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Bachelor thesis

2019 **Maximilian Hönig**

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The correlations of economic changes to the super luxury car sector

Bachelor thesis

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Abstract

Within the thesis, the effects of macroeconomic and societal changes on the sale of Ferrari automobiles is examined. The main focus of this thesis is to discover, whether known factors, influencing luxury goods and total car sales, are also relevant for super luxury sport cars. This is done, by regressing Ferrari sales and total car sales on these factors and comparing the results to the ones for normal car sales, in each of the analyzed regions.

Keywords: Super luxury automobiles, Luxury goods, Car market, USA, China, Germany, Czech Republic, Fixed Effects, OLS

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Abstrakt

V rámci práce je zkoumán vliv makroekonomických a společenských změn na prodej automobilů Ferrari. Hlavním cílem této práce je zjistit, jestli známé faktory ovlivňující luxusní zboží a celkový prodej automobilů jsou relevantní i pro super luxusní sportovní automobily. To se provádí tak, že v každém z analyzovaných regionů dochází k regresi prodeje Ferrari a celkového prodeje automobilů na tyto faktory a následuje porovnání výsledků.

Klíčová slova: Super luxusní automobily, luxusní zboží, automobilni trh, USA, Čína, Německo, Česká republika, Fixed Effects, OLS

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Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague July 31, 2019 Maximilian Hönig

Institute of Economic Studies
Bachelor thesis proposal

Research question and motivation

Do economic changes have an effect on demand for luxury cars? Are there cultural preferences between these brands?

With many emerging markets such as China, India and Eastern Europe there are completely new markets for luxury car manufacturers in the likes of Bentley or Ferrari. However, also in western countries there are economic up and downturns, which might affect the demand for these companies' products. That is why in my work, I want to look at these economic factors in different countries and analyze their effect on the demand for such luxury cars.

On top of that, I want to see the cultural preferences regarding these brands.

Therefore, my hypotheses are:

1. Temporary economic downturns (e.g. 2008) do not negatively affect the demand for luxury cars.
2. Long-term economic downturns (e.g. Russia) do negatively affect the demand for luxury cars.
3. Above average long-term economic growth (China, Eastern Europe, etc.), positively affects the demand for luxury cars.
4. There are cultural preferences, which have an effect on the sale of luxury cars.

I am deeply interested in these brands and further understanding of the economic side of this market is something that I would love to gain. My knowledge is already fairly good. However, it will take in depth analysis in order to understand these aspects of the market.

Contribution

At the moment, there is literature on the reaction of luxury goods to economic fluctuations and it is described as "weak for the richest 5% of society" (Choi, S. (2009). Global luxury brands' strategies to Fight recession.). This statement supports my first hypothesis. However, there is very little research on testing these claims and the actual numbers and correlations in different markets of a specific type of product. That is why I believe that my contribution will be significant. I will explore actual changes in the demand for luxury cars due to economic fluctuations and make specific conclusions. On one side, it will be

interesting to have an example that goes into more detail than the broad research that has been done on this market so far. On the other hand, my findings will be useful for further understanding of the supercar market and it will help manufacturers and retailers to make better predictions based on the state of the economy.

Methodology

I will use the official data of countries in order to get the historical statistics on GDP per Capita, average incomes and growth rates, while using the annual reports of multiple luxury car producers to find out what the sales numbers in each market. From this I can create models that will provide the data that is necessary to either prove or disprove my hypotheses.

For the cultural analysis, I will again utilize the data of the annual reports and analyze it in comparison to the Hofstede cultural dimensions. Here I can differentiate between the following dimensions while using the already available data:

a) The extent to which the less powerful members of organizations and institutions accept and expect that power is distributed unequally.
b) The degree to which people in a society are integrated into groups.
c) A society's tolerance for ambiguity.
d) A preference in society for achievement, heroism, assertiveness and material rewards for success.
e) Connection of the past with the current and future actions/challenges.
f) The measure of happiness.

Outline

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Content

1. Introduction

Do the top earners in society react the same to economic fluctuations as the rest of the market, in terms of adjusting their consumption? If no, what are the influences and trends changing their consumption patterns? These are the two questions that this Bachelor thesis is aiming to answer, using the example of Ferrari sales. These cars are an ultra-high priced good, that only the top earners in the society can afford and is one of the most traditional luxury sports vehicle producers today. In order to understand the differences compared to normal consumers, these sales will also be compared to the regression results of total car sales.

The thesis will study these effects in four countries with different characteristics, regarding their population size, overall wealth and stage of economic development. The four countries are the US, China, Germany and the Czech Republic. The timeframe chosen for this is 2001 to 2018 for the US and Germany, and 2005 to 2018 for China and the Czech Republic. These timeframes were not only chosen due to data limitations, but also due to the economic crises that occurred throughout these years. The most notable one being the subprime mortgage crisis in 2008, significantly influencing economies around the whole globe. This should give a good understanding of how the previously mentioned economic players compare to regular consumers, in terms of adjusting their consumption in times of short- to mid-term fluctuations, as well as to socioeconomic developments, in the likes of the trend of increased urbanization rates, that is present around the globe.

The literature for the market of these cars is however very limited, which is why research on mostly personal luxury goods, as well as the entire automobile sector is used, in order to set up the models and later understand and explain the correlations found. For this, Choi (2009), as well as David Haugh, Annabelle Mourougane and Olivier Chatal (2010) give a foundation in understanding these markets. However, many more research and academic papers are used to comprehend these sectors and are outlined later on in the thesis. These state that the main influencing factors for the automobile sector, as well as the luxury goods market turn out to be GDP per capita, GDP growth, the disposable income growth, as well as the inflation and unemployment rates. A key role in the past

and future increase for the demand of these goods, is also the urbanization rate, which is described in detail by Holmes (2011) and Preksha (2016).

The findings in this thesis prove, that some of these factors indeed show correlation to Ferrari sales, such as the expected positive relations to the urbanization rate and the wealth of a country, which is measured by GDP per capita. Here, the relationship of the urbanization rate is also in line with the regression results of the total car sales models. However, some correlations turn out to not be fully in line with the literature and the regressions for the car market. Under these fall the inflation and unemployment rates. The inflation rate shows a positive correlation, while the inflation rate has mixed results. It is positively correlated in the general model, while there can be seen a negative relationship in the one for the United States. For the variables GDP growth and disposable income growth, on the other hand, there could not be found any significant correlation, which is why this thesis cannot comment on the magnitudes and coefficients found, in regards to these variables in the Ferrari sales models.

This bachelor thesis is organized in the following way: The beginning is made up of a brief literature review, which gives a theoretical background and insights into the already researched topics related to this matter. The next chapter then explains the methodology used in this thesis and gives a deep understanding of what the dataset consists of and where the data is obtained from. Also, the models created in order to study the previously mentioned correlations, are introduced in this chapter. The fourth chapter is then introducing the regression results and interpreting the correlations and magnitudes of the significant variables found, while also connecting the findings to the already existing literature. This is done for each country and for the general model, which includes all observations. All the important findings are then again summarized in the conclusion, which is the last part of this thesis.

2. Literature Review

2.1. Super luxury car market

The super luxury car market is booming in recent years, with sales in 2016 reaching an all-time high, which is reported to be in close correlation with the increased number of billionaires around the world. A total of 28,493 cars were sold globally in that year. The traditional markets, such as the United States and the United Kingdom were still the biggest markets with 8,377 and 4,600 units sold, respectively. However, the main market fueling the before mentioned growth is China. Here 4,400 cars were sold in 2016 alone and a year-to-year growth of 54.2% was recorded between the years 2015 and 2016. The most popular brands on an international scale were Bentley and Ferrari. These two manufacturers had a 37% and 24% market share respectively (McCarthy, 2017). While Bentley is a British company owned by the Volkswagen Group, Ferrari is an Italian luxury sports car manufacturer and the brand of interest in this thesis. The company was founded in 1947 and is up to this date headquartered in the city of Maranello. According to the 2018 annual report released by the firm, Ferrari managed to generate more than 3.4 billion US dollars, while selling 9,251 cars worldwide in that year alone.

2.2. Luxury goods

Nueno and Quelch (1998) define luxury goods as: "... those whose ratio of functionality to price is low, while the ratio of intangible and situational utility to price is high". In today's consumer-oriented world, exactly these types of goods are a central aspect of many peoples' lifestyles and became an important part of the economy. The market for these goods has some specific characteristics. The factors correlated to this market, found and described in this thesis, include the wealth of a country measured by GDP per capita, the consumer groups relevant for luxury goods, as well as the economic growth and the ongoing international trend of urbanization.

2.2.1. Macroeconomic influences

There are specific types of consumer-behavior and main influencers creating demand for certain luxury goods. The consumers of luxury products and therefore also the target audience of companies producing such goods, can be split into three groups, the absolute, the trigger and the bandwagon consumers, representing the top 0,5%, 5% and 20% of society, respectively. The absolute consumer is the most relevant one for this paper, as

this is the consumer group, that is interested in ultra-high priced goods and heavily customized services, under which Ferrari falls. The effects of consumer behavior during an economic downturn also heavily vary in between the groups, and the literature states that the higher the income of a group, the lower the effect on their consumption. It can also be found, that the absolute consumers are usually not effected by a downturn and mostly maintain their original consumption patterns (Choi, 2009). The number of such high net worth individuals with wealth of over 1 million US dollars, and therefore a possible client base for a firm like Ferrari is also varying between countries. It can be seen that the more developed a nation, the higher the amount of such individuals. This is shown in the 2018 Global Wealth Report released by the Swiss Bank, Credit Suisse (2018). Here, from the Top 20 countries with the most millionaires, all are developed and mostly western nations with the exception of China and Taiwan, which can still be seen as developing nations. These developed nations typically have a higher GDP per capita than countries that are less developed. The Top 5 nations with the most millionaires are the US, China, Japan, the UK and Germany with 17350, 3480, 2809, 2433 and 2183 millionaires respectively. However, there are also different kinds of behaviors, especially between emerging and developed markets. These are described in the Diamond Report (2012), which defines luxury goods as anything that only few people have and many more aspire to get, while it also has to be a good or service that takes extraordinary effort to obtain. Furthermore, the report states that consumers in developed markets stopped proving wealth using such products due to a spread out high standard of living. Instead, they are looking for functionality and great quality in higher priced products. Meanwhile, luxury good consumers in emerging markets are willing to pay a lot higher prices, due to the main purpose of buying status. The report also describes a high correlation between the sales of luxury goods and GDP per capita, as well as disposable income growth. This makes China, with its 6.6% gross domestic product growth rate (Worldbank, 2019), one of the biggest drivers for the growth in the luxury market. Just in 2017 the sales of personal luxury goods, which include all goods used for self-grooming purposes such as apparels, shoes and beauty products, to Chinese consumers rose by 18% on a year-to-year basis, with fixed exchange rates, according to the Luxury Market report by Teresa Lam and Tracy Chan (2018).

2.2.2. Urban population

Another correlation found in the literature is the so-called urbanization. This is defined by the Cambridge dictionary as “the process by which more and more people leave the countryside to live in cities” (Cambridge Dictionary, 2019). According to the United Nations’ 2018 Revision of World Urbanization Prospects (2018), today around 55% of the global population lives in urban areas. This is an enormous increase from 751 million people living in such environments in 1950 to a total of 4.2 billion in 2018. Nowadays, the most urbanized region is Northern America with 82%, followed by the Caribbean with 81%, Europe with 74% and Oceania, where 68% of the population lives in urban environments. Asia is following with an urbanization rate of 50%, which is slightly below the global average, while Africa is the only mostly rural continent with only 42% of its population living in urban areas. However, this trend of increased urbanization is here to stay. It is projected, that the share of the global population is set to increase to a total of 68% by 2050. This development had, has and will have major impacts on the demand in the luxury market. This is described by Preksha (2016), as she outlines that the so-called urban culture heavily influences the lifestyles chosen and lived by the individuals of that environment. She also describes the long-term trend of an increasing urban population and the positive effects this development will have on the demand for luxury goods. This is highly likely to be connected to the consumption for status, which is an important aspect of urban culture. Such consumption exists in order to gain status in society, which is described to be a form of power consisting of respect and envy from others (Csikszentmihalyi & Rochberg-Halton, 1981). Eastman, together with Fredenberger, Campbell and Calvert (1997), focused on this type of consumption and revealed that expensive jewels, vacations and also cars are important aspects of most societies, no matter whether it is traditionally rich countries, such as the ones in Western Europe and the US, or whether it is emerging countries, such as China.

2.3. Automotive industry

The automotive industry fights problems, such as overcapacity and low profitability (KcKinsey, 2013), but despite these issues, it remains a key international sector, producing over 73 million cars and 23 million trucks annually. On top of that, it employs over 800 thousand workers directly and many millions more indirectly in each of the main automotive countries, which are the US, Japan and Germany (Saberi, 2018). However, there are many factors influencing the prosperity of this sector and many of them are key

macroeconomic indicators. These include the GDP per capita, GDP growth, the inflation and unemployment rates, as well as the disposable income growth and the already previously described urbanization rate.

2.3.1. Macroeconomic indicators

Haugh, Mourougane and Chatal (2010) found in their report called "The Automobile Industry in and Beyond the Crisis" that the automobile sector has shown, that it is strongly correlated and that it behaves according to the overall business cycles. This relationship is especially strong in the before mentioned countries, which are the United States, Japan and Germany. Particularly in times of an economic downturn, the automobile sector is hit hard. This can be seen on the drop in sales due to the financial crisis in 2008. Here, sales decreased by an average of more than 20% between September 2008 and January 2009. Furthermore, the report states that the automobile sector has an effect on broader economic performance, which is why governments responded to the crisis with giving incentives aimed to increase car sales. These included subsidized credits, bonuses for switching an old car for a new one or subsidies to troubled companies. Countries chose different approaches in order to implement these subsidies. Germany, for example, chose to strongly incentivize car sales in the crisis times by introducing non-targeted scrapping subsidies of 2,500 EUR throughout the whole of 2009. This meant that, throughout the whole of 2009, people received 2,500 EUR support, when buying any car in the country that satisfied the Euro 4 emission standards introduced in 2005. These subsidies could also be used for any personal vehicles that are not older than one year (Leheyda & Verboven, 2013). However, not all countries decided to support their automobile markets in this way. The US, for example, chose to not support buyers, but had to save its national car manufacturers. Two out of the so-called American Big 3, consisting out of General Motors, Ford and Chrysler, were in deep financial trouble and needed government support in order to overcome the cash shortages and turn away from possible bankruptcy and liquidation, which would lead to possibly losing three million American jobs, as well as a major destabilization to the American manufacturing sector (McCracken & Stoll, 2008). This ended with the US and Canadian governments bailing out the troubled companies, Chrysler and General Motors, with an amount of over $80 billion, while also allocating some funds to Ford in order to not fuel unfair competition (Hartman, 2018). However, even though there was an, for the car sector, unprecedented use of financial means, the

sales were not incentivized, and therefore also no real increase in car sales could be noticed during the time of the financial support.

Another strong relation besides the GDP growth can be found in the GDP per capita. Looking at the data presented by Our World in Data (2014), there is a clearly exponential relationship between GDP per capita and car ownership. The data shows the amount of road vehicles per 1,000 inhabitants and the GDP per capita of each country. It can be seen that countries with a particularly high GDP, such as the US, Australia and Iceland, have a car density of over 700 road vehicles per 1,000 inhabitants, while countries with a lower GDP per capita, in the likes of China and Indonesia, have a density of only around 100 vehicles per 1,000 inhabitants. On these countries, it can be seen that, while the GDP per capita of the richer countries is only five times the one of China, the road vehicle density is over seven times the amount of the Chinese. Due to that, the previously mentioned positive and exponential relationship between GDP per capita and the sale of cars is excepted. One more macroeconomic indicator is the inflation rate. A study by Nawi et al. (2013), analyzing the effects of different indicators on the car sales in Malaysia, found that inflation has a negative relation. This translates to a decrease of car sales in the country in the case, when the inflation rate rises. The same observation was made by another study for the Malaysian automobile market by Islam et al. (2016). The previously mentioned studies by Islam et al. (2016) and Nawi et al. (2013) also found that there is a negative relationship to the unemployment rate and the total car sales. Also, another paper by Christina Babatsou and Efthimios Zervas (2011), focusing on the entire EU15 as well as ten individual countries from the EU15, which are Germany, France, Italy, Spain, the United Kingdom, Austria, Belgium, Greece, Sweden and Portugal, analyzes this relationship. Here, there can also be found a negative correlation between car sales and the unemployment rate. This observation is the same in every country analyzed, as well as in the model for all EU15 countries. However, while the results for the EU15 model are very reliable, the ones for individual countries have to be interpreted more carefully, as the data is fairly limited. The paper by Babatsou and Zervas (2011) also tried to find some correlation between the income per individual and car sales, however the results were not reliable for the EU15 model. The individual countries on the other hand showed mixed results. While Germany and Portugal showed a negative correlation, all other countries had a positive one. Again, the individual results have to be interpreted carefully due to the limited dataset used in the regressions.

2.3.2. Urban population

A Business Insider article by Holmes (2011) describes the positive relationship between car sales and urbanization on the example of China. With increased wealth and urbanization people are looking for alternatives to living in the center of cities. The ownership of a car increases mobility and enables people to reside in suburban areas around Chinese cities. This again increases both, the demand for better housing in suburban areas, but also the one for cars. The numbers support this theory, as car ownership in China increased from below 1% to 13% in a ten-year period and cities, such as the capital, Beijing, even see car ownership rates of 30%. This phenomenon was already present in the US during the 1950s, with the rise of the American suburban family. This was induced with increased access to personal cars and gave people the opportunity to access better quality housing on the outskirts of the city, while using personal cars to commute to the center.

2.4. Contribution

As seen in the literature review, there has been spent a lot of effort in the past, on trying to understand the factors influencing the automobile market in general, as well as the market for luxury goods, mainly personal luxury goods, all around the world. There is already an understanding of what the economic and social implications are and how they impact the previously mentioned markets. However, there is very little known about the specific case of luxury automobiles and especially on one of the most traditional and well-known brands, which is Ferrari.

This Bachelor's thesis is focusing on exploring exactly this matter and should give a basic understanding of how and to what extend the already known implications of the general car market and luxury goods can be translated to the sales of these super luxury sports vehicles. The research is also not only focused on the general behavior, but it researches the correlations in specific countries, which are the United States, China, Germany and the Czech Republic, as well as a more global model including all of these countries.

This should give an understanding of different markets for these cars, as the analyzed nations include developed and emerging markets and should therefore provide a wide range of information for future research in this area.

3. Methodology, Data and Regressions

The objective of this chapter is to introduce and give an understanding of the dataset used in the regressions, as well as defining the independent variables used. Lastly, all regression models utilized in this thesis will be constructed and described. This is done in order to showcase, how the previously mentioned factors are correlated to the sale of Ferrari cars in countries that find themselves in different situations regarding their population, geographical location and economy. The analysis will focus on the time period between 2001 and 2018.

The first part is describing the data retrieved and utilized in the model. The second one is explaining and defining the statistics of the dataset and in the last section of this chapter the regression models are constructed and outlined.

3.1. Data & Constrictions

The dataset created for this analysis combines data about Ferrari sales and was obtained directly from Ferrari for the US, China and Germany, as well as from the Czech Car Importers Association for the sales in the Czech Republic. Furthermore, it includes the total car sales in the countries analyzed, which were taken from the national authorities responsible for this matter. The dataset also includes macroeconomic data, more specifically GDP per capita, GDP growth, disposable income growth, unemployment rate and inflation rate, all taken from the OECD databases. Likewise, the urbanization rates for each country, released by the UN World Urbanization Prospects 2018, are part of the dataset. However, due to the lack of data provided by Ferrari, the dataset's sample size is limited, in regards to the timeframe and the countries included. The nations being analyzed are restricted to the four states mentioned before, while the timeframe includes all years from 2001 to 2018 in the cases of the US and Germany, and 2005 to 2018 for the Czech Republic and China. These countries were chosen due to providing a fairly large sample size, while also at the same time representing countries with vastly different circumstances regarding their economy, geographic location and size. The US is a highly developed and large economy in North America, while Germany is also highly developed, however with a smaller population and its geographic location in Western Europe. The Czech Republic is a small, transitional country in Central Europe and China is a large developing country in Asia, showing extreme growth rates. Another interesting aspect is that, while the other three countries showed negative GDP growth throughout the

financial crisis in 2008, China was the only nation still having positive results regarding its economy. As a result, the total sample size consists of 64 observations, which will be further explained in the following sections. All data can be also found in full detail in the appendix.

3.1.1. Dependent Variables

In order to understand the difference between the relation of Ferrari car sales and that of total car sales, all models will be run once for Ferrari sales, being the dependent variable, and once for total car sales, being the dependent variable. The data on Ferrari sales is, as mentioned before, taken out of the annual reports of the company for the main markets being the United States, Germany and China and from the Czech Car Importers Association for the Czech Republic.

3.1.2. Independent Variables

There is a number of variables, which are important for the demand of luxury goods, as well as for the one of total car sales. There will be six independent variables, which will be included in all of the following models, in order to get a deeper understanding of what correlations exist to the sales of Ferrari and the car market as a whole. These can all be found in the literature in chapter two. The first ones included in the models are GDP per Capita and GDP growth. These will show how sensitive certain countries and markets as a whole are regarding macroeconomic fluctuations and how the increase in wealth changes the demand for Ferraris, but also for the total sale of cars. The rest of the regressed variables are also control variables found in the literature and are as well described in chapter two. These are the urban population, the growth of disposable income, the unemployment rate and the inflation rate. Urban population is described as a key factor driving both luxury good sales and car sales, especially in countries such as China, which are still not as urbanized as more developed nations. This is connected to the urban lifestyle and the desire to purchase status in society by owning luxury goods. However, also the car sales might be affected, as people get the opportunity to explore housing possibilities in suburban areas. The growth of disposable income also showed mostly positive correlation in both segments, however with car sales there were found mixed results among different countries. This might be a result of an increase in disposable income, giving the consumer the possibility to spend more on luxury goods and on enhancing his or her lifestyle, which might also simply include the acquisition of an

automobile. The last variables included are the unemployment and inflation rates. These are expected to have a negative correlation to car sales, however not a major impact on the sale of Ferrari's cars, as the relevant consumer group for these ultra-high priced cars is not as vulnerable to macroeconomic changes.

Therefore, the independent variables included in all the models in this thesis are:

- x_1 independent variable: GDP per capita
- x_2 independent variable: GDP growth
- x_3 independent variable: Urban population
- x_4 independent variable: Disposable income growth
- x_5 independent variable: Unemployment rate
- x_6 independent variable: Inflation rate

Table 1 summarizes the names of the data and variables used in the econometric models and the scale of the values, and gives the sources from where the data is obtained from.

Table 1 – Variable overview

Name	**Scale**	**Source(s)**
Dependent Variable		
Ferrari_Sales	Units	Annual Reports / Czech Car Importers Association
Car_Sales	Millions of units	National Authorities
Independent Variables		
GDP_PerCapita	mUSD	OECD
GDP_Growth	%	OECD
Disposable_Income_Growth	%	OECD
Urban_Population	%	UN World Urbanization Prospects 2018
Unemployment_Rate	%	OECD
Inflation_Rate	%	OECD

3.1.3. Dataset Overview

The dataset used includes all statistics used in the regressions. The sample includes a total of 64 observations from all countries, including 18 observations for the US and for Germany, and 14 for China and for the Czech Republic.

Table 2, shows a summary of all statistics for the general model including all countries.

Table 2 – Statistics summary for dataset

General

	Variables	Min	Max	Mean	Standard Deviation	Sample Size
1	Ferrari_Sales	16.0	3,737.0	851.0	847.0	64
2	GDP_PerCapita	5.1	62.5	34.2	15.4	64
3	GDP_Growth	-5.6	14.2	3.5	3.8	64
4	Car_Sales	0.1	27.6	9.2	8.4	64
5	Disposable_Income_Growth	-4.2	17.2	3.8	4.4	64
6	Urban_Population	42.6	82.3	71.5	11.5	64
7	Unemployment_Rate	2.2	11.2	5.9	2.0	64
8	Inflation_Rate	-0.7	6.4	2.0	1.3	64

3.2. Model Framework

In order to properly understand the differences and implications regarding Ferrari sales in different countries and in comparison to the car market as a whole, it is necessary to use a couple of different models, so that a deeper understanding of the behavior in each country, as well as in a more global perspective, is obtained. On top of that, it is needed to do the same regressions for Ferrari sales and total car sales, as the dependent variables, in order to understand the differences in their behavior.

There are two main types of regressions. The first one focuses on the general model, utilizing all observations from all four countries included in the dataset. The second type of regressions are focusing on analyzing the behavior in each individual country, using a smaller, country-specific sample size, while only focusing on one country at a time. This will give an understanding on how the sales in characteristically different countries are correlated to economic fluctuations. As mentioned before, in both types of regressions, the dependent variable is once Ferrari sales and once total car sales.

In the general models, the fixed effects method was used, as the individual countries have to be regressed within themselves and the main interest lies in understanding the time variation of the variables within each cross-sectional observation (Wooldridge, 2006). In the country-specific models, on the other hand, the Ordinary Least Squared method was run, in order to estimate the correlation of the independent variables on the sales, as the datasets are limited to observations only for the individual country analyzed in each model. All regressions were run through the open source software R, provided by RStudio, Inc.

3.2.1. The general models

There are two general models using the fixed effects models with data from the complete dataset with all 64 observations. These models have the biggest sample size and should result in the most reliable outcomes.

The first model here is regressing Ferrari sales on all independent variables. These are the GDP per capita and GDP growth, as well as the control variables - disposable income growth, urban population, unemployment rate and inflation rate. This model should give

an understanding of how Ferrari sales are generally correlated across all countries regardless of their special characteristics.

The first regression equation, focusing on the Ferrari sales, is the following:

$$Ferrari\_Sales_{i,t} = \beta_1 * GDP\_PerCapita_{i,t} + \beta_2 * GDP\_Growth_{i,t} + \beta_3 * Disposable\_Income\_Growth_{i,t} + \beta_4 * Urban\_Population_{i,t} + \beta_5 * Unemployment\_Rate_{i,t} + \beta_6 * Inflation\_Rate_{i,t} + \varepsilon$$

The second model utilizes the same sample as the first one. Here, however, the dependent variable is the normal car sales. This should explain the relationship of the independent variables to the total car sales throughout the analyzed countries and give an opportunity to compare it to the ones of Ferrari.

The second regression equation, focusing on the total car sales, is the following:

$$Car\_Sales_{i,t} = \beta_1 * GDP\_PerCapita_{i,t} + \beta_2 * GDP\_Growth_{i,t} + \beta_3 * Disposable\_Income\_Growth_{i,t} + \beta_4 * Urban\_Population_{i,t} + \beta_5 * Unemployment\_Rate_{i,t} + \beta_6 * Inflation\_Rate_{i,t} + \varepsilon$$

3.2.2. The country-specific models

There are eight country specific models. All are using the Ordinary Least Squared model with a limited dataset, only utilizing a limited amount of observations for each particular country. These models should give an outcome that brings more clarity into the differences in the correlations between all countries, however the sample sizes are very small with 18 for the US and Germany, and 14 for China and the Czech Republic. Due to this reason, the results should be interpreted with caution.

As before, every model will be regressed once using the dependent variable Ferrari sales and once the total car sales. However, this time there will be four separate regressions - one for each of the four countries: the United States, China, Germany and the Czech Republic. Every regression will start with estimating the dependent variable in two dimensions and by a constant. These are the independent variables, GDP per capita and GDP growth. After this, the other control variables will be added one by one. This is done, in order to get an understanding of the interconnection of the control variables and how these effect the results of the model.

The first model is regressing all independent and control variables onto Ferrari sales. This should give an insight into the correlations of the control variables to Ferrari sales for each country, as the model is run separately for the US, China, Germany and the Czech Republic.

The first general country-specific regression equation is the following:

$$Ferrari\_Sales = \beta_0 + \beta_1 * GDP\_PerCapita + \beta_2 * GDP\_Growth + \beta_3 * Disposable\_Income\_Growth + \beta_4 * Urban\_Population + \beta_5 * Unemployment\_Rate + \beta_6 * Inflation\_Rate + \varepsilon$$

The second model uses the same data for each country, as the first country-specific model, however this time the dependent variable is total car sales instead of Ferrari sales. Again, this is done for all four countries of interest.

The second general country-specific regression equation is the following:

$$Car\_Sales = \beta_0 + \beta_1 * GDP\_PerCapita + \beta_2 * GDP\_Growth + \beta_3 * Disposable\_Income\_Growth + \beta_4 * Urban\_Population + \beta_5 * Unemployment\_Rate + \beta_6 * Inflation\_Rate + \varepsilon$$

4. Results & Interpretation

In this chapter, the results of the previously described models are displayed and interpreted for both Ferrari sales and total car sales. For each set of models, first the results are shown and then described.

The first section focuses on the general model, while the second one shows the results for all of the individual countries, which are the United States, China, Germany and the Czech Republic. Here, the significant variables with a p-value under 0.05 are listed and their correlations and magnitudes are shown. These results are then also interpreted and put into comparison with the magnitudes of other control variables within the model. In the last section of this chapter, there is a summary of all results and the findings are connected to the previously described literature.

4.1. The general model – All countries

In this section of chapter four, the results for the general model, that includes all countries, are presented. Both, the results for Ferrari sales and total car sales, can be found in Table 3.

Table 3 – Results for general models one and two – All countries

Variable	Ferrari Sales	Car Sales
GDP per Capita	45.45 ***	-0.25 ***
	(0.000)	(0.000)
GDP Growth	12.77	0.06
	(0.533)	(0.516)
Disposable Income	-1.67	0.00
Growth	(0.939)	(0.980)
Urban Population	10.45	1.68 ***
	(0.615)	(0.000)
Unemployment Rate	71.32 *	-0.56 ***
	(0.019)	(0.000)
Inflation Rate	8.61	-0,24
	(0.796)	(0.107)
Tests		
R^2	0.450	0.897
R^2 Adjusted	0.358	0.879
F Statistic	7.367	77.999
Significance Levels: * p<0.05, ** p<0.01, *** p<0.001		Observations: 64

The general model – All countries – Interpretation

There are two significant variables for the model focusing on Ferrari sales and three in the one for total car sales. In the Ferrari model, both of the independent variables, GDP per capita and the unemployment rate, are in positive correlation. In the model for total car sales, it can be seen that there are one positive correlation for the urban population and two negative relationships, which are the GDP per capita and the unemployment rate. In the Ferrari sales model, the unemployment rate has the biggest coefficient with 71.32, while the GDP per capita indicates a 45.45 increase in sales with a 1,000 US dollar

increase. For the model regarding the total car sales, there are some contradictory findings in comparison to the Ferrari one. Here, the biggest magnitude is shown by the coefficient of the urban population and translates into a 1,680,000 increase in sales, if the urban population rises by one percent. However, while there could previously be seen a positive coefficient in the variables GDP per capita and the unemployment rate, they have now the magnitudes -250,000 and -560,000, which translate into a 250,000 and 560,000 decrease in total car sales in the case of a 1,000 US dollar and one percent unemployment rate increase, respectively.

The statistically not significant variables here are GDP growth, disposable income growth, urban population and the inflation rate for the model regarding Ferrari sales, and GDP growth, disposable income and the inflation rate for the total car sales regression. Due to this fact, it is not possible to take any reliable conclusion from these variables.

4.2. The country specific models

In this section, the results for each country specific model are presented. There are two models for each country, one focusing on Ferrari sales and the other one looking at total car sales. Here, in each model, there are five individual regressions. In the first one, the control variables are GDP per capita and GDP growth. Then the rest of the control variables are added one by one in the following order: Disposable income growth, urban population, unemployment rate and the last one being the inflation rate. Below, all the individual regressions and their results, with a basic interpretation, can be found for the United States, China, Germany and the Czech Republic.

The country specific models – USA – Regression Results

Table 4 – Results for country specific model one – Ferrari Sales

Variable	Model_US 1	Model_US 2	Model_US 3	Model_US 4	Model_US 5
Intercept	-2,245.3 ***	-2.217.8 ***	-28.940.0	-121.142.1 *	-120.400.9
	(0.00)	(0.00)	(0.53)	(0.02)	(0.06)
GDP per Capita	84.9 ***	84.6 ***	39.70	-120.0	-118.9
	(0.00)	(0.00)	(0.61)	(0.16)	(0.25)
GDP Growth	38.5	49.0	60.30	19.2	19.6
	(0.47)	(0.41)	(0.35)	(0.71)	(0.73)
Disposable	-	-14.7	-18.50	-21.8	-21.9
Income Growth		(0.66)	(0.60)	(0.44)	(0.46)
Urban	-	-	358.2	1.610.5 *	1600.6
Population			(0.56)	(0.02)	(0.07)
Unemployment	-	-	-	-152.6 *	-152.35 *
Rate				(0.01)	(0.02)
Inflation Rate	-	-	-	-	-1.89
					(0.98)
Tests					
R^2	0.831	0.833	0.838	0.908	0.908
R^2 Adjusted	0.808	0.797	0.788	0.869	0.857
F Statistic	36.80	23.30	16.80	23.50	18.00

Significance Levels: *p<0.05, **p<0.01, ***p<0.001 Observations: 18

Table 5 – Results for country specific model two – Total car sales (in mil.)

Variable	Model_US T1	Model_US T2	Model_US T3	Model_US T4	Model_US T5
Intercept	12.76 ***	12.71 **	-8.04	-729.00 **	-508.96 *
	(0.00)	(0.00)	(0.98)	(0.00)	(0.05)
GDP per Capita	0.02	0.02	-0.02	-1.26 **	-0.92 *
	(0.75)	(0.75)	(0.98)	(0.00)	(0.03)
GDP Growth	1.17 **	1.15 **	1.16 **	0.84 **	0.95 **
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Disposable	-	0.03	0.03	-0.00	-0.01
Income Growth		(0.89)	(0.91)	(0.99)	(0.97)
Urban	-	-	0.28	10.07 **	7.14 *
Population			(0.94)	(0.00)	(0.04)
Unemployment	-	-	-	-1.19 ***	-1.13 ***
Rate				(0.00)	(0.00)
Inflation Rate	-	-	-	-	-0.56
					(0.11)
Tests					
R^2	0.495	0.496	0.496	0.852	0. 885
R^2 Adjusted	0.428	0.388	0.341	0.790	0.822
F Statistic	7.35	4.59	3.20	13.80	14.10

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 18

The country specific models – USA – Interpretation

The US model is the most informative model, as three control variables are significant for the Ferrari sales regression and four are significant for the total car sales one.

In the Ferrari models, there are positive relationships noticeable for GDP per capita and the urban population, while there is a negative correlation to the unemployment rate. The total car sales in the US on the other hand, are positively correlated to GDP growth and urban population. Negative relations can be found to the GDP per capita and the unemployment rate.

Regarding the magnitudes of the relations, the biggest correlation has the urban population with an increase of about 1,611 more Ferraris being sold with a one percent increase in urban population. A lot smaller is the magnitude of GDP per capita. For this control variable, the magnitude lies between 84.6 and 84.9. The magnitude of the unemployment rate is, as mentioned before, a negative one and can be interpreted as a decrease of 152.4 to 152.6 in Ferrari sales in the case of the unemployment rate rising by one percent.

For the total sales of cars, the by far biggest magnitude is once again seen in the urban population. Here, there can be seen a 7,140,000 to 10,070,000 increase in the case of a one percent increase in urban population. The second biggest, positive relationship lies in the GDP growth. The coefficient for this variable lies between 840,000 and 1,170,000. This can be interpreted as an increase in these numbers with a one percent increase in GDP growth. However, the magnitude is nearly 10 times smaller than the one of an increase in urban population. The coefficients of the other variables are strictly negative, with a magnitude of -920,000 to -1,260,000 for GDP per capita, and -1,130,000 to -1,190,000 for the unemployment rate.

There are a few statistically not significant variables in the US model. It is the GDP growth, disposable income growth and the inflation rate for the model regressing the control variable onto Ferrari sales, and disposable income growth and the inflation rate for the total car sales model. From the coefficients of these variables, there again cannot be drawn any conclusions, due to the lack of a significant relationship with the dependent variable.

The country specific models – China – Regression Results

Table 6 – Results for country specific model three – Ferrari sales

Variable	Model_CN 1	Model_CN 2	Model_CN 3	Model_CN 4	Model_CN 5
Intercept	198.37	179.86	-2,051.16	2.710.31	1177.56
	(0.41)	(0.47)	(0.31)	(0.64)	(0.88)
GDP per Capita	37.54 **	37.97 **	-31.49	15.42	2.06
	(0.00)	(0.00)	(0.61)	(0.85)	(0.98)
GDP Growth	-22.45	-26.74	-14.18	-91.41	-69.09
	(0.17)	(0.16)	(0.50)	(0.33)	(0.56)
Disposable	-	4.91	1.65	3.73	8.90
Income Growth		(0.60)	(0.86)	(0.71)	(0.64)
Urban Population	-	-	57.26	19.89	31.54
			(0.27)	(0.76)	(0.69)
Unemployment	-	-	-	-614.73	-420.88
Rate				(0.39)	(0.66)
Inflation Rate	-	-	-	-	-8.47
					(0.74)
Tests					
R^2	0.927	0.930	0.939	0.945	0.946
R^2 Adjusted	0.914	0.908	0.912	0.910	0.899
F Statistic	70.30	44.00	34.60	27.30	20.30

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 14

Table 7 – Results for country specific model four – Total car sales (in mil.)

Variable	Model_CN T1	Model_CN T2	Model_CN T3	Model_CN T4	Model_CN T5
Intercept	2.01	2.59	-120.99 **	-144.04	-97.32
	(0.75)	(0.69)	(0.01)	(0.20)	(0.49)
GDP per Capita	1.69 ***	1.68 ***	-2.17	-2.39	-1.99
	(0.00)	(0.00)	(0.07)	(0.14)	(0.28)
GDP Growth	-0.39	-0.25	-0.44	0.82	0.14
	(0.35)	(0.59)	(0.25)	(0.63)	(0.95)
Disposable Income	-	-0.15	-0.33	-0.34	-0.50
Growth		(0.53)	(0.07)	(0.09)	(0.17)
Urban Population	-	-	3.17 **	3.35 *	3.00
			(0.01)	(0.02)	(0.07)
Unemployment Rate	-	-	-	2.98	-2.93
				(0.82)	(0.87)
Inflation Rate	-	-	-	-	0.26
					(0.58)
Tests					
R^2	0.965	0. 966	0.987	0.987	0.987
R^2 Adjusted	0.958	0.956	0.981	0.979	0.977
F Statistic	150.00	95.10	167.00	119.00	91.30

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 14

The country specific models – China – Interpretation

The Chinese models show one significant control variable for the Ferrari sales and two for the total car sales.

The control variable found in the Ferrari sales model is GDP per capita and it shows a positive correlation. The significant ones for the total car sales regressions are once again the GDP per capita, as well as the urban population. These are also both positively correlated to their dependent variable.

In the Ferrari models, the magnitude of the GDP per capita coefficient ranges from 37.54 to 37.97. This can be interpreted as an increase of around 37 Chinese Ferrari sales in the case of a 1000 US dollar increase in the country's GDP per capita.

For the Chinese models focusing on the total car sales, the biggest magnitude is shown by the coefficient of the urban population, with a range from 3,170,000 to 3,350,000. This is in line with the US models, where this variable was also the one with the highest magnitude. GDP per capita is the second significant variable and its coefficient ranges from 1,680,000 to 1,690,000.

The variables, not having a p-value under 0.05 and therefore being statistically insignificant in the models regressing these variables onto Ferrari sales, include the GDP growth, disposable income growth, urban population, unemployment rate and the inflation rate. In the models focusing on total car sales the variables, GDP growth, disposable income growth, unemployment rate and the inflation rate, are insignificant. Therefore, these variables cannot give us any information, in order to further understand the influences on the Chinese market.

The country specific models – Germany – Regression Results

Table 8 – Results for country specific model five – Ferrari Sales

Variable	Model_DE 1	Model_DE 2	Model_DE 3	Model_DE 4	Model_DE 5
Intercept	605.93 ***	592.57 ***	6,411.51	6,411.42	4,888.53
	(0.00)	(0.00)	(0.11)	(0.12)	(0.09)
GDP per Capita	1.77	2.39	9.82	9.29	9.80 *
	(0.29)	(0.22)	(0.07)	(0.18)	(0.05)
GDP Growth	-0.15	1.42	2.56	2.76	-7.45
	(0.98)	(0.83)	(0.68)	(0.68)	(0.17)
Disposable Income	-	-13.10	-29.10	-30.02	-12.98
Growth		(0.49)	(0.18)	(0.20)	(0.42)
Urban Population	-	-	-79.68	79.22	-61.30
			(0.14)	(0.16)	(0.11)
Unemployment Rate	-	-	-	-1.94	2.86
				(0.89)	(0.77)
Inflation Rate	-	-	-	-	62.86 **
					(0.00)
Tests					
R^2	0.078	0.109	0.253	0.254	0.693
R^2 Adjusted	-0.045	-0.082	0.023	-0.057	0.525
F Statistic	0.63	0.57	1.10	0.82	4.13

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 18

Table 9 – Results for country specific model six – Total car sales (in mil.)

Variable	Model_DE T1	Model_DE T2	Model_DE T3	Model_DE T4	Model_DE T5
Intercept	3.27 ***	3.35 ***	17.10	17.10	17.55
	(0.00)	(0.00)	(0.24)	(0.20)	(0.21)
GDP per Capita	0.00	-0.00	0.02	0.04	0.04
	(0.82)	(0.73)	(0.44)	(0.09)	(0.10)
GDP Growth	-0.05 *	-0.06 *	-0.06 *	-0.07 **	-0.07 *
	(0.03)	(0.02)	(0.03)	(0.01)	(0.03)
Disposable Income	-	0.08	0.04	0.08	0.08
Growth		(0.27)	(0.61)	(0.28)	(0.35)
Urban Population	-	-	-0.19	-0.21	-0.22
			(0.34)	(0.25)	(0.26)
Unemployment Rate	-	-	-	0.09	0.09
				(0.07)	(0.09)
Inflation Rate	-	-	-	-	-0.02
					(0.82)
Tests					
R^2	0.277	0.340	0.386	0.534	0.537
R^2 Adjusted	0.180	0.199	0.197	0.340	0.284
F Statistic	2.87	2.40	2.04	2.75	2.12

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 18

The country specific models – Germany – Interpretation

When looking at the results of the regressions focusing on the German markets, there can be seen two significant variables for the sales of Ferrari and one for the total car sales. The significant independent variables found for the Ferrari sales are again GDP per capita and for the first time also the inflation rate. Both of these are in positive relation to Ferrari sales. For the total car sales, there is a negative relationship to the GDP growth. In the Ferrari sales model, the coefficient with the biggest magnitude is the inflation rate with a magnitude of 62.86. This is nearly seven times bigger than the one of GDP per capita, which is 9.80. The only significant correlation for the total car sales in Germany is the variable GDP growth. It shows a range in magnitude reaching from -50,000 to -70,000.

For Germany, the independent variables that show no statistical significance are GDP growth, disposable income growth, urban population and unemployment rate for the models focusing on Ferrari sales, and GDP per capita, disposable income growth, urban population, unemployment rate and inflation rate for the total car sales regressions.

The country specific models – Czech Republic – Regression Results

Table 10 – Results for country specific model seven –Ferrari Sales

Variable	Model_CZ 1	Model_CZ 2	Model_CZ 3	Model_CZ 4	Model_CZ 5
Intercept	-17.21	-17.50	2,400.94	1,827.72	1,775.22
	(0.41)	(0.43)	(0.48)	(0.62)	(0.64)
GDP per Capita	1.93 *	1.95 *	2.43 *	3.02	1.06
	(0.01)	(0.02)	(0.03)	(0.08)	(0.71)
GDP Growth	-0.84	-0.71	-0.17	-0.15	-0.20
	(0.44)	(0.60)	(0.91)	(0.93)	(0.90)
Disposable Income	-	-0.37	1.48	1.61	-0.45
Growth		(0.86)	(0.67)	(0.66)	(0.92)
Urban Population	-	-	-33.20	-25.83	-23.67
			(0.48)	(0.61)	(0.65)
Unemployment Rate	-	-	-	2.51	-3.59
				(0.61)	(0.69)
Inflation Rate	-	-	-	-	-4.07
					(0.42)
Tests					
R^2	0.484	0.486	0.515	0.531	0.576
R^2 Adjusted	0.390	0.331	0.299	0.239	0.213
F Statistic	5.16	3.15	2.39	1.81	1.59

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 14

Table 11 – Results for country specific model eight –Total car sales (in ths.)

Variable	Model_CZ T1	Model_CZ T2	Model_CZ T3	Model_CZ T4	Model_CZ T5
Intercept	-103.76 **	-103.46 **	-1,993.27	-3,314.66	-3,417.70
	(0.00)	(0.00)	(0.67)	(0.51)	(0.48)
GDP per Capita	9.45 ***	9.45 ***	9.08 ***	10.44 ***	6.60
	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)
GDP Growth	1.07	0.94	0.52	0.58	0.48
	(0.47)	(0.61)	(0.81)	(0.79)	(0.82)
Disposable Income	-	-0.39	-1.06	-0.77	-4.80
Growth		(0.90)	(0.82)	(0.87)	(0.40)
Urban Population	-	-	25.94	42.92	47.16
			(0.69)	(0.53)	(0.48)
Unemployment Rate	-	-	-	5.79	-6.18
				(0.38)	(0.58)
Inflation Rate	-	-	-	-	-8.00
					(0.22)
Tests					
R^2	0.916	0.916	0.918	0.926	0.941
R^2 Adjusted	0.901	0.881	0.881	0.879	0.890
F Statistic	59.90	36.40	25.10	19.90	18.60

Significance Level: *p<0.05, **p<0.01, ***p<0.001 Observations: 14

The country specific models – Czech Republic – Interpretation

The results for the Czech Republic show only one significant variable for each model, the one focusing on Ferrari sales and the one studying total car sales. In both models, this variable is the GDP per capita and each time it is also in positive correlation to the dependent variable. In regards to the magnitude of the coefficients, it can be observed that in the Ferrari sales model it ranges from 1.93 to 2.43, while in the total car sales model it varies from 9,080 to 10,440.

In the models for the Czech Republic, the independent variables, GDP growth, disposable income growth, as well as urban population, unemployment rate and inflation rate, are all insignificant in both models.

4.3. Interpretation of results

In this section of chapter four, the previously found results are gathered and the findings are connected to the literature found in the chapter "Literature Review".
In the following, the correlation of each variable in every single model will be showcased and the signs of the coefficients will be interpreted and explained by the previously gathered literature. Furthermore, the magnitudes of the coefficients will be interpreted and commented on.

The Tables 12 and 13 showcase all of the significant variables with a p-value under 0.05 and the sign of their coefficients, which were previously found in the regressions.

Table 12 – Signs of coefficients of independent variables – Ferrari sales

Country	US	CN	DE	CZ	General
GDP per capita	+	+	+	+	+
GDP growth	n/a	n/a	n/a	n/a	n/a
Disposable Income Growth	n/a	n/a	n/a	n/a	n/a
Urban Population	+	n/a	n/a	n/a	n/a
Unemployment rate	-	n/a	n/a	n/a	+
Inflation rate	n/a	n/a	+	n/a	n/a

n/a : Insignificant / + : Positive coefficient / - : Negative coefficient

Table 13 – Signs of coefficients of independent variables – Total car sales

Country	US	CN	DE	CZ	General
GDP per capita	-	+	n/a	+	-
GDP growth	+	n/a	-	n/a	n/a
Disposable Income Growth	n/a	n/a	n/a	n/a	n/a
Urban Population	+	+	n/a	n/a	+
Unemployment rate	-	n/a	n/a	n/a	-
Inflation rate	n/a	n/a	n/a	n/a	n/a

n/a : Insignificant / + : Positive coefficient / - : Negative coefficient

Summary

Across all models, it can be seen that the wealth of a country, as well as the increase in the urban population and inflation rate, all positively impact the sales of Ferrari cars. Mixed effects, on the other hand, can be seen in the unemployment rate. When these findings are compared to the total car sales, some similarities can be found, but most coefficients show a different correlation.

The urban population is the only variable that has a strictly positive relationship in both models. Different results can be, for example found in the GDP growth and the unemployment rate. The only variable, for which there were found no significant correlations in any of the models, is the disposable income growth, which also takes away the possibility of interpreting any of its coefficients. Looking at the magnitudes of the coefficients, it can be seen that, whenever urban population becomes a significant variable, its coefficient is the highest in the model. This goes for both Ferrari and total car sales. Another big magnitude can be found in the GDP per capita, as in all models except for one this variable was significant and often times had at least the second largest positive coefficient.

GDP per capita

In the model regarding Ferrari sales, there can be seen a clearly positive relation to this control variable. This can be explained with the fact that there is a larger customer group in highly developed nations, as, according to the previously mentioned study by Credit Suisse, 18 out of the 20 countries with the highest number of millionaires are developed nations with a particularly high GDP per capita. Regarding the total car sales, the picture is not as clear. While the US and the general model show a negative correlation, China and the Czech Republic show a positive relation to total car sales. Here, the results of the US and the general model, are not aligned with the data provided by Our World in Data, as an exponential growth in sales is expected from an increase in GDP per capita.

GDP growth

The GDP growth does not show any statistically significant results for the Ferrari sales models and is therefore not usable for further interpretation. For the total car sales, on the other hand, there are mixed results visible. The US car market reacts positively to increased growth rates regarding the gross domestic product. German car sales, on the

other hand, react negatively to such macroeconomic developments. Due to large time frames of this data being impacted by the financial crisis in 2008, these changes might be explained with the previously mentioned demand stimulations in the automobile sector. While Germany allocated massive resources towards inducing demand during the recession, the US allocated more funding towards rescuing troubled American car manufacturers. This led to the American consumer not being incentivized to buy cars during that period, unlike in wide parts of Europe and especially in Germany. This led to Germany raising the sales of cars during these economically troubled times, which resulted in decreased sales in more economically prosperous years, due to demand being overly covered during the 2009 subsidies. The US car sales on the other hand developed with the general economic situation, as there have been no real subsidies incentivizing the public to buy cars.

Disposable income

For the control variable, disposable income, there could not be found any significant relationship. Neither in the country specific models nor in the general one, for both the Ferrari sales and the total car sales. Therefore, no statements regarding this variable and its correlation can be made.

Urban population

Regarding Ferrari sales, there is only one correlation that is significant and that is the one in the US. Here, the rate of urban population is in positive relation with the dependent variable, which indicates that the more people move to urban areas, and therefore are adjusting their lifestyle to the urban culture, the more do the sales of Ferrari increase. This is described in the literature as a common driver for luxury good demand, as showing status is a big part of urban culture in most societies. For urban population influencing total car sales there is even clearer evidence. There is a significant positive relationship in the US, China and the general model. This is also in alignment with the literature, as often times people use this possibility of increased mobility by personal car ownership in order to seek housing in suburban areas. This phenomenon was already observed in the US during the 1950s, when access to personal cars increased and gave people the opportunity to explore these housing possibilities. When taking into account the magnitudes of the coefficients, it could be seen that urban population turns out to be a major driver for both, the sale of total cars and Ferraris.

Unemployment rate

Regarding the unemployment rate, there are again mixed results for the sale of Ferraris. While in the US the increase in unemployment has a negative correlation to the sale of these cars, it has a positive one in the general model. This might be explained by the fact that the customer group of Ferraris is mostly not employed and is also less vulnerable to macroeconomic changes, such as a rise in unemployment. However, a rise in unemployment often results from less prosperous years for companies, which might lead to a reduction in consumption of the owners and stakeholders. For the total sale of cars, the relationships are much clearer, as the correlation is negative in the US and the general model. This is again in correlation with the literature on the automobile sector, as the unemployment rate rises with economic downturns, during which the demand for cars decreases significantly, which also leads to the reduction of workplaces in the automobile sector.

Inflation rate

The inflation rate, is the last control variable in the models. Here, only one significant correlation can be found. That is the one of the inflation rate to the sales of Ferrari in Germany. The relation of the inflation rate is positive, which is in contradiction to the literature found for the automobile sector. The total car market, on the other hand, has no significant correlation to the inflation rate in any of the models.

Interpretation conclusion

In conclusion of this interpretation, it can be said that Ferrari sales can neither be treated as the rest of the automobile sector nor can they be viewed as typical personal luxury goods. While richer countries are more likely to have a larger client base for the Italian brand, urbanization is a key driver for its sales. This positive correlation and high magnitude of the urban population can also be seen, when comparing the results of the Ferrari sale models to the ones of the total car sales regression. Not in correlation with the literature for luxury goods or the one for total car sales, however, is the relationship of unemployment. Here, there are mixed correlations visible, which differ from the regions included in the models analyzed. The inflation rate is again in contradiction with the literature and has a positive correlation in the German model regressing Ferrari sales.

5. Conclusion

This thesis managed to partly answer the initial research question of how the consumption patterns, regarding super luxury automobiles, change in the case of Ferrari and what variables these changes are correlated to. Furthermore, there can be found parallels, but also differences in comparison to the factors' relationships to total car sales. This was done by regressing GDP per capita, GDP growth, the disposable income growth, the inflation and unemployment rates, as well as the urban population, onto Ferrari sales and total car sales for the United States, China, Germany, the Czech Republic and for a general model including all of the previously mentioned nations. In these models, there were found multiple significant correlations to Ferrari sales. These show positive relationships of GDP per capita, the urban population and the inflation rate, as well as mixed results among the models for the correlation of the unemployment rate. These findings are however not fully in line with the ones expected in regards to total car sales nor with the ones for luxury goods from the literature. Also, in comparison to the regression for total car sales, only one similarity can be found, which is the positive correlation of an increase in the urban population. This gives an indication that the top earners react differently to most of the economic fluctuations than the rest of the market. No conclusions can be made about the disposable income growth, as this variable does not show significance in any of the regressions.

The thesis starts with the chapter focusing on explaining the factors known to influence either total car sales or the demand for luxury goods, as well as giving a brief overview of the super luxury car market. Here, there are many macroeconomic, but also social developments outlined, that are often brought into connection with either total car sales or luxury goods by the existing literature.

The next chapter then introduces the obtained data and its organization. Furthermore, the control variables are outlined, which are GDP per capita, GDP growth, as well as other macroeconomic factors, such as the growth of disposable income, the inflation rate and the unemployment rate. The most important of the previously mentioned social trends is the urbanization trend, which is also included in the independent variables. Lastly, this chapter constructs the models for all regressions included in this thesis.

The forth chapter presents the regression results for each model and continues with interpreting these. Positive relations to Ferrari sales can be seen in GDP per capita for all models. Such relationship is also visible for the urban population in the United States and the general model for the unemployment rate, as well as for the inflation rate in Germany. The only negative correlation to Ferrari sales is found with the unemployment rate in the regression focusing on the United States. The total car sales only show the same correlations throughout all models for the urban population. In all other control variables, the relationships vary.

This thesis gives a good basic understanding of the luxury car sales and offers a foundation for further analysis. The author sees multiple steps on how to improve results and continue with research on this topic. Firstly, the reliability of the findings could be majorly improved. This can be done by increasing the sample size in terms of the timeframe, but also in regards to the number of countries included in the models. Another improvement would be to consolidate the entirety of the market and include all luxury brands and their sales. This way, potential omitting of fluctuations in regards to individual brands due to outdated models or an increase in competition, can be prevented. However, in order to be able to do any of the suggested steps, it would be necessary to get reliable and internal data of the companies, which might turn out to be a key problem.

The goal of the thesis is to give a basic understanding of how the sales of luxury brands can be expected to develop, in regards to other fluctuations in our societies and show the differences to the total car consumption. This can help future research in this topic and also benefit brands in this area, in order to further understand different markets.

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7. Appendices

Appendix 1: Datasets

In the following, all datasets used in the previous regressions are presented for each individual country. However, in the general model, all the data seen below is merged into one model including all 64 observations from all nations.

Table 14 – Dataset – USA

Year	Ferrari sales	GDP per capita	GDP growth	Total car sales	Disposable income growth	Urban Population	Unemployment rate	Inflation
2001	1,206	37.1	1.0	16.5	1.9	79.2	4.7	2.8
2002	1,206	38.0	1.7	17.9	3.6	79.4	5.8	1.6
2003	1,312	39.4	2.9	17.4	3.4	79.6	6.0	2.3
2004	1,434	41.6	3.8	18.1	5.7	79.8	5.5	2.7
2005	1,580	44.0	3.5	17.2	-0.4	79.9	5.1	3.4
2006	1,709	46.2	2.9	17.1	3.6	80.1	4.6	3.2
2007	1,761	47.9	1.9	16.0	1.1	80.3	4.6	2.9
2008	1,700	48.3	-0.1	10.4	0.6	80.4	5.8	3.8
2009	1,467	47.0	-2.5	11.3	0.0	80.6	9.3	-0.4
2010	1,672	48.4	2.6	12.6	3.6	80.8	9.6	1.6
2011	1,866	49.8	1.6	13.8	1.6	80.9	9.0	3.2
2012	2,050	51.5	2.2	15.5	6.5	81.1	8.1	2.1
2013	2,382	53.0	1.8	15.8	-4.2	81.3	7.4	1.5
2014	2,462	54.9	2.5	17.2	5.4	81.5	6.2	1.6
2015	2,640	56.7	2.9	17.5	2.7	81.7	5.3	0.1
2016	3,737	57.8	1.6	18.4	1.7	81.9	4.9	1.3
2017	2,811	59.8	2.2	17.8	2.8	82.1	4.4	2.1
2018	3,000	62.5	2.9	18.0	3.6	82.3	3.9	2.4

Table 15 – Dataset – China

Year	Ferrari sales	GDP per capita	GDP growth	Total car sales	Disposable income growth	Urban Population	Unemployment rate	Inflation
2005	82	5.1	11.4	5.8	11.4	42.6	4.1	1.8
2006	121	5.9	12.7	6.6	12.1	43.9	4.0	1.5
2007	177	6.8	14.2	7.8	17.2	45.2	3.8	4.8
2008	212	7.6	9.7	8.3	14.5	46.5	4.4	5.9
2009	349	8.4	9.4	12.4	8.8	47.9	4.3	-0.7
2010	256	9.3	10.6	16.4	11.3	49.2	4.2	3.3
2011	449	10.4	9.5	17.3	14.1	50.5	4.3	5.4
2012	454	11.3	7.9	18.4	12.6	51.8	4.5	2.6
2013	454	12.3	7.8	20.7	9.7	53.0	4.5	2.6
2014	675	13.4	7.3	22.4	9.0	54.3	4.6	2.0
2015	572	14.4	6.9	23.6	8.2	55.5	4.6	1.4
2016	619	15.5	6.7	27.2	5.7	56.7	4.7	2.0
2017	617	16.8	6.9	27.6	8.3	58.0	4.7	1.6
2018	695	17.9	6.6	27.0	7.8	59.2	4.7	2.1

Table 16 – Dataset – Germany

Year	Ferrari sales	GDP per capita	GDP growth	Total car sales	Disposable income growth	Urban Population	Unemployment rate	Inflation
2001	651	28.8	1.8	3.3	2.5	75.2	7.8	2.0
2002	683	29.7	0.0	3.3	-0.5	75.4	8.7	1.4
2003	672	30.4	-0.7	3.2	0.8	75.6	9.6	1.0
2004	660	31.8	0.7	3.3	0.5	75.8	9.8	1.7
2005	639	32.4	0.7	3.3	0.4	76.0	11.2	1.6
2006	677	34.7	3.7	3.5	1.0	76.2	10.3	1.6
2007	717	37.0	3.3	3.1	0.4	76.4	8.7	2.3
2008	714	38.7	1.1	3.1	1.1	76.6	7.5	2.6
2009	644	37.7	-5.6	3.8	-0.1	76.8	7.7	0.3
2010	617	39.9	4.1	2.9	0.7	77.0	7.0	1.1
2011	695	42.7	3.7	3.2	1.0	77.2	5.8	2.1
2012	756	43.6	0.5	3.1	0.9	77.2	5.4	2.0
2013	659	45.2	0.5	3.0	0.5	77.2	5.2	1.5
2014	616	47.2	2.2	3.0	1.7	77.2	5.0	0.9
2015	595	48.0	1.7	3.2	2.3	77.2	4.6	0.5
2016	675	49.9	2.2	3.4	2.6	77.2	4.1	0.5
2017	710	52.6	2.2	3.4	1.7	77.3	3.8	1.5
2018	803	54.4	1.4	3.4	1.8	77.3	3.4	1.7

Table 17 – Dataset – Czech Republic

Year	Ferrari sales	GDP per capita	GDP growth	Total car sales	Disposable income growth	Urban Population	Unemployment rate	Inflation
2005	21	21.9	6.5	0.1	3.3	73.6	7.9	1.9
2006	16	23.7	6.9	0.1	4.3	73.5	7.2	2.5
2007	23	26.1	5.6	0.1	2.9	73.5	5.3	2.9
2008	26	27.7	2.7	0.1	2.1	73.4	4.4	6.4
2009	40	27.5	-4.8	0.2	2.4	73.3	6.7	1.0
2010	58	27.6	2.3	0.2	0.4	73.3	7.3	1.5
2011	40	28.8	1.8	0.2	-1.8	73.2	6.7	1.9
2012	40	29.1	-0.8	0.2	-1.2	73.2	7.0	3.3
2013	31	30.5	-0.5	0.2	-0.3	73.3	7.0	1.4
2014	30	32.3	2.7	0.2	2.8	73.4	6.1	0.3
2015	60	33.7	5.3	0.2	3.6	73.5	5.1	0.3
2016	58	35.2	2.5	0.3	3.2	73.6	4.0	0.7
2017	39	38.0	4.4	0.3	2.0	73.7	2.9	2.5
2018	60	40.0	2.9	0.3	4.1	73.8	2.2	2.2