

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Statistics



Bachelor Thesis

**Development of coronavirus pandemic in the United
States of America**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

Diana Jamysheva

Business Administration

Thesis title

Development of coronavirus pandemic in the United States of America

Objectives of thesis

The aim of the bachelor thesis is to describe the main statistics of the development of the incidence of covid-19 at certain stages: subject to strict quarantine measures, upon cancellation, during different times of the year.

The number of PCR tests performed, antigen tests in accordance with the age category and gender will also be analyzed as well as the the number of positive and negative coronavirus tests according to the day of the week.

The thesis also aims to compare the development of the coronavirus pandemic in America by major state: Texas, California, Arizona, Montana.

Methodology

The bachelor thesis will consist of two main parts – theoretical part and practical part. For the theoretical part, data sources such as scientific literature, academic journals and online libraries will be used. The theoretical part is devoted to clarify the important terms of this thesis. The second, practical part, aims to analyze main indicators of covid-19 pandemic in the USA using methods of exploratory data analysis and statistical methods for time series analysis. To analyze the data, MS Excel and SAS Studio will be used.

The proposed extent of the thesis

30-40 pages

Keywords

COVID-19 Pandemic, COVID-19 global changes, statistical analysis, United States of America

Recommended information sources

FIELD, A. Discovering statistics using IBM SPSS Statistics. Thousand Oaks: SAGE Publications, 2013. ISBN 978-1-4462-4917-8.

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Amsterdam: Amsterdam, 2009. ISBN 978-0-12-374765-5.

The Centers for Disease Control's Website. Coronavirus. Start Publishing LLC (March 19, 2020) ISBN13: 9781952438981

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Declaration

I declare that I have worked on my bachelor thesis titled "**Development of coronavirus pandemic in the United States of America**" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on date of submission

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Development of coronavirus pandemic in the United States of America

Abstract

As a result of the recent global pandemic of 2020 which was caused by the COVID-19, the world has experienced a social, economic shock. Moreover, damages to financial sectors, unemployment, mental health, and other problems came with the COVID-19. The author, however, is focused on analysing the development of the COVID – 19 dynamic in four different states, Arizona, California, Montana, and Texas. This thesis studies the relationship of daily positive cases and death cases in the above-mentioned state. Additionally, the author evaluates the ratio of total cases, hospitalized cases, and death cases among genders in each state.

Keywords: COVID-19 pandemic, COVID-19 global changes, statistical analysis, United States of America.

Vývoj pandemie koronaviru ve Spojených státech amerických

Abstrakt

V důsledku nedávné globální pandemie v roce 2020, kterou způsobil COVID-19, svět zažil sociální a ekonomický šok. S COVID-19 navíc přišly škody na finančních sektorech, nezaměstnanost, duševní zdraví a další problémy. Autor se však zaměřuje na analýzu vývoje dynamiky COVID – 19 ve čtyřech různých státech, Arizoně, Kalifornii, Montaně a Taxisů. Tato práce studuje vztah denních pozitivních případů a případů úmrtí ve výše uvedených stavu. Dále autor hodnotí poměr celkových případů, hospitalizovaných případů a případů úmrtí mezi pohlavími v jednotlivých státech.

Klíčová slova: Pandemie COVID-19, globální změny COVID-19, statistická analýza, Spojené státy americké

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1 Introduction

On 30 January of 2020, a public health emergency related to the Covid-19 pandemic was declared, and on March 11, 2020, it gained global significance. A massive outbreak of the disease affected a huge number of different states. In the field of healthcare, there have been big problems with the overload of people directly related to the blockage, namely, the mobility of the world's population, supply chains, lack of places in hospitals, lack of medicines, millions of deaths and much more. All countries of the world have experienced a shock from an economic and social point of view. In order to prevent the spread of the virus, various states have taken all possible steps to combat the outbreak of the disease in order to reduce its spread, limiting people's mobility, and have taken measures to support population groups that turned out to be the most vulnerable segments of the population during the pandemic. These primarily include elderly people, usually with chronic diseases, as well as health care workers and other vital services. Thus, many countries have announced a temporary quarantine, and the United States is no exception.

The first case of the disease in America was confirmed on January 20, 2020, in a 35-year-old man who had returned from the Chinese city of Wuhan the day before, 5 days before. Two days later, US President Donald Trump announced the introduction of an emergency. Since then, the number of cases has been increasing, and by March 12, the number of diagnosed cases exceeded one thousand, after which this number doubled every two days and by March 20 reached the mark of 17 thousand. By March 26, the United States came out on top in the world in terms of the number of cases, according to the website worldometers.info.

About how the United States has suffered in one way or another, the author studies the consequences of the coronavirus pandemic for the American economy. The comparative method was used to determine the difference between GDP growth (Todaro & Smith, 2015) and other economic indicators, the productivity of sectors over the same period. Government measures aimed at supporting businesses and people affected by the pandemic have been identified. The author of the dissertation tries to assess the overall impact on the American population, how people's reaction to strict quarantine measures developed. In the practical part, a survey with multiple-choice questions is used to analyse the impact assessment on the population.

2 Objectives and Methodology

2.1 Objectives

The objective of this Bachelor Thesis is to compare the development of the COVID-19 in four different states: Arizona, California, Montana, and Taxes. The author describes the effect of covid-19 on different economic sectors in USA within its theoretical part as well as advantages and disadvantages that has been noticed on a global scale. With the help of the theoretical literature review, the author discloses the economic problems that have been manifested due to covid.

2.2 Methodology

The author analyses the secondary data of positive cases per day, death cases per day, negative tests per day, hospitalized people per day and gender ratio who went through COVID-19. The data was mainly retrieved from covidtracking.com for the chosen state, the time observed was from 03.03.2020 up to 07.03.2021. The author has run the Linear Regression model to see the correlation analysis between variables, the main assumption of the author was the following:

1) The more cases of covid-19 are registered, the more death cases will be registered.

Hence, the direction of relation is positive.

The author analyses the ration of cases, and it was divided between genders. The data the analysis is based on was the same: confirmed cases, death cases, and hospitalized cases in four states.

A linear regression model assumes that the relationship between the dependent variable y and the p -vector of regressors x is linear, whereas:

y ...dependent variable ... (Death cases per day, numeric)
 x_1 ... independent variable (Positive cases per day, numeric)
 ϵ — an unobserved random variable

$$y = X\beta + \epsilon,$$

3 Literature Review

In this chapter, the author describes the aspects of a selected country “United States” and highlights the response of economy in regards of COVID-19. The chapter touches upon relevant economic matters and how covid-19 had negatively and positively influenced the development of state economy.

3.1 Selected country: The United States of America

The United States of America (USA), or as it is simply known as America, is a state located in North America. Administratively, the state consists of 50 states, the federal (capital) District of Columbia and dependent territories. The capital of America is Washington. The United States ranks fourth in terms of the territory of the countries of the world (excluding territorial and coastal waters - 9,526,468 km² according to the (Encyclopaedia Britannica, 2006), after China, Canada and Russia. As can be seen from Figure 1, America borders Canada in the north, Mexico in the south, and Russia (by sea) in the northwest. In the West it is washed by the Pacific Ocean, in the east by the Atlantic, in the south by the Gulf of Mexico. The United States is one of the largest countries in the world in terms of population, strong influence on the economy (\$14.2 trillion) and politics, scientific, technical, and military potential (the only superpower), powerful armed forces, including the navy (OECD, 2021).

Figure 1: The United States of America on map



Source: WordAtlas (2021).

America's economy has benefited from many natural resources, including raw materials and energy, the United States is considered the world's largest exporter of goods. Structurally, the U.S. economy posted its highest growth since 1984 in 2021 after spending a lot of money (\$6 trillion) in COVID-19 relief (OECD, 2021).

Most of the USA GDP comes from the service sector, namely, education, science, healthcare, finance, trade, transport, communications, and more. In 2020, America's GDP fell by 3.4%, the biggest drop in 74 years, and in 2021, US GDP grew by 5.7%, the biggest jump since 1984. Economic growth was supported by increased spending on various goods and services for personal use, growth in exports and private investment.

Despite its positive performance, there are also weaknesses in the American economy. In the USA, there is a strong decline in the number of jobs in industrial production, strong competition in technology, in comparison with Asia and the EU, the bankruptcy of the largest firms, which leads to a crisis of confidence (OECD , 2018). The United States spends the most money on health care, both in absolute terms and as a percentage of gross domestic product (GDP) per capita. According to the latest estimates, about 16% of GDP is used for health care in the US. About 84% of citizens have health insurance, 64% of them are provided by the employer, 9% have purchased it on their own, 27% of citizens are provided with insurance under government programs (disabled people, the elderly, children, veterans, low-income people) (Statista.com, 2021.). Many Americans without private insurance are covered by government programs such as Medicare and Medicaid, as well as other low-income programs by various states and local governments. One study showed that about 25% of uninsured USA residents (about 11 million people) could participate in one or another government program, but for some reason did not fall under them.

3.2 Positive impact of COVID-19

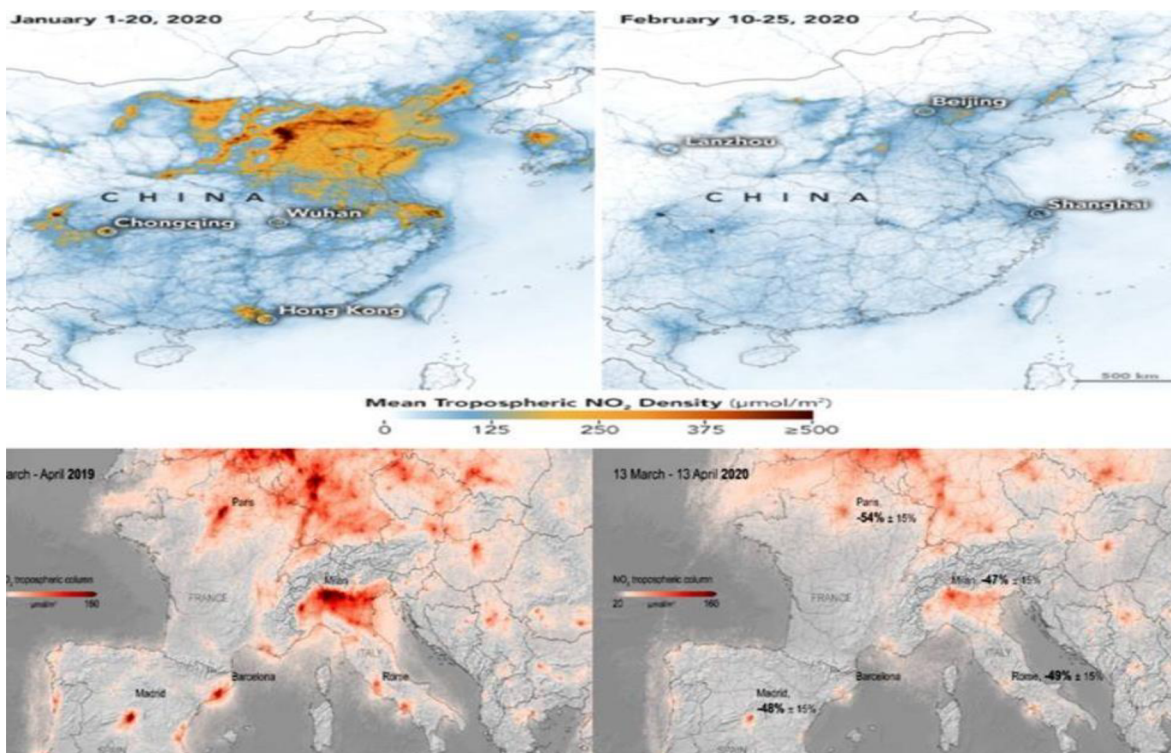
The coronavirus pandemic has affected the climate of our planet. Due to significant restrictions, the cancellation of concerts, events, championships, the rare use of public transport in the atmosphere, a large amount of CO₂ emissions has been reduced.

As you can see in Figure 2, Earth pollution observation satellites show a huge decrease in air pollution in China, in Europe, in America. So, for the first time in a long time in March 2020, the water in the canals of Venice became so transparent that you could see swimming

fish underwater. This improvement occurred after the introduction in Italy of a complete quarantine and a ban on the movement of boats on the waterways of Venice.

According to the (Ken, L. & Greenstone, M., 2021) between February 3 and March 1, carbon dioxide emissions in China decreased by 25% in one month, while low concentrations were noted in India by 25%, in Paris by 54%. The International Air Transport Association announced that global air travel in January 2020 showed the lowest monthly growth since April 2010, with US aircraft accounting for about 3% of total greenhouse gas emissions.

Figure 2: Air pollution reduction, January - February 2020.



Source: NASA (2020).

NASA and ESA have been observing the change in nitrogen dioxide gases dropped significantly at the beginning phase of the COVID-19 pandemic.

3.3 Negative impact of COVID-19

Gondi S., Beckman A.L., Deveau N., Raja A.S., Ranney M.L., Popkin R., He S, (2021) claimed that the most significant tragedy of the coronavirus pandemic was, of course, population decline, economic losses, unforeseen shocks, and crises. But the high consumption of plastic packaging has also become a huge problem for the atmosphere. Due to restrictive measures and strict quarantine rules during the pandemic, food delivery services began to actively develop, after which there was a significant increase in the amount of plastic. The demand for disposable personal hygiene items has increased, the amount of medical waste that is not recycled will be gigantic. The development of the “green” technology industry and the financing of the production of solar, wind and other alternative types of energy have significantly slowed down. In the case of climate change, namely global warming, there may be an acceleration of infection by the COVID-19 virus, dengue fever, which was previously considered tropical.

The entire global economy has undoubtedly been affected by the COVID-19 pandemic. For the first time since 1998, global poverty will increase, with some 49 million people at risk of falling into extreme poverty (OECD, 2021)

3.4 Global evaluation of policy frameworks to combat COVID-19

To combat the spread of the coronavirus infection, various strategies have been introduced to prevent it, which differed at different times, at different times of the year, in different states. According to Siow (2020) statistics from, China, USA, Korea, Italy, UK have been most affected by Covid-19. Hospitals are overcrowded, and due to a huge shortage of beds, patients are being housed in field hospitals, parks, and even cathedrals. For the speedy first aid, the well-known company General Motors has produced more than one hundred thousand ventilators. One of the rule during quarantine was the introduction of a lockdown, that is, the closure of enterprises and institutions, a ban on events with crowds of people is valid throughout the country. The Centers for Disease Control and Prevention (CDC) has advised residents of New York, New Jersey and Connecticut to refrain from domestic travel for 14 days due to the spread of the coronavirus. Wearing medical masks or respirators, a distance of 2 meters between people. In various places (supermarkets, pharmacies, taxis) they installed a transparent curtain as a measure of additional protection for their customers. As a result of the restrictions, a large number of industries related to

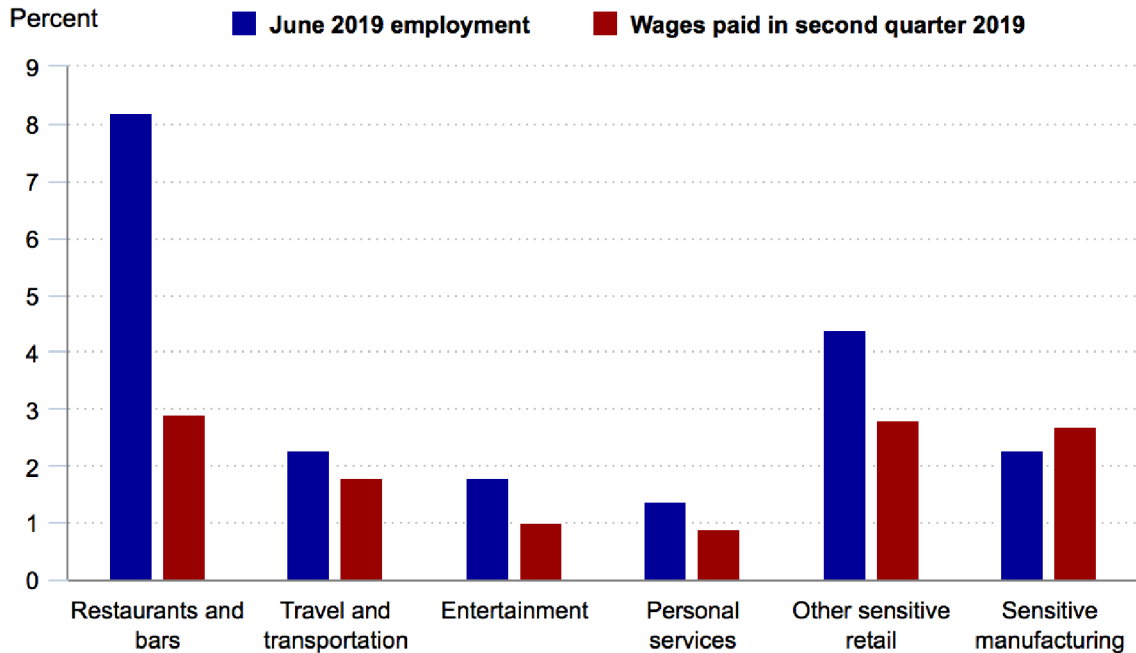
their profitability and productivity have suffered, especially the restaurant business, tourism and transportation, the entertainment industry (casinos and amusement parks), part of the manufacturing industry (aircraft and automotive). As can be seen from **Table - 1** and **Figure - 4**, restaurants and bars accounted for just over 8% of total employment in June 2019. Approximately 20.4% of all workers are employed in industries hardest hit by COVID-19 restrictions.

Table 1: Industry statistics, by firm size class in the USA

Firm size (number of employees)	Total	All other	Most exposed sectors						
			Restaurants and bars	Travel and transportation	Entertainment	Personal services	Other sensitive retail	Sensitive manufacturing	Most exposed sectors combined
Employment levels in June 2019 (thousands)									
10 or less	14,139.9	10,813.4	1,124.6	140.1	209.2	845.7	779.8	227.1	3,326.5
11 to 50	22,257.7	14,994.6	4,022.0	545.2	541.1	743.5	961.4	449.9	7,263.1
51 to 100	10,572.4	7,644.2	1,533.8	198.5	294.7	100.9	556.5	243.8	2,928.2
101 to 500	25,483.5	20,893.5	1,668.0	558.9	642.0	146.2	830.9	744.0	4,590.0
More than 500	77,528.8	65,076.8	3,925.1	2,050.6	957.0	249.9	3,419.9	1,849.5	12,452.0
Total	149,982.3	119,422.5	12,273.5	3,493.3	2,644.0	2,086.2	6,548.5	3,514.3	30,559.8
Total wages paid in second quarter 2019 (billions of dollars)									
10 or less	\$144.894	\$120.886	\$5.183	\$0.926	\$1.951	\$7.731	\$5.844	\$2.373	\$24.008
11 to 50	242.971	194.789	19.428	3.350	2.581	7.412	9.954	5.457	48.182
51 to 100	132.246	108.932	8.192	1.674	1.649	1.010	7.550	3.239	23.314
101 to 500	358.286	314.502	8.519	5.413	5.783	1.453	12.052	10.564	43.784
More than 500	1,240.032	1,121.793	20.876	27.118	8.879	2.259	24.403	34.704	118.239
Total	2,118.429	1,860.902	62.198	38.481	20.843	19.865	59.803	56.337	257.527

Monthly Labor Review, April 2020.

Figure 3: Shares of total U.S. employment and wage earnings in most exposed sectors.



Source: Monthly Labor Review, April 2020.

By June 26, 2020, the fastest growing number of infected people is no longer in New York, but in the western and southern states, primarily in Texas, Florida and Arizona. In Florida, 8942 people were immediately diagnosed with coronavirus per day. In Arizona, the number of infections reached 63,000, according to the New York Times by the end of June 2020. In California, due to a shortage of medical personnel, doctors and nurses who have a mild form of coronavirus began to be called to work. *“The point is that employees who are sick with COVID-19 are caring for those who are already infected with COVID-19.”* (Schwartz, Nelson D., 2020).

As a result of psychological panic, people began to make large purchases in supermarkets, stock up on food, hygiene products, and medicines, which disrupted supply chains, employees did not have time to display goods, products did not have time to deliver to stores, pharmacies, supermarkets. Therefore, the United States activated the Defense Production Act and forced car manufacturers to focus on the production of ventilators (American Geriatrics Society, 2020) supplied to hospitals and hospitals. The same thing happened with a huge shortage of N95 masks, medical gloves, antiseptics, and other necessary protective equipment. On April 1, 2020, the export of personal protective equipment was suspended due to their acute shortage within the country.

On 03/19/2020, the President signed a law providing every US resident to undergo free testing for COVID-19 (even without insurance). On the streets of all cities, public utilities are trying to disinfect places of potential congestion of people, including bus stops, parking lots, playgrounds and spaces near shops. U.S. companies ramp up medical production: Honeywell increased the production of N95 type masks several times, Jockey plans to supply from 30 to 50 thousand medical gowns per week, United Technologies will donate to the Federal Agency as a support measure emergency management more than 1 million units of funds personal protection.

The American corporation Apple has designed protective face shields, with which it is planned to supply physicians working with infected COVID-19. The company plans to produce 1 million of them weekly. shields. From 03/30/2020 to 04/05/2020, Ford produced more than 1 million protective face screens. In addition, the company began production of a new type of respirators for medical personnel. The respirator closes completely face, and air is supplied through the tube using a filter pump²⁰.

To help citizens, the White House and Congress draw up support measures, namely packages of measures for certain amounts of money. On March 6, 2020, the President signed the first package of measures in the amount of \$8.3 billion. The funds were intended to support the national health system and fund research to find treatments and vaccines. Two weeks later, the President provided financial assistance to people affected by the coronavirus. For example, providing paid leave to employees who fall ill with COVID-19, reimbursement to insurance companies, Medicare (for the elderly) and Medicaid (for the unsecured) health insurance systems (OECD, 2021). On March 27, 2020, the President of the United States signed the third package of measures in the amount of \$ 2.3 trillion, which includes unemployment benefits, loans and grants for small businesses, support for the healthcare system, increased funding for the education system, support for transport operators (grants to air cargo carriers, airports and companies providing transport services).

3.5 Economic crisis

The main economic blow from the coronavirus pandemic came at the beginning of 2020. From January to April 2020, the number of people who lost their jobs in the United States was 9.9 per 100 people. Young people suffered the most, among whom, aged 25-44, 11.6 people out of 100 lost their jobs during that period. According to statistics, in April

2020, 61.3% of Americans aged 16 and over were able to have a job, but the actual data showed that in April 2020, this proportion was only 51.5%.

By the end of April 2020, 1.7 million New Yorkers had filed for unemployment benefits. In the second quarter of 2020, New York State's GDP shrank by 20%. The most affected counties include, for example, the state of Florida, the state of California. The most negative impact on the economy was the closure of amusement parks, such as Disneyland, and restrictions on the hotel and restaurant business (Wang C, Li Z, Clay Mathews M, Praharaj S, Karna B, Solís P., 2022).

3.5.1 Negative productivity shock

Supply shock

Supply shock was noticed before the pandemic, however, there is a small consensus on the long-term impact of the crisis. Based on the report of DHL, there were four main distinct types of transactions which were affected the most: trade, capital, information, and people. The report puts an attention of the effect of cross-border movements, where people struggle the most, which eventually impacted the trade with a sharp contraction in the global economy. Capital flows also dropped during 2020 as a response on the lockdown, which affected the corporate earnings, business travel restrictions, negative business prospects and global supply chain. As a results, some companies decided to change their suppliers and shifted to a new production line, which ended up being very costly for some firms and such companies faced new risks with the logistics. Besides these challenges, Barriball, E. and Lund, S. (2022) reported the number of risks on supply chains. The report highlighted that, from 16 % to 26 % of global goods exports, around 2,9 trillion to 4,9 trillion USD, could potentially move to new countries, in case if countries restructure their networking among suppliers.

Demand shock

The covid crisis has majorly impacted the three main mechanisms of economy. First, the income due to economic slowdown, which led to the reduction of consumption. Thus, directly impacting the household consumption on household income. Consumers had to adjust to the patterns of consumption based on the access of goods and services, due to supply shocks, there were shortages of most of the goods. Finally, when people live in uncertainty, they tend to reduce the spending and increase their savings. The COVID

lockdown has created many problems with the consumption of certain goods and services around the globe, where 50 % of consumption is estimated to be restricted (Central Bank of Ireland, 2020). Revolute data demonstrates a sharp decline in consumption in March of 2020, but a rapid increase in consumption in late April and May, it demonstrated the patterns of converting back an old consumption (Department of Finance, 2020). The pandemic impact on consumption is seem to be uniform across households. The shift parameters of nourishment consists of agriculture and food, beverages and tobacco products). At the same, the decrease in transportation services and commodities is also noticable. However, the demand for physical commodities have decreased, the demand for telecommunication services have actually increased. Hance, if consumers are pessemistic about their future economic development, the would rather decrease their spendings and supress demand.

3.6 Changes in global GDP and trade

According to Moody's Analytics, the coronavirus epidemic in March and April led to a 29% shutdown of economic activity in the United States. US GDP declined by 2% in 2020 due to a moderate contraction in economic activity in the first quarter and a significant contraction in the second. The unemployment rate peaked at 9% to 16% in the second quarter, and the average unemployment rate for 2020 was 6.5%. The number of unemployed in the US is growing at 6.6 million people a week. The total number of people who lost their jobs is about 16 million people. The World Bank estimates that the crisis caused by the spread of COVID-19 will lead to a drop in US GDP by 1.67% - 3.4%, depending on the scale of the pandemic.

The volumes of global import and export terms dropped by 7,8 % and 6,6 % respectively, in the first quarter, the second quarter registered the decrease of 11,6 % and 11,1 %. The value's numbers for the first quarter were 10,6 % and 8,6 % and 13,4 % and 14,1 %. The WTO (2021) concluded that some economic sectors were affected more than others, especially fuel and mineral sectors experienced the decrease of 38,5 %, whereas agricultural sector fell by 5,2 %. However, the third quarter has retrieved the export and import numbers back by 20,7 % and 18,3 % respectively. The fourth quarter has registered the increase of 9,5 % and 9,9 % by value terms. The updated prediction at the end of 2021 was not pleasant as it projected the global decrease of GDP by 5 %. Eventually, the WTO claimed that the global response to pandemic, by announcing a massive lockdown in Asia,

Europe, USA, and the rest of the world, have potentially shaved the global trade by 2 – 2,2 %.

3.6.1 Industry

Due to the disruption of production chains due to the pandemic, it has reduced the ability of countries to purchase US-made components. Countries with significant epidemics have reduced exports, including from the United States. There has been a decline in output due to the global recession, pent-up consumer demand and deferred investment by businesses. The Dow Jones Industrial Average fell 9.99%, the biggest drop since Black Monday in 1987.

In the automotive industry, such giants as Ford, Fiat, Chrysler and General Motors were forced to close for a while. Under the tangible impact of the crisis came the military-industrial, agro-industrial complexes. Due to the huge labour shortage on farms as a result of visa restrictions, the American Farm Bureau approached the US administration to solve this problem.

The construction industry, which imports up to 50% of all materials from China, is seeing rising material costs and project completion times. Toll Brothers, the largest housing company in the US, announced a sharp decline in profits and delays in the delivery of houses due to the lack of necessary consumables for construction.

The pandemic has also affected the activities of the US pharmaceutical industry. As a result of supply disruptions in May 2021 in the United States, according to the Food and Drug Administration there was a shortage of 162 important drugs, such as atropine, cortisone, dexamethasone, heparin, ketamine, morphine, prednisolone, and others (U.S Food & Drug Administration, 2022). At the same time, the country's pharmaceutical companies have focused their efforts on the development and mass production of coronavirus vaccines.

The information technology sector is also experiencing problems due to the pandemic. For example, Apple missed its Q1 2020 financial plan because production slowed and, in some cases, stopped altogether. About 15% of Apple's revenue depends on the production of the company's products in China. Microsoft is also warning of lower revenue, primarily due to supply chain disruptions.

On the contrary, due to the mass use of the Zoom telecommuting program and a 585% increase in traffic over the past month, Zoom Video Communications stock has almost

doubled. At the same time, it is reported that the staff of the company has been completely transferred to remote work.

3.6.2 Education

Educational institutions are closed in 50 states of the country and the District of Columbia. Closing times vary across the country, ranging from two weeks to more than a month. Students and students switched to online learning. In the largest US metropolitan areas, schools will not function until at least 04/20/2020. At the same time, teachers will come to work to conduct online lessons, as well as professional retraining. As of March 16, 2020, more than 30 million schoolchildren switched to online learning. All universities have temporarily switched to distance learning, including the oldest US university, Harvard, and Ohio State University, which has more than 60,000 students.

On March 20, 2020, the President announced the cancellation of school exams. University entrance exams have been postponed from April to June. 14 states have decided to complete their studies within the current academic year. In 3 more states, authorities recommended that schools consider ending the school year early. Some universities have announced that exams will be conducted online. Some universities have frozen their international programs (for example, Villanova, Elon, Florida International and Sirakuzas). Initially, such a measure was introduced until 03/30/2020, however, most educational institutions extended this measure until the end of April.

By adopting a new system of remote learning, the quality of education at universities became concern able. Murphy et., el (2020) concluded the survey on students and the way the preferred the teaching seasons, it resulted that most students prefer face-to-face interactions. However, online learning bereaved students of face-to-face interaction and support. Neither college students nor teachers were ready for such an abrupt shift from offline to online. Moreover, students reported that chores and family members interrupt them from studying from home, which is the case of all students.

3.6.3 Telecommunications and other technologies

The coronavirus pandemic has had an impact on the development of technologies, especially in the field of healthcare: scientists have prepared the first version of a full three-dimensional model of the coronavirus, which helped to develop an effective vaccine. Apple has partnered with the US Centres for Disease Control and Prevention and the Federal

Emergency Management Agency to launch an app that allows screening for the coronavirus. By analysing responses to various questions based on the CDC's recommendations, the app suggests what actions to take, including the need to take a coronavirus test if a user thinks they have symptoms of COVID-19. The Food and Drug Administration (FDA) has approved a new sterilization technology for medical masks. The technology allows each N95 type protective mask to be disinfected up to 20 times. Facebook and the Private Kit will collect geodata about the movement of users in order to analyse and prevent the possibility of infection. Apple has released a dedicated Apple COVID-19 app that provides simple instructions on how to behave during the epidemic and when to see a doctor and get tested for coronavirus. The largest American IT companies provide free or preferential access to their services for organizing remote work and education.

4 Practical Part

In the empirical part of the thesis, the author demonstrates the descriptive statistic background in numeric format for the chosen states such as: Texas, Arizona, California, and Montana.

4.1 California data

The author has gathered the following data for and run a univariate analysis of each variable, which could be seen in the **Figure – 5 and 6**, the time-period, based on the availability of the data for California is the following, from 04.03.2020 – 07.03.2021, N – 369.

Table 2: Summary of cases - California

Cases	3 501 394	Ratio % of total
Average daily Cases	9 489	
Deaths Total	54 124	1,55%
Average daily Deaths	147	
Hospitalized Total	601 245	17,17%
Average of daily Hospitalizations	1 629	

Source: Own processing in Excel Software.

Table 3: Vaccination rate of California

California	Not Fully Vaccinated	Fully Vaccinated	Booster of Vaccination	Total
Cases	1 271 006 (36 %)	724 788 (21%)	1 505 599 (43 %)	3 501 394
Hospitalizations	189 93 (33 %)	141 29 (24 %)	24 784 (43 %)	57 907
Deaths	19 484 (36 %)	17 373 (32 %)	17 265 (32 %)	54 124

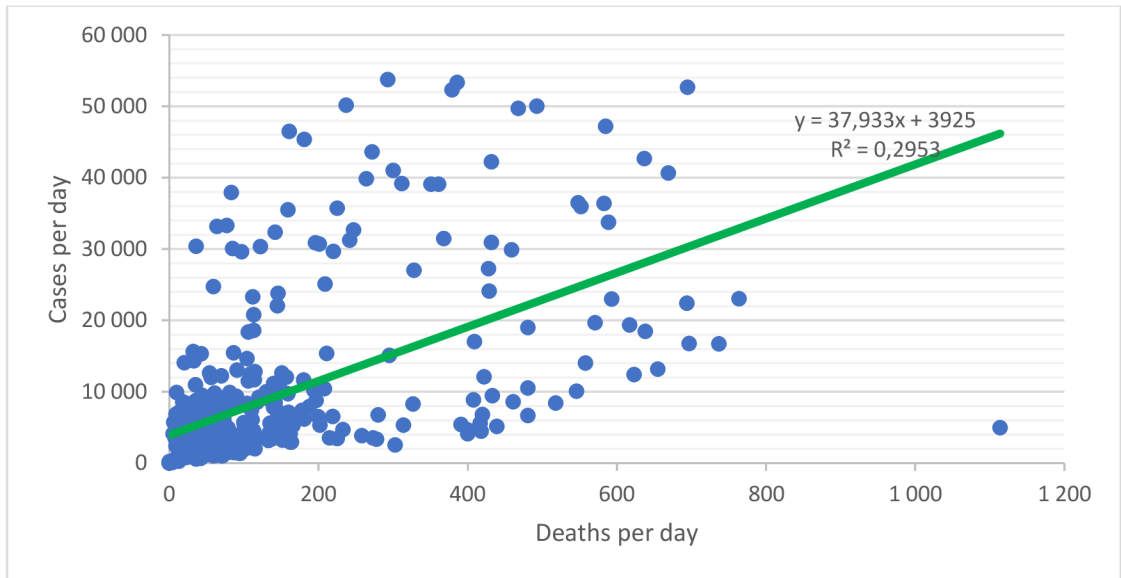
Source: Own processing in Excel Software.

From the table above, the author puts an attention on mean between all variables such as death rate per day, which is 147 people. Positive tests between the chosen period, per day are 9489 people, however, the average increased due to its peak period between the 05.12.2020 up to 14.02.2021, which is seen on the **Graph – 2**. The same **Graph – 3**, demonstrates the death rate, in the same period, hence the author might assume that there is a positive relationship between positive results and death cases. Which is logical, the more

people get sick with a COVID-19, the probability of death increases, however, the author will further run a correlation analysis and depicts it on the **Figure – 1**.

The author might assume that there is a positive relationship between increasing cases per day and death ratio, meaning that the more people get sick with a COVID-19, the more deaths are expected.

Graph 1: Linear Regression Model for California



Source: Own processing, Excel.

With a help of (Regression function) the author has received the following data and attached the data of the Linear Regression function.

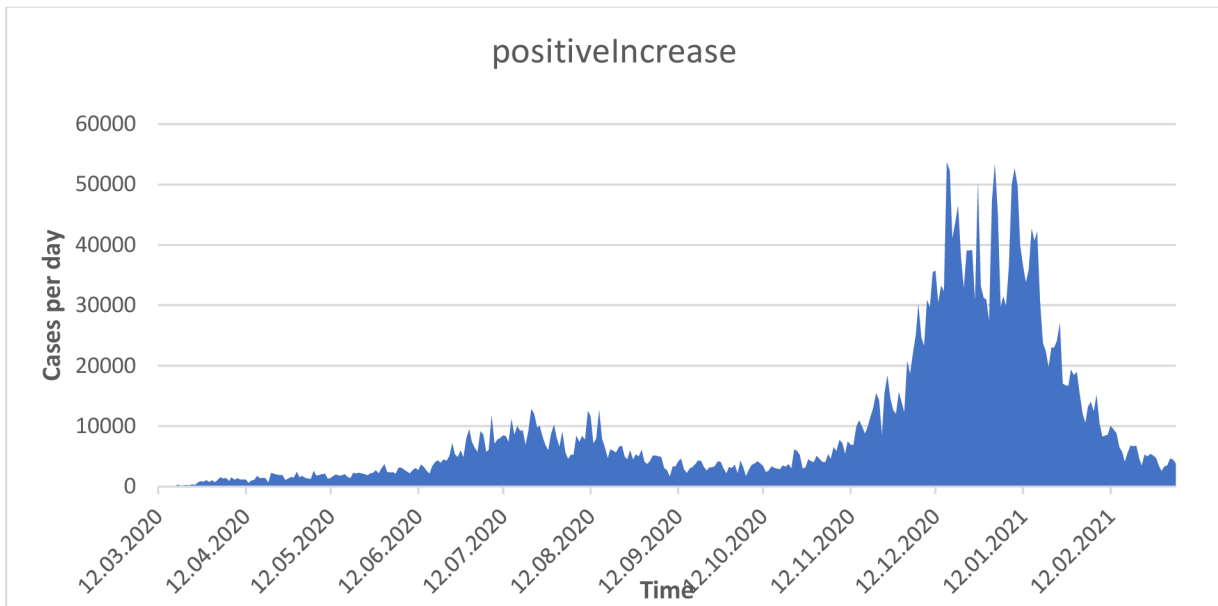
Table 4: Regressions of California model

Multiple R	55%
R Square	30%
Adjusted R Square	30%
Standard Error	140,9129977
Observations	366

Source: Own Processing, Excel.

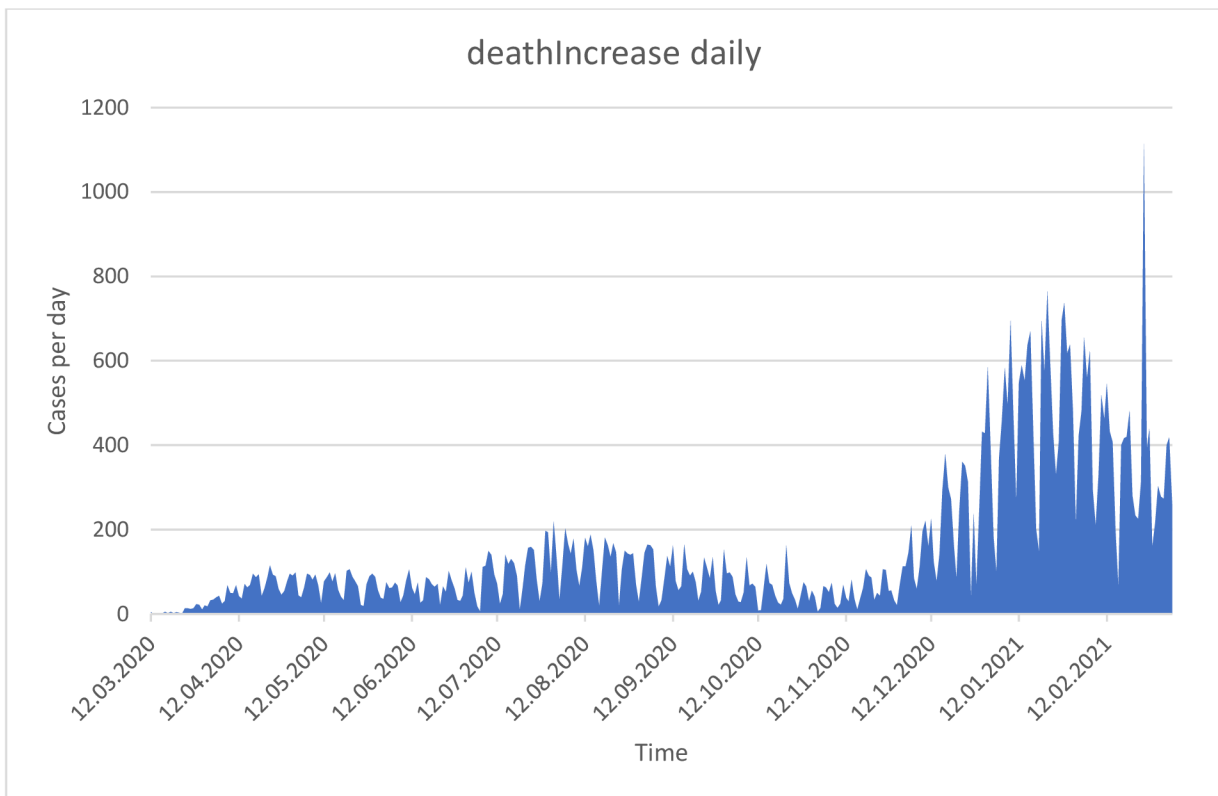
Based on the results of the data, the correlation seems to be high, over 55 %. Which means that the more people get sick with the COVID-19, the more deaths are expected. The final regression analysis is seen on the **Figure – 7**. The Graphs – 1 and 2, depicts the development of the COVID-19 daily, in California.

Graph 2: Positive Cases in California between 04.03.2020 – 07.03.2021



Source: Own Processing in Excel Software.

Graph 3: Death cases in California between 04.03.2020 - 07.03.2021



Source: Own Processing in Excel Software.

The Graph – 3, depicts high case of deaths in between the period of 05.12.2020 and lasted up to 07.03.2021, the highest peak is registered on the day 25.02.2022, due to a high

increase of positive cases per day (4965 cases) and due to a high rate of “Currently hospitalized people”, which was (6520 cases). The flow of positive people was that high and obviously resulted in a high rate of death.

Table 5: Gender ratio for California

California	Confirmed cases	Ratio	Death	Ratio	Hospitalized	Ratio
Ratio	3 501 394	100%	54 124	100%	57 907	100%
Mean	42	n/t	51	n/t	46	n/t
Age range	0 - 100	n/t	0 - 100	n/t	0 - 100	n/t
Male	1 610 641	46%	35 722	66%	18 067	31%
Female	1 890 753	54%	18 402	34%	39 840	69%

Source: Own Processing in Excel Software.

From the **Table – 3**, it is seen that among two genders, females are more who went through the coronavirus, however, the death ratio indicates the opposite, man are more likely to experience death than women, the median age of death is 51, as their ratio of death is much higher. Hospitalization rate also indicates that women were more hospitalized than men, hospitalization median age is 46 years old.

4.2 Taxes data

The data for Taxes was gathered in the same way, where the author had a time period of data started from 03.03.2020 – 07.03.2021, N – 370. The author has considered the total cases of COVID-19, total cases of death and total cases of hospitalized people, for the chosen period, See, **Figure – 9**.

Table 6: Summary of cases – Taxes

Cases	2 686 818	Ratio % of total
Average daily Cases	7 262	
Deaths Total	44 445	1,65%
Average daily Deaths	120	
Hospitalized Total	158 522	5,90%
Average of daily Hospitalizations	428	

Source: Own Processing in Excel Software.

The average daily cases of Covid in the state of Taxes for the time of 03.03.2020 – 07.03.2021, was 7 262 people per day, however its main peak falls onto the period of December 1st and keeps on increasing, which indicates that break – out of pandemic in Taxes. The **Graph – 4**. On 1.11.2020, there were 72 thousand people tested as positive on the covid-19, which doesn't seem to be an outlier but a real case.

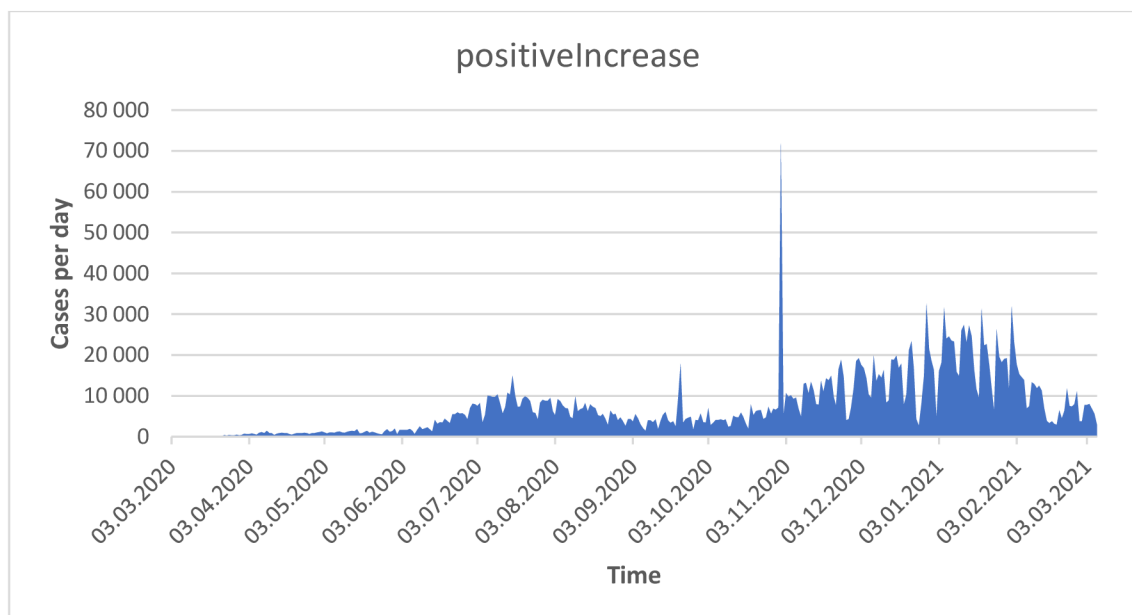
The Table – 4, represents the vaccination rates among total cases of death, hospitalized people and people who were tested positive. The highest rate of death was among not vaccinated people, 38 %. Followed by one vaccination dose (32 %) and the last place was taken by two doses of vaccine (booster vaccination). The hospitalization rate and the cases also indicate that, the more people who got sick with the covid and were hospitalized were the ones who didn't have any vaccination.

Table 7: Vaccination rate of Taxes.

Taxes	Not Vaccinated	Fully Vaccinated	Booster of Vaccination	Total
Cases	1 115 029 (42 %)	91 8891 (34 %)	652 897 (24 %)	2 686 818
Hospitalizations	23 858 (41 %)	14 129 (24 %)	19 920 (34 %)	57 907
Deaths	16 978 (38 %)	14 267 (32 %)	13 200 (30 %)	44 445

Source: Own processing, Excel.

Graph 4: Positive Cases in Taxes between 03.03.2020 – 07.03.2021

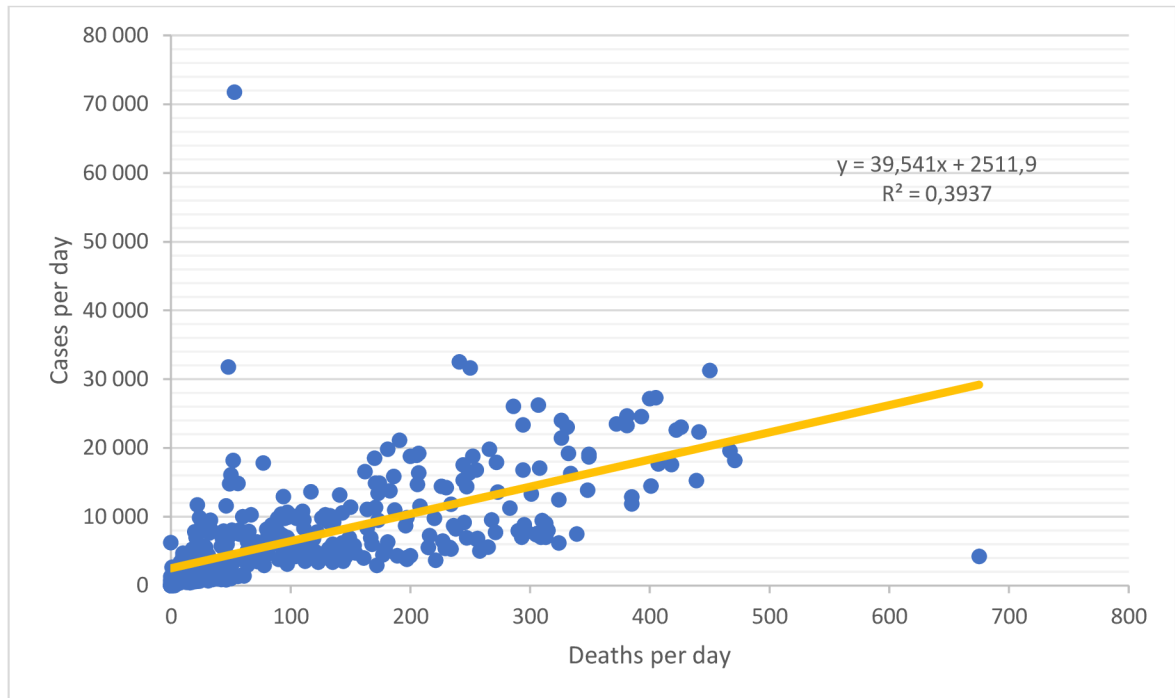


Source: Own processing, Excel.

The assumption, which was applied in California stays the same, the more people tested positively with a covid, the more death rating will be, meaning that there is a

positive correlation between those two variables, for the confirmation the author has run the Linear Regression Model, See, **Graph – 5**.

Graph 5: Linear Regression Model for Taxes



Source: Own processing, Excel

With a help of (Regression function) the author has received the following data and attached the data of the Linear Regression function. The **Table – 5** demonstrates the relatively high correlation between two variables of 62 %. Which confirms the stated assumption. The R-square is 39 %, which indicates how much the dependent variable is explained by the independent variable.

Table 8: Regressions of Taxes Model

Multiple R	63%
R Square	39%
Adjusted R Square	39%
Standard Error	93,37861358
Observations	370

Source: Own processing, Excel

The following table demonstrates the gender rations among total cases, death cases and hospitalization cases.

Table 9: Gender ratio for Taxes

Taxes	Confirmed cases	%	Death	%	Hospitalized	%
Ratio	2 686 818	100%	44 445	100%	57 907	100%
Mean age	46	n/t	53	n/t	47	n/t
Age range	0-100	n/t	0-100	n/t	0-100	n/t
Male	953 820	36%	17 556	40%	29 822	52%
Female	1 732 998	64%	26 889	60%	28 664	48%

Source: Own processing, Excel

The median age of cases in Taxes is 46 years old, the ratio of females who experienced COVID-19 is 65 % and men are 35 %. The death rate as expected is also higher between females and that is 60 %. The hospitalized rate among males are more than females (52 %). The author can see the negative correlation of hospitalization rate and the death rate among females, as when people are hospitalized, they get more of a medical attention, hence have more chances to survive. The mean age among death is 53 years old and hospitalized age of mean is 42 years old.

4.3 Montana Data

The data for Taxes was gathered in the same way, where the author had time of data started from 07.03.2020 – 07.03.2021, N – 366. The author has considered the total cases of COVID-19, total cases of death and total cases of hospitalized people, for the chosen period, See, **Table – 7**. The daily increase of cases is 276 people a day, the death rate per day is 4 people and hospitalized people per day were 13.

Table 10: Summary of cases – Montana

Cases	100 914	Ratio % of total
Average daily Cases	276	
Deaths Total	1 381	1,37%
Average daily Deaths	4	
Hostpitalized	4 632	4,59%
Average of daily Hospitalizations	13	

Source: Own processing, Excel

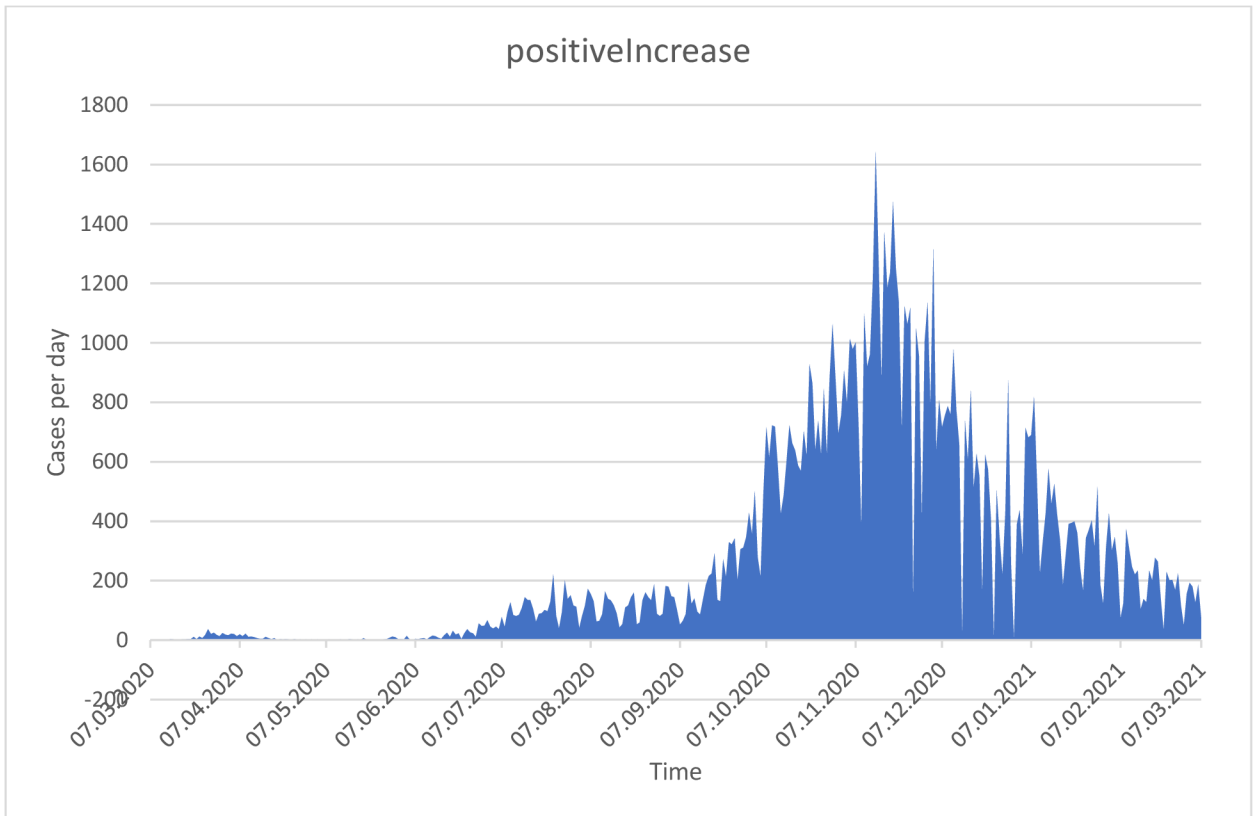
The following **Table – 8**, represents the total amount of cases who experienced COVID-19 disease, the fact is that people who had a boosting dose of vaccination (43%) had been tested positively the most, and the same applies for the hospitalization rate (43%) and death rate. It is the first state with the lower cases of diseases, however, with a high rate of mortality, followed by not vaccinated people who went over COVID-19 (36%), and one does of vaccination (21%).

Table 11: Vaccination rate for Montana

Montana	Not Fully Vaccinated	Fully Vaccinated	Booster of Vaccination	Total
Cases	36 631 (36 %)	20 889 (21 %)	43 393 (43 %)	100 914
Hospitalizations	1 518 (33%)	1 129 (24%)	1 981 (43 %)	4 632
Deaths	443 (32%)	443 (32%)	495 (36 %)	1 381

Source: Own processing, Excel.

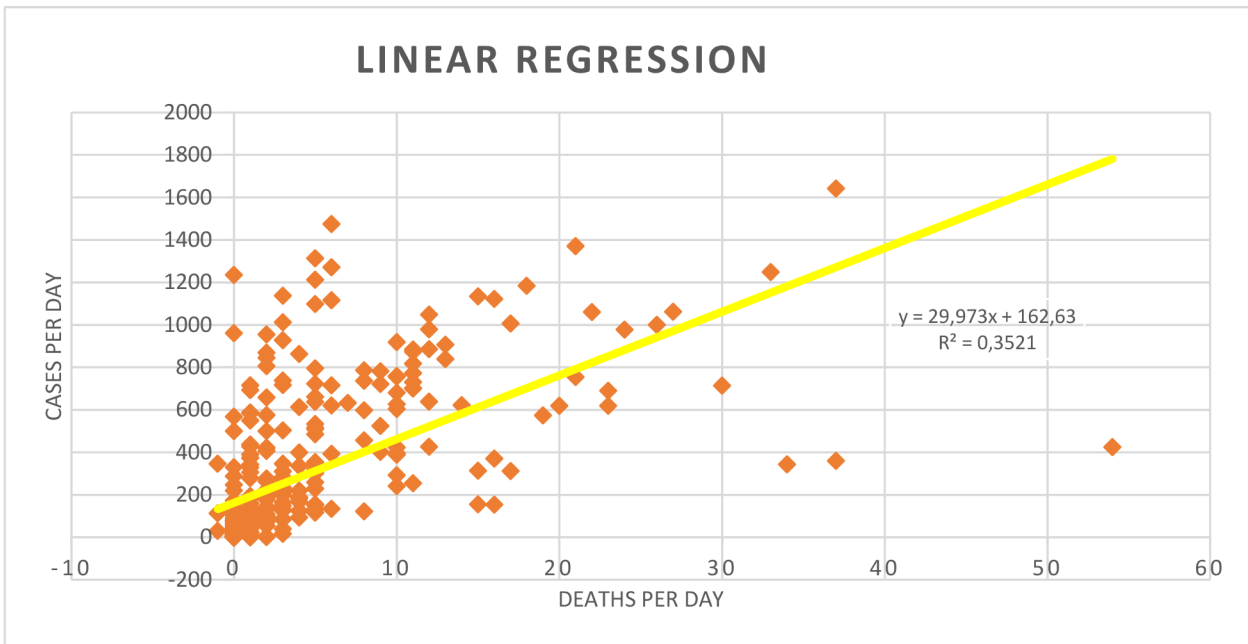
Graph 6: Positive Cases in Montana between 07.03.2020 – 07.03.2021



Source: Own processing, Excel.

Its main peak has been developing since 24.09.2020 and went up to 07.02.2021.

Graph 7: Linear Regression Model for Montana



Source: Own processing, Excel.

With a help of (Regression function) the author has received the following data and attached the data of the Linear Regression function. The **Table – 9** demonstrates the relatively high correlation between two variables of 59 %. Which confirms the stated assumption. The R-square is 35 %, which indicates how much the dependent variable is explained by the independent variable.

Table 12: Regression of Montana model

Multiple R	59%
R Square	35%
Adjusted R Square	35%
Standard Error	5,425431135
Observations	366

Source: Own processing, Excel.

Table – 10 indicates the ratio of confirmed cases between males and females. Most of the confirmed was noticed among male genders (66%) and female accounted for (35%). The mean age of confirmed cases was 49 years old. The ratios of death among genders are divided in (62%) for males and (38%) females and mean age of death was 52. The rate of

hospitalized male was also higher than female (73%) and (27%) respectively, the mean age of hospitalized people was 50 years old.

Table 13: Gender ratios for Montana

Taxes	Confirmed cases	%	Death	%	Hospitalized	%
Confirmed cases	100 914	100	1 381	100%	4 632	100%
Mean age	49	n/t	52	n/t	50	n/t
Age range	0 – 100	n/t	0 – 100	n/t	0 – 100	n/t
Male	66 099	66%	859	62%	1 260	27%
Female	34 815	35%	522	38%	3 372	73%

Source: Own processing, Excel.

4.4 Arizona Data

The author has gathered the data for Arizona, where the total number of cases was 826 454 for the time period of 04.03.2022 up to 07.03.2021. The daily increase of cases was accounted for 2 240 people, average death was 44 people per day, and hospitalization rate per day was 157 people, See, **Table – 11**. Its main peak of the disease was registered between 04.07.2020 up to 04.09.2020 and the second wave hit the Arizona state at the beginning of the year 01.04.2021 and lasted up to 04.03.2021, See **Graph – 8**.

Table 14: Summary of cases – Arizona

Cases	826 454	Ratio % of total
Average daily Cases	2 240	
Deaths Total	16 328	2,0%
Average daily Deaths	44	
Hospitalized Total	57 907	7,007%
Average of daily Hospitalizations	157	

Source: Own processing, Excel.

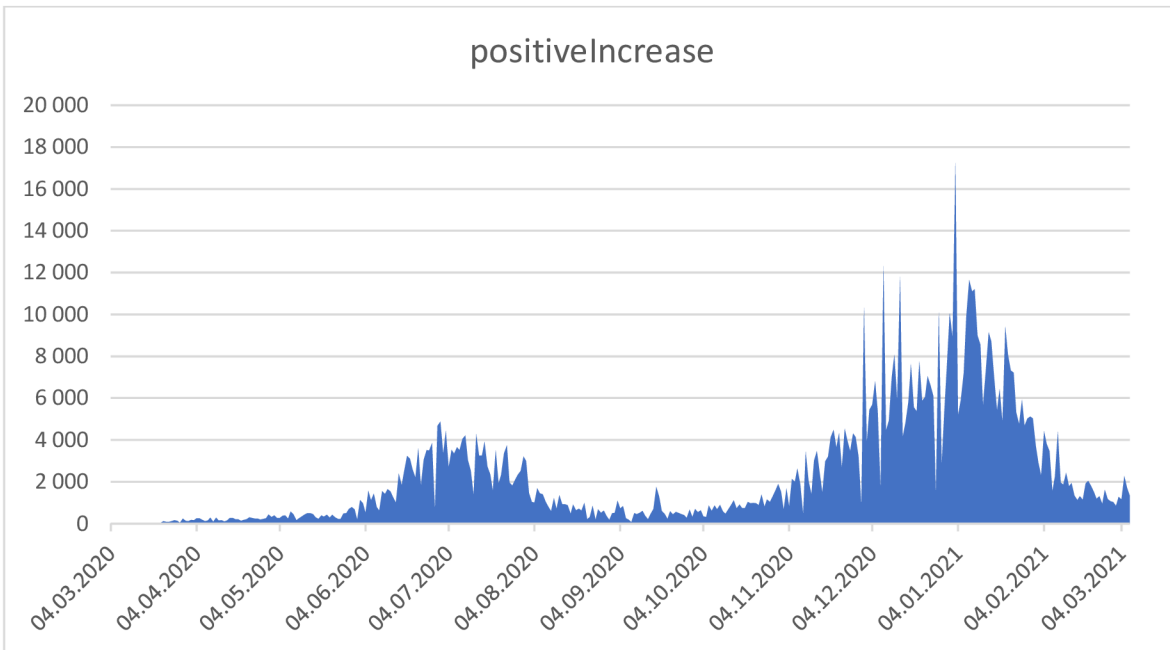
The next **Table – 12**, demonstrates how many were non-vaccinated, with a first dose and booster dose. People who didn't receive any vaccination were accounted for 36 % out of all, however, the most cases were registered among the people who had a boosted does of vaccination (43%). However, still the percentage rate of dead people without vaccination exceeds those who had the first and second vaccination. The hospitalization rate is the highest with those who had the second dose of vaccination (43%).

Table 15: Vaccination rate for Arizona

Montana	Not Fully Vaccinated	Fully Vaccinated	Booster of Vaccination	Total
Cases	300 002 (36%)	171 076 (21%)	355 375 (43%)	826 454
Hospitalizations	18 993 (33%)	14 129 (24%)	24 784 (43%)	57 907
Deaths	5 878 (36 %)	5 241 (32%)	5 209 (32%)	16 328

Source: Own processing, Excel.

Graph 8: Positive Cases in Arizona between 04.03.2020 – 07.03.2021



Source: Own processing, Excel.

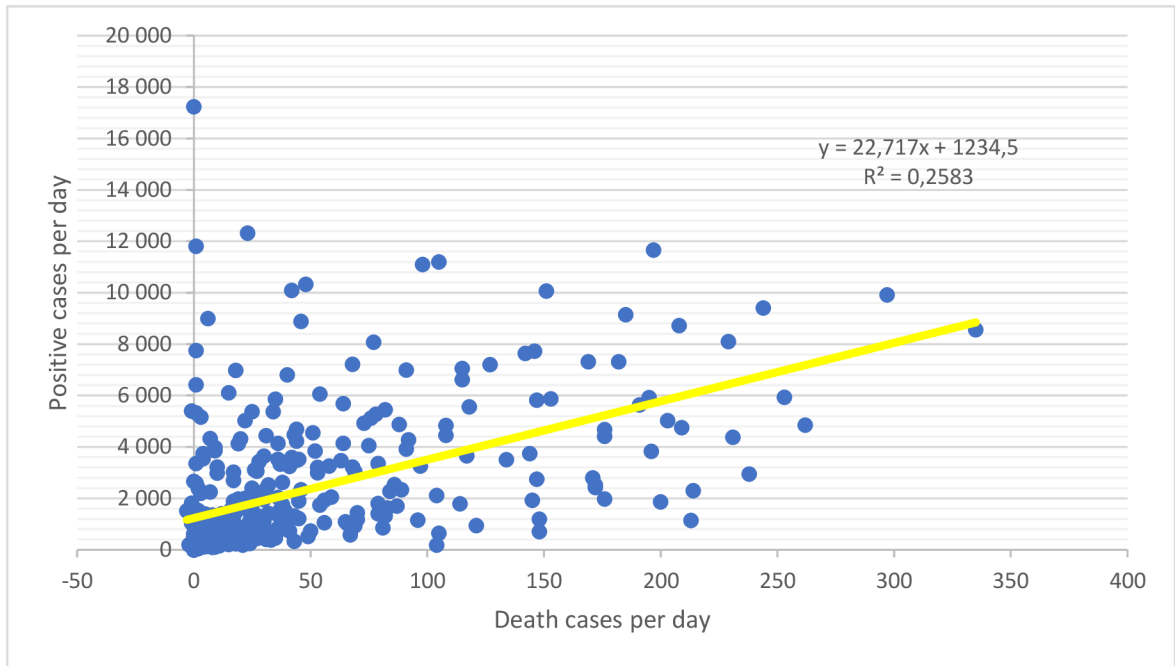
The Linear Regression model also depicts the positive direction between cases per day and death per day. Hence, it is clear to expect more death when the number of cases increase. The result of the regression is seen below, in the **Table – 13**.

Table 16: Regression of Arizona Model

Multiple R	51%
R Square	26%
Adjusted R Square	26%
Standard Error	51,12194953
Observations	369

Source: Own processing, Excel.

Graph 9: Linear Regression Model for Arizona



Source: Own processing, Excel.

The regression model is presented above, in the Graph – 9. The intercept has got a 1234,5 and the slope of 22,717, The R^2 demonstrates how dependent variable is explained by the independent variable. The correlation between two variables is strong and positive, and equals to 51%, See, **Table – 13**.

Table 17: Gender ration for Arizona

Taxes	Confirmed cases	%	Death	%	Hospitalized	%
Confirmed cases	826 454	100%	16 328	100%	57 907	100%
Mean age	49	n/t	52	n/t	50	n/t
Age range	0 - 100	n/t	0 - 100	n/t	0 - 100	n/t
Male	504 137	61%	4 376	27%	41 809	72%
Female	322 317	39%	11 952	73%	16 098	28%

Source: Own processing, Excel.

The Table – 16, demonstrates the gender ratio of people who went through COVID-19 in total, death cases and hospitalized cases. The frequency of confirmed cases predominates mostly by males (61%) and hospitalization ratio (72%), whereas female’s death ratio is higher than males almost by 3 times. The mean age of confirmed cases is 49, mean age of death is 52 and mean age of hospitalized is 50.

5 Results and Discussion

The author has run a Linear regression model to see how strong the correlation between the cases per day and deaths per day in the selected states. Additionally, the author analysed the total cases of covid, total cases of death and total cases of hospitalization. Even though the number of cases are different per each state, in terms of total cases, total death and total hospitalization, still there is a high rate of death observed in Arizona State, almost (2%) death cases of the total cases. Out of all death cases (16 328), most of the people who died didn't have any vaccination and it is (36%). The hospitalization rate is more occupied by the people who have had the second does of vaccination, out of total (57 907) cases, (43%) were hospitalized. The mean death age for Arizona is 52 years old and the male's positive cases prevails the female, however, female gender experienced more death cases than males. The hospitalization rate of Arizona the second after California.

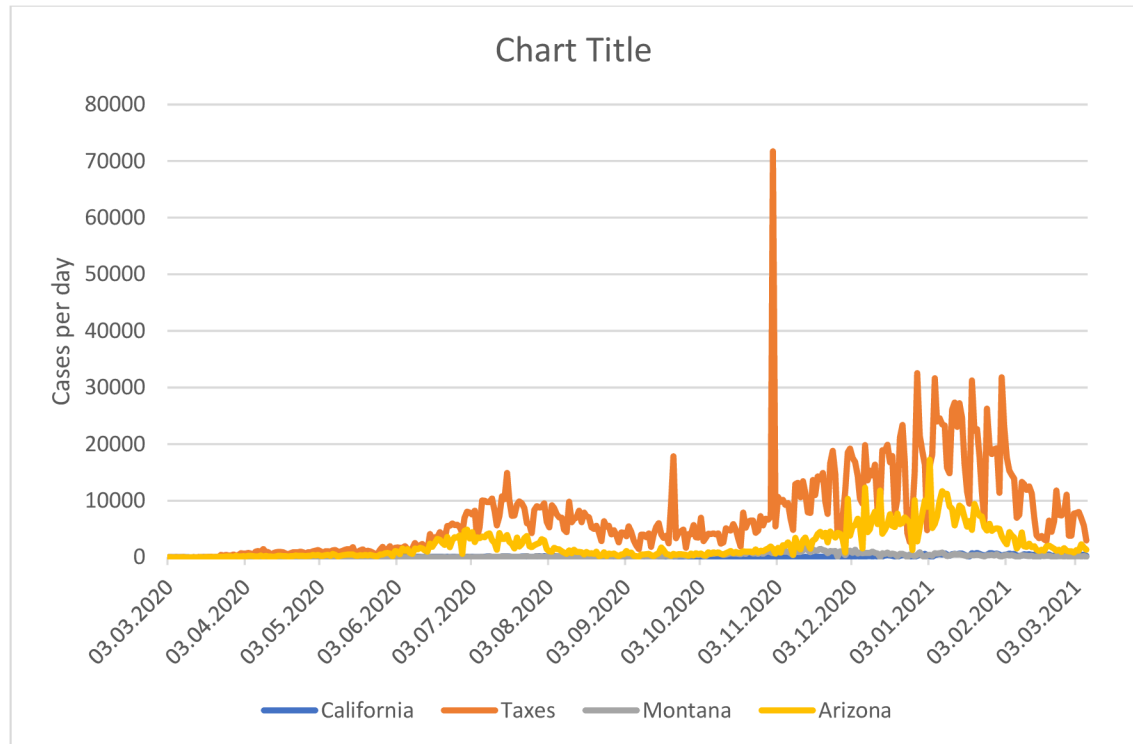
The California state has registered most of the confirmed cases out of all, however, its percentage ration of death is less than in Arizona, and it is (1,55%). The hospitalization rate of California is the highest of all and it is (17,17%) of all cases. The California also demonstrates that the highest rate of people who died from COVID-19 were those who didn't have any vaccination, out of total 52 124 cases (36%). The mean age of all cases was 42 years old, and the mean of death was 51 years old. The mean age of hospitalized cases was 46 years old. The gender ratio was split almost in half, out of total cases (46%) males and (54%) female. Females have been hospitalized more than males and the death ratio of males is more than females.

Montana state has the lowest cases registered, however; its death ratio is the same as in California, and that is (1,37%). The hospitalization rate is (4,59%) out of total cases, 100 914. Montana state registered most of the death cases among the people who had the second dose of vaccination, which is controversial to the Arizona and California state, hance the death ratio is also higher among the people who had the second dose of vaccination. The mean age of confirmed cases was 49 years old; the death mean age was 52 years old and the hospitalization mean age was 50 years old.

The Taxes state takes the second place among the confirmed cases and that is 2 686 818 in total. Its death ratio is (1,65%). Which is relatively the same as Montana and California. The hospitalization ratio of total cases is (5,90%). Most of the people who experienced covid-19, didn't have any vaccination (38%). More people were also hospitalized without

any vaccination (41%). Most of the confirmed cases are followed by females (65%) and (35%) respectively. The death cases are also followed by females (61%) and (39%). More hospitalization cases are more registered under male gender (51%). The mean age of confirmed cases was 46 years old. The mean age of death cases was 48 years old, and the hospitalization mean age was 53.

Graph 10: Comparison of death among all states



Source: Source: Own processing, Excel.

Based on the Graph – 10, the most impact that COVID-19 had was detected in Taxes state. The most death cases were registered on day 01.10.2020, in Taxes it reached 71734 cases of death per day. The numbers for Taxes state are shocking. It could only indicate that the healthcare system of Taxes lags behind other states. It would be a good idea to actually study other variables that deal with the health care sector, such as expenditures per capita in healthcare system, numbers of staff who involved in medical sector, number of institutions and etc.

6 Conclusion

The begin with, the work provides the literature review from different authors who studies the impact of COVID-19 in the United States of America. The theoretical review includes the findings of economic and social matters. Further the author discloses the impact of covid-19, from positive and negative perspectives. The global policy frameworks which were presented by globally. Further, the global GDP decline is described because of supply shock and undermined supply chain. The author also highlights the impact on education and telecommunication spheres in USA.

However, its practical part is strictly based on a secondary data, where an author assessed the development and dynamic of COVID-19 in four different states, where main variables for consideration were: Total cases, total death cases and hospitalized cases, the time frame was taken 367 days on average, as there were differences in registering the cases among the mentioned states, however the deviation was maximum 3-4 days, which had a minor impact on total results in the regression models. The direction of relations between the cases confirmed and death cases as assumed had a positive direction. The author relied on ratio analysis of each indicator to see the percentage ratio out of total cases. The results are summarized in the **Chapter – 5**.

First, besides working with the data, the author gained many skills working with the Excel Software and analysing the data with big numbers. The author also noticed the correlation between the ratio of people who dies and ratio of people who were not hospitalized from the gender perspective. The author highlighted the numbers with a red colour in Table – 16,12,8 and 4. However, this data was not available daily, thus the author couldn't run the correlation analysis. However, the pattern is clear that people who get hospitalized receive more of a medical attention and hence have more chance to survive the COVID-19.

The author has demonstrated the development of the COVID-19 in four different states, the objective of the thesis has been achieved. All the necessary analysis and assessments have been commented.

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