

A Work Project, presented as part of the requirements for the Award of a Master's degree in
Economics / Finance / Management from the Nova School of Business and Economics

Analysis of the impact of China's accession to the World Transaction Organization on the German automobile companies in the Chinese market

Haipeng Yang

Work project carried out under the supervision of:

Margarida Soares

26/09/2023

ABSTRACT

The following document represents a master thesis dissertation, that consists of research in which its main objective is to research the impact of China's accession to the World Trade Organization on the German foreign automobile firms in the Chinese market. Prior to the analysis, this dissertation will introduce the overall situation, and changes in the Chinese automobile industry brought about by the accession to WTO. Afterward, from the perspective of Firms Deciding to do Foreign Direct Investment (FDI), this research focuses on analyzing three representative German companies, Volkswagen Group China, BMW Brilliance, and Beijing Benz. In the analysis process, we gather comprehensive data to perform the Granger causality test and conduct several cross-sectional comparisons. This approach allows us to illustrate the combined impact that China's accession to the WTO may have had on Volkswagen Group China, BMW Brilliance, and Beijing Benz, leading to a conclusive assessment of its effects on German automobile companies.

Key words: China's accession to WTO; FDI; Volkswagen Group China; BMW Brilliance; Beijing Benz; Granger causality analysis

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209)

INDEX

1. Introduction.....	1
2. Macro background of Chinese automobile industry before China's accession to WTO	3
2.1 Chinese automobile industry	3
2.2 Vehicle purchase tax	5
2.3 Vehicle import related taxes and regulation.....	7
2.3.1 Tariff.....	7
2.4 Target corporates: Volkswagen Group China, BMW Brilliance, and Beijing Benz	8
2.4.1 Volkswagen Group China	9
2.4.2 BMW Brilliance	10
2.4.3 Beijing Benz	10
3. Methodology.....	12
3.1 Introduction	12
3.2 Main changes of automobile industry caused by China's accession to the WTO	13
3.2.1 Tangible changes.....	13
3.2.2 Intangible changes.....	14
3.3 Data processing	15
3.4 Granger causality test	16

3.5	Horizontal comparison	17
4.	Results and discussion	18
4.1	Results of the Granger causality test	18
4.1.1	The Granger causality test between the Granger-cause and “Increasing rate of sales”	19
4.1.2	The Granger causality test between the Granger-cause and “Increasing rate of revenues”	20
4.2	Results of horizontal comparisons	20
4.2.1	Comparison of increasing rate of sales between German FDI automotive companies and other automotive companies	20
4.2.2	Comparison of increasing rate of sales between German FDI automotive companies and the whole Chinese automotive market	21
5.	Conclusion	23
6.	Reference:	26
7.	Appendix.....	29
7.1	Vehicle production and import status in China before 2001.....	29
7.2	Chinese Vehicle tariff change after 2001	29
7.3	Sales and revenue performance of three German automotive FDIs.....	30
7.4	Sales of comparative automotive companies and Chinese whole automotive market...	30
7.5	Results of Granger causality test of increasing rate of sales	30

7.6	Results of Granger causality test of increasing rate and revenue.....	31
7.7	Result of comparison of increasing rate of sales between German FDI automotive companies and other automotive companies.....	31
7.8	Result of comparison of increasing rate of sales between German FDI automotive companies and the whole Chinese automotive market	32

LIST OF FIGURES

Figure 1 – The number of produced vehicles in China before 2001	4
Figure 2– The number of imported vehicles in China before 2001	5
Figure 3 – Comparison of increasing rate of sales	21

LIST OF TABLES

Table 1– Vehicle tariff after 2001	14
Table 2– Vehicle sales and revenue performance in Chinese market	15
Table 3– Vehicle sales and operating results of comparative companies	15
Table 4– Sales of Chinese whole automotive market	16
Table 5– The result of the test between the Granger-cause and “Increasing rate of sales”	19
Table 6 – The result of the test between the Granger-cause and “Increasing rate of revenues”	20
Table 7– Comparison of increasing rate of sales between German FDI automotive companies and other automotive companies.....	21
Table 8- Comparison of average increasing rates of sales between German FDI automotive companies and the whole Chinese automotive market	22

1. Introduction

China's accession to the World Trade Organization (WTO) in 2001 marked its ascent as a significant participant in the global trading landscape. After that, China swiftly evolved into a formidable contender and lucrative market, boasting a comparatively open economy that held a vested stake in implementing a series of reforms under the requirements of the WTO. One sector under this great reform accomplished an astonishing development is the automobile industry, which realized an increase in annual gross product from 105.6 billion RMB in 2001 to almost 10 times reaching 1,057.8 billion RMB in 2015. Behind the explosive growth, there were many foreign automobile firms that caught this wave to achieve boosting¹.

Most previous studies only focus on researching the impact of China's accession to WTO on the development of the Chinese macro economy, or the development of the Chinese automobile industry after accession to WTO from many aspects, including regulatory changes and compliance, market liberalization and increased competition, growth and expansion and so on. Some influential studies include "China's Integration into the World Economy: Implications for Developing Countries" by Nicholas R. Lardy, "The Impact of the China's Accession to the WTO on the Chinese Automotive Industry" by Xiaolan Fu. Besides concluding the development of the Chinese automobile industry after its accession to WTO, one progress of this dissertation is trying to narrow down the research and move the research focus from the domestic market to foreign firms to research how would China's accession to the World Transaction Organization affect Firms Deciding to Foreign Direct Investment (FDI) by analyzing the foreign automobile firms in the Chinese automobile market. Moreover, to mitigate the influence of external factors,

¹ Automobile industry gross product data is cited from Chinese Automobile Industry Yearbook 2001-2015.

this dissertation focuses on a single representative country: Germany. The selection is based on the presence of automobile firms with similar brand characteristics and reputation. By studying the effects of China's accession to the WTO on German automobile firms, we aim to uncover valuable insights. This dissertation begins with an introduction to the Chinese automobile industry before its accession to WTO, the achievement of the automobile industry of this reform, and the incurred policy changes which could trigger the increase in the gross product of the automobile industry, including the purchasing tax, tariffs, quotas, and so on.

Hereafter, three typical German FDI automobile firms (Volkswagen Group China, BMW Brilliance, and Beijing Benz) that are chosen as targets to analyze will be introduced. Then the Granger causality test and several horizontal comparisons will be conducted based on those three target companies to check out the impact of China's accession to the World Trade Organization on the German automobile firms in Chinese market by analyzing test and comparison result.

2. Macro background of Chinese automobile industry before China's accession to WTO

2.1 Chinese automobile industry

During the initial stages of the reform period in China that commenced in the late 1970s, the Chinese automotive industry which heavily relied on Russian and Eastern European technology was characterized by its relative backward, this situation stimulated China to actively pursue technological advancements of its own. In 1978, the local producers consisting of 56 auto assembly plants, primarily focused on manufacturing trucks and cars intended for government use (McCaleb, 2015). By 1980, the overall vehicle production stood at a meager of 222.3 thousand units (Shown in Figure 1) which couldn't meet the growing demand for passenger vehicles among households caused by the increase in income level at all. Therefore, it resulted in a significant influx of imported cars flooding the Chinese market to meet the surging demand (Shown in Figure 2). At the same time of conducting plenty of imported cars, in order to protect the vulnerable and immature domestic Chinese automobile industry from the shock of highly advanced and mature foreign automobile firms, China government set the tariffs as high as 250% (Li, Xiao, & Liu, 2015).

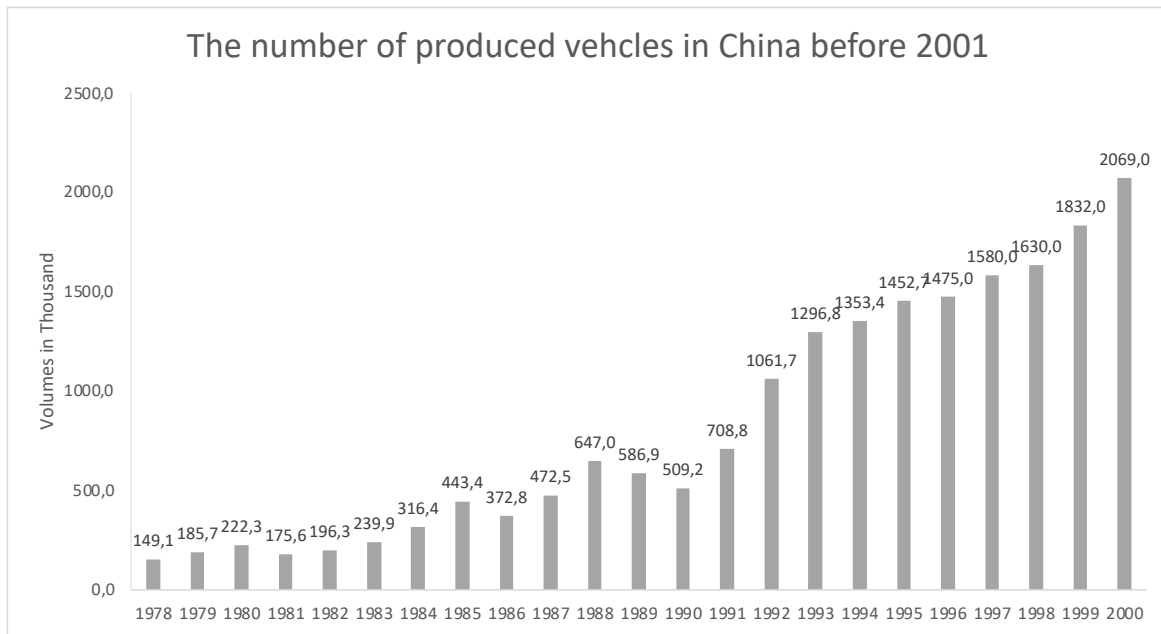


Figure 1 – The number of produced vehicles in China before 2001²

In the mid-1980s, the Chinese government aimed to consolidate the automotive industry by establishing three major and three minor producers (Thun, 2004). Motivated by this policy, several prominent state-owned automobile firms in China actively sought partnerships with foreign auto manufacturers to form joint ventures to augment their production capacity and enhance their technical expertise. The earliest automobile joint venture companies include Beijing Jeep Corporation jointed by American Motors Corporation with Beijing Automotive Manufacturing Factory, Shanghai Volkswagen Automotive Corporation jointed by Volkswagen with Shanghai Automotive Industry Corporation, and Guangzhou Peugeot Automobile Company jointed by Guangzhou municipal government with Peugeot. However, there was a policy ruling that foreign ownership in these joint ventures was limited to a maximum of 50% to safeguard the interests of domestic producers. In 1994, China's National Development and Reform

² Annual produced data is cited from Chinese National Bureau of Statistics.

Commission (NDRC) initiated an automobile industry policy to further encourage state-owned firms to partner with international car makers to form joint ventures (Sun, 2010). Following this policy, more joint ventures were formed between large state-owned automobile companies and foreign auto manufacturers (Li, Xiao, & Liu, 2015). Meanwhile, local, and private producers also entered the market.

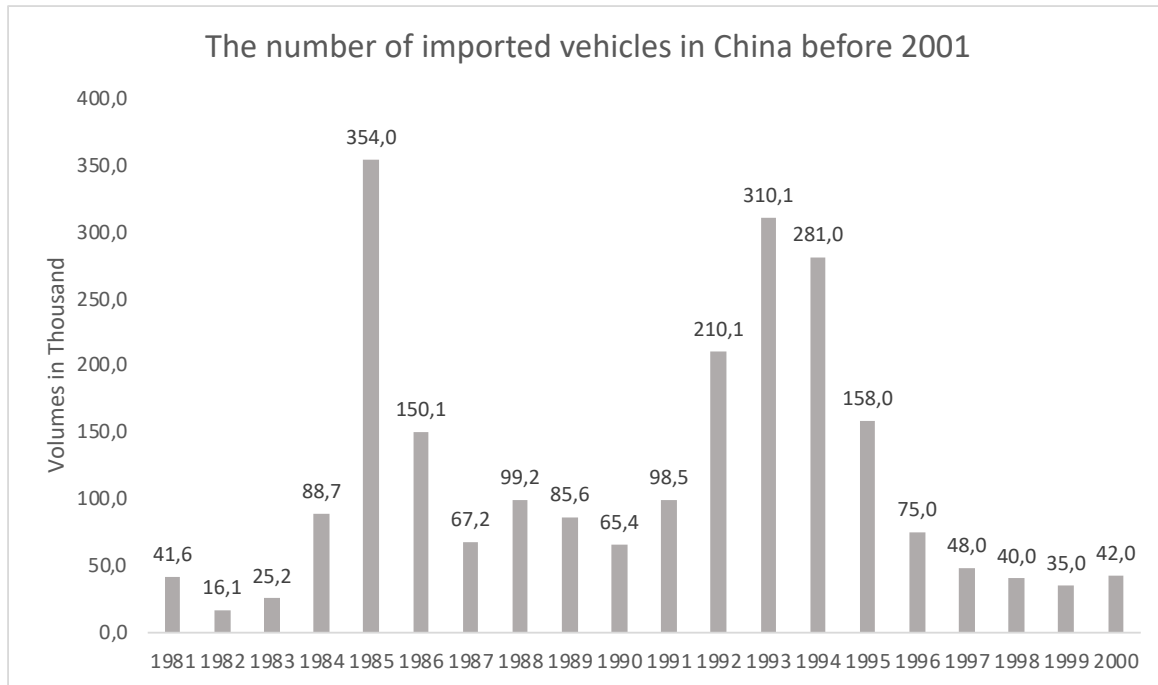


Figure 2– The number of imported vehicles in China before 2001³

2.2 Vehicle purchase tax

Vehicle purchase tax is the most essential and important item levied by the government. In 1985, with the approval of the State Council, the purchase fee of the vehicle which occupies 10% of the vehicle purchase price was levied nationwide as a special fund for national transportation infrastructure construction and maintenance (Xi et al., 2009). This fee item was collected from

³ Vehicle imported data is cited from Chinese National Bureau of Statistics, and China Automobile Industry Yearbook 2006.

units and individuals who purchase and use vehicles. Since its introduction, the vehicle purchase fee has played a very important role in addressing the serious shortage of funds for road construction in China. On the one hand, the fee has effectively played a role in regulation and guidance and has fully mobilized the enthusiasm of both the central and local governments by changing the situation where the construction of road infrastructure relies solely on state investment.

On the other hand, it also played an important role in optimizing the investment environment for road infrastructure construction, maximizing the investment efficiency of limited funds, and achieving significant optimization of the structure and layout of China's road transportation in a short period of time. Hereafter, in the year 2000, through the method of "fee to tax" translation, the State Council issued the "Provisional Regulations of the People's Republic of China on Vehicle Purchase Tax", which stipulated that vehicle purchase tax would replace vehicle purchase fee to be levied from January 1, 2001, unifying the same tax rate for all use links to 10%, and no longer distinguishing between domestic and imported vehicles (Zhou, L.Y., 2002). The essential difference between taxation and fee collection lies in the legality standardization, and flexibility. The vehicle purchase fee is closely related to national policies and changes with the times. In practical operation, it is easy to have the behavior of "additional charging", which leads to a certain degree of disorder. On the contrary, tax behavior is regulated by law, which has a fixed and deterministic nature. Therefore, it can eliminate the phenomenon of arbitrary fees in tax behavior, reduce the burden on enterprises, institutions, and individuals fundamentally, and curb government non-standard behavior. To encapsulate, tax and fee reform was not only an economic issue but also a political issue. It not only deepened the reform of the financial and tax system but also contributed to the construction of anti-corruption.

2.3 Vehicle import related taxes and regulation

Back in the day when the Chinese automotive industry was not as advanced, the only way to meet the domestic demand for vehicles was through importation. But at the same time, over-reliance on overseas might hamper the development of domestic automobile industry. To promote the growth of the domestic automobile industry while still allowing for the benefits of vehicle importation, the Chinese government implemented high tariffs and set specific quotas.

2.3.1 Tariff

Before 1985, the import tariff for complete vehicles in China was 120% -150%, except that, 80% import adjustment tax was also imposed on the original basis. Since 1986, the Chinese government has implemented a new system that merged tariffs and import adjustment taxes, resulting in a lower but still significant tariff rate of 220% for vehicles with a displacement of 3.0 and above, and 180% for vehicles with a displacement of less than 3.0 (National Research Council, 2003). This tax rate has been in use for 8 years. During this period, the prices of imported vehicles to China were 3-4 times higher than those in the international market, and the prices of imported component assembly vehicles were also several times higher than international prices.

On April 1, 1994, China lowered the tariffs on imported automobiles for the first time by lowering 105 automobile tax items out of 175, meanwhile, the average tax rate decreased by 13 percentage points. In the end, the tariff on vehicles with a displacement of less than 3.0 liters has been reduced to 110%, while the tariff on vehicles with a displacement of 3.0 liters and above has been reduced to 150%, each by 70 percentage points.

In 1996, China progressed further on decreasing tariff and promised to reduce the average tariff item rate from 23% to 15% by 2000. Correspondingly, on October 1, 1997, the tariff rate on

imported vehicles with a displacement of less than 3.0 liters was reduced to 80%, and for vehicles with a displacement of more than 3.0 liters was reduced to 100%, achieved halving compared to the level in the beginning which indicates a positive step forward in promoting international trade (Xiao, H.Z., 2000).

2.3.2 Quotas

In 1980s, China implemented a quotas system named “Automotive Import Control System” and remained in effect until the end of 2004.

Under the Automotive Import Control System, China imposed strict limitations on the number of vehicles that could be imported into the country. The quota was determined by the Chinese government and allocated to foreign automakers based on factors such as their production capabilities, technology transfer agreements, and joint ventures with domestic partners.

Foreign automakers had to apply for import licenses and were only allowed to import vehicles up to their allocated quota. The purpose of this system was to protect the domestic automotive industry, promote joint ventures with foreign manufacturers, and encourage technology transfer to enhance China's automotive capabilities.

2.4 Target corporates: Volkswagen Group China, BMW Brilliance, and Beijing Benz

In 1980s, China encouraged local automobile firms to set up joint ventures with foreign automakers, which allowed Chinese companies to gain access to advanced technology, management expertise, and global market channels. Hereafter, Germany's involvement in the Chinese automobile industry through joint ventures and technology transfer led to the enhancement of domestic manufacturing capabilities, the introduction of advanced design and styling elements, and the establishment of a strong reputation for German brands among Chinese consumers. At the meantime, German brand vehicles keep occupying the biggest market share

among foreign automobile firms, consistently held a dominant position in the Chinese automotive market for several years (Jin, 2023).

2.4.1 Volkswagen Group China

Volkswagen was the second foreign automobile firm which responded to the call of Chinese policy to set up the joint venture company Shanghai Automotive Industry Corporation (SAIC) with Shanghai Automotive Industry Corporation in 1985. The company is headquartered in Anting, Shanghai, and has successively established production bases in Nanjing, Yizheng, Urumqi, Ningbo, Changsha and other places (Azarhoushang, 2013). The mature and well-known Volkswagen brand has not only introduced a variety of models with excellent manufacturing and outstanding personality, but also carried out excellent localized design and adjustment for the series of models according to the characteristics of Chinese roads and the aesthetic needs of Chinese consumers, to fully integrate the Chinese domestic market. The appearance of the first joint venture company represents the termination of Chinese domestic auto industry's history of making cars alone. In the early stage of the company, SAIC started the business with the production of Volkswagen Santana and Audi 100, which became immensely popular in China and laid the foundation for SAIC's growth. Both on product level and on manufacturing technology level, Shanghai Volkswagen is setting new standards.

In 1991, in order to further take root into Chinese automobile market, FAW-Volkswagen Automotive Co., Ltd. (FAW-VW) was established as a joint venture between Volkswagen and the First Automobile Works (FAW) in Changchun, Jilin Province. Initially, FAW-VW only produced Jetta and various Audi models, over the years, FAW-VW expanded its product lineup, introducing more Volkswagen and Audi models to cater to different segments of the Chinese market. At the beginning of September 1999, the factory in Changchun shipped the first “China version” of the Audi A6 in order to compete successfully in luxury brands with models from

DaimlerChrysler and BMW. After 1996, the Shanghai Automotive Industry Corporation and the First Automotive Works, where Volkswagen is involved in joint ventures, achieved astonishing output of even more than 200,000 vehicles per year (Grimm, K., 1999).

2.4.2 BMW Brilliance

BMW Brilliance is a joint venture between BMW AG, the renowned German automaker, and Brilliance China Automotive Holdings Ltd., a Chinese automaker involving an equal equity share, with both BMW AG and Brilliance China Automotive Holdings holding a 50% stake in the company. Established in 2003, this strategic collaboration brought together the engineering expertise of BMW and the manufacturing capabilities of Brilliance to produce high-quality luxury vehicles for the growing Chinese market (Gao, 2015). Operating from its headquarters in Shenyang, China, BMW Brilliance has become a prominent player in the premium automotive sector, delivering a range of innovative and performance-driven cars that cater to the discerning preferences of Chinese consumers. In 2004, BMW Brilliance began its initial production of BMW vehicles in China. The first model to roll off the production line was the BMW 3 Series, which was a popular choice among Chinese consumers. Over the years, BMW Brilliance expanded its product range to include a variety of models, such as the BMW 5 Series, BMW X1, BMW X3, and more. The joint venture introduced both gasoline-powered and electric vehicles to cater to the diverse preferences of Chinese consumers.

2.4.3 Beijing Benz

Beijing Benz Automotive Co., Ltd. (BBAC), is a joint venture automotive company based in Beijing, China, which was established in 2005 through a collaboration between two major automotive giants: Daimler AG (the parent company of Mercedes-Benz) and Beijing Automotive Industry Holding Co., Ltd. (BAIC Group) holding a 50% stake respectively. The joint venture was formed with the aim of producing high-quality luxury vehicles for the Chinese market,

capitalizing on the growing demand for premium cars in China (Liu, 2008). Beijing Benz combines the expertise and technologies of both Daimler and BAIC, leveraging their strengths to manufacture and market Mercedes-Benz vehicles specifically tailored to meet the preferences and needs of Chinese consumers. BBAC started production in 2007 and manufactured its first locally assembled Mercedes-Benz C-Class sedans. This marked the beginning of localized production of Mercedes-Benz vehicles in China, enabling the brand to offer more competitive prices and respond better to market demands. Alongside local car production, the joint manufacture of engines by Beijing BBAC started in Beijing in 2013. The first locally produced compact cars from Mercedes-Benz rolled off the assembly line in 2014. (Mercedes-Benz Group Annual Report, 2014) By combining German engineering with local market knowledge, Beijing Benz has been able to produce and sell a wide range of Mercedes-Benz models in China, including sedans, SUVs, and other luxury vehicles. The collaboration has been successful in establishing Mercedes-Benz as a prestigious and sought-after brand in the Chinese luxury car market.

3. Methodology

This section provides an overview of the development process of the dissertation, commencing with an examination of policy changes pertaining to the automobile industry in conjunction with China's accession to the WTO. Then, the section will introduce the various tools and analyses utilized to gain a comprehensive understanding of the impact of this significant event on the development of Volkswagen Group China, BMW Brilliance, and Beijing Benz. Furthermore, it delves into the rationale behind the data selection, outlining the reasons for choosing specific datasets. Additionally, the section discusses the assumptions made during the data analysis process and addresses any limitations encountered while constructing the model and conducting the analyses.

3.1 Introduction

As previously mentioned, the focus of this dissertation is to examine the impact of China's open policy and its accession to the WTO on German automobile companies operating within the country. The research endeavors to achieve this by extracting and analyzing pertinent data, constructing a Granger causality test to assess the companies' development status, and subsequently conducting several horizontal comparison to depict their developmental outcomes. The primary source of data for this study predominantly comes from the annual reports of Volkswagen Group China, BMW Brilliance, Beijing Benz, JAC, and Dongfeng, supplemented by relevant data from the China Automotive Industry Yearbook. The data processing, visualization, and model construction were executed using Python programming language. The dataset development can be divided into two key stages. The initial phase involved extracting, elucidating, and visualizing all the pertinent information related to each company. Subsequently,

in the second stage, this information was mapped to create an appropriate model for our research objectives.

3.2 Main changes of automobile industry caused by China's accession to the WTO

3.2.1 Tangible changes

Tangible policy changes mainly consist of two parts, the vehicle purchase tax, tariff and quotas, which affects the vehicle price collectively. After China's accession to the WTO, the vehicle purchase tax has changed several times, and mainly concentrated on the vehicle with a displacement of less than 1.6 liters. In 2003, China implemented a policy of halving the purchase tax for small-displacement vehicles, to decrease the purchase tax rate to 5. In 2010, purchase tax exemption for small passenger cars with a displacement of less than 1.6 liters, a policy known as "trade-in". In 2011, the acquisition tax was resumed for small passenger cars with a displacement of less than 1.6 liters at a rate of 3%. In 2014, The purchase tax rate for small passenger cars with a displacement of less than 1.6 liters was lowered to 1% again. During this phase, the purchase tax for vehicle with a displacement of more than 1.6 liters basically remained at 10%.

Regarding the vehicle tariff and the quota system for imported cars: Before joining the WTO, China implemented a quota system for imported cars, limiting the number of imported cars to protect its local market and producers. On July 1, 2001, following the agreement with the WTO, China decided to gradually liberalize the quota system by increasing 15% every year on the basis of 6 billion U.S. dollars in 2000 (Ianchovichina, 2001), and abolish the imported automobile quota system on January 1, 2005. In the meantime, China gradually implemented tariff reduction measures to open up the imported automobile market step by step. On January 1, 2002, the tariff rate for imported cars with a displacement of 3.0 liters or less was reduced to 43.8%, and that for cars with a displacement of 3.0 liters or more was reduced to 50.7% from 70% and 80%

respectively. On January 1, 2003, the tariff rate for imported cars with a displacement of 3.0 liters or less was reduced to 38.2%, and that for cars with a displacement of 3.0 liters or more was reduced to 43%. On January 1, 2004, the tariff rate for imported cars with a displacement of 3.0 liters or less was reduced to 34.2%, and that for cars with a displacement of 3.0 liters or more was reduced to 37.6%. On January 1, 2005, my country lowered the tariff level on imported automobiles to 30%. On January 1, 2006, my country again lowered the tariff rate on imported automobiles from 30% to 28%, and the calendar finally turned to the last year when my country fully fulfilled its commitment to join the WTO. On July 1, 2006, my country's imported automobile tariff rate will finally be reduced to 25% after the 9th adjustment (Li, 2006).

	2001	2002	2003	2004	2005	01.01.2006	01.07.2007
Displacement of 3.0 liters or more	80,0%	50,7%	43,0%	36,7%	30,0%	28,0%	25,0%
Displacement of 3.0 liters or less	70,0%	43,8%	38,2%	34,2%	30,0%	28,0%	25,0%

Table 1– Vehicle tariff after 2001

3.2.2 Intangible changes

China's accession to the WTO opened the market to foreign competition, facilitated technology transfer, and spurred the industry's growth. Furthermore, it represents not only a new national policy consisting of many policy changes but also a change in Chinese national development strategy and attitude, meaning that China marked a significant step in integrating into the global economy and liberalizing trade. From the perspective of the automobile industry, it not only directly led to the implementation of many open policies, but also increased people's average income by shaping a freer business environment to further stimulate their needs for vehicles. Therefore, the contribution of the economic revolution cannot be credited to any single policy change just like the deduction of tariffs or others, this dissertation will combine the tangible changes and intangible changes caused by China's accession to the WTO to treat all changes as a

variable to research how that event affects the development of foreign automobile firms in the Chinese market.

3.3 Data processing

To assess the impact of China's accession to the WTO on the operations of German automobile firms within the Chinese market, this dissertation examines key variables such as vehicle sales and revenue performance of Volkswagen Group China, BMW Brilliance, and Beijing Benz spanning from 2002 to 2022 (a span of 20 years following China's WTO accession). The aim is to compute the relative growth rates for each of these metrics (Shown in Table 2).

Volkswagen Group China																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales	513,000	698,000	649,000	512,000	711,000	910,000	1,024,000	1,400,000	1,923,000	2,260,000	2,815,000	3,271,000	3,675,000	3,549,000	3,982,000	4,184,000	4,207,000	4,234,000	3,849,000	3,305,000	3,185,000
Increasing rate		36.06%	-7.02%	-21.11%	38.87%	27.99%	12.53%	36.72%	37.36%	17.52%	24.56%	16.60%	12.35%	-3.43%	12.20%	5.07%	0.55%	0.64%	-9.09%	-14.13%	-3.63%
Revenue (In Millions of Euros)	8,656	11,724	11,002	8,521	12,273	14,580	18,945	18,920	43,890	61,340	84,240	95,690	120,770	119,370	110,940	111,910	114,270	111,100	97,440	87,400	88,270
Increasing rate		35.44%	-6.16%	-22.55%	44.04%	18.80%	29.94%	-0.13%	131.98%	39.76%	37.33%	13.59%	26.21%	-1.16%	-7.06%	0.87%	2.11%	-2.77%	-12.30%	-10.30%	1.00%
BMW Brilliance																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales				17,501	23,600	32,100	35,068	44,888	70,488	108,189	160,849	206,729	278,529	287,073	310,026	386,549	466,182	545,919	605,050	652,000	664,934
Increasing rate					34.85%	36.02%	9.25%	28.00%	57.03%	53.49%	48.67%	28.52%	34.73%	3.07%	8.00%	24.68%	20.60%	17.10%	10.83%	7.76%	1.98%
Revenue (In Millions of Euros)				700	803	1,003	1,086	1,465	2,062	3,671	5,894	8,155	10,504	11,371	11,616	13,668	20,061	23,076	24,674	27,383	30,495
Increasing rate					34.27%	37.20%	7.37%	32.48%	46.41%	74.69%	49.61%	30.31%	29.21%	-2.50%	3.61%	16.85%	24.29%	22.16%	11.11%	13.47%	10.28%
Beijing Benz																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales						6,882	14,355	18,726	58,382	93,377	103,445	116,006	145,468	250,188	317,069	422,558	485,006	567,306	610,816	561,008	591,716
Increasing rate							108.59%	30.45%	211.77%	59.94%	10.78%	12.14%	25.40%	71.99%	26.73%	33.27%	14.78%	16.97%	7.67%	-8.15%	5.47%
Revenue (In Millions of Euros)						251	447	530	1,673	2,705	2,921	3,250	4,612	7,385	9,478	14,404	16,470	19,000	24,543	22,876	24,004
Increasing rate							108.76%	30.23%	212.82%	58.87%	12.28%	9.16%	32.26%	50.81%	28.75%	36.88%	15.96%	14.56%	9.39%	-1.02%	9.04%

Table 2⁴– Vehicle sales and revenue performance in Chinese market

Additionally, for the purpose of comparison of development between German automobile companies with other automobile companies, this study analyzes vehicle sales for other Chinese automobile companies: JAC and Dongfeng (Shown in Table 3), alongside the corresponding growth rates observed in the broader Chinese automobile market (Shown in Table 4).

JAC																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales					171,562	205,665	198,516	310,251	442,547	466,459	448,813	495,737	446,802	588,052	643,342	510,892	462,477	421,241	456,125	524,224	500,401
Increasing rate						19.88%	-3.48%	56.29%	42.64%	5.40%	-3.78%	10.46%	-9.87%	31.61%	9.40%	-20.59%	-9.48%	-8.92%	8.28%	14.93%	-4.54%
DongFeng																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales				594,801	751,088	949,526	1,057,922	1,430,742	1,945,956	2,172,723	2,155,445	2,567,655	2,733,508	2,867,037	3,156,810	3,284,238	3,052,172	2,931,953	2,868,309	2,775,057	2,464,502
Increasing rate					26.28%	26.42%	11.42%	35.24%	36.01%	11.65%	-0.80%	19.12%	6.46%	4.88%	10.11%	4.04%	-7.07%	-3.94%	-2.17%	-3.25%	-11.19%

Table 3⁵– Vehicle sales and operating results of comparative companies

⁴ The sales and revenue data for all companies were sourced from their respective annual reports. The absence of data for BMW Brilliance and Beijing Benz can be attributed to their relatively recent establishment compared to the Volkswagen Group China.

⁵ The sales data for all companies were sourced from JAC and Dongfeng annual reports.

	Chinese Automotive Market																				
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales (Units in million)	3,248	4,391	5,071	5,758	7,216	8,792	9,381	13,644	18,061	18,505	19,306	20,716	22,395	23,609	27,199	27,563	27,008	24,464	23,433	26,275	26,864
Increasing rate		35,18%	15,49%	13,55%	25,32%	21,83%	6,70%	45,45%	32,37%	2,46%	4,33%	7,30%	8,11%	5,42%	15,21%	1,34%	-2,01%	-9,42%	-4,22%	12,13%	2,24%

Table 4⁶– Sales of Chinese whole automotive market

3.4 Granger causality test

Granger causality is a statistical concept that provides a framework for exploring potential predictive relationships between two time series variables, which could be used for single analyzing if the China's accession to the WTO Granger-cause the development of German automobile firms in Chinese market. The reason for choosing granger causality test rather than OLS is that there are only two variables: China's accession to the WTO or not, therefore, under this situation, the Granger causality test could test for causation in a more precise way.

Developed by Clive Granger, an economist, the concept is widely employed in various fields, including economics, finance, social sciences, and more recently, in the study of complex systems like brain networks in neuroscience (Li, 2020).

The Granger causality test involves comparing predictive models: A model that includes past values of both the potential "cause" variable and the "effect" variable. A model that considers only the past values of the "effect" variable. If the first model demonstrates significantly enhanced predictive accuracy compared to the second model, it suggests that the potential cause variable Granger-causes the effect variable. In essence, the potential cause variable contributes information that aids in predicting the behavior of the effect variable (Stephanie, 2018).

This dissertation will adopt the Granger causality test by directly using “*grangercausalitytests*” function in Python, the influence of China's accession to the WTO is treated as the Granger-

⁶ The sales data for the whole Chinese automotive market were sourced from China Automotive Industry Yearbook.

cause named variable IF_WTO, and the 20 years since China's accession to the WTO have been divided into two phases: The first 10 years (2002 to 2012) influenced by China's accession to the WTO which is labeled as 1, and the second 10 years without influence by China's accession to the WTO which is labeled as 0. Hereafter, the increasing rate of sales (Treated as dependent variable S) and increasing rate of revenue (Treated as dependent variable R) from Volkswagen Group China, BMW Brilliance, and Beijing Benz will be integrated together and tested with the predefined Granger-cause by Python respectively to uncover if there is a causal relationship between Granger-cause: Accession to the WTO, and the development of German auto companies in the Chinese market.

$$y_t = \gamma + \sum_{m=1}^p a_m y_{t-m} + \sum_{m=1}^p \beta_m x_{t-m} + \varepsilon_t$$

3.5 Horizontal comparison

For getting more intuitive results, this dissertation also collects data from a Chinese local automotive company: JAC, another joint venture automotive company: Dongfeng (Joint venture with Japan), and the entire automotive industry for the same period, and conducts several horizontal comparisons of increasing rates with three target companies (Volkswagen Group China, BMW Brilliance, and Beijing Benz), including:

- Horizontal comparison of increasing rates of sales between target companies and other automotive companies
- Horizontal comparison of average increasing rates between target companies and Chinese automotive market

4. Results and discussion

The current section has the purpose of critically analyzing the empirical results found. Firstly, it will present the outcomes of the Granger causality test conducted in Python, followed by an explanation of the results. Subsequently, it will showcase the findings of the horizontal comparison and provide an insightful explanation for the observed outcomes.

4.1 Results of the Granger causality test

In the results of the Granger causality test performed by Python, the null hypothesis in the Granger causality test is that the lagged values of the potential cause variable: China's accession to the WTO do not significantly improve the prediction of the effect variable. In other words, there is no causation between x and y . The alternative hypothesis which is concluded by rejecting the null hypothesis is that the lagged values of the potential cause variable: China's accession to the WTO do significantly improve the prediction of the effect variable. In other words, there is causation between x and y . The p-value associated with the F-statistic is used to determine whether the test result is statistically significant. If the p-value is less than a chosen significance level (Adopting 0.05 as significant level), we will reject the null hypothesis and conclude that Granger causality exists. If the p-value is greater than the significance level, we will fail to reject the null hypothesis. Furthermore, the F-statistic value indicates the strength of the relationship between the variables. A higher F-statistic suggests a stronger Granger causality effect.

4.1.1 The Granger causality test between the Granger-cause and “Increasing rate of sales”

Result of Granger Causality Test		
	F Value	P Value
Number of Lags 1	0,0211	0,8852
Number of Lags 2	0,1900	0,8276
Number of Lags 3	4,1686	0,0113
Number of Lags 4	3,2651	0,0211
Number of Lags 5	2,2885	0,0663

Table 5– The result of the test between the Granger-cause and “Increasing rate of sales”

$$S_t = \gamma + \sum_{m=1}^p a_m z_{t-m} + \sum_{m=1}^p \beta_m \text{IF_WTO}_{t-m} + \varepsilon_t$$

The operating result depicts that there is evidence of Granger causality between the Granger-cause variable and the "Increasing rate of Sales" variable at lag orders 3 and 4 which have p-value 0.0113 and 0.0211 respectively lower than 0.05. These lag orders show statistically significant causality relationships between Granger-cause and “Increasing rate of sales”, while the other lag orders do not demonstrate strong statistical evidence of Granger causality. It means that the past values of "IF_WTO" from 3 periods ago and 4 periods ago all have some predictive power in forecasting the "Increasing rate of Sales" three periods into the future.

4.1.2 The Granger causality test between the Granger-cause and “Increasing rate of revenues”

Result of Granger Causality Test		
	F Value	P Value
Number of Lags 1	0,1113	0,7401
Number of Lags 2	0,3232	0,7255
Number of Lags 3	7,8352	0,0003
Number of Lags 4	5,9065	0,0008
Number of Lags 5	4,0489	0,0051

Table 6 – The result of the test between the Granger-cause and “Increasing rate of revenues”

$$R_t = \gamma + \sum_{m=1}^p a_m z_{t-m} + \sum_{m=1}^p \beta_m \text{IF_WTO}_{t-m} + \varepsilon_t$$

The operating result depicts similar result that there is evidence of Granger causality between the Granger-cause variable and the "Increasing rate of Sales" variable at lag orders 3, 4, and 5 which have p-value 0.0003, 0.0008, and 0.0051 respectively lower than 0.05. These lag orders show statistically significant causality relationships between Granger-cause and “Increasing rate of revenues”, while the other lag orders do not demonstrate strong statistical evidence of Granger causality. It means that the past values of "IF_WTO" from 3 periods ago, 4 periods ago, and 5 periods ago all have some predictive power in forecasting the "Increasing rate of Rales" three periods into the future.

4.2 Results of horizontal comparisons

4.2.1 Comparison of increasing rate of sales between German FDI automotive companies and other automotive companies

Comparison of Average Increasing Rate of Sales			
German FDI Automotive Companies		Other Automotive Companies	
Volkswagen Group China	11,01%	JAC	8,64%
BMW Brilliance	24,98%		
Beijing Benz	41,85%	Dongfeng	9,60%

Table 7– Comparison of increasing rate of sales between German FDI automotive companies and other automotive companies

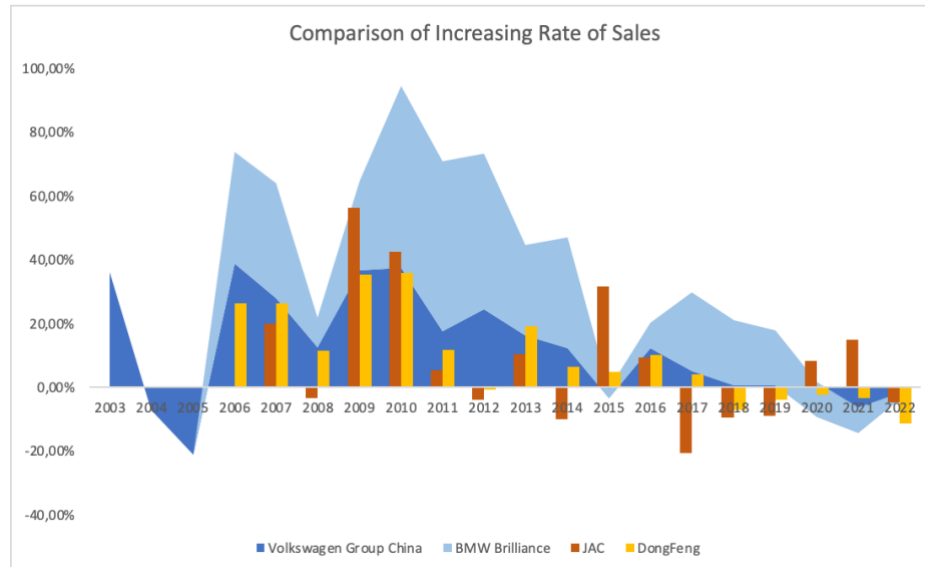


Figure 3 – Comparison of increasing rate of sales

This part aims to figure out the depth of the impact of China’s accession to the WTO on German FDI automotive firms by comparing their increasing rate after 2002 to the increasing rate of other Chinese automobile companies: JAC and Dongfeng. The result (Shown in Table 7 and Figure 3) stands for that German FDI Automobile companies got better development after China’s accession to the WTO.

4.2.2 Comparison of increasing rate of sales between German FDI automotive companies and the whole Chinese automotive market

Comparison of Average Increasing Rate of Sales			
Volkswagen Group China	11,01%	Chinese	
BMW Brilliance	24,98%	Automotive	11,94%
Beijing Benz	41,85%	Market	

Table 8- Comparison of average increasing rates of sales between German FDI automotive companies and the whole Chinese automotive market

To eliminate the specificity of the selected examples which are used to compare and make our results more generalizable, this part continuously compare the average increasing rate of German FDI automotive companies after 2002 to the average increasing rate of the whole Chinese automobile market. The result (Shown in Table 7) depicts that BMW Brilliance and Beijing Benz had obviously higher average increasing rate of sales than the whole Chinese automotive market, and Volkswagen Group China had a slightly lower increasing rate of sales mainly due to quite a low increase rate after 2014 and its large scale causing hard to develop.

Overall, the three German automotive FDIs experienced remarkable growth following China's accession to the WTO. Notably, German joint venture automobile companies often outperformed both local Chinese automobile companies and other joint venture firms in the post-WTO period. In line with this conclusion, this dissertation compiles the factors that can elucidate this phenomenon:

- Experience: International joint venture partners, especially Volkswagen, Benz, and BMW which had a longer globalization history had global best practices in management, manufacturing, and quality control for their operations. In comparison, Chinese automobile companies just started their business and didn't have too much experience.
- Technology: German joint venture partners often invested significantly in research and development to meet global standards and comply with stricter environmental regulations, which allowed them to have obvious technological advantages and to develop innovative and competitive products.
- Customers' preference: German joint ventures benefited from the reputation and brand recognition of their international partners, which often had a long history of producing high-

quality vehicles known for their precision engineering, safety, and reliability. Therefore, Chinese consumers were more likely to trust and purchase vehicles from joint ventures due to the perceived higher quality (Fombrun, 2006).

- Adjustment: German car companies have been successful in adapting their products to suit Chinese consumer preferences. This includes features like extended rear legroom (important for chauffeur-driven cars), special trims and options tailored to the Chinese market, and even the development of electric vehicles (EVs) to meet China's growing demand for clean and efficient transportation (Wei et al., 2015).

5. Conclusion

In conclusion, the analysis of the impact of China's accession to the World Trade Organization on German automobile firms operating in the Chinese market has provided valuable insights into the complex interplay between global trade dynamics and the strategies of multinational corporations. The study set out to introduce overall situation, and changes in the Chinese automobile industry brought about by the accession to WTO by combining and concluding previous literature research, and examine how the opening of China's markets as a result of its WTO accession influenced the business environment for German automobile companies, and the implications this had on their market presence, and overall performance.

Through a meticulous examination of trade policies, market trends, firm-level data, and results of tests and comparisons, this research has illuminated several key findings. It has become evident that China's WTO accession has acted as a catalyst for a substantial transformation of the Chinese

automotive sector. The liberalization of trade barriers and the introduction of more transparent regulations paved the way for increased foreign investment and technology transfer, enabling German automobile firms to forge closer partnerships with local stakeholders and extend their market reach.

However, the analysis also revealed that this opportunity was not without challenges. The intense competitive landscape, coupled with evolving consumer preferences and regulatory nuances, demanded that German firms adapt their strategies in order to navigate the intricacies of the Chinese market. Although high-quality German automotive companies also met several times risks of sales decreasing during development phase. The significance of localization, collaboration, and innovation emerged as pivotal factors influencing success in this rapidly evolving business environment.

Moreover, this study underscores the interconnectedness of global trade and its implications for multinational corporations. The experiences of German automobile companies in China exemplify the need for businesses to adopt flexible and context-specific approaches in order to capitalize on emerging market opportunities while mitigating risks (Schnellbach, 2015).

In a broader sense, this dissertation contributes to the literature on international business and trade, shedding light on the importance of free trade and cooperation for countries and multinational companies. The insights gained from this research have practical implications for both policymakers and business leaders, emphasizing the importance of fostering an enabling environment that encourages cross-border collaboration and knowledge exchange.

Meanwhile, it is important to acknowledge the limitations and shortcomings of this dissertation. Firstly, the scope of data used to gauge the developmental landscape of automotive companies remains narrow, primarily focusing on sales and revenue figures. Enriching the research with supplementary dimensions of data, such as market share, could provide a more comprehensive

understanding. Secondly, the absence of pre-China's WTO accession data hinders a robust comparison between the periods before and after China's WTO entry, which would have bolstered the argument. Thirdly, while efforts were made to minimize variances among target companies by selecting those subjected to similar government policies from the same country, the potential influence of varying corporate governance structures persists. Moreover, external national and economic events also intersected with the growth trajectory of German automotive firms in the Chinese market, potentially confounding the isolated impact assessment of China's WTO accession on these firms.

As we conclude this study, it is apparent that the impact of China's accession to the World Trade Organization on German automobile firms in the Chinese market has been multifaceted, shaping their strategies, influencing their interactions with local actors, and redefining their global positioning. The dynamics observed serve as a testament to the intricate dance between economic liberalization and corporate adaptability. In the context of this dissertation, it primarily confirms that China's accession to the WTO had a favorable influence on German FDI in the automotive sector. While it briefly outlines certain contributing factors, more comprehensive explanations remain to be investigated. As we look ahead, it is imperative that both scholars and practitioners continue to explore these themes, deepen understanding of the ever-evolving landscape of international business from those historical international events, to conclude more business development experience.

6. Reference:

- Li, S., Xiao, J. and Liu, Y. (2015). The price evolution in China's automobile market, *Journal of Economics & Management Strategy*, 24(4), pp. 786–810. doi:10.1111/jems.12116.
- Thun, E. (2004). Industrial Policy, Chinese-Style: FDI, Regulation, and Dreams of National Champions in the Auto Sector. *Journal of East Asian Studies*, 4(3), 453–489.
<http://www.jstor.org/stable/23417950>
- Sun, P., Mellahi, K., & Thun, E. (2010). The dynamic value of MNE political embeddedness: The case of the Chinese automobile industry. *Journal of International Business Studies*, 41, 1161-1182.
- Xi, L., Lei, L. and Guisheng, W. (2009) 'Evolution of the Chinese automobile industry from a sectoral system of Innovation Perspective', *Industry & Innovation*, 16(4–5), pp. 463–478. doi:10.1080/13662710903053755.
- National Research Council. (2003). *Personal cars and China*. National Academies Press.
- Zhou, L.Y. (2002). On the inevitability of tax and fee reform for vehicle purchase surcharges. *Research of Finance and Accounting*, (09), 17-18.
- Xiao, H.Z. (2000). The impact of China's automobile tariffs on the competitiveness of imported automobiles. *Enterprise Group Guide*, (2), 26-29.
- Grimm, K.: Die chinesische Automobilindustrie und ihre Zulieferer. In: Deutsch-Chinesisches Wirtschaftsforum 4, 1999, S. 7
- General Introduction to Dongfeng Motor Company Limited Introduction. Available at: <https://www.dfl.com.cn/sp/html/corporateStyle/companyIntroduction-eg.html> (Accessed: 20 July 2023).

Ianchovichina, E., & Martin, W. (2001). Trade Liberalization in China's Accession to WTO.

Journal of Economic Integration, 16(4), 421–445. <http://www.jstor.org/stable/23000767>

Xu Li. (2006). Issues and industrial policy research on the development of China's automobile industry after China's accession to the WTO (Master's thesis, Jilin University) .<https://kns.cnki.net/kcms2/article/abstract?v=RpalHLswg4Gb9lWpSmg0gPvBsKYZkq7B-Yv6P5gq6jjUXxQFKQwxlrSAfE8kaVtUSb3IKl5Sl9KLOl23c8jBDq3HWUtafWgPNepuWqJdvDhwTD9AsGHoE2Fc6VRvNJLi&uniplatform=NZKPT&language=CHS>

Jin, Q. (2023) *Top-selling cars in June 2023 in China – BYD First, VW Second, Toyota Third*, *CarNewsChina.com*. Available at: <https://carnewschina.com/2023/07/11/top-selling-cars-in-june-2023/> (Accessed: 03 August 2023).

Azarhoushang, B. (2013). The effects of FDI on China's economic development; case of Volkswagen in China (Doctoral dissertation, Hochschulbibliothek HWR Berlin).

Gao, S., & Krogstie, J. (2015, October). Understanding business models of mobile ecosystems in China: a case study. In Proceedings of the 7th International Conference on Management of computational and collective intelligence in Digital EcoSystems (pp. 64-71).

Liu, W., & Yeung, H. W. C. (2008). China's dynamic industrial sector: the automobile industry. *Eurasian Geography and Economics*, 49(5), 523-548.

Annual Report 2014. - Mercedes-Benz Group (no date) *Daimler annual report 2014*. Available at: <https://group.mercedes->

benz.com/documents/investors/berichte/geschaeftsberichte/daimler/daimler-ir-annualreport-2014.pdf (Accessed: 05 August 2023).

Li, S. (2020) *A quick introduction on Granger causality testing for time series analysis*, Medium. Available at: <https://towardsdatascience.com/a-quick-introduction-on-granger-causality-testing-for-time-series-analysis-7113dc9420d2> (Accessed: 10 August 2023).

Stephanie Glen. (2018) "Granger Causality: Definition, Running the Test" From StatisticsHowTo.com: Elementary Statistics for the rest of us! <https://www.statisticshowto.com/granger-causality/>

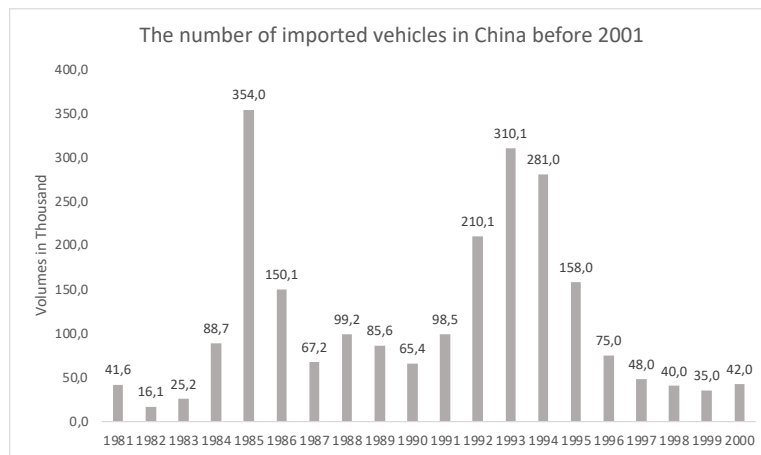
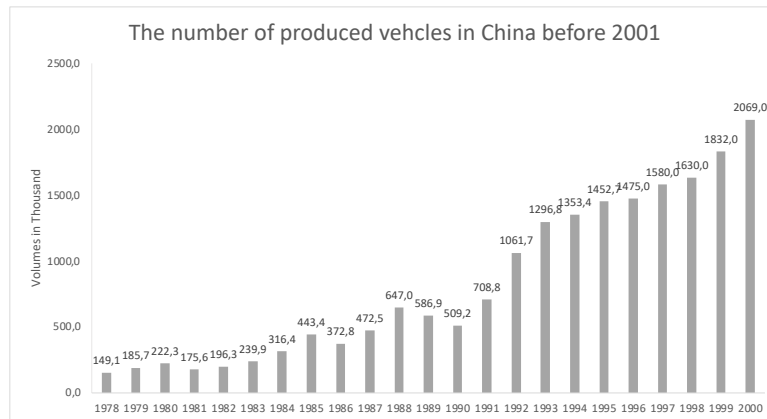
Schnellbach, C., & Man, J.Y. (2015). Germany and China: Embracing a Different Kind of Partnership?

Fombrun, C., Pan, M. Corporate Reputations in China: How Do Consumers Feel About Companies?. *Corp Reputation Rev* 9, 165–170 (2006). <https://doi.org/10.1057/palgrave.crr.1550024>

Wei, J. et al. (2015). 'An empirical study of the volkswagen crisis in China: Customers' information processing and behavioral intentions', *Risk Analysis*, 36(1), pp. 114–129. doi:10.1111/risa.12446.

7. Appendix

7.1 Vehicle production and import status in China before 2001



7.2 Chinese Vehicle tariff change after 2001

	2001	2002	2003	2004	2005	01.01.2006	01.07.2007
Displacement of 3.0 liters or more	80,0%	50,7%	43,0%	36,7%	30,0%	28,0%	25,0%
Displacement of 3.0 liters or less	70,0%	43,8%	38,2%	34,2%	30,0%	28,0%	25,0%

7.3 Sales and revenue performance of three German automotive FDIs

Volkswagen Group China																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales	513.000	698.000	649.000	512.000	711.000	910.000	1.024.000	1.400.000	1.923.000	2.260.000	2.815.000	3.271.000	3.675.000	3.549.000	3.982.000	4.184.000	4.207.000	4.234.000	3.849.000	3.305.000	3.185.000
Increasing rate		36,00%	-7,02%	-21,11%	38,87%	27,99%	12,53%	36,72%	37,36%	17,52%	24,56%	16,20%	12,35%	-3,43%	12,20%	5,07%	0,55%	0,64%	-9,09%	-14,13%	-3,63%
Revenue (In Millions of Euros)	8.656	11.724	11.002	8.521	12.273	14.580	18.945	18.920	43.890	61.340	84.240	95.690	120.770	119.370	110.940	111.910	114.270	111.100	97.440	87.400	88.270
Increasing rate		35,44%	-6,16%	-22,55%	44,04%	18,80%	29,94%	-0,13%	131,98%	39,76%	37,33%	13,59%	26,21%	-1,16%	-7,06%	0,87%	2,11%	-2,77%	-12,30%	-10,30%	1,00%
BMW Brilliance																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales				17.501	23.600	32.100	35.068	44.888	70.488	108.189	160.849	206.729	278.529	287.073	310.026	386.549	466.182	545.919	605.050	652.000	664.934
Increasing rate				34,85%	36,02%	9,25%	28,00%	57,03%	53,49%	48,67%	28,52%	34,73%	3,07%	8,00%	24,68%	20,60%	17,10%	10,83%	7,76%	1,98%	
Revenue (In Millions of Euros)				700	803	1.003	1.086	1.465	2.062	3.671	5.894	8.155	10.504	11.371	11.616	13.668	20.061	23.076	24.674	27.383	30.495
Increasing rate				34,27%	37,20%	7,37%	32,48%	46,41%	74,69%	49,61%	30,31%	29,21%	-2,50%	3,61%	16,85%	24,29%	22,16%	11,11%	13,47%	10,28%	
Beijing Benz																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales						6.882	14.355	18.726	58.382	93.377	103.445	116.006	145.468	250.188	317.069	422.558	485.006	567.306	610.816	561.008	591.716
Increasing rate						108,59%	30,45%	21,77%	59,94%	10,78%	12,14%	25,40%	71,99%	26,73%	33,27%	14,78%	16,97%	7,67%	-8,15%	5,47%	
Revenue (In Millions of Euros)						251	447	530	1.673	2.705	2.921	3.250	4.612	7.385	9.478	14.404	16.470	19.000	24.543	22.876	24.004
Increasing rate						108,76%	30,23%	212,82%	58,87%	12,28%	9,16%	32,26%	50,81%	28,75%	36,88%	15,96%	14,56%	9,39%	-1,02%	9,04%	

7.4 Sales of comparative automotive companies and Chinese whole automotive market

JAC																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales					171.562	205.665	198.516	310.251	442.547	466.459	448.813	495.737	446.802	588.052	643.342	510.892	462.477	421.241	456.125	524.224	500.401
Increasing rate					19.88%	-3.48%	56.29%	42.64%	5.40%	-3.78%	10.46%	-9.87%	31.61%	9.40%	-20.59%	-9.48%	-8.92%	8.28%	14.93%	-4.54%	
DongFeng																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales				594.801	751.088	949.526	1.057.922	1.430.742	1.945.956	2.172.723	2.155.445	2.567.655	2.733.508	2.867.037	3.156.810	3.284.238	3.052.172	2.931.953	2.868.309	2.775.057	2.464.502
Increasing rate					26.28%	26.42%	11.42%	35.24%	36.01%	11.65%	-0.80%	19.12%	6.46%	4.88%	10.11%	4.04%	-7.07%	-3.94%	-2.17%	-3.25%	-11.19%
Chinese Automotive Market																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales (Units in million)	3,248	4,391	5,071	5,758	7,216	8,792	9,381	13,644	18,061	18,505	19,306	20,716	22,395	23,609	27,199	27,563	27,008	24,464	23,433	26,275	26,864
Increasing rate		35.18%	15.49%	13.55%	25.32%	21.83%	6.70%	45.45%	32.37%	2.46%	4.33%	7.30%	8.11%	5.42%	15.21%	1.34%	-2.01%	-9.42%	-4.22%	12.13%	2.24%

7.5 Results of Granger causality test of increasing rate of sales

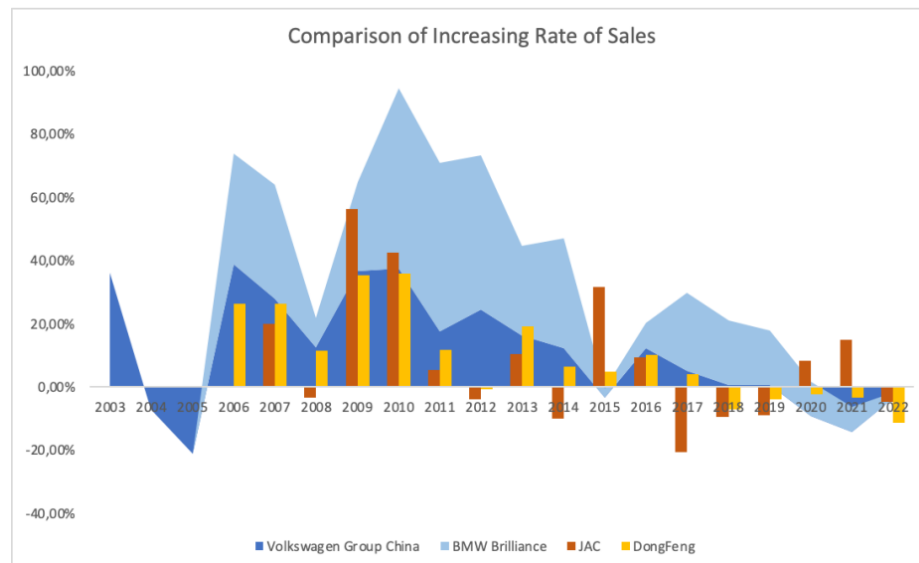
Result of Granger Causality Test		
	F Value	P Value
Number of Lags 1	0,0211	0,8852
Number of Lags 2	0,1900	0,8276
Number of Lags 3	4,1686	0,0113
Number of Lags 4	3,2651	0,0211
Number of Lags 5	2,2885	0,0663

7.6 Results of Granger causality test of increasing rate and revenue

Result of Granger Causality Test		
	F Value	P Value
Number of Lags 1	0,1113	0,7401
Number of Lags 2	0,3232	0,7255
Number of Lags 3	7,8352	0,0003
Number of Lags 4	5,9065	0,0008
Number of Lags 5	4,0489	0,0051

7.7 Result of comparison of increasing rate of sales between German FDI automotive companies and other automotive companies

Comparison of Average Increasing Rate of Sales			
German FDI Automotive Companies		Other Automotive Companies	
Volkswagen Group China	11,01%	JAC	8,64%
BMW Brilliance	24,98%		
Beijing Benz	41,85%	Dongfeng	9,60%



7.8 Result of comparison of increasing rate of sales between German FDI automotive companies and the whole Chinese automotive market

Comparison of Average Increasing Rate of Sales			
Volkswagen Group China	11,01%	Chinese	
BMW Brilliance	24,98%	Automotive	11,94%
Beijing Benz	41,85%	Market	