Impact of financial crisis factors on the Economic Value Added (EVA) of automotive producers

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# CHAPTER 1. INTRODUCTION

For years, crises have had a negative effect on the economy as a whole. Since the 2008 crisis, the world has experienced significant downturns in various fields and industries. In Europe, many vital industries react to the recession in different ways. One of the leading industries in Europe is the automobile industry.

The automobile sector takes up a large part of the country's exports and brings significant profits. During the crisis, this industry is one of the first to suffer because production is mixed, unemployment increases, and production costs rise, so company profits fall significantly.

An indicator of the company's performance was chosen to investigate how automobile companies react to crisis changes, called economic added value. EVA is one of the critical indicators of the company; it shows the profitability of implemented projects and the efficiency of the company's use of resources. Therefore, this indicator is taken to evaluate the company.

Analyzing the crisis, it is possible to identify factors that show the presence of a problem, that is, indicators that primarily change during the crisis. These indexes include macroeconomic indicators, such as interest rate, house price, GDP, unemployment rate, market capitalization, and manufacturing.

There is much literature on crises and their impact. Still, we are interested in considering the effects of financial indicators of the crisis on the company's activities and seeing the opportunities to improve company performance in different situations.

Moreover, this study aims to investigate and analyze the importance of financial crisis factors to understand if they can be used as an opportunity to increase EVA and company performance, respectively. This leads to the formation of two theories that will be key in this study. The first one supposes that financial crisis factors such as excessive risk-taking in a favorable macroeconomic environment, increased borrowing by banks and investors, stresses in the financial system, and an increase in interest rates negatively

affect on EVA of automotive producers. And the second one states that financial crisis factors could be used to increase automotive producers' EVA.

For this research, we have decided to focus mainly on EU countries in which the automotive industry is concentrated, notably Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, and United Kingdom. For this study, it was decided to use Panel data because it is collected over a period. There are three types to estimate panel data: Pooled OLS model, Fixed effects model, and Random effects model.

So firstly, we will regress, Pooled Ordinary Least Squares regression (OLS) is used to estimate linear regression equation coefficients. It can help determine the relationship between the dependent variable and some independent quantitative variables, and interpretation is beneficial for research.

Secondly, the other two models will be regressed as Fixed effect and Random effect. We assume that our result shows that all our indicators positively impact EVA. But to choose one of these two models, Hausman's test will be conducted, and if it is not significant, then it will be used Random effect estimation and vice versa.

Following is an overview of the rest of the study. In chapter 2, the literature review is presented. A detailed discussion of the model specification and estimation process methodology is provided in Chapter 3, and a description of the data is presented in Chapter 4. The estimation results are presented in Chapter 5. Based on chapter 4, key findings and conclusions are summarized in Chapter 6.

# CHAPTER 2. INDUSTRY OVERVIEW AND RELATED STUDIES

## 2.1. Automotive industry overview

The automotive sector includes organizations involved in automobile manufacture, distribution, retail, and service. It is considered the fifth most appealing and investable market that is booming. This sector has one of the most consistent and constant growth rates in the entire world.

Europe is one of the world's top makers of automobiles, and this industry represents the most significant private investor in R&D.

The automotive sector has been integrating into Europe and developing for over 100 years. The European Union takes the most prominent place among all motor vehicle producers. To support competitiveness, the EU commission invests heavily in Research & Development. In perspective, it will keep the leadership place of the EU among other countries.

Due to providing an essential part of the economy. The European automotive industry exports over 5.6 million vehicles annually, producing 74 billion euros. Overall, the sector counts nearly 1.4 million automotive companies.

More than EUR 62 billion was involved in 2019 in the research and development department by private investors due to the inventive capacity of the automotive industry.

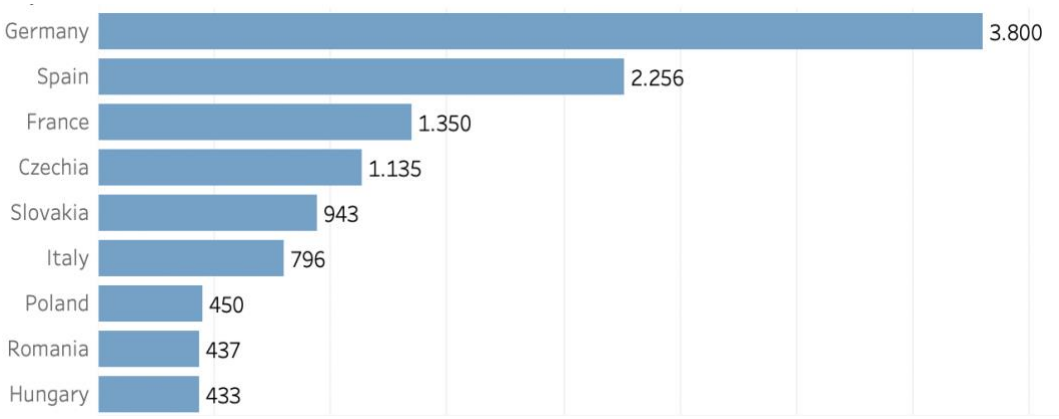
Strong economic integration has seen emerging economies move up the value chain, becoming strategic players in the EU value chain. To continue with revenue estimation, in Europe are located giant companies such as Volkswagen, Daimler, and BMW with 1st, 3rd, and 7th by revenue amount globally in 2020. Automotive makers such as Hyundai have assembly plants centered in the Czech Republic, EU.

Considering an automotive global value chain, it is the most integrated sector in Europe. More than 45% of automotive production depends upon cross-border value chains within the EU. The global value chain includes vehicle production, suppliers of automobiles, motor battery development, green energy/electrical equipment, suppliers of different raw materials, and car maintenance.

Hungary, the Czech Republic, France, Spain, and Italy are highly specialized enterprises that deal with segments of the global value chain, such as interior design and exhaust care tooling, that perform a fundamental role in the worldwide ecosystem of machine production and the whole automotive ecosystem.

As it was mentioned before, Europe is a leader in car production. One of the biggest global vehicle markets is in Europe. Including around a million passenger vehicles and commercial vehicles manufactured, Germany was the leading auto manufacturing nation in Europe.

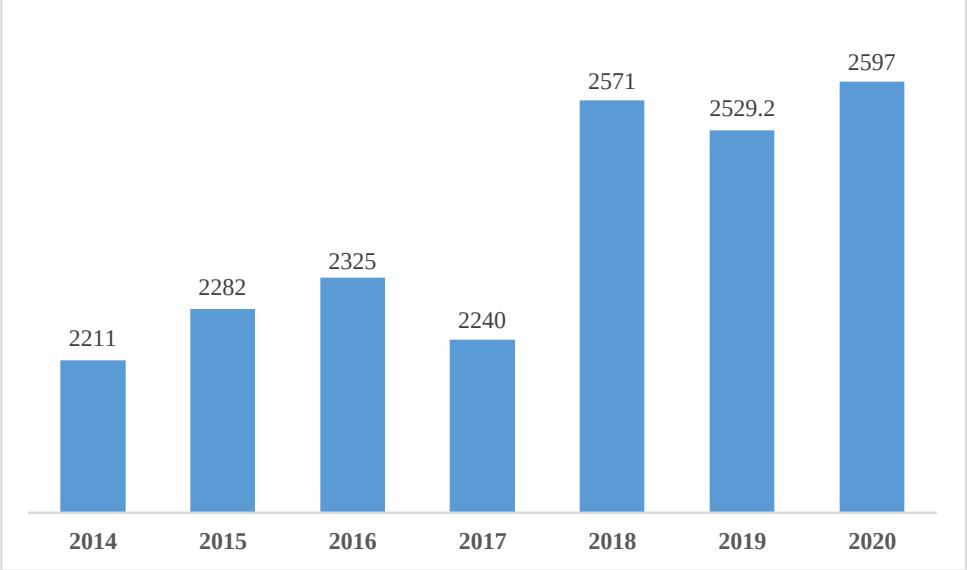
Figure 1. Motor vehicle production volume in Europe in 2020, by country




Source: Eurostat

The automobile sector is prominent in Europe's stable development, especially employment. Nearly 13.8 million Europeans have been employed in automotive companies (that equals an extensive range of services offered by businesses and a supply chain, the automotive industry is 6% of all employment in the EU). Talking about manufacturing, almost 2.6 million people work in the direct development of motors.
The five largest EU nations for direct employment in the automotive sector are Slovakia, Romania, Sweden, the Czech Republic, and Hungary. To see the amount of employed people and compare it across different countries, let´s take a closer look at Figure 2.

Figure 2. Direct employment in the motor vehicle manufacturing industry in the EU, (in 1000 employees)




Source: Eurostat

2.2. Environmental trends of the automotive industry

The EU has been developing standards to reduce emissions in the automotive industry. Taking care of the environment is fateful for the European Commission, so it easily quickly became a number one trend. Other trends are connected with noise reduction or implementing green-electricity technologies.

The first and foremost trend is to reduce CO2 emissions. As road traffic is a crucial source of greenhouse gas emissions, replacing ~ 15% of all EU's CO2 emissions, it is essential to find ways to reduce its amount in the air.

Trends that are concentrated on the reduction of emissions can be categorized:

- for cars or vans;
- for trucks or buses;
- for bulldozers or elevators;

Now, limits for emissions have been applied to cars, vans, trucks, and buses. In the future new regulations are expected to be implemented for agriculture equipment and forestry tractors.

The second trend in this industry is to reduce noise for people's well-being. The first step was done in 2014 by EU Regulation, which states some requirements for automobile manufacturing.

The third trend in vehicle production is implementing green battery systems to reduce emissions. As technologies move forward, greener consumer preferences change along with electric automobiles.

When consumers select a property car for themself, their choice relies on trends from a consumer point of view, such as car connectedness, off-line driving, keyless access, control from the phone, and other digital features that procedures have been implemented in the last five years.

### 2.3. Future vision and strategy of the automotive industry in Europe

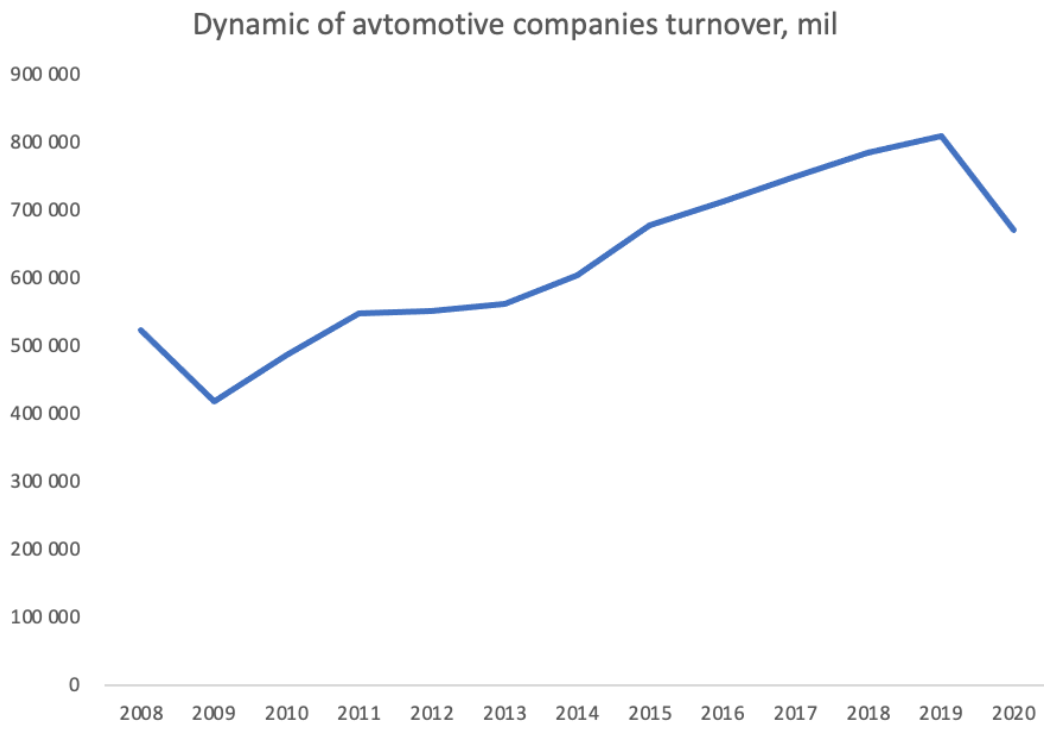
Some companies are going to follow customer trends that are mentioned above and increase the production of electric cars. Stellaris, Volkswagen, Mercedes-Benz, and Volvo committed to enlarging production and selling EVs cars by up to 50% in the next ten years.

Other companies also expressed their intentions regarding implementing electric motors but expected it to be smoother. Because of this, investments in the production of electric cars will increase significantly over the next few years.

### 2.4. Automotive industry under the influence of crises in Europe

Overall, during a crisis, all companies face various types of difficulties. It includes a shutdown in production and productivity: fewer vehicles are sold. Also, a company suffers from an inability to pay debts, changing user preferences to cheaper cars, etc. As shown in figure 3, companies have a decreasing turnover during crises.

Figure 3. Dynamic of automotive companies turnover 2008 – 2020 years

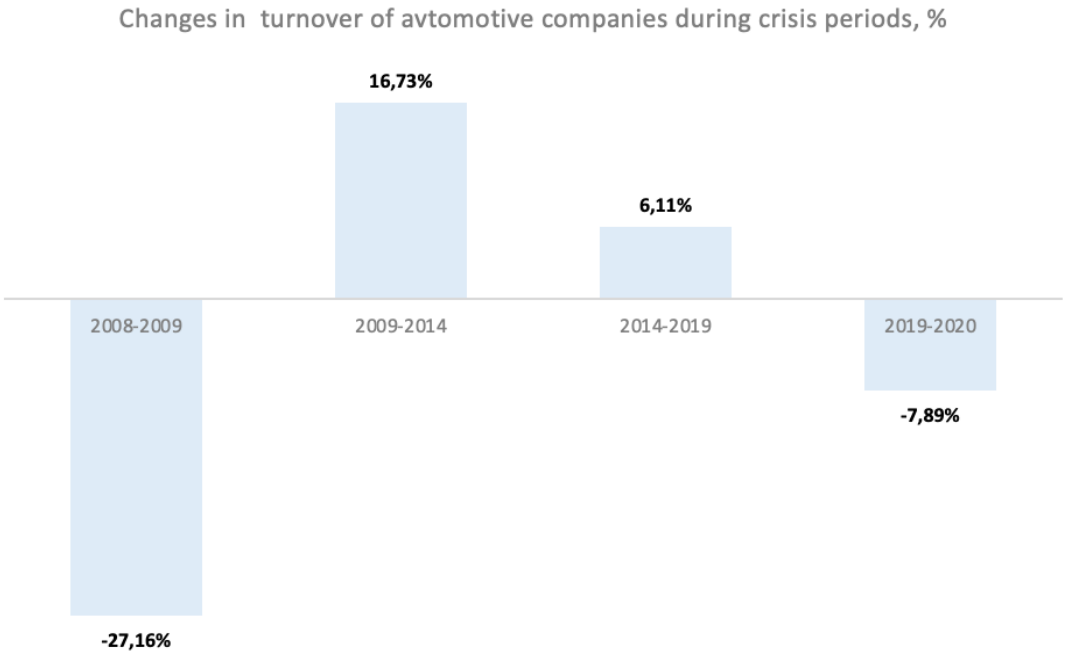



Source: Eurostat

2.5. The Automotive industry during crises in Europe

During the 2009 - 2014 period, in Europe, as seen in Figure 2, turnover increased by 16,53%, which means that companies started recovering and overcoming the consequences of the crisis by opening new departments, hiring more employees, and increasing production. The growth of this index continued until the COVID crisis in 2019, which led to company turnover falling by 7,9%. These losses resulted from the closures of factories (because of the 'lockdown' months) and production capacity, which was challenging to keep at a stable level.

Figure 4. Changes in turnover of automotive companies during crisis periods

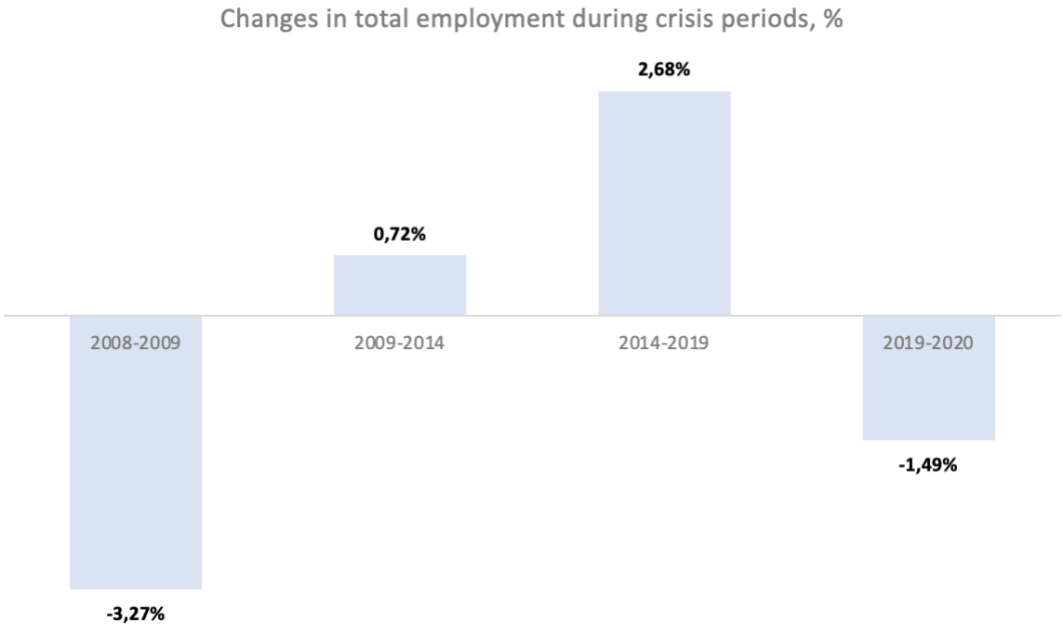



Source: Eurostat

As a result of the economic crisis, government intervention in the sector has become even more critical. European governments offered assistance to different automotive factories by giving more loans, some wage subsidies, and so on. In most cases, these instruments were created to avert factory closures and mass dismissals of employees.

Despite the government's efforts, as shown in Figure 5, a worker decrease was equal to 3,27%. After that, from 2009 to 2014, a slight percentage increase in the number of employees was equal to 0,72%. And significant growth from 2014 till the COVID crisis in 2019 (2,68%). The coronavirus crisis caused a decline in the labor force (-1,49%), a fall in the employment rate as follows an increase in unemployment.

Figure 5. Changes in total employment during crisis periods




Source: Eurostat

## 2.6. Related Studies

The question about companies that suffered the consequences of the impact of the crisis has been analyzed extensively in the literature.

The first group of studies describes the Automotive sector across all European Union and examines methods to choose a suitable measure that displays a level of a company's performance.

The second one focuses on the financial indicators of the automotive sector that was affected by both the 2008 crisis and COVID crises.

In the study about EVA and Key Performance Indicators, the authors, during the quality analysis, discovered different choices of reasonable measures to analyze a company's performance and the key performance indicators.

Economic Value Added EVA has been analyzed and described as one of the best company profit indicators. What is interesting, EVA usually allows managers to explore a company's corporate value. Also, the author analyzed EVA behavior across factories in the car sector before and after an economic crisis.

It was found that there are financial indicators with the most profound negative impact of the EVA indicator. It was also determined that automotive companies showed very similar EVA indicator meanings in the period of economic crisis.

Addressing the question about what is and how fast the automotive sector in Europe is growing, the author clearly describes vital players and other companies with examples.

Moreover, according to the study, the automotive industry is a critical part of the European Union's economy. It has become one of the most important in the last decade, breaking out ahead of other industries.

Further, the competitive ability of the automotive sector was analyzed nationwide, and the future vision of trends in the European Union was described globally. Also, it has outlined, at great length, future changes that may occur.

The authors used statistical analysis methods to develop symmetrical indexes to demonstrate the strengths of the automotive industry in the EU.

Furthermore, it is crucial to investigate the question of the consequences of the economic crisis of the 2008-2009 economic crisis and how financial indicators can be used to warn industries about the coming problem.

Considering that the automotive industry had been one of the most affected sectors by the crisis, we can affect company performance during crises.

The authors' primary research shows that the 2008–2009 economic crisis is considered one of the most brutal in history. It is interesting to see what could have been done if company managers could determine that a crisis was near.

Global motor manufacturing dropped in both the 2008 and 2019 crises. All divisions of global vehicle production were affected by the crisis significantly. As the automotive industry is sensitive to business cycles, this decline is not surprising; this is what the author explains.

According to a study about Covid-19 and transformational megatrends in the European automotive industry, the effects of the Covid pandemic in the European automotive sector were spread in Central and Eastern Europe.

The industry's ongoing transformations and, from year to year, digitalization is used to investigate how the EVA in the automobile industry changes depending on the change in the financial crisis indicators.

In their findings, they discovered that the pandemic crisis provoked the already existing concepts of digitalization and electrification in the automotive industry in Europe.

The first wave of the pandemic in 2019 called up enormous discussions regarding temporary business operations, mostly factory closures. There were also layoffs, but they weren't expected.

Then, the second wave in 2021 and lockdown resulted in a global shortage of semiconductor chips that adversely influenced the EU semiconductor sector.

Finally, according to the creators of the working paper about early warning indicators of crises under closer scrutiny, it turns out that the recognition of appropriate, timely cautionary financial indexes controls the determination of depression occurrence,

which is the dependent variable in early warning models, and on the choice of sample countries.

However, no absolute agreement has been reached on determining depression cases in the literature.

# CHAPTER 3. METHODOLOGY

Pooled Ordinary Least Squares regression (OLS) is used to estimate linear regression equation coefficients. It can help determine the relationship between the dependent variable and some independent quantitative variables, and interpretation is beneficial for research.

Firstly, Pooled OLS regressions will be estimated overall years and then during both the 2008 crisis and COVID crises.

Secondly, we will estimate the likelihood of changing EVA depending on increasing or decreasing the crisis indicators to see how those indexes alter likely EVA through the regression with the Panel model. A Panel model is a regression where data are collected across time and over the individuals, in our case, countries and years. Also, it will help to deal with omitted variable bias. It has three types, and we all of them we will use.

The first type is a Pooled Ordinary Least Square model that estimates cross-sectional data and concludes results overall. The second type is the Fixed effects model, which counts differences between individual entities. And the third type is the Random effects model. Due to this model, we control for differences between countries. Also, we will use the Hausman test to decide whether to use fixed or random effects.

Our independent variables are:

- turnover of companies
- house prices
- interest rate
- EU GDP
- the unemployment rate
- yield curve
- European stock ETFs

Additionally, we are interested in comparing EVA during in and out crises, specifically with factors that affect it. To run this comparison, we include the two samples

where “crise” will consist of periods of 2008,2014,2019 years and subset «not-crises,» which provides for other years.

Finally, after analyzing the studies about 2008-2009 and the crisis in the pandemic and presenting the methodology, control variables and their expected effect on the dependent variables are shown in Table 1.

Table 1. Explanatory variables and their effect on an independent variable

| Variable | EVA |
|---|---|
| Market capitalisation | + |
| ST nterest rate | - |
| EU GDP | + |
| Employment, mln | - |
| LT yield curve | + |
| EU stock | + |

Note: + denotes positive effect, - denotes negative effect

Also, we will find marginal effects that show the change in probability when the predictor or independent variable increases by one unit. For binary variables, the difference is from 0 to 1, so one 'unit' is usually thought.

Finally, we have to avoid the Dummy Variable Trap, which occurs when two or more dummy variables created by one-hot encoding are highly correlated (multi-collinear). This means that one variable can be predicted from the others, making it challenging to interpret predicted coefficient variables in regression models.

# CHAPTER 4. DATA DESCRIPTION

## 4.1. Preliminary analysis of data

The initial data was obtained from the OECD stat platform, which includes data and metadata for OECD countries and selected non-member economies. For this study, we use data from different European countries such as Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, and United Kingdom.

Countries were selected due to their volume of automotive production and the sale of cars. Hence, we understand that the automobile industry is well developed, so research will be relevant and appropriate for estimating the automotive industry.

Data consist of 320 observations and twelve variables. All comments were collected from 2006 to 2021 years. Eleven variables were collected from an online resource in the segment of the country's automobile industry; the leading indicator of EVA was estimated independently since it is not general information.

The selected indicators are the housing price, vehicle production, market capitalization, short-term interest rate, the bond market in the long term, and two types of GDP, employment and unemployment. The change in these indicators leads us to assume that a crisis is approaching or has already occurred, so we will use them in our analysis to assess how they affect the company's EVA.

## 4.2. Secondary data for EVA estimation

Our dependent variable and indicator of companies effectiveness – EVA, was calculated with a formula:

Economic value added = net operating profits after tax - (weighted average cost of capital x capital invested).

All variables were estimated by collecting Europe company's financial reports and grouping them by country.

The formula was decomposed, and EVA was estimated. To decompose a recipe, I took country companies' Sum of Net Income, Sum of Long Term Liabilities, Sum of Total Shareholders Equity, and WACC.

From table 2, we can see the EVA calculation with the following formula:

$$NI*WACC*(TA-CL)$$

where,

NI - Net Income

WACC –the weighted average cost of capital

TA – total assets

CL – current liabilities

Table 2. EVA calculation

| Country | NI | CL | TA | WACC | EVA, |
|---|---|---|---|---|---|
| Austria | 4134829962 | 258449446 | 7465828189 | 4% | 3,826 |
| Belgium | 54755216 | 2763167910 | 8602288732 | 4% | -0,400 |
| Bulgaria | 4620353 | 1426577 | 44711753 | 4% | 0,003 |
| Croatia | 5141377 | 40233395 | 126280170 | 4% | -0,002 |
| Denmark | 149102572 | 273280395 | 803252373 | 4% | 0,106 |
| Finland | 44218339 | 528200872 | 213480781 | 4% | 0,015 |
| France | -3575732740 | 52243283742 | 63681422003 | 4% | -8,213 |
| Germany | 70966998447 | 509149404875 | 487500463079 | 4% | 31,101 |
| Greece | 8000388 | 14015759 | 47920397 | 4% | 0,006 |
| Ireland | 225263168 | 5439392688 | 3183431740 | 4% | -0,120 |
| Italy | -779785880 | 40653589913 | 62483339345 | 4% | -4,905 |
| Latvia | -337736 | 5153598 | 1294531 | 4% | -0,001 |
| Luxembourg | 16788302 | 8938408 | 33295817 | 4% | 0,015 |
| Netherlands | 665853288 | 13692004500 | 10182880014 | 4% | -0,289 |
| Poland | 46363536 | 166552727 | 367084820 | 4% | 0,025 |
| Portugal | 179853828 | 1217864761 | 2850483619 | 4% | 0,017 |
| Romania | 17656617 | 68736039 | 280018830 | 4% | 0,004 |
| Spain | -359576011 | 25121355232 | 21051151357 | 4% | -2,206 |
| Sweden | 2063854181 | 12294455242 | 17926204019 | 4% | 0,855 |

Finally, we used 20 companies and their characteristics as a dataset for the research, and 16 years were taken. To explore data more deeply, let's see overall variations in our dataset(Table 3)

Table 3. Overall variations in statistics of the data

| Statistic | N | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|
| Country | 320 | 5.78 | -9.50 | -4.75 | 4.75 | 9.50 |
| Year | 320 | 4.62 | -7.50 | -3.75 | 3.75 | 7.50 |
| EVA | 320 | 2,587.60 | -7,143.28 | -295.96 | -219.17 | 30,808.01 |
| motor_vehicles_parts | 304 | 74.40 | -57.54 | -47.85 | 14.03 | 269.48 |
| gdp_ppp | 320 | 947.47 | -766.71 | -612.44 | 343.89 | 2,850.64 |
| gdp_2010 | 320 | 1,038.46 | -836.33 | -654.33 | 185.54 | 3,087.62 |
| st_ir | 320 | 2.11 | -2.04 | -1.64 | 0.85 | 9.98 |
| emp | 320 | 10.85 | -8.88 | -7.44 | 5.98 | 30.83 |
| unemp | 320 | 1.14 | -0.93 | -0.77 | 0.55 | 5.04 |

Table 3 represents the overall variations statistics of the data used for the regression analysis. It estimates actual part-to-part variation, excluding the effect of measurement error.

Also, in Table 4, within variation is calculated to centralize data. It refers to variations caused by differences within individual groups (or levels). These are differences not caused by the independent variable.

Table 4. Within variation statistics of the data

| Statistic | N | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|
| EVA | 320 | 2,514.70 | -9,064.78 | -99.67 | 1.19 | 28,886.51 |
| motor_vehicles_parts | 304 | 9.10 | -56.44 | -2.28 | 2.02 | 43.58 |
| gdp_ppp | 320 | 78.17 | -348.31 | -26.78 | 22.26 | 313.69 |
| gdp_2010 | 320 | 78.34 | -371.78 | -25.13 | 21.23 | 334.72 |
| st_ir | 320 | 1.86 | -3.94 | -1.21 | 0.51 | 7.08 |
| emp | 320 | 0.62 | -2.77 | -0.19 | 0.19 | 2.43 |
| unemp | 320 | 0.40 | -2.20 | -0.10 | 0.10 | 2.01 |

# CHAPTER 5. ESTIMATION RESULTS

## 5.1. Panel data model output

As was discussed in chapter 3, two models will be estimated. The first regression is the Panel model, as we want to check the variability of EVA across time, and the second model is a Probit model, as we would like to see how EVA changes during the presence of a crisis through a dummy variable.

The initial dataset was carefully selected and analyzed to meet these requirements:

- completeness of information
- dependence of fluctuations on the period
- lack of correlation between independent variables
- accurate reflection of the crisis period

To meet the requirements to use Panel data, we checked such criteria:

- Sample should be chosen, nº of countries and nº of observed have to be at least 10:1, meaning that the sample size is to be around 100-200 observations (cases).
- contains information across time; in our case, it is 2006 – 2021 years
- data selected from official sources for accuracy
- our data set provides information on indicators, both across countries and over time(data from many units, over many points in time)

To begin with, in our Panel data, the country is the cross-sectional dimension, and the year is the time series dimension.

There are three main types of panel data models estimators:

- Pooled OLS model
- Fixed effects model
- Random effects model

Firstly, we have estimated Pooled OLS model; it is an OLS regression without any cross-sectional or time effects, so all individual special technics were ignored entirely.

From Table 5, we can state that for one additional unit of production of cars across the countries and EVA increases over time.

For this reason, we state that the companies with higher production of cars increase the company's EVA.

Then, we used the «Between estimator,» where each variable is replaced by its mean to see how company production of cars changes EVA in more detail. It was done by regressing the averages of the explanatory variables of the countries against the standards of the outcome variables of the countries. After getting the results, we can conclude that if one country produces units one million more than other countries, it will cause an increase in EVA.

Further, we have done the first-differenced (FD) estimator to solve the problem of omitted variables. The results in Table 5 showed that if GDP increases by one unit from one period to the next, it will positively affect EVA, so changes in private consumption, investments, and government spending can decrease or increase the economic added value of the automotive industry. And overall, the well-being of the whole country's attitudes automotive sector.

To control for the individual-specific characteristics that don't change over time, we use the Fixed effects model, which lets us suppose variables have different intercepts in the regression. Table 5 shows that if market capitalization in a specific country will increase by one unit over its mean, the country`s EVA increases. It follows the size of a publicly traded company and costs more when it has a higher EVA.

Further, by exploring the country`s individual specific effects (where we extract fixed effects to see the leftover variation in EVA that the regressors cannot explain), we can conclude that the first country would have EVA FE higher than the average country; it means that there is something else in countries that makes EVA higher.

To continue, we also regress the Random effects estimator, and unlike fixed effects, random effects hypothesize that a particular country/year has different disturbances.

The conclusion is that EVA increases if the average production changes by one unit, as if more cars are produced and sold, profit will be higher. Interpretation of the coefficients is tricky since they include both the within-entity and between-entity effects.

In our case, data represents the average effect of car production over EVA when cars' production changes across time and between countries by one unit.

Table 5. Summary of Panel data models

| | Dependent variable: | | | |
|---|---|---|---|---|
| | EVA | | | |
| | RE | FE | FD | OLS |
| | (1) | (2) | (3) | (4) |
| motor_vehicles_parts | 9.6245* | 28.4628 | 23.1693 | 9.6245* |
| | (5.7848) | (18.2651) | (26.9597) | (5.7848) |
| ls_mar_cap | -0.00002 | 0.0017** | 0.0008 | -0.00002 |
| | (0.0003) | (0.0007) | (0.0009) | (0.0003) |
| LT_bond | -52.6824 | -13.1674 | 6.4083 | -52.6824 |
| | (73.0997) | (91.1739) | (173.3167) | (73.0997) |
| st_ir | -9.4282 | 11.5660 | -30.8925 | -9.4282 |
| | (99.6673) | (112.3901) | (253.7356) | (99.6673) |
| gdp_ppp | 0.6932 | 3.7622 | 27.6368*** | 0.6932 |
| | (1.3301) | (4.0068) | (7.0948) | (1.3301) |
| emp | -91.1135 | -258.6541 | -1,647.3060 | -91.1135 |
| | (102.7026) | (509.5594) | (1,268.7330) | (102.7026) |
| Constant | 302.3838 | | -0.5807 | 302.3838 |
| | (300.2708) | | (242.9951) | (300.2708) |

To decide which model to use, the Hausman test is used to determine whether to use fixed effects or random effects estimators. Here are two hypotheses that we are exploring:

- H0: FE coefficients are not significantly different from the RE coefficients
- Ha: FE coefficients are substantially different from the RE coefficients

After the test, we see that the Hausman test statistic is insignificant, so we use the RE estimator because it is efficient.

Also, if we take two different subsets, where a crises dataset includes data from 2008, 2015, and 2020 years and no crises – all other data, to see how EVA changes during crises, in Table 6, we have results that the production of cars negatively changes

EVA during crisis years and positively when there are no crisis years. Such independent variables as car production negatively influence EVA during crises and vice versa.

Table 6. Results on Pooled OLS estimation during two periods

| | Dependent variable: | |
|---|---|---|
| | EVA | |
| | Not | Crisis |
| | (1) | (2) |
| motor_vehicles_parts | 16.970** | -19.270*** |
| | (6.819) | (4.432) |
| ls_mar_cap | -0.0002 | 0.0001 |
| | (0.0003) | (0.0003) |
| LT_bond | -77.434 | 0.668 |
| | (81.821) | (87.392) |
| st_ir | -63.311 | 58.337 |
| | (109.276) | (137.705) |
| gdp_ppp | 0.159 | 1.243 |
| | (1.545) | (1.150) |
| emp | -59.156 | -48.207 |
| | (120.132) | (87.076) |
| Constant | 413.062 | 105.167 |
| | (354.545) | (240.462) |
| Observations | 242 | 56 |
| R2 | 0.089 | 0.459 |
| Adjusted R2 | 0.066 | 0.392 |
| F Statistic | 3.824*** (df = 6; 235) | 6.922*** (df = 6; 49) |
| Note: | | *p<0.1; **p<0.05; ***p<0.01 |

# CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

In this study, we investigated the impact of financial crisis indicators on the Economic Value Added by automotive producers. The main focus was searching for any crisis factors' dependence on EVA through regressions. As we have time-series data, we decided to make a panel dataset and use panel model estimation.

The literature studied mainly describes the automotive industry as a significant contributor to Europe's steady development, particularly in terms of employment. The automobile industry has employed almost 13.8 million Europeans, or 6% of all employment in the EU. Speaking of manufacturing, the direct creation of motors employs roughly 2.6 million people. The most prominent producer of motor vehicles is the European Union. The EU Commission makes significant R&D investments to promote competitiveness. In context, it will maintain the EU's position as a global leader.

Firstly, OLS estimation was done, and we had to choose between fixed-effect or random-effect estimation. To do so, the Hausman test was done.

While collecting information, many studies were explored, and most concentrated on the general crisis impact on different industries, especially the automotive industry. The first group of studies examines the Automotive sector across the European Union and identifies the most appropriate performance indicators demonstrating a company's level of performance.

The second one examines the financial indicators of the automotive sector, which was also affected by the financial crisis of 2008 as well as the COVID crisis.

As part of the quality analysis of the study of EVAs and Key Performance Indicators, the authors determined that various reasonable measures can be used to analyze a company's performance and KPIs.

Graphs were created and analyzed to check how the company reacted to the crisis. For example, it is shown in Figure 3, which describes a dynamic of automotive companies' turnover during the whole period that companies have a decreasing turnover during crises, and it is because of financial stability of the country falls, and for

sure it will impact all companies that are in a country that is in crisis. Also, we can see in Figure 4 very contrasting changes in the turnover of automotive companies before, during, and after crisis periods. We can conclude that companies started recovering and overcame the consequences of the crisis as companies turnover increased by 16,53% after the crisis, it was done by opening new departments, hiring more employees, and increasing production. During crises, despite the government's efforts, as was shown in Figure 5, an employment rate fell to 3,27%, cause companies should fire employees and cut celeries.

To see from the statistic side how crises impact the automotive sector, we collected some data. The original data was obtained from the world the OECD stat platform, which includes data and metadata for OECD countries. Dataset has 320 observations and twelve variables. All observations were collected from 2006 to 2021 years.

To see in practice the impact of crisis factors on EVA, we did three models: the general panel model for the whole period and two other panel model estimations for the crisis period and non-crisis. Pooled OLS model was used to look through overall how EVA changes over time. Fixed and Random effect was used to estimate Panel data with attention to detail. A fixed-effects model for prediction supports only the levels/categories of characteristics utilized for training. In contrast, a random-effects model enables prediction regarding the population from which the sample was taken.

Overall, after models were run, we can state that one additional unit of production of cars across the countries causes EVA increases over time, so one of the main factors in companies' success is manufacturing. Such variables as market capitalization and GDP showed a positive impact on EVA during the whole period.

Additionally, when we analyze the impact in more detail and investigate the influence of indicators over two periods: crises and not crises, we will get the following result - Table 6 shows that the production of cars affects EVA negatively during crises and positively when there are no crises. A crisis dataset includes data from 2008, 2015, and 2020, while a no crises dataset includes data from all other years. During the crisis, independent variables, like vehicle production, negatively impacted EVA and vice versa.

So, our hypothesis is confirmed. Companies' performance depends on the market situation, the nation's well-being, the number of employees, and manufacturing.

In general, prediction models are helpful to managers of automotive companies, and it is critical to developing new models to increase their accuracy and decision-making speed.

Finally, for a deeper analysis, taking into account the constraints of the dataset utilized in this study, it would be helpful to think about launching a survey that would include other business characteristics such as monthly or yearly financial reports, salaries, and age to have more personalized data of each company.

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