Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics and Management

Diploma Thesis

A Strategic Analysis of Covid-19 Impacts on a Selected Company

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bc. Daniil Maslennikov

Economics and Management
Economics and Management

Thesis title

A Strategic Analysis of Covid-19 Impacts on a Selected Company

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Objectives of thesis

Abstract
In order to precisely evaluate the impacts of COVID-19 on Carrier Global Corporation, the thesis will discuss the company overview, revenue data on the year 2020 as well as the previous year of 2019 in order to carry out a sophisticated comparative analysis of the two data sets. The thesis will shed light on various strategies the company has implemented to overcome the pandemic driven economic challenges, as with major changes in the manufacturing ecosystem, many companies are struggling to meet high demands while others are facing extreme pressure to cut operational costs. The practical part will represent a thorough econometric analysis to process the acquired data. Hypothesis will be proposed in the form of assumptions in each econometric model. The acquired results will then be presented. Conclusions based on the interpretation of results will be discussed. The diploma thesis will discuss strategies for future success to achieve better results when it comes to business continuity and pose questions for future research.
Objectives of thesis

The main objective of the thesis is to examine the revenue shift in a selected company in the year 2020 considering the impacts of COVID-19. The selected company is Carrier InterAmerica Corporation (CIAC) where I am employed. The company is a subsidiary of Carrier Enterprise, a joint venture formed by Watsco Inc. and Carrier Corporation. CIAC opened its doors in September 1985 and supports Central America, Caribbean and Andean Countries. Carrier offers air conditioning, heating and refrigeration solutions for residential, light commercial to commercial applications. The offering includes equipment, controls, parts, supplies and service. The company has helped cool many important projects across Latin America, from shopping malls, hospitals, universities, factories, supermarkets to office buildings.

The partial goals of the thesis are such as following:
- To collect data on the year 2020 as well as 2019
- To analyse and interpret the obtained data
- To carry out a comparative analysis on the two data sets
- To process the collected data using econometric models

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. The journal of finance, 52(4), 1411-1438.
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Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of financial economics, 3(4), 305-360.
Lancaster, T. (1990). The econometric analysis of transition data (No. 17). Cambridge university press.
McFadden, D. L. (1984). Econometric analysis of qualitative response models. Handbook of econometrics, 2, 1395-1457.
Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. The Journal of finance, 43(1), 1-19.

Methodology

Methodology

Further literature review will be conducted to facilitate better understanding of the research problem being studied. Methodology of the thesis will be based on a general empirical quantitative approach gathered from the company databases. Econometric analysis will be conducted in the practical part of the thesis to evaluate the acquired data.

Keywords: COVID-19, coronavirus, manufacturing industry, technology, HVAC, Carrier Global Corporation, forecasting, information, data, production

The proposed extent of the thesis

45

Keywords

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Recommended information sources

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Expected date of thesis defence

2020/21 WS – FEM (February 2021)

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Prague on 29. 03. 2021

Declaration

I declare that I have worked on my diploma thesis titled "**A Strategic Analysis of Covid-19 Impacts on a Selected Company**" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2021 _____

Acknowledgement

I would like to thank Ing. Inna Čábelková, Ph.D. for her advice and support during my work on this thesis.

A Strategic Analysis of Covid-19 Impacts on a Selected Company

Abstract

In order to precisely evaluate the impacts of COVID-19 on Carrier Global Corporation, the thesis will discuss the company overview, revenue data on the year 2020 as well as the previous year of 2019 in order to carry out a sophisticated comparative analysis of the two data sets. The thesis will shed light on various strategies the company has implemented to overcome the pandemic driven economic challenges, as with major changes in the manufacturing ecosystem, many companies are struggling to meet high demands while others are facing extreme pressure to cut operational costs. The practical part will represent a thorough econometric analysis to process the acquired data. Hypothesis will be proposed in the form of assumptions in each econometric model. The acquired results will then be presented. Conclusions based on the interpretation of results will be discussed. The diploma thesis will discuss strategies for future success to achieve better results when it comes to business continuity and pose questions for future research.

Keywords: COVID-19, coronavirus, manufacturing industry, technology, HVAC, Carrier Global Corporation, forecasting, information, data, production

Strategická Analýza Dopadů Covid-19 na Vybranou Firmu

Abstrakt

Aby bylo možné přesně vyhodnotit dopady COVID-19 na Carrier Global Corporation, bude práce diskutovat o přehledu společnosti, údajích o tržbách za rok 2020 i za předchozí rok 2019 s cílem provést sofistikovanou srovnávací analýzu těchto dvou datové sady. Tato práce osvětlí různé strategie, které společnost zavedla k překonání pandemických ekonomických výzev, protože s velkými změnami ve výrobním ekosystému se mnoho společností snaží splnit vysoké požadavky, zatímco jiné čelí extrémnímu tlaku na snižování provozních nákladů. Praktická část bude představovat důkladnou ekonometrickou analýzu pro zpracování získaných dat. Hypotéza bude navržena ve formě předpokladů v každém ekonometrickém modelu. Získané výsledky budou poté prezentovány. Budou diskutovány závěry založené na interpretaci výsledků. Diplomová práce pojednává o strategiích budoucího úspěchu k dosažení lepších výsledků, pokud jde o kontinuitu podnikání, a položí otázky pro budoucí výzkum.

Klíčová slova: COVID-19, koronavirus, zpracovatelský průmysl, technologie, HVAC, Carrier Global Corporation, předpovědi, informace, data, výroba.

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1 Introduction

The future normally follows a predictable pattern. However, a year unlike any other meant that the future came early and in a foul mood for consumer goods and retail industries. COVID-19 shut down retail locations across the world in March 2020, causing customers to change their shopping habits, and as a result, these two industries will never be the same. (25)

Executives around the world are worried about the crucial next months of the pandemic now that scientists have begun working on vaccines. Now is the time for companies to concentrate their energies on supporting key aspects of their operations that will help them stabilize in the new normal and plan for the future. (42)

It goes without saying that the pandemic has brought with it a number of unpredictable variables, many of which current contingency plans and teams were unprepared to deal with. While the impacts on smaller business can be devastating, many larger organizations have managed to successfully build incident response strategies tailored to this crisis.

The HVAC (Heating, Ventilation, and Air Conditioning) industry, like many others, is extremely sensitive to economic downturns. (26) As the coronavirus outbreak worsens, European and American companies will experience significant losses as a result of a decline in local industrial output, while Asian producers, already facing a sharp supply cut as a result of China's lockdown, will see a drop in demand.

The industry's key players have largely concentrated on the imminent problems that must be overcome in order to sustain optimum market stability, as well as a deeper understanding of the supply chain ecosystem's limitations and ever-changing output needs.

Simultaneously, there is a need to rebuild businesses into ones that are as future-oriented as possible, using innovative technologies to ensure their resilience. These policies aim to boost business resilience, protect production, and provide essential support to employees not only during the recession, but also to help businesses retain a competitive edge, which will help them develop faster once the economy recovers.

Various technologies have adapted more quickly as a result of the pandemic. In the near term, the pandemic is putting pressure on organisations to innovate, allowing for ecosystem-wide innovation. Development and technology opportunities, that companies previously had to plan for over a few years, are now available in just a few weeks. The

problems and challenges that have come with the pandemic necessitate fast innovation and rethinking of how businesses operate.

COVID-19 has the potential to have three significant impacts on the global economy:

- Directly impacting production and demand,
- Creating supply chain and customer volatility,
- Affecting companies financially.

In most countries, COVID-19 has resulted in flight cancellations, travel bans, and quarantines, as well as all indoor activities being limited. A significant slowdown in the Industrial HVAC market has been registered, as has a drop in company morale, rising public fear, and uncertainty about the future.

Globally, companies record a drop in demand for their goods and services. The situation could be better for large businesses; however, large businesses face greater value chain challenges than small and medium businesses.

Although the effect of Covid-19 on companies' financial well-being varies by sector, one thing is certain: customers have cut back on their spending due to lower incomes or uncertainty and fear of a potential long-term crisis.

Overall, at the time of a pandemic, it is vital for a large company like Carrier Corporation, to preserve organizational stability, continuity, and security while delivering a guaranteed level of service. Since the company's production processes, as well as its customers' business processes, cannot be prevented, it is important to closely track and evaluate the evolution of the situation, as well as take steps to ensure the continuity of production processes and customer service, all while protecting health and safety of staff, customers, partners, and visitors. (15)

2 Objectives and Methodology

2.1 Objectives

The main objective of the thesis is to examine the revenue shift in a selected company in the year 2020 considering the impacts of COVID-19. The selected company is Carrier InterAmerica Corporation (CIAC) where I am employed. The company is a subsidiary of Carrier Enterprise, a joint venture formed by Watsco Inc. and Carrier Corporation. CIAC opened its doors in September 1985 and supports Central America, Caribbean and Andean Countries. Carrier offers air conditioning, heating and refrigeration solutions for residential, light commercial to commercial applications. The offering includes equipment, controls, parts, supplies and service. The company has helped cool many important projects across Latin America, from shopping malls, hospitals, universities, factories, supermarkets to office buildings.

2.2 Methodology

Further literature review will be conducted to facilitate better understanding of the research problem being studied. Methodology of the thesis will be based on a general empirical quantitative approach gathered from the company databases. Econometric analysis will be conducted in the practical part of the thesis to evaluate the acquired data.

3 Literature Review

Fundamental shifts in customer behaviour, supply chains, and routes to market have thrown businesses off balance as a result of the COVID-19 crisis. As a result of the pandemic, industry leaders must intensify the implementation of agile working practices and value chain change to better navigate uncertainty. (8)

Becoming an Intelligent Enterprise today, means moving away from top-down decision-making to empowering teams directed by intent, driven by data, powered by technology, and enabled by cloud. The Intelligent Organization has the potential to self-manage and adapt dynamically. It's designed for adaptability, resiliency, and expansion. (36)

3.1 Coronavirus and the World Economy

While the way Covid-19 has impacted the financial well-being of companies may vary from industry to industry, one thing that remains certain is that consumers have reduced their spending due to lower incomes or uncertainty and fear of a possible long-term crisis. (4)

Companies globally report falling demand for their products and services. The trend was more reflected in medium and small businesses. For large companies the situation might be better, however, large businesses, in their turn, face greater value chain challenges compared to small and medium businesses. (4)

The spread of COVID-19 has disrupted the largest value chains in China, the United States and Europe. This has led to a drop in industrial production, a decrease in exports and imports, in some cases - even to a halt in production. (1)

There is a widespread agreement that the pandemic will have a serious long-term negative impact on the world economy. Early estimates predicted that if the virus became a global epidemic, most economies would, already have cut their economic growth forecast for 2020 from 3.0 to 4.5 percent. Global GDP in 2019 was estimated at about $ 6,866.6, which means that a 0.4 percent drop in economic growth accumulates to an almost $ 3.5 trillion loss in economic output. However, those forecasts were made before COVID-19

became a global epidemic, before large-scale steps could be made to stop the spread of the virus. (52)

Since the outbreak of the Covid-19, global industries have faced growing challenges. The first impact came from China, where strict quarantine measures were taken, within which several large cities were closed from the outside world, causing the suspension of production, retail and wholesale trade in the country. Now that large segments of the global economy are isolated, especially in Europe and North America, in addition to manufacturing and trade, local consumption has also been hit hard. Lower demand in these regions will also affect the production and import of goods. (41)

The prolonged closure of Chinese assembly plants has led to the suspension of orders to manufacturers of electronic components, especially those located in countries that produce the most advanced memory chips, computing and telecommunications chips used in consumer electronics. South Korea (which accounts for 19% of global value added in electronics manufacturing), Taiwan (13%) and Japan (12%), as well as Chinese manufacturers themselves (19%) faced the greatest risks. Manufacturers of semiconductors and microcircuits based in Europe and the United States supply products mainly to customers located in their region, and therefore did not initially feel the impact of the quarantine measures introduced in China. (1)

The market capitalization of companies in the industry declined globally by more than 10% between the onset of the coronavirus outbreak and March 10, 2019 indicating a decrease in liquidity for the most vulnerable players. (16)

The crisis has already affected 81% of the global workforce, including 463 million industrial workers. The decline in supply and demand leads to a drop in the income of enterprises, which, in turn, cut wages and lay off employees. (16)

The crisis has had the greatest impact on the automobile and aircraft manufacturing, electronics, and extractive industries. All of these sectors face similar challenges: declining demand, staff shortages, limited supply and forced plant closures.

Enterprises now have to adapt to the new realities of the market: revise product lines and promotion channels, introduce robotics and artificial intelligence, and change working conditions for employees. But the state should not stand aside either. Delays in payments and taxes, loans to businesses and the gradual lifting of restrictions - all this will help companies survive the crisis.

It goes without saying, that it is almost impossible to find an area that has not been affected by the pandemic. While this situation has few positive aspects, such as the improved ecology, the global changes in industrial production caused by the COVID-19 pandemic have serious operational, social and financial implications. This is forcing manufacturers to simultaneously rethink their risk management and response plans, business recovery and continuity, manufacturing operations and new ways of working. (49)

The decline in economic activity and restrictive measures have improved the air quality and led to a reduction in greenhouse gas emissions. The main contribution was made by the closure of industrial enterprises, a decrease in traffic flow and the suspension of passenger flights. However, there are fears that a return to the original level of pollution will not only not be long in coming but will also be aggravated by new types of waste. And here it is important to approach the solution of environmental and climate issues at a qualitatively different level, taking into account the changes caused by the coronavirus. (49)

The industry key players have largely focused on the immediate challenges needed to maintain maximum business stability, to better understand the ever-changing production needs and the constraints of the supply chain ecosystem. At the same time, there is also a need to focus on creating businesses that are as future-oriented as possible, using new technological solutions to make them resilient. Those strategies aim not only to improve business resilience, protect production and provide the necessary support to workers during the crisis, but also help maintain a competitive advantage, which will accelerate business growth when the economy begins to recover. (46)

Demand priorities in product portfolios have changed dramatically. Here we see three main options for the development of the situation with the participation of production assets:

- Manufacturers are shifting to take advantage of the opportunities to create fast-growing businesses (for example, canned, shelf-stable and frozen foods, respirators, personal protective equipment).
- Manufacturers are realigning existing lines to create new products to support the needs of the community (for example, distilleries that make hand sanitizers).
- Manufacturers are reducing volumes or phasing out production in areas where there is a sharp decline in demand or supply chains have been seriously disrupted.

In all three scenarios, manufacturers need to quickly identify the products most critical to achieving stability and growth, strengthen their supply chains, and align the necessary knowledge and skills to meet near-term and future demand.

COVID-19 has impacted almost every area of the global economy, in some cases even more so than the financial crisis of 2008-2009. When the global economy will be able to completely recover is still unknown. The effect of the coronavirus epidemic on society, and thus on consumer behaviour, international trade ties, and regulatory requirements for the protection of manufactured products, is difficult to predict. Experts are attempting to consider what kind of world we are heading to, as well as the economic prospects for nations, continents, and leading sectors, in one way or another. (45)

Experts are attempting to consider the kind of world we are heading to, as well as the economic opportunities for individual states and leading industries, as the world rapidly moves into the second phase of the COVID-19 pandemic amid relaxing restrictions and attempts to coexist with the virus.

This is unsurprising, considering that countries like Italy and the United Kingdom are on the verge of losing 9.5 percent and 14% of their GDP, respectively. The US GNP was expected to fall 5.9% in 2020 in the previous IMF survey, but it fell 32.9 percent in the second quarter of this year alone. (45)

The COVID-19 pandemic has exacerbated the situation for most multinational corporations. Traditional sources of foreign direct investment have been disrupted by quarantine steps and the decline of global economic activity (FDI). A slew of new restrictive FDI policies around the world has harmed global growth opportunities even further. When it comes to foreign trade, the picture is bleak, particularly when it comes to supply chains. (37)

CEOs are turning their attention away from short-term economic damage management and toward long-term corporate sustainability. Global supply chains are likely to become more geographically and territorially scattered in the future. However, cost considerations, global political instability, and the need to plan for potential post-coronavirus crises would necessitate a highly diversified and versatile approach.

A variety of sectors that are prime targets for FDI have also been disrupted by the virus. Due to social distancing, quarantines, and travel restrictions, demand for hospitality, tourism, retail, entertainment, and transportation (especially aviation) has plummeted.

Electricity consumption, a key indicator of economic activity, has dropped dramatically, as has demand for electricity.

The issue is that it is unclear how soon the global economy will recover. Furthermore, the effect of the coronavirus epidemic on culture and, as a result, consumer behaviour, foreign trade ties, and new legislation governing manufacturing safety standards is difficult to predict. In all countries around the world, the government's mission is to restore jobs and economic growth.

The resumption of production necessitates cooperation with suppliers, technical improvements to provide the required "social distance," and the receipt or manufacture of personal protective equipment. (18) In the automotive industry, nearly half of workers will work from home without losing any productivity (for example, engineers developing new models or test samples). When it comes to manufacturing parts or running an assembly line, however, this is not feasible. (2)

3.2 Carrier Corporation: Company Overview

United Technologies Corporation announced their intention to divide into three separate companies in November 2018: (50)

1- UTC, a leading aerospace company consisting of the Collins Aerospace and Pratt & Whitney businesses,
2- Carrier Global Corporation (“Carrier”), a leading global provider of HVAC, refrigeration, fire, and protection solutions,
3- And Otis Technologies Corporation (“Otis”).

They concluded a merger agreement with Raytheon Company (“Raytheon”) in June 2019, under which the UTC aerospace businesses and Raytheon will combine on an equal footing. UTC's common stock will remain outstanding after the Otis and Carrier spin-offs and the Raytheon merger are completed, and the company will be called "Raytheon Technologies Corporation." (50)

In this thesis, we will carry out a strategic analysis of Carrier Corporation. Carrier is the world's largest supplier of HVAC, cooling, fire, and protection solutions. Starting with its founders, Willis Carrier, who invented the world's first modern air conditioning device, Robert Edwards, who patented the first electronic alarm bell, and Walter Kidde, who created

the first integrated smoke detection and extinguishing system for use, the business is founded on a tradition of invention.

As an independent publicly traded firm, Carrier holds a strong position by:

- Investing in desirable geographical areas,
- Developing new technology to further broaden our services and spare parts business,
- Strategically optimize our product and service portfolio and,
- Focus on cost-effective results.

Carrier's core mission, to concentrate on developing smart, sustainable, and effective solutions to meet the complex challenges of megatrends in urbanization, climate change, and food security driven by the increasing global population, rising living standards, and rising energy and environmental efficiency, continues the company's creative spirit today. Their wide range of goods and services, as well as the credibility of their top brands for quality and creativity, make them a supplier and business partner of choice, with over 200 new products launched in the last couple of years. (11)

Carrier's cutting-edge technologies allow smarter, safer, and more sustainable buildings and infrastructure, as well as effective protection of perishable products' freshness, quality, and safety in a variety of industries. The company is a trusted provider for their customers' critical applications in building, transportation, defence, food retail, pharmaceutical, and other industries because of our broad range of products and services, our reputation for quality and innovation, and our top brands. (50)

Carrier is founded on a legacy of innovation. This subculture of innovation helps with the strategy of developing intelligent, sustainable and green solutions to meet the complicated challenges of megatrends in urbanization, weather exchange and growing meals security requirements due to the meals needs of our growing international population, rising living standards and growing energy and environmental performance. (29)

The global presence of the company is extensive, with approximately 53,000 employees worldwide, and with solutions sold in more than 160 countries. Distributors, independent sales representatives, wholesalers, dealers, other channel partners, and retail outlets market the goods and services directly to end customers and indirectly by distributors, independent sales representatives, wholesalers, dealers, and other channel partners. (50)

It goes without saying that the industry-leading portfolio of iconic brands, a wide variety of diverse product and available services, the outstanding reputation for innovation and quality distinguish Carrier as a noted trustworthy provider to its customers across an abundance of emerging markets and channels for commercial and residential building, industrial, and intelligent applications.

The company's strategic advantages include the following:

- **Iconic brands and market-leading positions are represented in its portfolio.** The prevailing and iconic brands that fall under the company, are among the most well-known in their respective fields. While being market-leaders in their respective segments, when taken together, those brands form a distinctive portfolio of trusted assets that, when combined with the corporation's ability to deliver broad, cutting-edge solutions, make the company a preferred supplier and business partner.
- **A wide and diverse selection of solutions, sectors, and clients.** In many sectors, the company provides a wide and diverse range of goods and services. Despite the fact that many of the products and brands are market leaders, the business model is not reliant on any single product, brand, industry, or consumer. The offered solutions address a wide range of problems for a wide range of customers in a variety of applications and places, all while benefiting from the core operating strategies with innovation emphasis.
- **Global reach and a presence in emerging markets.** In terms of design, production, sourcing, distribution, and marketing, the company's global scope and broad offering of goods and services give it an advantage over other providers. With its knowledge of local circumstances, legislation, and consumer needs the company is able to concentrate on appealing verticals and geographies while adapting more quickly to evolving regulatory conditions. This experience also allows for adapting the learnings, innovations, and products created for one area or group of consumers to others, resulting in increased development and value for its stakeholders.
- **Long standing and strong relationships with distributors.** Over the years, the company has developed continuing partnerships with a large network of channel partners, acquiring a unique position to meet the needs of the customers across industries and geographies. In several cases, these alliances have evolved over decades of selling HVAC, refrigeration, fire, and protection products to provide

personalized solutions for a wide range of customers and applications. There also exist a variety of joint ventures and strategic partnerships with channel partners that match the company's incentives making it easier to attract new businesses together.

- **Proven innovation track record with an emphasis on global megatrends.** With a long history of innovation in all of its divisions, the current goals of the company include solutions targeting the challenges posed by mega-trends such as urbanization, climate change, and the rising global population's food needs. As a result, the company has extended its global technical team by around 20% to about 3,600 engineers. To secure the R&D investments in new products and services, Carrier has approximately 7,000 active and pending patent applications around the world.
- **Management team consisting of experienced and a well-trained staff.** On top of all operations is an experienced team that employs approximately 53,000 people worldwide. With 80% of the total workforce based outside the territories of the USA, the broad regional expertise is presented, helping Carrier Corporation to maintain strong customer relationships. The extensive experience of the executive team drives growth and operational excellence across various industries. (50)

Carrier Corporation plans to expand by offering a wide range of solutions to its diverse sectors, geographies, and customer bases to address the evolving challenges presented by global mega-trends, as well as innovating ahead of market constraints. With its main strategies including a dedication to establishing a best-in-class cost structure as a stand-alone business, the company aims at becoming a market leader maintaining its proven record and dedication to designing smarter and more sustainable environment for all of us to live in. (50)

3.2.1 Competitors within the HVAC Industry

The HVAC market is projected to expand by $ 2.82 billion between 2020 and 2024. The increased demand for energy-efficient HVAC systems and the rising adoption of cleanrooms across industries are driving the market forward now more than ever. Furthermore, the market is expected to expand in response to rising demand for energy-efficient HVAC systems. (38)

The key players in the global HVAC system market in 2019 were Daikin (Japan), Ingersoll Rand (Ireland), Johnson Controls (US), LG Electronics (South Korea), Carrier Corporation (US), Electrolux (Sweden), Emerson (US), Honeywell (US), Lennox (US), Mitsubishi Electric (Japan), Nortek (US), and Samsung Electronics (Korea). (38)

Daikin (Japan) is a major player in the air conditioning and fluorochemicals industries, thus playing as a major competitor for Carrier Corporation. It manufactures general air-conditioning equipment and has in-house departments that specialize in both air conditioning and refrigerants. The firm is divided into three market segments: air conditioning, chemicals, and others.

Another major competitor is Johnson Controls. Building technology and power solutions are two of the company's main business segments. HVAC equipment, HVAC controls, energy-management systems, protection systems, fire detection systems, as well as fire prevention solutions are all part of the Building Technologies & Solutions segment. It also sells heating, cooling, air handling, and control systems. (38)

As opposed to its competitors, Carrier Corporation has a leadership position in North America offering a wide variety of products and solutions, including cooling, heating, ventilating, and building automation systems; refrigeration; fire, flame, gas, smoke, and carbon monoxide detection; portable fire extinguishers; fire prevention systems; intruder alarms; access control and video monitoring systems, trying its best to stay ahead of competition.

3.2.2 An Overview of Impacts of COVID-19 on the HVAC Industry

The HVAC industry, as well as those producing intermediate goods, is highly reactive to the economic downturn. As the coronavirus outbreak intensifies, European and American companies will suffer serious losses due to a drop in local industrial production, while Asian manufacturers, already affected by a sharp supply cut as a result of China's quarantine measures, will face a drop in demand due to an expansion of quarantine globally. (35)

Companies all over the world are cancelling major events, festivals and promotions and coming up with ways to help people who fear for their lives. In 2020, organizations were forced to move quickly to digital rails of business development, placing IT staff in leading

positions to cope with critical changes and minimize the impact of the COVID-19 pandemic on their financial performance. According to the study, this led to a 3-fold acceleration in the implementation of digital transformation projects.

But such rapid innovation also has a downside, so it's not surprising that IT professionals find themselves in a difficult situation reporting that they are under increasing pressure at work and admitting that it is difficult for them to recover from end of the working day and switch to personal matters.

A recent study by AppDynamics highlights that accelerated digital transformation has led to significant technical complexity in IT departments, with IT professionals citing the following factors as the main reasons: (6)

- Updated set of priorities and challenges,
- Growth in the rate of deployment of technologies and the simultaneous use of traditional and cloud solutions,
- Accelerated transition to cloud,
- Many disparate monitoring solutions.

The increasing complexity of IT infrastructures has led to a significant increase in the amount of data generated by the technology stack, from applications and infrastructure to networking and security.

While most technicians recognize the importance of monitoring the IT stack, an overwhelming majority of all 92% of respondents believe that the most important result of innovation in 2021 should be the ability to link technology performance with business outcomes, such as customer service quality, quantity completed transactions, sales volume and total income. (6)

Standard monitoring tools deliver massive amounts of information that are too resource intensive to analyse, while technicians need the ability to monitor key metrics and focus on those aspects that affect core business processes.

At the same time, the stakes are higher than ever as HVAC organizations need to link end-to-end observability of the technology stack with business metrics over the next 12 months to stay competitive in the market.

The summer wave of research recorded the stabilization of the confidence index at low values, fluctuating for the second month at a level close to 28% decrease by 2018. According to the research, the pandemic has changed the role and meaning of the digital

shopper experience - just look at the rise in the volume of e-commerce around the world. In April 2020, Visa reported an 18% increase in spending on online sales in the United States. The company also announced that 13 million Latin American Visa cardholders made their first online transactions in the first quarter of 2020. This date is very important for our research as Latin America is a top market for Carrier Corporation. (50)

A way to quickly update information and data is important to understand the needs of customers, as well as to quickly remove from offers what is no longer relevant. If the company can provide customers with the ability to manage digital experiences, it will also provide a quick way to get information about wishes and needs.

As of June 2020, many businesses are working with reduced headcounts as well as distancing rules. AI can help people come up with solutions and ideas to create a more agile organization. From virtual assistants to AI thermal cameras for fever detection, artificial alert tools help keep people healthy and informed. (6)

In the long term, the entire robotics ecosystem will grow at an accelerated pace. Robotization will spark a surge in the development of IoT devices and 5G networks. There will be more demand for tools for telemedicine and VR- assisted learning. (44)

As of June 2020, consumers are increasingly frustrated by the constant changes and updates in their purchased products. Meanwhile, the crisis is increasing the need for smart and renewable solutions. In the short term, such devices are becoming tools in the fight against the pandemic. For example, smart thermometer company Kinsa has a dataset of users' body temperature, from which the US Health Weather Map was created, which breaks down the data by county. (44)

The pandemic has accelerated the adaptation of various technologies. In the short term, the pandemic is stressing ecosystems for innovation, opening up opportunities for ecosystem-wide innovation. Opportunities for growth and technology renewal that businesses previously had to prepare for within a few years are available in June 2020 in a matter of weeks. Other types of challenges and challenges require organizations to innovate and rethink how they work quickly.

Overall, COVID-19 has the potential to have three major effects on the global economy:

- Directly influencing production and demand,
- Causing supply chain and consumer instability,

- Having a financial impact on businesses and financial markets.

COVID-19 has had a wide range of consequences, including flight cancellations, travel bans, and quarantines, restaurants closing, and all indoor activities being limited in over forty countries. A huge slowing of the Industrial HVAC market has been announced, as has falling business morale, increasing fear among the population, and confusion about the future.

3.3 Measures Taken During the Global Financial Crisis

It goes without saying that governments have the responsibility of protecting populations from the economic fallout of the current global health crisis. Depending on the available administrative capacity, governments can now provide assistance to the public and private companies in several ways; (22)

- The allocation of funds for the prevention, detection, control, treatment and containment of the virus and providing basic services to people in quarantine as well as affected businesses. For example, national governments can provide funds to local governments to fight the virus or mobilize clinics and medical personnel in affected areas.(9)
- The provision of prompt, targeted and temporary material assistance to the most affected people and companies until the emergency situation is resolved, providing wage subsidies to workers and companies to stop the spread of the disease. For example, in France, Japan and Korea, companies and individuals are subsidized for forced parental leave, which workers take due to school closures. France offers paid sick leave to those directly affected by the virus and voluntarily quarantining.
- Increased transfers of cash and in-kind subsidies, especially for vulnerable groups. China has accelerated the payment of insurance premiums for unemployment and expanded social protection programs. Korea has increased unemployment benefits for young people and started providing benefits to low-income families.
- Providing tax incentives to individuals and businesses that do not have enough funds. China has reduced the tax burden of companies in the most vulnerable regions and

sectors, including transport, tourism and hospitality. Korea extended the deadlines for the payment of income and value-added taxes for businesses in the affected industries. China, Italy and Vietnam are offering tax deferrals for businesses in financial distress. In China, companies are allowed to suspend social security contributions.

- Drawing up a business continuity plan. In the event of a large-scale epidemic, whether it is the finance ministry or the tax or customs administration, they need to provide services to citizens, taxpayers and importers in the event of widespread infection, relying as much as possible on electronic means. (20) For example, in the United States, the Federal Emergency Response Agency coordinates the continuity of the federal government.

Some of the measures taken may be carried out using administrative resources, while others will require the use of an emergency budget, which will also critically affect the total financial costs.

It is also important to educate the public on how emergency measures and changes to the original budget are consistent with the objectives of stability and economic acceptability. The IMF's Capacity Development Program is designed to help countries strengthen administrative capacity to respond to emergencies within the framework of public financial and fiscal revenue management. (40)

To support governments in need of financial assistance, the IMF and the international community are proposing several mechanisms, as listed in the IMFC statement. (6)

The above measures are currently the most effective for budgetary support of the economy. They will help prevent or limit the spread of the disease and protect the people and companies most affected. The countries will also use the so-called automatic stabilizers - tax cuts and increases in unemployment benefits and other benefits for people facing a reduction in income and profits.

With the spread of the pandemic, businesses have become more and more certain of the importance of ensuring there are strong business continuity and recovery plans in the company, as those are the tools that solve the key tasks of the company's management during the crisis. The COVID-19 epidemic has become a test of the readiness of personnel and resources to ensure the declared level of operational performance in emergency situations. (31)

In particular, the following risks may be realized at the moment:

- Retirement of personnel due to illness,
- Disruptions or interruptions in the supply chain of goods and services,
- Interruption of operating and production activities
- Risks associated with IT infrastructure and information security breaches.

Every executive today has to answer the question of how prepared his company is for these and other risks.

In Carrier Corporation, the implemented business continuity and recovery plans, together with the risk-based approach to management have shown their effectiveness. The management system is built and implemented on a methodological basis containing elements of the theory of reliability, a risk-based approach to company management, guidelines and standards.

For a large corporation, like Carrier, in a pandemic, it is important to maintain the stability, continuity and security of operation, providing a guaranteed level of service. Due to the fact that the production processes of as well as the business processes of its customers, cannot be stopped, it is necessary to quickly and in detail monitor and analyse the development of the situation, take measures to ensure the continuity of production processes and the provision of services to customers, as well as protect health and safety of employees, customers, partners and visitors.

In particular, as part of the implementation of tasks related to the operation of critical systems, upon receipt of new information from both official and secondary sources, on the development of the global situation with countering the spread of the virus, the introduction of restrictions at various levels of company activities and logistics, and also in connection with the introduction of the self-isolation regime, the Carrier team have been analysing new emerging risks, which, in turn, can affect the operational stability of the company.

The company's internal analytical team has developed and activated a plan to ensure the full operability at the current moment and in case of further negative development of the situation, which includes, among other things: (50)

- List of works affecting the critical infrastructure,
- Shift composition,
- Interactions with service providers,
- Number of spare parts in warehouses,

- Project management,
- Safe movement of employees and visitors to and from the workplace,
- Moving all possible work online.

Let's talk about some of the measures that have already been implemented in the company.

- The personnel not responsible for the operational activities have been transferred to a remote mode of operation.
- To improve the resiliency in terms of human resources, a team specialists was formed, transferred to remote work. Currently, this group performs administrative tasks and, if necessary, is ready to replenish partially or completely the retired composition of the main data centre operation group, to maintain 100% data centre operation until the end of the self-isolation mode.
- Back-up shifts of full-cycle customer support have been organized, which can quickly replace all current personnel without any impact on operational processes,
- Measures are being developed to deliver all staff on duty shifts along the home - work - home route without using public transport.
- The planned maintenance of the corporate infrastructure, where applicable, has been postponed to a later date.
- Measures have been implemented to monitor the health of visitors and company employees - mandatory temperature measurement, daily health surveys.
- All common access rooms in the building are provided with additional disinfectants; periodic sanitization of employees' workplaces is carried out.

Based on the results of the analysis of the effectiveness of the above measures of the business recovery plan, the following conclusions can be drawn:

- It is critical to keep your business continuity plans, disaster management and recovery plans for business processes and critical resources up to date.
- Unlikely events cannot be excluded from consideration, COVID-19 restated this point strongly.
- Analysing and planning the implementation of scenarios and conducting full-scale practical tests increase the preparedness and efficiency of the company's actions in unusual situations.

- Due diligence and training of company employees, customers and counterparties ensures efficient operation in non-standard situations
- International companies need to keep their finger on the pulse and stay ahead of the curve to maintain business continuity and resilience.

The outbreak of the coronavirus has changed the agenda for businesses, which should start thinking as soon as possible about how to respond to major shocks, as well as plans to rebuild and transform work in the future.

3.4 Key Learnings of the Research and Recommendations for a Strong Business Recovery Plan

During our thesis research, we've identified five priority areas, primarily based on the lessons that companies like Carrier Corporation hit by the epidemic have had to learn. (13)

1. Safety of People and Business Continuity

The safety and well-being of workers has become increasingly important. People expect instructions from employers, public figures and politicians. An open and transparent dialogue will help reduce tensions, increase cohesion and ensure the smooth running of the business as a result.

Companies can take a number of measures, such as introducing or expanding flexible work schedules and other opportunities, to enable employees to work from home and be safe. Depending on the industry, it is possible to reorganize teams and reallocate resources, as well as develop measures to protect personnel and create a safe working environment. In addition, regular mailings can be organized to keep employees informed of the current situation and decisions taken at the government and health authorities. This will help staff and the organization survive the crisis.

It is important to find a balance to support current operations in the new environment with minimal business losses. If the nature of the work does not allow staff to work from home or to move to flexible hours due to the need to stay in the workplace or interact with customers, measures should be taken to prevent the spread of the virus.

In an effort to keep workers safe, municipal authorities in some regions are working with big data collected by IT companies and mobile operators to create a QR code system that tracks a person's movements and allows them to confirm that they have not been in high-risk areas in the past 14 days. At the central and local level, decisions are made on partial or full exemptions from the payment of rent and social security contributions or granting an extension.

It is important to find a balance to support current operations in the new environment with minimal business losses. But even with all these measures, some companies will not be able to avoid operational disruptions. Restrictions on the movement of staff, which are introduced in different countries at the national and local level, lead to staff shortages and increased costs. Companies facing unusual issues that have not been addressed by their coronavirus initiatives should seek advice from their local authorities. A number of countries are adopting programs for financial and other support for small businesses and entire industries, including hospitality and tourism, which are under serious threat due to COVID-19.

2. New Business Continuity Strategy

Many will not be able to avoid significant disruptions to operations during the COVID-19 epidemic, and this will affect the effectiveness of the business. Enterprises working with China were the first to be hit by the crisis - they began to experience serious supply problems. Today, both Europe and the United States are in crisis, where more companies are experiencing disruptions and changing consumer demand, especially in industries such as consumer goods manufacturing, retail, manufacturing, biotechnology and automotive.

Measures taken to ensure the continuity of service delivery, the safety of customers and employees and the protection of their health in the context of the global spread of coronavirus infection (COVID-19) include both full compliance with regulatory requirements and restrictions imposed in the region, as well as the implementation of a continuity strategy business and related Continuity and Recovery Plans. (13)

Most of the employees shall be transferred to remote work and for employees who continue to work in the office, conditions shall be organized that minimize health risks in the current situation.

To ensure uninterrupted provision of services, organizations should constantly monitor the development of the situation both globally and within the region and the company separately, analyse the associated risks and threats, and apply optimal responses and business continuity strategies, including both organizational and technical solutions. (47)

The transfer of the majority of employees to a remote mode of work and the adaptation of processes to the new conditions of interaction should have no negative impact on the quality of provided services.

3. Interaction with Stakeholders

Transparent, direct and regular dialogue can be a good foundation for transforming operations and obtaining ongoing support from consumers, workers, suppliers, lenders, investors and regulators.

Companies should inform consumers in a timely manner about possible disruptions in the supply of goods or services. It is extremely important to have open communication channels in case of non-fulfilment of contractual obligations due to a production or supply disruption, in order to inform contractors in time about delays or the occurrence of force majeure circumstances. Such proactive actions will help to avoid penalties for non-fulfilment of obligations to consumers. (30)

The order of interaction with personnel should aim to find a balance between taking precautions and maintaining a working attitude.

Companies need to constantly stay in touch with suppliers of goods and services in order to be prepared for possible disruptions due to the COVID-19 epidemic, to understand their time frames and to be able to quickly find alternatives.

It may be necessary to analyse loan agreements, the failure of which is associated with special risks. It is also important to avoid formal breaches of conditions. Timely action can pave the way for negotiations with creditors to renegotiate or refinance debt. (51)

The companies' lawyers may need to be consulted regarding their potential obligations. Business units may be required to engage heavily with stakeholders to resolve disputes and gather evidence.

4. Get Maximum Support from the State

China is taking a number of measures at the national and local level to support business, including in terms of financing, social security and taxation. The China Securities Regulatory Commission, for example, has begun offering debt refinancing to public companies. The United States, the United Kingdom and several other developed countries recently announced a decision to revise some aspects of taxation and financing mechanisms. (6)

Companies need to keep track of what support measures are being taken at the state level, which of them can bring the maximum benefit, taking into account the specifics of the business, and what other assistance they can get. Government support programs may vary by industry and country. It is necessary to identify and analyse all the available opportunities in order to understand which of them will bring the most benefit to the organization. (30)

Companies should monitor government initiatives in order to take advantage of the opportunities offered and to protect themselves from risks. (6)

- VAT exemption or VAT refund for organizations performing epidemic control work or producing essential supplies for contaminated regions
- Full income tax exemption for purchases of equipment for the production of preventive care products
- Income tax exemption for bonuses and other incentive payments to those participating in epidemic containment activities
- Encouraging public donations
- Temporary insurance premiums and tax exemptions provided by the tax administration and the Treasury have helped reduce the burden on companies.

5. Increasing Resilience and Readiness for a New "Normality"

After testing the strategies for strength and agreeing with stakeholders on possible development paths, it will be necessary not only to implement the adjusted plans, but also to closely monitor the development of the situation, which remains uncertain. Significant deviations from the initial plan should be noticed by the management in time. So, the organization will be able to quickly respond to them and avoid additional negative consequences.

Once the coronavirus epidemic is brought under control, plans to maintain business continuity will need to be reassessed and adjusted. It is also important to evaluate the effectiveness of the measures taken. If gaps are identified, their possible causes should be understood, which may include delayed action, underdeveloped infrastructure, staff shortages, or external environmental factors. The lessons learned can form the basis for developing new operating principles and contingency plans that will help make your business more resilient in the face of future challenges.

6. Start Planning your Work for the Post-crisis Period

The COVID-19 epidemic could not have been predicted based on common logic and available forecasting tools. However, companies can learn many lessons that will continue to be beneficial in the aftermath of a crisis if they take a holistic view of their responses. (14)

In the meantime, when making decisions, companies need to be guided by the fact that the crisis will eventually end. Once completed, it will become clear which companies are flexible and resilient enough to effectively transform business strategy and achieve future prosperity. (48)

In the long term, it will be necessary to go back and evaluate the effectiveness of activities, leadership and initiatives during the crisis. It is also important to analyse the assumptions on which the supply chain and other key business elements are being built that are most at risk due to the epidemic.

When the crisis subsides, companies will need to re-evaluate the effectiveness of management during the epidemic and understand how to become more resilient to cope with new shocks in the future.

Companies around the world are trying to understand how the COVID-19 coronavirus will affect their businesses. But the current crisis is not only a serious risk, but

also an opportunity to find new areas for increasing resilience and transforming activities for the future.

4 Practical Part

The global market has collapsed as a result of the novel coronavirus (COVID-19) pandemic, and firms are facing severe financial difficulties. It directly affected performance of the companies. Nowadays, the investigation of coronavirus impact on company's performance is the main objective of number of authors.

It goes without saying that given the lack of publicly available long-term data, it is challenging to econometrically model the effects of the pandemic on the different reporting indicators. However, among all the companies Carrier allows us to collect the data and study it. Besides, apart from the econometric modelling we have also carried out forecasting the results.

It is assumed that sales of the company have been affected the most by the pandemic. Therefore, hypothesis about this relationship has been stated as well as the hypotheses about the relationships between the variables. Our econometric model is based on an economic model. Forecasting is a crucial part of decision making, and our practical work covers it thoroughly.

The practical part of this thesis carries out an economic and mathematical analysis of the financial statements of the Carrier Corporation for the period from 1996 to 2020. The aim of the work is to build an adequate econometric model to express the relationship between the company's sales and individual items of its balance sheet. The relevance of this work lies in the possibility of using the results obtained for making management decisions in the strategic planning of the company's financial activities. (7), (12)

The accounting financial statements of Carrier, published on the company's website, are used as the initial data. The reports for the indicated periods were exported to Excel for further econometric analysis, which was conducted using the Eviews program. The following indicators were chosen for the dataset as well: sales of the company, number of employees, research and development expenditures, total assets of the company and capital expenditures. (7)

4.1 The Aim of the Practical Work

The aim of the practical part of this thesis is to build a model, which will show the dependency of sales of the company from other indicators in financial report of the company such as number of employees, research and development expenditures R&D, total assets of the company and capital expenditures (CapEx). All the variables are measured in millions of dollars.

Moreover, it is necessary to conclude if the COVID-19 impacted the sales in any way.

To achieve this goal of the research, it is necessary to complete the following tasks:

1) To collect the data of Carrier from its annual financial reports;
2) To create a methodology appropriate for the data analysis;
3) To conduct the exploratory data analysis;
4) To estimate the multiple regression and VAR models and to interpret their results;
5) To make conclusions about the character of dependency between the variables and effect of COVID-19 on sales of Carrier.

4.2 Overview of the Chosen Variables

While creating our econometric model, we have considered the following variables:

The number of Employees

We have looked into the number of employees working at Carrier Corporation for the past 25 years.

Net Sales (Revenue)

Another indicator we have looked into is the revenue. We have closely monitored the development of revenue over the last 25 years.

The company revenue depends mainly on the volume of products sold, work performed, services rendered, their prices and accounts receivable. Revenues also depend on the financial discipline of buyers of products and consumers of works and services. The

higher the share of receivables in the composition of income, the less real financial resources the organization has. The composition and proportion of accounts receivable are of particular importance in an unstable economic situation. In times of crisis, the risk of non-payment by the buyer is especially strong, which can lead to the seller's insolvency. Thus, this is a rather important indicator for our analysis. (5)

The amount of revenue also depends on the pricing policy of the organization. In a competitive environment, the firm seeks to maintain its position in the market, lowering prices, thereby reducing its revenue.

Most organizations expect moderate to serious impacts on their annual revenues caused by the pandemic. While most companies have adopted technology to facilitate remote working, the workforce often find it difficult to adapt to this sudden shift. The challenges of maintaining a stable and safe network infrastructure to allow new ways of working have become a common theme across the industry. It is fair to expect a substantial effect on efficiency and quality as a result of this. All these will have a significant effect on the revenue. (17)

R&D

As technology improves productivity, it acts as a springboard for economic development. The transition to innovation, which is unlikely without human capital investment, is the most difficult challenge on the path to an R&D Economy. Every company nowadays desires the implementation of advanced research and development, which aids in the acceleration of development of the high-tech sector, as well as the transition from unregulated economic growth to sustainable development. (3)

It goes without saying that accumulated advanced scientific knowledge and information tools, the main component of which is an individual with his mind and scientific ideas, are increasingly moving to the main sources of financial growth and improving people's well-being. Human capital efficiency can be correlated to economic growth, so investing in human capital can help to boost the company ROI. Thus, through high labour productivity, technological re-equipment of production a company creates the required conditions for growth. (24)

Even if it's just to keep their current product lines competitive, any company should invest in research and development. This type of 'incremental' innovation is distinct from the type of 'disruptive' innovation that results in entirely new types of goods.

Businesses have different business models, so it's no wonder that their approaches to innovation differ as well. Putting the emphasis on innovation has allowed Carrier Corporation to move from an extensive to an intensive path of development. (43)

In the innovation process, research and development is crucial. It's basically a bet on potential capabilities and innovations that's turned into new goods, processes, and services. R&D is a critical component of innovation and a central factor in creating new competitive advantages in manufacturing and technology sectors. (33)

Those businesses that in particular have dedicated themselves to research and development, as a result, consistently outperform their competitors. If you're looking for a great example of a forward-thinking business, look no further, as Carrier International is a wonderful example.

When a company invests in R&D, it receives a large influx of expertise. This is why Carrier is so successful: all of their research and development results in valuable information that the business can use to improve its key product lines. (21)

Total Assets

The term "total assets" is widely used and refers to the assets held by the company that have an economic value and can be used to derive potential benefits. (32)

Assets are further divided into liquid and illiquid categories.

- An asset that can be quickly transformed into cash or exchanged for cash is referred to as a liquid asset.
- otherwise, it is referred to as an illiquid asset.

On the balance sheet, assets are often known as either current assets or long-term assets. A current asset is one that can be liquidated in less than a year, while a long-term asset can be liquidated in more than a year. (32)

Capital Expenditure

A company's capital expenses (CapEx) are funds used to purchase, upgrade, and retain physical assets such as land, plants, structures, technology, or machinery. CapEx is often used by companies to finance new ventures or acquisitions. Repairing a roof, buying

equipment, or constructing a new plant are both examples of capital spending on fixed assets. (19)

Companies make this form of financial investment to extend the scale of their activities or to bring any economic value to the operation.

4.3 Hypothesis

It is necessary to introduce the hypotheses about the relationship between the variables as well as the influence of coronavirus on sales of the company. The hypotheses are presented below:

Hypothesis 1

An increase of the number of employees will lead to an increase of the sales of the company.

It is assumed that the number of employees grows when there is a necessity to manufacture the bigger volume of the product/service, or to expand the business. Therefore, the increase of working force will lead to higher production rates and higher sales.

Hypothesis 2

Research and development (R&D) expenditures and sales of the company are positively related.

It is assumed that research and development investments help to conquer the market, thereby increasing the sales. However, this relationship may have some lag, as the effect of investment into research and development does not have an immediate effect.

Hypothesis 3

An increase of total assets will lead to an increase of sales of the company.

Again, total assets are increasing with the necessity of company growth. Therefore, positive relationship is stated. The same relation with the lag is expected here, as the increase of total assets may have an effect on sales only on the next year.

Hypothesis 4

Capital expenditures (CapEx) have a positive impact on sales of the company.

Capital expenditures are the expenditures of the company into the physical assets such as property, plants, buildings. Technology and so on to upgrade, acquire or maintain them. That is why the relationship between the variables should be positive. Time lag is expected here as well, because the implementation of new property and plants needs some time to increase the production capacity.

Hypothesis 5

COVID-19 has a negative impact on sales of the company.

COVID-19 has already caused the negative consequences for the companies of different industries. Quarantines, lockdowns and other restrictions influence the purchase power of people as well as the opportunities of the companies to sell. Thereby, negative relationship is considered here.

4.4 Data Analysis

The dataset consists of 25 observations, which are the indicators from the annual financial report of Carrier for the period of 1996-2020. The data includes 5 variables, which are sales of the company, number of employees, research and development expenditures, total assets, and capital expenditures. The net sales is the dependent variable, while other four are independent ones.

As there are only 25 observations and the data have time series type, the outliers will not be deleted from the dataset, as it will influence the structure. Anyway, the number of independent variables is equal to 4 and when squaring this number, it does not exceed the number of observations, which is good.

However, for the better understanding of the dataset, it is necessary to consider the graphs and descriptive statistics of the variables.

The graphs are presented below:

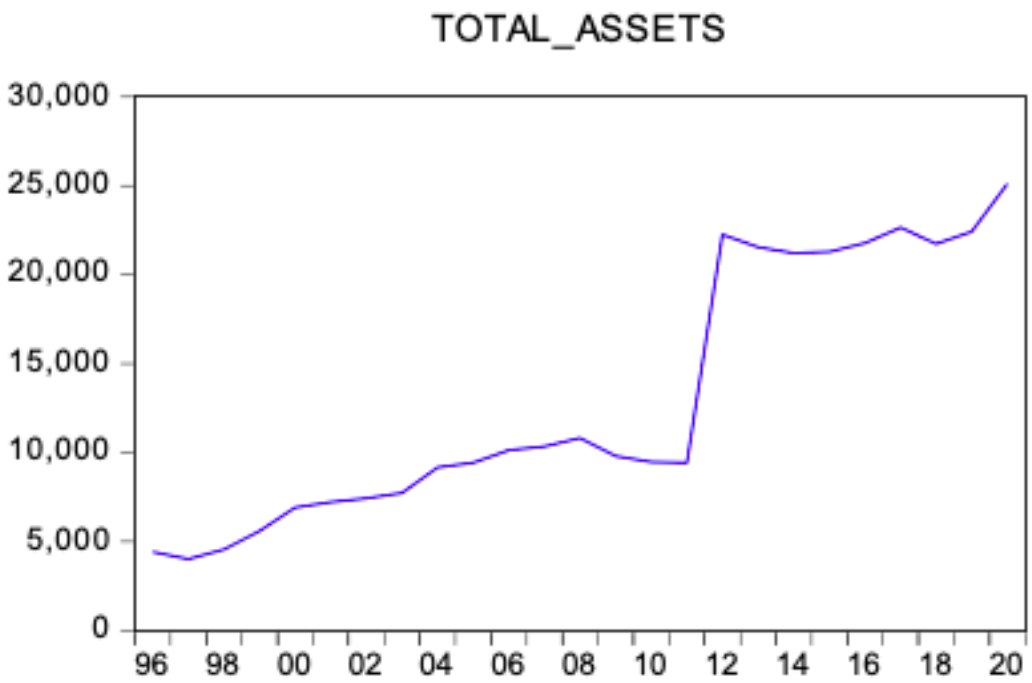


Figure 1: Line graph for the variable Total Assets (measured in millions of dollars)

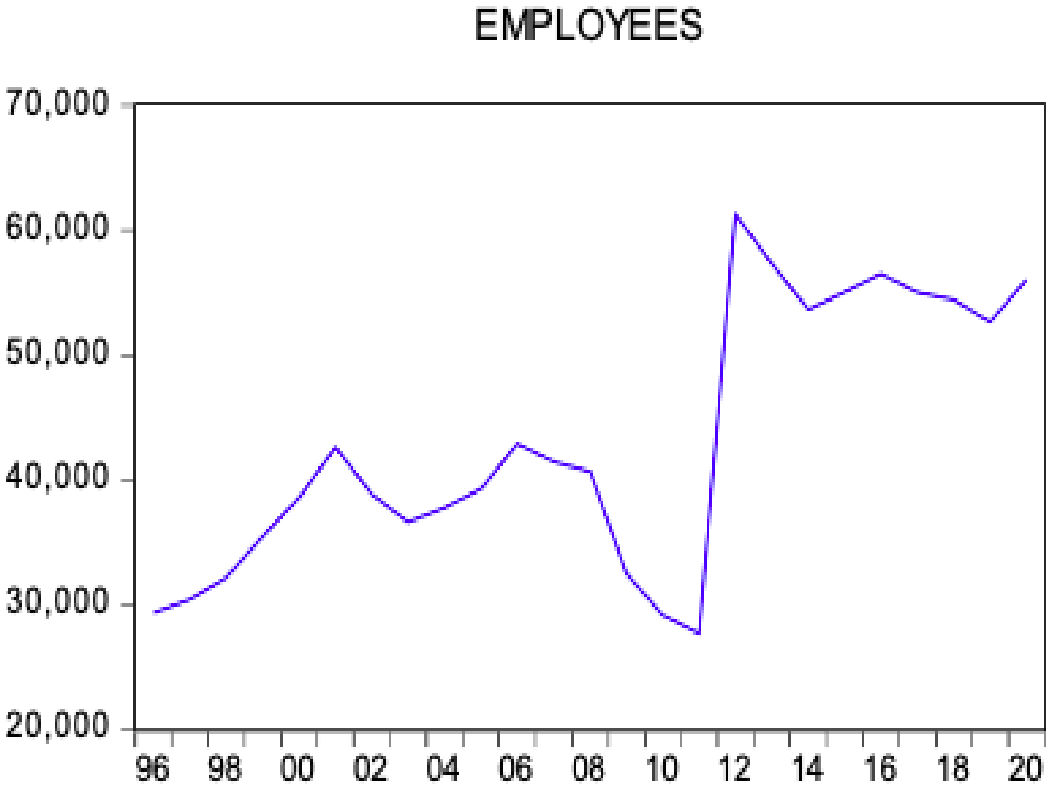


Figure 2: Line graph for the variable Employees

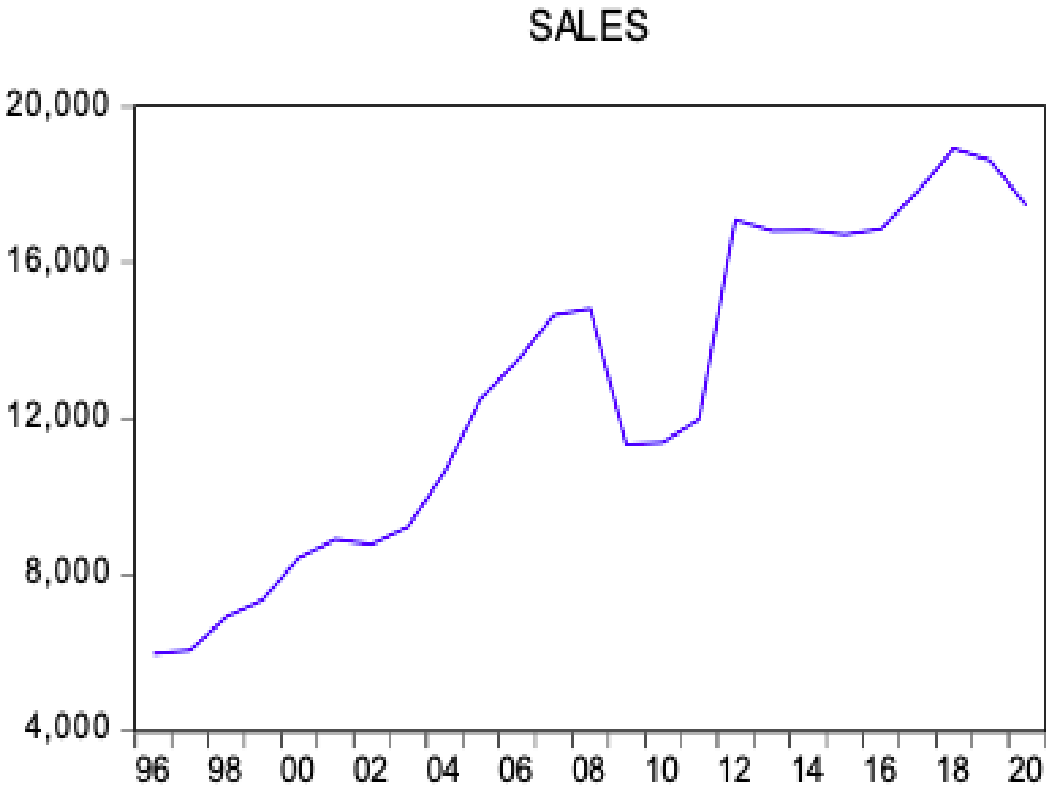


Figure 3: Line graph for the variable Sales (measured in millions of dollars)

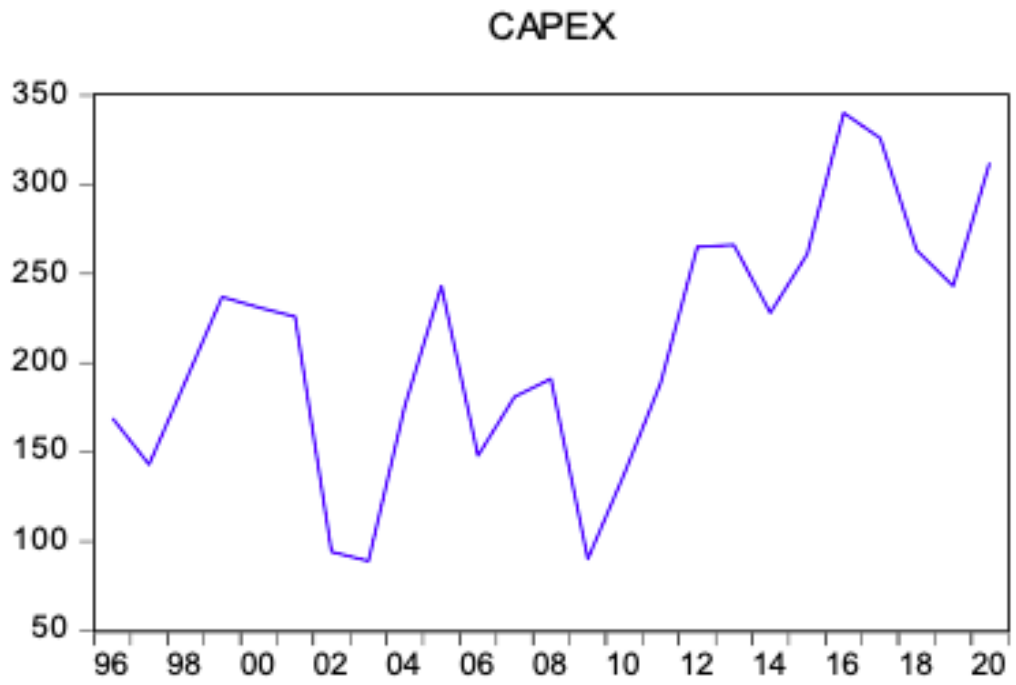


Figure 4: Line graph for the variable CAPEX (measured in millions of dollars)

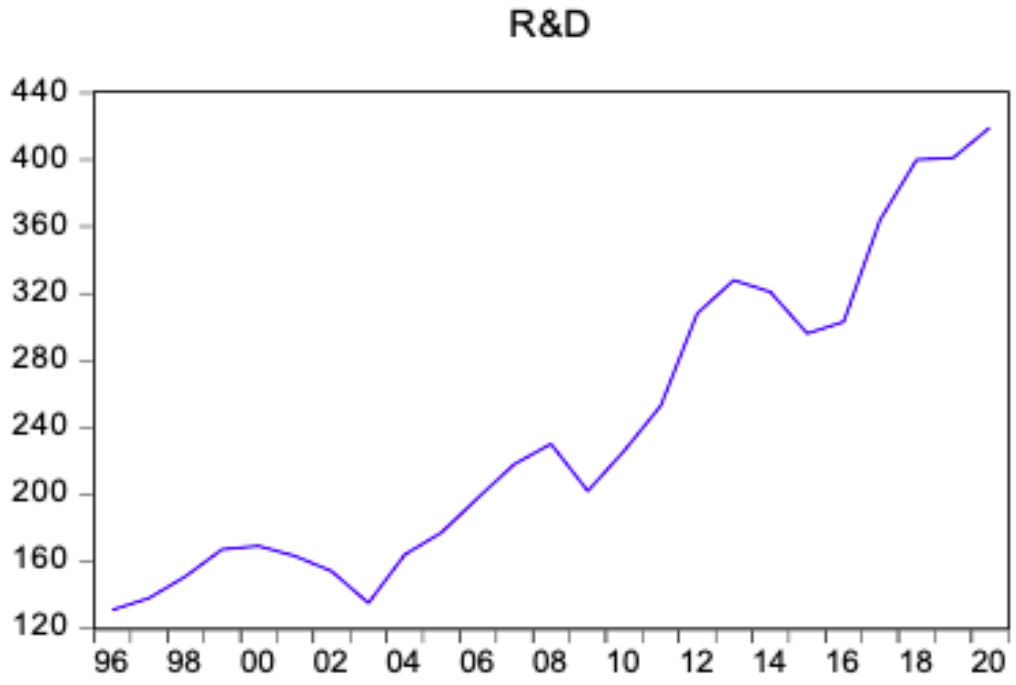


Figure 5: Line graph for the variable R&D (measured in millions of dollars)

There is an upward trend on all the graphs, which shows the growth of all the values. However, this growth is not stable and there are some fluctuations in the data.

The variable of interest is the sales of the company. From 1996 to 2008, the company's sales increased from to 14.900 billion. After 2008 when the crisis came, there was a sharp decline from 14.900 billion to 11.400 billion. In 2009 and 2010 the company showed the same value of sales (14.9 billion). In 2012, the company experienced a sharp jump in sales to 17.100 billion. From 2012 to 2018, there is a gradual increase in sales. Overall, there is an increasing trend.

As it can be seen, since 2006 there has been a gradual decrease in employees working in the company until 2011. After 2011 there is a sharp jump in workers from 27676 workers to 61272. After a sharp jump, there is a decrease in workers again from 2012 to 2014. From 2014 to 2016, the number of employees increased by approximately 3,000 thousand, after which the workers were laid off. In general, according to the graph, it can be determined that the trend in the number of employees shows an increase.

Besides, other variables also had fluctuations. For example, it can be seen that the capital expenditures decrease almost after all increases. The same situation can be seen for the research and development expenditures.

Regarding the last year of 2020 when the pandemic of COVID-19 influenced the world, only the reduction of sales can be obtained, while other variables are still growing. The reason for that may be the politics of the company to invest money to gain the further growth and to deal with the negative influence of COVID-19 in the future. We can approve hypothesis 5 at this stage, as there is a reduction of sales in 2020.

The descriptive statistics of the variables can be seen as well:

Table 1

Descriptive Statistics

	CAPEX	EMPLOYEES	R&D	SALES	TOTAL_ASSETS
Mean	209.5600	43081.32	240.6400	12778.20	13055.56
Median	226.0000	40651.00	218.0000	12512.00	9804.000
Maximum	340.0000	61272.00	419.0000	18914.00	25093.00
Minimum	89.00000	27676.00	131.0000	5958.000	4012.000
Std. Dev.	69.86539	10599.93	92.14792	4270.387	7273.203
Sum	5239.000	1077033.	6016.000	319455.0	326389.0
Sum Sq. Dev.	117148.2	2.70E+09	203789.8	4.38E+08	1.27E+09

The variables are measured in millions of dollars

The maximum and minimum values can be obtained for every variable as well as the mean values. On average over the years 1996-2020 the company has the level of capital expenditures equal to 209.56 millions of dollars, research and development expenditures equal to 240.64 millions of dollars, sales equal to 12778.20 millions of dollars, assets equal to 13055.56 millions of dollars and 43081 employees. By the sales and total assets maximum and minimum values it can be seen, how much the company grew: sales grow from 5958 to 18914, while total assets vary from 4012 to 25093.

The data seems to be non-stationary based on the graphs, as it has a trend. However, the analysis of the stationarity will be conducted in the results section, as the stationarity assumption is necessary for the time series data.

4.5 Methods

Two models will be estimated in this research. First, despite the data type, multiple regression model will be estimated, which is expressed by the following formula:

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \varepsilon,$$

where y is the dependent variable;

β_0 is the intercept of the model;

$\beta_1, \dots, \beta_k$ are the regression coefficients;

$x_1, \dots, x_k$ are the independent variables;

ε is a random error of the model.

Based on the variables that are used in the dataset, the model will take the following form:

$$Net\ sales_i = \beta_0 + \beta_1 \cdot Employees_i + \beta_2 \cdot CapEx + \beta_3 \cdot R\&D_i + \beta_4 \cdot Total\ assets_i + \varepsilon$$

The main stone of stumbling here is the assumption of linear regression that the residuals are not autocorrelated. However, this assumption can be checked after the estimation. Another argument against using linear regression for time series is that the

prediction from such a model is seldom reliable, but special techniques for the time series data can be doubted as well. Therefore, this model will be estimated with OLS method and its quality will be checked after the estimation.

If we take into consideration the time series structure of the data, it is necessary first to achieve the stationary of the time series. It can be checked with the unit root test. As there are multiple variables, the best model will be Vector Autoregressive Model or VAR. This model allows to capture relationship between multiple variables as they change over the time. The model for two variables looks as follows:

$$\begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} \alpha_0 \\ \beta_0 \end{pmatrix} + \begin{pmatrix} \alpha_1 & \alpha_2 \\ \beta_1 & \beta_2 \end{pmatrix} + \begin{pmatrix} y_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_t \\ u_t \end{pmatrix}$$

The model consists of the equations for each of the variables. Unlike ARIMA or other time series models, besides the variable's lagged values the equation includes the lagged values of other variables as well. As we expect influence of other variables on sales, thereby among all the models for time-series the VAR has been estimated. The influence of lagged values can be checked with the help of this model.

4.6 Results

The first estimation is the multiple regression model with the raw data that we have. The results of the estimation are presented below:

Table 2

Multiple regression results based on the raw data

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3115.097	3123.454	0.997324	0.3305
CAPEX	-9.017411	7.024133	-1.283776	0.2139
EMPLOYEES	0.073979	0.098312	0.752499	0.4605
R_D	19.77755	13.13281	1.505965	0.1477
TOTAL_ASSETS	0.276234	0.248893	1.109853	0.2802
R-squared	0.895189	Mean dependent var		12778.20
Adjusted R-squared	0.874227	S.D. dependent var		4270.387
S.E. of regression	1514.469	Akaike info criterion		17.66037
Sum squared resid	45872355	Schwarz criterion		17.90415
Log likelihood	-215.7547	Hannan-Quinn criter.		17.72799
F-statistic	42.70508	Durbin-Watson stat		0.552953
Prob(F-statistic)	0.000000			

By the results of this model, it can be seen that none of the variables are significant as the p-value is more than any significance level. The intercept is insignificant as well. Besides, low Durbin-Watson statistics shows that there is an autocorrelation of residuals in the model. For 25 observations and 5 terms included in the model (with intercept) the intervals for Durbin-Watson statistics should be 1.03811 to 1.76655. The value of Durbin-Watson in the table is much lower. To check the presence of autocorrelation, the Breusch-Godfrey serial correlation LM test has been used with the null hypothesis of no serial correlation. The results of the test including 6 lags are as follows:

Table 3

Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.903002	Prob. F(6,14)	0.0168
Obs*R-squared	15.64622	Prob. Chi-Square(6)	0.0158

As the p-value of the test is smaller than 5% significance level, we can reject the null hypothesis about the absence of serial correlation. There is the serial correlation of residuals in the model.

Another issue here is that when using non-stationary variables in OLS, there is a problem of spurious regression. Therefore, the stationary of the time series should be achieved.

For the stationarity checking the Augmented Dickey-Fuller unit root test has been applied for each variable. The null hypothesis for this test is that the time series has a unit root. The presence of unit root shows the non-stationarity of the data.

The results of this test to each of the variables are presented below:

Table 4

Augmented Dickey-Fuller unit root test results for all variables

Null Hypothesis: CAPEX has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.004178	0.2831
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	

Null Hypothesis: EMPLOYEES has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.847378	0.3499
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	

Null Hypothesis: R_D has a unit root				
Exogenous: Constant				
Lag Length: 3 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			1.957029	0.9996
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	

Null Hypothesis: SALES has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.264796	0.6285
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	

Null Hypothesis: TOTAL_ASSETS has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.501491	0.8746
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	

All the probability values are more than any significance levels, which means that the null hypothesis is approved. Each of the time series has a unit root, which means that they are non-stationary. Therefore, it has been decided to take the first difference for each of the variables and check the presence of unit roots once again. The results are shown below:

Table 5

Augmented Dickey-Fuller unit root test results for the first differences

Null Hypothesis: D(CAPEX) has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.302231	0.0003
Test critical values:	1% level		-3.769597	
	5% level		-3.004861	
	10% level		-2.642242	

Null Hypothesis: D(EMPLOYEES) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic			-5.097424	0.0005
Test critical values:	1% level		-3.752946	
	5% level		-2.998064	
	10% level		-2.638752	

Null Hypothesis: D(R_D) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.096806	0.0051
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	

Null Hypothesis: D(SALES) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.681557	0.0014
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	

Null Hypothesis: D(TOTAL_ASSETS) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=5)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.219872	0.0003

Test critical values:	1% level		-3.752946	
	5% level		-2.998064	
	10% level		-2.638752	

Now all the probability values are less than 1% significance level, which means that the null hypothesis should be denied. All the variables do not have a unit root, so the time series is stationary. We will work with the first differences of the data.

Now, the multiple regression can be estimated again, but based on the stationary time series. In this model, first differences of each variable are included instead of the raw data, which is shown by D in the beginning of the name of each variable.

Table 6

Multiple regression model based on the stationary time series

Dependent Variable: D(SALES)				
Method: Least Squares				
Date: 03/28/21 Time: 21:20				
Sample (adjusted): 1997 2020				
Included observations: 24 after adjustments				
White heteroskedasticity-consistent standard errors & covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	217.2445	173.6480	1.251063	0.2261
D(CAPEX)	1.028234	3.217131	0.319612	0.7528
D(EMPLOYEES)	0.217570	0.081090	2.683076	0.0147
D(R_D)	22.73040	7.371514	3.083546	0.0061
D(TOTAL_ASSETS)	-0.300231	0.237494	-1.264163	0.2215
R-squared	0.745944	Mean dependent var		479.0833
Adjusted R-squared	0.692458	S.D. dependent var		1432.983
S.E. of regression	794.6814	Akaike info criterion		16.37681
Sum squared resid	11998852	Schwarz criterion		16.62224
Log likelihood	-191.5217	Hannan-Quinn criter.		16.44192
F-statistic	13.94665	Durbin-Watson stat		1.541963
Prob(F-statistic)	0.000018			

In comparison with previous model, it is seen that the R-squared reduced. The coefficient of determination approves the argument about the spurious regression. In this model it is smaller, but still quite high and can be interpreted in the following way: regression equation describes 74.6% of the variance of the endogenous variable; the remaining 25.4% are not explained.

The Darbin-Watson test calculates a coefficient that lies in the range from 0 to 4. For 25 observations and 5 terms included in the model (with intercept) the intervals for Durbin-Watson statistics should be 1.03811 to 1.76655. Right now, the value of this statistics lays in this range, which is a good result. The autocorrelation of the residuals should be checked with the Breusch-Godfrey serial correlation LM test again with null hypothesis of no serial correlation. The results are shown in the Table below:

Table 7

Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.288766	Prob. F(6,13)	0.3280
Obs*R-squared	8.951232	Prob. Chi-Square(6)	0.1763

Now both p-values are greater than any significance levels. Therefore, the null hypothesis of no serial correlation can be approved. The model does not have autocorrelation of the residuals.

We can interpret the coefficients of the model. It is seen that only the employees number and research and development expenditures are significant in this model. While employees variable is significant at 1% significance level, research and development variable is significant only at 5% significance level.

Employees variable has a positive impact on the sales of the company based on the results of the model. The interpretation of its coefficient is as follows: with all other variables being equal, with an increase of number of employees on 1 person, on average the sales will increase on 0.22. Hypothesis H1 can be approved.

Research and development expenditures are positively related to sales of the company, as it has been considered before. With all other variables being equal, with an

increase of R&D expenditures on 1 unit, on average the sales of the company will increase on 22.73. Hypothesis H2 can be approved.

Despite these significant results, it is necessary to pay attention on time series structure of the data and check the influence of lagged values on the dependent variables. Therefore, VAR model has been estimated first on the raw data including 1 lag:

Table 8

VAR model results based on raw data

	CAPEX	EMPLOYEES	R_D	SALES	TOTAL_ASSETS
CAPEX(-1)	0.467162	48.54160	0.176636	7.803506	10.26370
	(0.24023)	(31.5609)	(0.09351)	(6.60412)	(11.7446)
	[1.94465]	[1.53803]	[1.88894]	[1.18161]	[0.87391]
EMPLOYEES(-1)	-0.006111	-0.100683	-0.004200	-0.204706	-0.315987
	(0.00328)	(0.43060)	(0.00128)	(0.09010)	(0.16024)
	[-1.86443]	[-0.23382]	[-3.29222]	[-2.27191]	[-1.97199]
R_D(-1)	-0.189561	15.07944	0.668742	-13.11861	14.78221
	(0.47447)	(62.3354)	(0.18469)	(13.0437)	(23.1966)
	[-0.39952]	[0.24191]	[3.62087]	[-1.00574]	[0.63726]
SALES(-1)	-0.010607	-0.193870	0.001575	0.904896	0.068111
	(0.00791)	(1.03878)	(0.00308)	(0.21737)	(0.38656)
	[-1.34148]	[-0.18663]	[0.51162]	[4.16301]	[0.17620]
TOTAL_ASSETS(-1)	0.020117	0.940802	0.007869	0.390574	1.114751
	(0.00846)	(1.11093)	(0.00329)	(0.23246)	(0.41340)
	[2.37904]	[0.84686]	[2.39072]	[1.68016]	[2.69652]
C	300.4446	25084.11	113.0790	6938.738	6452.813
	(105.209)	(13822.2)	(40.9532)	(2892.30)	(5143.60)
	[2.85568]	[1.81477]	[2.76117]	[2.39904]	[1.25453]
R-squared	0.613528	0.691983	0.964659	0.913375	0.910525
Adj. R-squared	0.506174	0.606423	0.954842	0.889313	0.885671
Sum sq. resids	44612.24	7.70E+08	6759.611	33715680	1.07E+08
S.E. equation	49.78411	6540.540	19.37870	1368.610	2433.905
F-statistic	5.715026	8.087661	98.26454	37.95859	36.63461
Log likelihood	-124.3870	-241.4609	-101.7425	-203.9196	-217.7364
Akaike AIC	10.86559	20.62175	8.978544	17.49330	18.64470
Schwarz SC	11.16010	20.91626	9.273057	17.78781	18.93921
Mean dependent	211.2500	43653.88	245.2083	13062.38	13415.79
S.D. dependent	70.84413	10425.54	91.19209	4113.687	7198.211
Determinant resid covariance (dof adj.)		5.76E+24			

Determinant resid covariance		1.37E+24			
Log likelihood		-837.1604			
Akaike information criterion		72.26336			
Schwarz criterion		73.73593			

The coefficient is presented in the first row, st.dev is presented in (), t-stat is presented in []

The model represent 5 simultaneous equations of each variable being regressed by the lags of other variables. It can be seen that such variables as sales and total assets have the coefficient close to 1 based on their own lag value, which indicates that we have the non-stationarity and the model should be re-estimated with the stationary time series.

Besides, the cointegration test has been conducted with the null hypothesis that series are not cointegrated. The Engle-Granger test has been used for that. The results of this test are presented below:

Table 9

Cointegration Test results

Series: CAPEX EMPLOYEES R_D SALES TOTAL_ASSETS				
Sample: 1996 2020				
Included observations: 25				
Null hypothesis: Series are not cointegrated				
Cointegrating equation deterministics: C				
Automatic lags specification based on Schwarz criterion (maxlag=4)				
Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
CAPEX	-5.098905	0.0461	-57.75060	0.0000
EMPLOYEES	-3.936321	0.2511	-33.51741	0.0004
R_D	-3.426119	0.4409	-29.05968	0.0065
SALES	-1.839274	0.9628	-6.759465	0.9631
TOTAL_ASSETS	-4.403109	0.1346	-43.12780	0.0000

It is seen that the p-values for almost all the variables are very close to 0 except for the sales. The null hypothesis can be rejected in this case, and there is a cointegration of the variables in the dataset.

If VAR is not stationary and there is a cointegration between the variables, it is necessary to estimate VAR for the first differences, if it allows to make it stationary. The first differences are pointed with D in the beginning of the variable's name. Therefore, the

model will be estimated with the implementation of the first differences, which will provide the stationary of the data. Besides, the Lag Selection Criteria has been calculated to check the best number of lags that should be included in the model. The results are as follows:

Table 10

Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Endogenous variables: D(TOTAL_ASSETS) D(R_D) D(SALES) D(CAPEX) D(EMPLOYEES)						
Exogenous variables: C						
Date: 03/28/21 Time: 21:57						
Sample: 1996 2020						
Included observations: 21						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-763.4989	NA*	4.21e+25	73.19038	73.43907	73.24435
1	-752.8824	15.16646	1.80e+26	74.56023	76.05241	74.88407
2	-724.3293	27.19344	2.10e+26	74.22184	76.95749	74.81555
3	-648.6069	36.05828	1.03e+25*	69.39113*	73.37027*	70.25471*

Most of the criteria show that the number of lags should be equal to 3, as it is shown by significance on the table. FPE, AIC, SC and HQ Mention 3rd lag as the best one, while LR says about implementation of no lags.

Therefore, the new VAR model with 3 lags and stationary time series has been estimated. The following results have been obtained:

Table 11

Estimation of VAR model with 3 lags

	D(TOTAL_ASSETS)	D(R_D)	D(SALES)	D(CAPEX)	D(EMPLOYEES)

R-squared	0.901168	0.818032	0.816213	0.658206	0.898931
Adj. R-squared	0.604673	0.272128	0.264851	-0.367175	0.595723
Sum sq. resids	16049670	2007.470	8625467.	26829.83	1.32E+08
S.E. equation	1791.629	20.03731	1313.428	73.25276	5133.082
F-statistic	3.039404	1.498492	1.480358	0.641914	2.964735
Log likelihood	-172.0378	-77.67884	-165.5176	-104.9016	-194.1420
Akaike AIC	17.90836	8.921794	17.28739	11.51443	20.01353
Schwarz SC	18.70419	9.717621	18.08322	12.31026	20.80935
Mean dependent	928.6190	12.00000	481.0952	3.571429	977.2381
S.D. dependent	2849.508	23.48617	1531.858	62.64868	8073.069
Determinant resid covariance (dof adj.)		6.04E+23			
Determinant resid covariance		4.62E+20			
Log likelihood		-648.6069			
Akaike information criterion		69.39113			
Schwarz criterion		73.37027			

The coefficients have not been reported this time in the table, as the table is quite wide, but in fact they are not for interpretation. The coefficients can be seen in the Appendix. What is informative and interpretable in the system of equations is the results of different tests. To check the issue of non-stationarity of the system and stability of the system, the AR roots table should be created. It looks as follows:

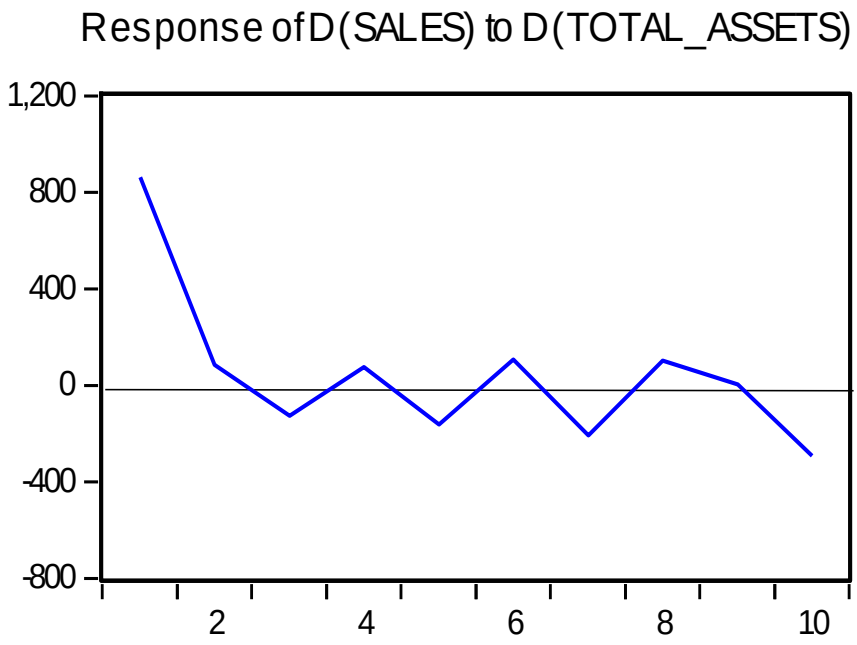
Table 12

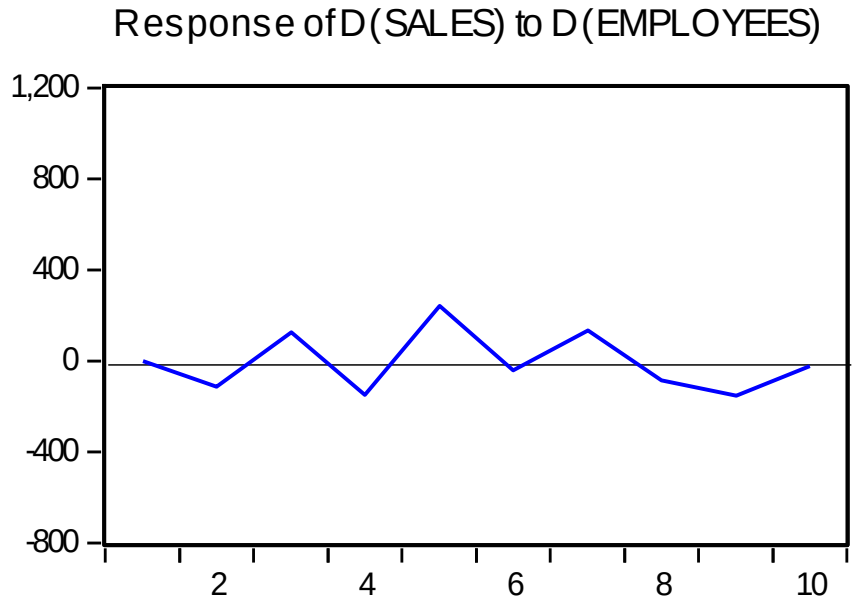
AR roots table

Root	Modulus
0.434347 – 0.909191i	1.007614
0.434347 + 0.909191i	1.007614
0.873205 – 0.407954i	0.963801
0.873205 + 0.407954i	0.963801
-0.073701 – 0.941009i	0.943891
-0.073701 + 0.941009i	0.943891
-0.922112	0.922112
-0.340395 – 0.807037i	0.875886
-0.340395 + 0.807037i	0.875886
-0.722748 – 0.487032i	0.871530
-0.722748 + 0.487032i	0.871530
0.518531 – 0.581535i	0.779139
0.518531 + 0.581535i	0.779139
-0.734444 – 0.197094i	0.760430
-0.734444 + 0.197094i	0.760430

We have here the modulus values which are equal to 1, which means that the system is not stationary.

We can see the impulse responses for the better understanding of the equations, which are presented below. The x-axis represent the period of influence on the sales variable, while the y-axis shows the amount of the response on the change of independent variable.





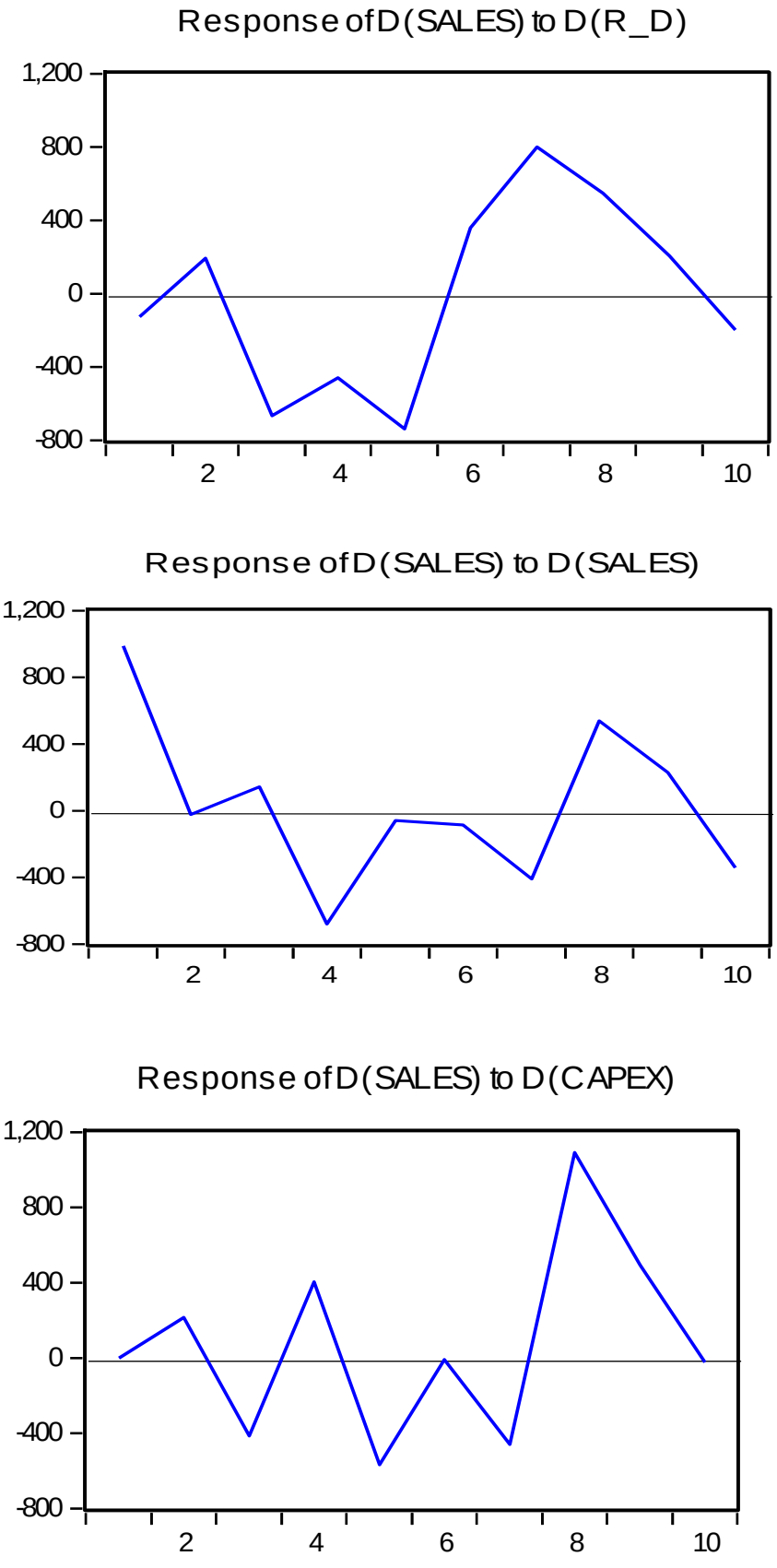


Figure 6: Impulse responses for sales

As the value of interest is sales of the company, only the impulse graph for the responses of sales have been provided here. However, there are 25 graphs for all the variables. Based on these graphs, it can be concluded that the shocks in different financial results will immediately influence the sales of the company, as there is immediate change of sales right after the first period of changing the independent variables. This influence is different from all the variables and it fluctuates. The first difference of the number of employees has the smallest effect on the sales in comparison with other variables. The response of sales to total assets in general has a decreasing trend.

Based on the results of this model, it is not possible to approve or deny any hypotheses. The model appeared to be unstable as it is non-stationary after all the corrections.

Two models have been estimated in this research, which are multiple regression model and Vector AutoRegression model.

According to the arguments presented above, based on the estimation of multiple regression model 2 hypotheses have been approved, which are the positive impact of number of employees on the sales and positive impact of research and development expenditures. However, two other hypotheses about the relationship between the variables could not be approved due to the insignificance of the variables.

The hypothesis about the negative influence of coronavirus on sales cannot be approved due to the lack of the data, but it can be seen by the visual analysis. There is a decline of sales in 2020, which may be caused by COVID-19 pandemic.

Some limitation of this research can be mentioned. First of all, the number of observations which affects the results of the analysis. Therefore, it is necessary to collect cross-sectional or panel data from multiple companies and their financial reports to see the actual relationship between the variables. This can be considered as a way for the future research. Besides, the influence of COVID-19 has been checked only visually. For the numerical interpretation and hypothesis checking Difference-in-Differences method would be a good option or just the variable responsible for coronavirus. With the help of this method and larger dataset it will be possible to check the influence of COVID-19 compared to those companies, which did not suffer from this pandemic.

Nevertheless, despite the existence of the limitations, the aim of the research has been achieved.

5 Results and Discussion

Our research has indicated that Carrier is one of the world's largest supplier of HVAC, cooling, fire, and protection solutions. As an independent publicly traded firm, Carrier holds a strong position in the market by investing in desirable geographical areas, developing new technology to further broaden services and spare parts business, strategically optimizing product and service portfolio and, focus on cost-effective results. Carrier's core mission, to concentrate on developing smart, sustainable, and effective solutions to meet the complex challenges of megatrends in urbanization, climate change, and food security driven by the increasing global population, rising living standards, and rising energy and environmental efficiency, continues the company's creative spirit today. (50)

5.1 Outcomes from the Theoretical Part

As a result of this research a connection was established between various factors; the significant influence of financial indicators on the determination of the impact of the pandemic on Carrier Corporation was emphasized.

Of great fundamental importance are the structural changes taking place in companies associated with the change of consumer behaviour. These transformations are ongoing, although the question remains open whether Carrier Corporation can maintain its role as a global player in HVAC market post-pandemic.

Furthermore, our research has shown that in order to survive a crisis, a business should: (46), (13)

- **Track short-term liquidity.** Companies need to implement a procedure for monitoring short-term cash flows in order to be able to predict their reduction in time and take prompt action. There is also a need to improve the efficiency of working capital management, especially in terms of collection of receivables and inventory control. In addition, it is important to seek out-of-the-box solutions and stay proactive to shorten the working capital cycle. Particular attention should be paid to regular interaction with suppliers in order to notice potential risks in time.
- **Assess financial and operational risks and respond quickly to them.** Companies need to monitor for signs of rising direct costs and profitability so that they can

quickly begin negotiating contract renegotiations, if necessary. Those who fail to respond in time or fail to renegotiate agreements can face financial problems with long-term consequences.

- **In addition to monitoring vulnerabilities within the company, it is also necessary to monitor factors that can affect customers, suppliers, contractors and partners.** In particular, it is possible to conduct a kind of stress testing of the business of a supplier of the first and second levels, which may be hit by the crisis. This is especially true for the automotive and pharmaceutical industries, which rely heavily on third-party suppliers. And finally, it should be remembered that the risks of asset impairment can not only worsen the state of the entire balance sheet, but also lead to violations of the restrictive conditions of agreements with banks and other credit institutions.
- **Explore supply chain alternatives.** Companies that buy parts and raw materials in markets overwhelmed by the coronavirus should consider looking for alternatives. Such quick measures will provide temporary space to fulfil obligations to clients. Companies that purchase goods as demand arises or have informal agreements with various service providers, including logistics, should be prepared for possible supply problems both during the crisis and after it due to a potential surge in demand.

  Organizations that adhere to the principle of transparency and conduct open communication with customers and suppliers have an advantage in situations where it is necessary to quickly respond to events and change.
- **Determine the impact of the COVID-19 outbreak on budgets and business plans.** Companies should test their financial plans for sustainability in various scenarios to assess how the crisis could affect financial performance and how long it will last. If business plans and preconditions for budgeting are out of date due to the effects of the crisis, they will have to be revised to adapt to the changes. And if the impact of a pandemic is threatening to become devastating, the minimum necessary to support operations should be determined in terms of staffing, interaction with suppliers, capacity and technology allocation.
- **There may also be problems with short-term capital replenishment to ensure business continuity.** Based on the results of the analysis, it is possible to consider the possibility of attracting short-term capital, refinancing debt, attracting additional

loans from banks and investors, and applying for government support. In addition, it is necessary to comprehensively analyse the operating costs in order to reduce, as far as possible, all items that are not critical for the business.

Chapter 3.4 presents the key learnings of the research and gives recommendations for implementing a strong business recover plan.

5.2 Outcomes from the Practical Part

As per the practical part of the thesis, the financial statements of Carrier Corporation for the years 1996 to 2020 have been subjected to an economic and mathematical review.

The objective has been to develop an appropriate econometric model that expresses the relationship between the amount of company's net sales and individual balance sheet products such as number of employees, research and development expenditures R&D, total assets of the company and capital expenditures (CapEx). The importance of this research stems from the prospect of using the findings to make management decisions about the company's financial activities.

The aim of the analysis was to construct an econometric model, as well as decide whether the coronavirus's effect has been felt.

As a result, the endogenous variable was selected as "net sales."

As exogenous variables, the following indicators were chosen:

- Number of workers,
- R&D,
- Total Assets,
- Capital Expenditure.

Two models have been estimated in this research, which are multiple regression model and Vector AutoRegression model.

According to the arguments presented above, based on the estimation of multiple regression model, 2 hypotheses have been approved, which are the positive impact of number of employees on net sales and positive impact of research and development expenditures. However, two other hypotheses about the relationship between the variables could not be approved due to the insignificance of the variables. However, in fact the

hypothesis about the negative influence of coronavirus on sales cannot be approved due to the lack of the data, but it can be seen by the visual analysis.

However, the VAR model did not appear to have a good quality, as it is non-stationary and unstable by the results of the tests.

Some limitation of this research can be mentioned. First of all, the number of observations is really small which affects the results of the analysis. Therefore, it is necessary to collect cross-sectional or panel data from multiple companies and their financial reports to see the actual relationship between the variables.

This can be considered as a way for the future research. Besides, the influence of COVID-19 has been checked only visually. For the numerical interpretation and hypothesis checking Difference-in-Differences method would be a good option or just the variable responsible for coronavirus. With the help of this method and larger dataset it will be possible to check the influence of COVID-19 compared to those companies, which did not suffer from this pandemic.

Nevertheless, despite the existence of the limitations, the aim of the research has been achieved.

6 Conclusion

The main goal of the thesis was to find out whether COVID-19 has had any impact on Carrier Corporation and its financial well-being, which was aimed to achieve by a thorough literature review and an econometric analysis.

The partial goals of this thesis were collecting data, analysing and interpreting the obtained data, then testing our hypothesis on the acquired data using econometric models.

Although innovative technologies have significantly enhanced building efficiencies, the global pandemic has forced building owners and employers to assess solutions that create healthy and secure indoor environments as quickly as possible. Carrier Corporation has succeeded in offering a variety of healthy building innovations that not only emphasize occupant wellbeing but also dramatically improve their experience. (10)

Our thesis has examined in detail not only the overview of the market state and challenges that the pandemic has brought along, but has also discussed various business recovery strategies that may play a decisive role for the company's well-being tomorrow.

For the practical part of the thesis, two models have been estimated in this research, which are multiple regression model and Vector AutoRegression model.

As a result of the conducted analysis, two theories have been approved through the calculation of a multiple regression model, those being the positive effect of employee number on revenue and the positive impact of research and development expenses.

Due to the insignificance of the variables, two other hypotheses about the relationship between the variables could not be confirmed. The visual analysis of the data, as expected, supported the hypothesis that coronavirus has a negative effect on revenue.

However, in fact the hypothesis about the negative influence of coronavirus on net sales cannot be approved due to the lack of the data, but it can be seen by the visual analysis. In 2020, sales are expected to decrease due to the COVID-19 pandemic.

The thesis can, also, pose questions for further research, the most important of them being the further impacts of COVID – 19 on not only the selected company but also the global economy.

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8 Appendix

Coefficients of VAR model with 3 lags

	D(TOTAL_ASSETS)	D(R_D)	D(SALES)	D(CAPEX)	D(EMPLOYEES)
D(TOTAL_ASSETS(-1))	0.485736	0.012297	0.487844	0.048014	3.507818
	(0.87964)	(0.00984)	(0.64486)	(0.03597)	(2.52020)
	[0.55220]	[1.24995]	[0.75652]	[1.33503]	[1.39188]
D(TOTAL_ASSETS(-2))	-1.271551	-0.004894	-0.300875	0.006761	-3.065673
	(0.61202)	(0.00684)	(0.44867)	(0.02502)	(1.75347)
	[-2.07762]	[-0.71494]	[-0.67059]	[0.27020]	[-1.74835]
D(TOTAL_ASSETS(-3))	1.417638	0.010193	1.004470	0.026500	3.506857
	(0.66272)	(0.00741)	(0.48584)	(0.02710)	(1.89873)
	[2.13910]	[1.37518]	[2.06750]	[0.97799]	[1.84695]
D(R_D(-1))	-33.18053	0.214927	-7.770074	-0.575481	-163.5768
	(33.9754)	(0.37998)	(24.9071)	(1.38912)	(97.3407)
	[-0.97661]	[0.56563]	[-0.31196]	[-0.41428]	[-1.68046]
D(R_D(-2))	40.58815	-0.429275	-25.97361	-1.335513	62.23909
	(39.0019)	(0.43619)	(28.5919)	(1.59463)	(111.742)
	[1.04067]	[-0.98414]	[-0.90842]	[-0.83750]	[0.55699]
D(R_D(-3))	-8.120122	-0.328160	-33.94037	1.343523	35.19765
	(48.2506)	(0.53963)	(35.3721)	(1.97278)	(138.240)
	[-0.16829]	[-0.60812]	[-0.95952]	[0.68103]	[0.25461]
D(SALES(-1))	0.131135	-0.008380	0.092315	0.015361	3.029313
	(1.03885)	(0.01162)	(0.76158)	(0.04247)	(2.97636)
	[0.12623]	[-0.72128]	[0.12122]	[0.36166]	[1.01779]
D(SALES(-2))	0.380147	0.014061	0.653935	0.032142	1.328882
	(0.96107)	(0.01075)	(0.70455)	(0.03929)	(2.75349)
	[0.39555]	[1.30823]	[0.92816]	[0.81798]	[0.48262]
D(SALES(-3))	-3.076729	-0.012063	-1.338054	-0.044045	-9.408053
	(0.92216)	(0.01031)	(0.67603)	(0.03770)	(2.64203)
	[-3.33643]	[-1.16966]	[-1.97928]	[-1.16818]	[-3.56092]
D(CAPEX(-1))	11.06345	0.272560	6.430260	0.197833	57.27663
	(12.4686)	(0.13945)	(9.14063)	(0.50979)	(35.7230)
	[0.88730]	[1.95457]	[0.70348]	[0.38807]	[1.60335]
D(CAPEX(-2))	-10.02707	-0.037677	-3.479062	-0.244248	18.49795
	(14.1016)	(0.15771)	(10.3378)	(0.57656)	(40.4016)
	[-0.71106]	[-0.23890]	[-0.33654]	[-0.42363]	[0.45785]
D(CAPEX(-3))	8.090051	0.393213	18.18101	0.656944	64.98780
	(16.7997)	(0.18789)	(12.3157)	(0.68687)	(48.1317)
	[0.48156]	[2.09284]	[1.47625]	[0.95643]	[1.35021]
D(EMPLOYEES(-1))	-0.260856	-0.004595	-0.221774	-0.020936	-2.003333
	(0.44795)	(0.00501)	(0.32839)	(0.01831)	(1.28338)
	[-0.58234]	[-0.91730]	[-0.67535]	[-1.14311]	[-1.56098]
D(EMPLOYEES(-2))	0.362919	-0.000869	0.047552	-0.007837	0.643798

	(0.27370)	(0.00306)	(0.20065)	(0.01119)	(0.78415)
	[1.32599]	[-0.28378]	[0.23699]	[-0.70033]	[0.82101]
D(EMPLOYEES(-3))	-0.148916	-0.003358	-0.186973	-0.007071	-0.297235
	(0.23922)	(0.00268)	(0.17537)	(0.00978)	(0.68536)
	[-0.62252]	[-1.25508]	[-1.06618]	[-0.72297]	[-0.43369]
C	1756.929	12.27466	801.8206	-26.79473	1967.432
	(861.026)	(9.62959)	(631.211)	(35.2040)	(2466.87)
	[2.04051]	[1.27468]	[1.27029]	[-0.76113]	[0.79754]