support the industry in times of crisis. Although sales of traditional automobiles have fluctuated, the auto industry has managed to remain an important pillar of the U.S. economy and adapt to environmental and market changes.

Importantly, post-2014, the automotive industry has continued to face new challenges, including rapid technological developments in electric and autonomous vehicles that have changed the way consumers perceive and purchase vehicles. Thus, the future of the automotive industry remains dynamic and will be influenced by significant changes in technology, sustainability and consumer behaviour.

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