The shock of COVID-19 on Oil & Gas Price, Labor Market

Project Report (Final Project Group 31)

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Introduction

Oil is important to the United States' economic development: It powers much of the U.S. economy, and its price fluctuations can influence inflation and unemployment. However, the impact of oil prices is often felt more directly (both positively and negatively) by local economies with close ties to the oil industry. The ongoing COVID-19 pandemic has hit each industry hard, but perhaps the one industry that has taken the biggest hit is the global oil and gas industry. The spread of this virus has forced many oil and gas companies to either stop or slow down their physical operations, which has impacted production in both upstream and downstream operations. The main objective of this project to observe the Oil & Gas market performed during the COVID-19 time. This paper is ordered as follows. Section 1 research questions; Section 2 the data describes; Section 3 presents analysis and the main results; Section 4 Conclusion; Section 5 Appendix.

1 Research Questions

1. Does Stay at home law, lockdown, and empty road affect the Oil price?

*I would like to express my sincere gratefulness towards my advisor Professor Kim J. Ruhl ruhl2@wisc.edu, for their valuable guidance and support for this project.

2. Does the unemployment rate in both oil & gas and all over increase or not in a pandemic?

3. What is the Demand and Supply of Petroleum Products during the COVID-19 pandemic?

2 Data

To answer my questions on the effect of COVID-19 on oil price and the labor market, I have to go through several data sets. My primary data source is FRED: The federal reserve bank of St. Louis, which contains various data sets. I am using monthly level crude oil price data for three different regions such as the USA, Europe, and Dubai. Similarly, I have used unemployment data for the oil & gas sectors and all over the United States. The second dataset from the U.S. Energy Information Administration (EIA) has provided more data on crude oil price, imports/exports, stocks, consumption/sales, petroleum products supplied. I use imports, and petroleum products supplied data from the year 2015 to 2020. All these datasets are time-series data.

3 Analysis

3.1 Crude Oil Price

Observing the impacts of travel limitations and stay-at-home orders on the U.S. economy, EIA[1] estimates that domestic consumption of oil and petroleum products will diminish, with gasoline consumption falling by almost 13% in 2020 and diesel decreasing about 10%. The production of crude oil in the U.S. arrived at an all-time high of 12.9 million barrels per day in November 2019. But during the COVID-19, it had fallen by 1.5 million barrels per day in May 2020 [Stephen Nalley, 2020][5]. For this project's scope, I decided to focus mainly on crude oil price, unemployment, and the demand-supply of crude oil and petroleum products. In figure 1, I have identified three major shocks in the crude oil price. First are the 2008 financial crisis and the great recession, sending the crude oil price from nearly $ 133.88 to $ 39.09 (per barrel) in just a few months. Second, the crude oil prices fell sharply in the fourth quarter of 2014 as robust global production was exceeded. In the current COVID-19 pandemic, the equilibrium crude oil prices come from adjusting oil supply and demand. We can observe that the oil price goes from $ 57.52 to $ 16.55 (per barrel). In figure 2, we can identify that during COVID-19, all three regions crude oil price rate shows unbalance -3.84 % in

[1]Energy Information Administration

January 2020, and in April 2020, it's -43.34 %.

In figure 7, I have tried to regress the crude oil price vs. consumption of motor gasoline, showing a positive correlation. This proved that the demand for petroleum products had influenced the crude oil price in the world economy. As I am using the time-series data in my analysis, I am curious to use the ARIMA[2] forecasting model to predict the U.S. crude oil price [David Hasan, 2020] [1]. In figure 8 shows a line graph that predicted the future trend of the U.S. crude oil price. However, the crude oil price has been placed in an unusual situation (price drop) because of the COVID-19 pandemic issue; it will take time for the trends to return to the previous status.

3.2 Unemployment Rate

The COVID-19 and economic downturn it engendered swelled the ranks of unemployed Americans. The rise in the number of unemployed workers due to COVID-19 is substantially greater than the increase due to the Great Recession in 2008. In figure 3, we can observe that the unemployment rate more during COVID-19 than the great recession, not only in all sectors but also in oil and gas too.

Near about 470000 people working in the oil and gas field of extraction, drilling in the year 2019 in the U.S. These jobs are amassed in a couple of areas whose local economies are significantly affected whenever there is a decline in the business. In this pandemic, a worldwide oil price war has prompted record-low costs of price and laborer cutbacks. The oil and gas industry lost 51,000 drilling and refining jobs in March alone. Significant petroleum derivative organizations are reporting pullbacks in their drilling activities and spending [Devashree Sahas] [2].

In figure 4, we can see that the unemployment rate increase by 14.7% in April 2020 in all over the sector and 17.8% in Jun 2020 in the Oil sector. This spike in unemployment coincided with various mandated stay-at-home orders implemented in response to the COVID-19 pandemic and other pandemic-related factors affecting the U.S. demand.

[2]Autoregressive Integrated Moving Average

3.3 Demand and Supply

Consumption of liquid fuels is measured by petroleum products supplied in the United States, and its reached month to month low since the early 1980s at an average of 14700 thousand barrels for each day (b/d). Consumption of the United States liquid fuels drops in March and April 2020 because of travel restrictions related to COVID-19 and its relief measures [EIA] [3]. We can see in figure 5, in the U.S., consumption of liquid fuels is decreased in 2020. The average consumption of petroleum products fell from 20825.75 to 18275.82; finished motor gasoline fell from 9339.55 to 8172.06; Kerosene-Type Jet Fuel fell 1775.55 to 1066.10; Distillate Fuel Oil 4006.71 to 3665.69 during the year 2019-2020 respectively.

Distillate Fuel Oil consumption in the United States is driven by economic activity and is more likely affected by slowing economic growth than travel restrictions (stay-at-home). Distillate fuel oil is also used in activities that are not directly affected by restrictions, such as diesel engines in heavy construction equipment and heating oil for space heating in buildings, and industrial heating.

According to the (EIA) data, the U.S. crude oil exports reached a record high in February 2020 and have since fallen each month, based on data through June. However, we can see in figure 6, the U.S. crude oil exports in the first half of the year are still higher than they were in the first half of 2019. Monthly crude oil imports declined sharply in April before increasing in May and June, but they were still lower in the first half of 2020 compared with the first half of 2019. Declining global demand for crude oil and petroleum products has driven the U.S. exports and imports lower.

The Organization of the Petroleum Exporting Countries (OPEC) is a group consisting of 14 of the world's major oil-exporting nations. OPEC was established in 1960 to organize the oil approaches of its individuals and give part states the specialized and financial guides. As the COVID-19 pandemic continued to spread across the world, Saudi Arabia, the world's second-largest oil producer behind the United States, urged fellow Organization of the Petroleum Exporting Countries (OPEC) members and Russia to cut production [Grant Smith] [4].

4 Conclusion

The impact of COVID-19 is on the various sectors. The oil and gas price war reflected the dramatic shift in economic activity caused by the onset of the COVID-19 pandemic. As per ARIMA forecasting in this project, we can see that it will take time to recover the oil price compared to the previous. Worldwide lockdown and travel limitations forced to stem the spread of the COVID-19, Hence cut out demand for oil and petroleum products in 2020. Shocks to demand and then supply pushed prices for petroleum products downward. Most Oil and Gas companies have reduced production, which affects the oil industries' employee unemployment. Similarly, all over other sector has facing unemployment; this is one of the most critical economic issues in the country.

References

[1] David Hasan, "Time Series Analysis; Applying ARIMA Forecasting Model to the U.S. Unemployment Rate Using Python" Nov 9, 2020 https://david-hasan.medium.com/time-series-analysis-arima-forecasting-model-using-python-9a7874cefcd7

[2] Devashree Saha, "COVID-19 Bailouts Should Target Oil and Gas Workers and Communities, Not Companies" - August 05, 2020 https://www.wri.org/blog/2020/08/covid-19-bailouts-US-oil-and-gas-workers-communities

[3] EIA forecasts U.S. petroleum demand will remain below 2019 levels for several more months

[4] Grant Smith, Nayla Razzouk, and Matthew Martin, "OPEC tries to force Russia into deeper cuts as oil price slumps," Bloomberg, March 5, 2020, https://www.bloomberg.com/news/articles/2020-03-05/opec-meets-in-effort-to-bridge-saudi-russia-divide-on-oil-cuts

[5] Stephen Nalley, June 16, 2020; U.S. Energy Information Administration

5 Appendix: Figures

Figure 1: Crude Oil Prices of three region: USA, Europe, Dubai [3]

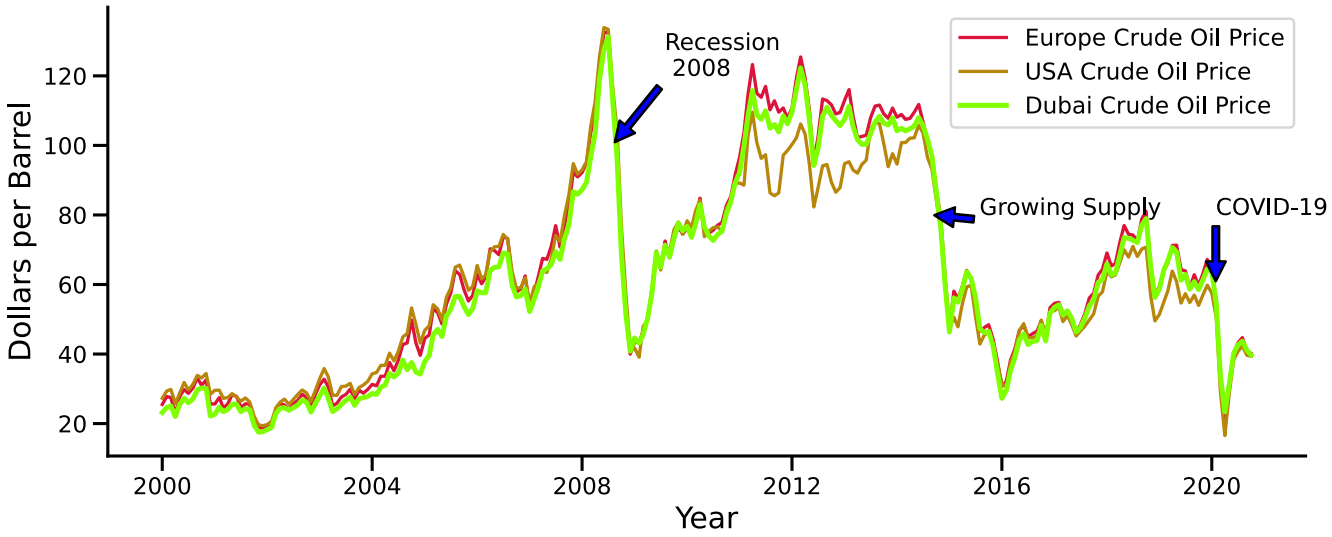
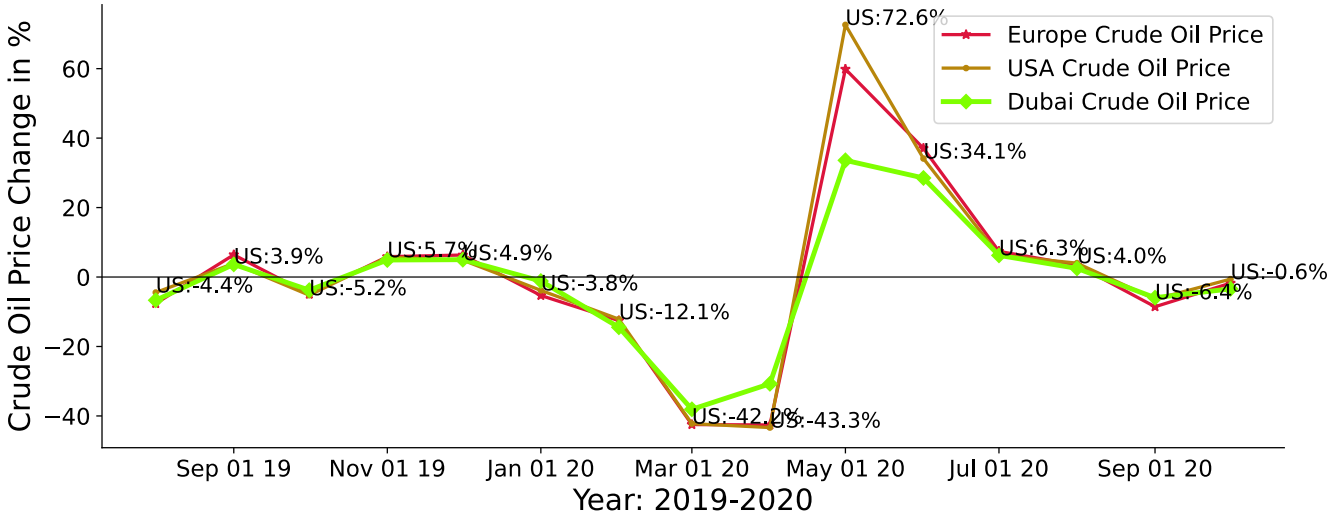


Figure 2: Crude Oil Price Change in % During COVID-19 [4]



[3] In this figure, I used crude oil price data from three different nations. This is a monthly level of time-series data from the period Jan 2000 to Oct 2020, Data source: FRED.

[4] In this figure, I would like to focus on the COVID-19 period more. So, I restricted the same figure 1 data from August 2019 to October 2020 and evaluated the percent change in crude oil price in the U.S. during COVID-19.

Figure 3: Unemployment Rate in USA at Oil and All other sector [5]

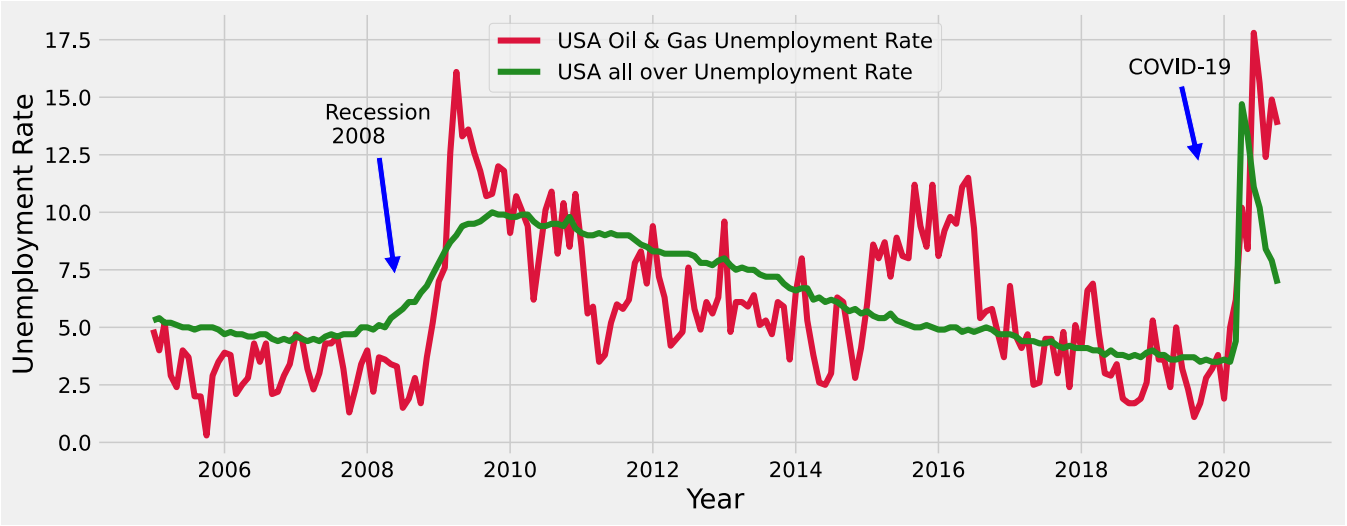
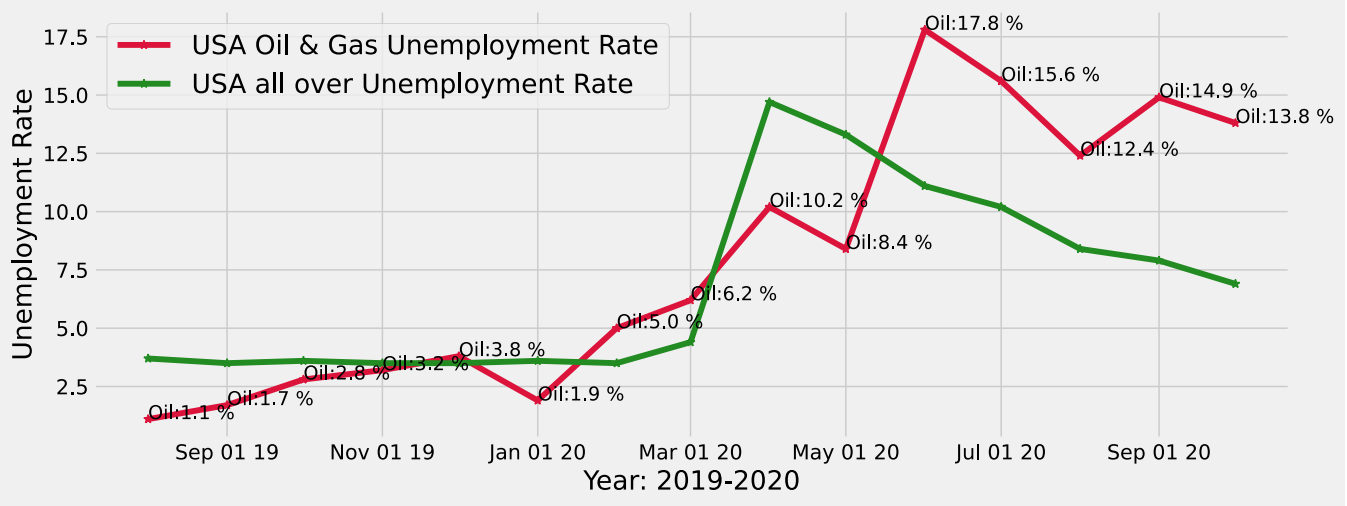


Figure 4: Unemployment Rate in USA During COVID-19 [6]



[5] In this figure, I have compared the overall and oil sector unemployment rate in the U.S. I used FRED data from the period 2005 to 2020.

[6] In this figure, I would like to focus on unemployment during the COVID-19 period. So, I restricted the same figure 3 data from August 2019 to October 2020.

Figure 5: U.S. Monthly Consumption of Petroleum Products (Thousand Barrels per Day) [7]

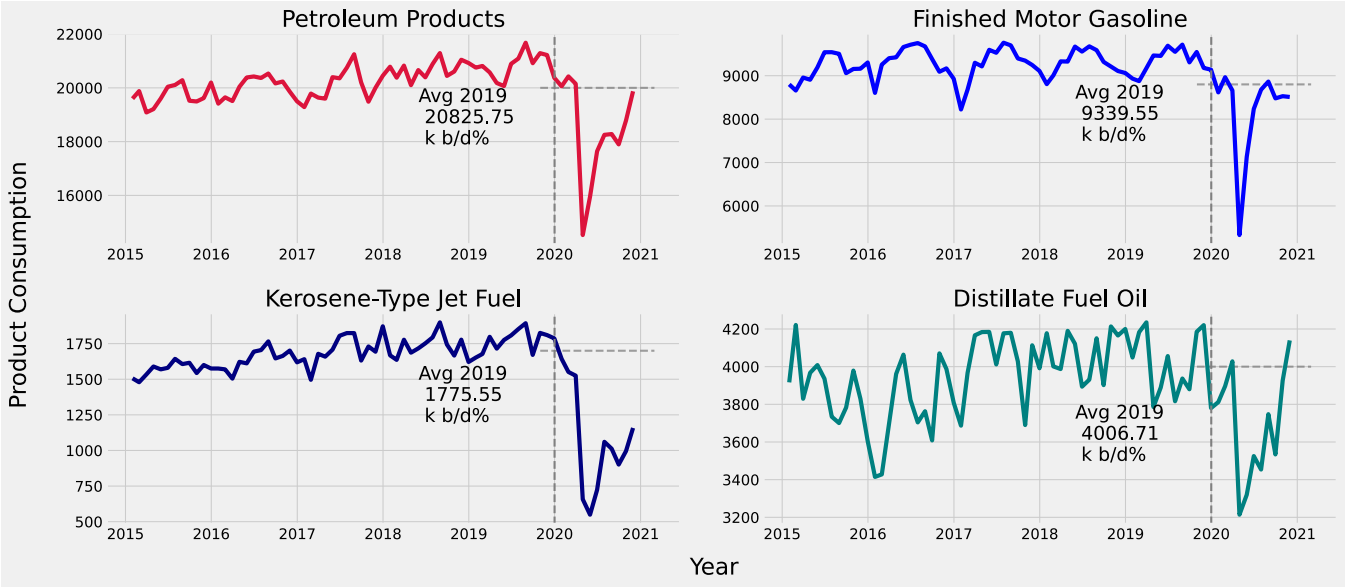
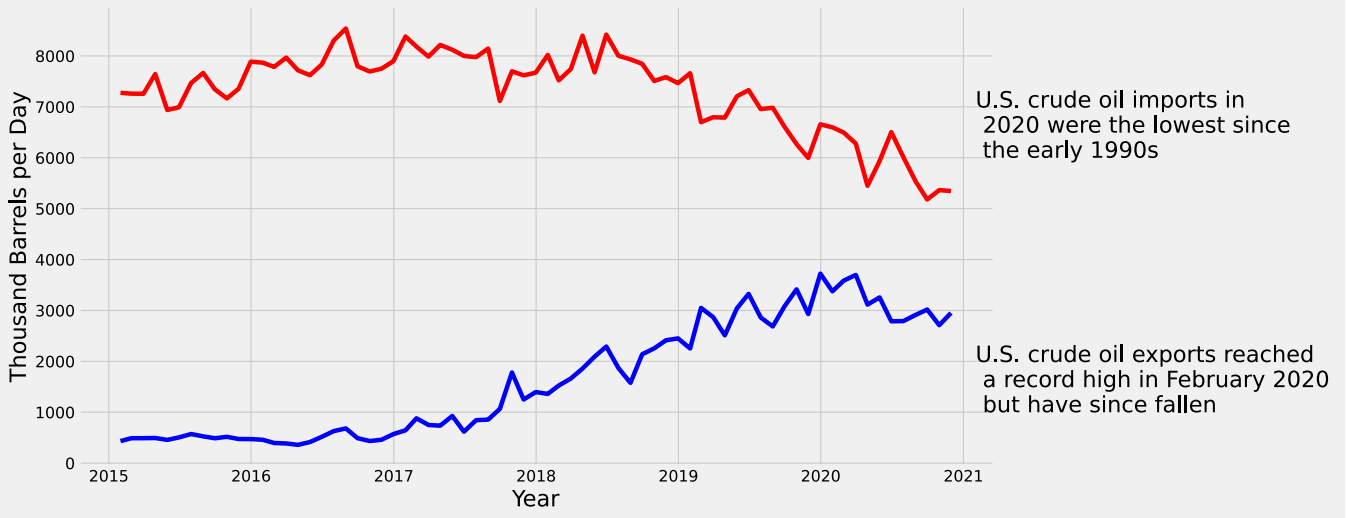


Figure 6: U.S. monthly Crude Oil import and export [8]



[7] In this figure, we can see the consumption of petroleum products. The petroleum products are used to making chemicals, plastics, and synthetic materials; the motor gasoline is used in vehicles; Jet Fuel is used in aircraft; Distillate fuel oil is used in on-highway diesel engines, trucks, automobiles, railroad locomotives, agricultural machinery, space heating, and electric power generation. Data Source: U.S. Energy Information Administration

[8] In this figure, we can observe the red line for import and blue for export of crude oil in the U.S.

Figure 7: Crude Oil Price and Finished Motor Gasoline [9]

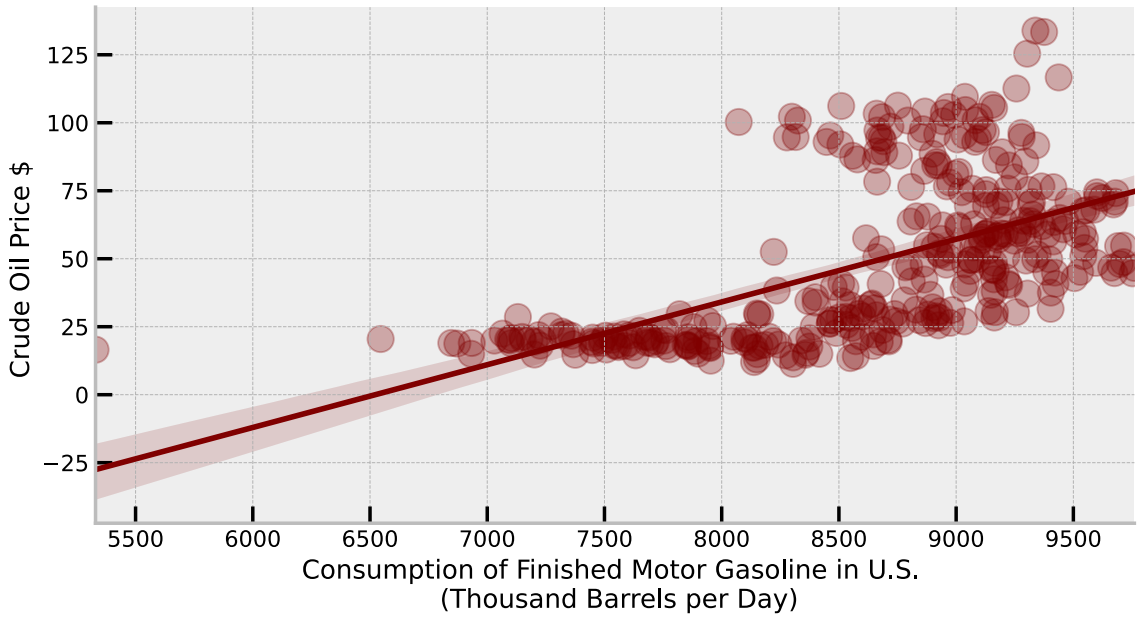
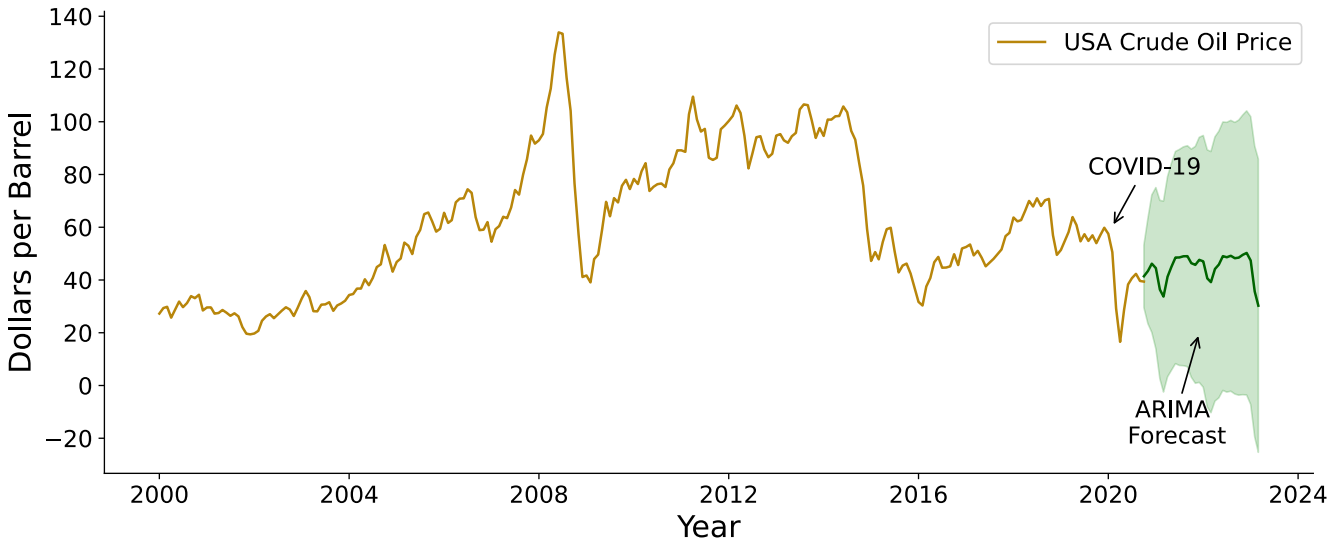


Figure 8: ARIMA MODEL - Forecasting of Crude oil Price in the U.S. [10]



[9]To analyze the relationship between crude oil price and finished motor gasoline consumption, I have merge two data set (the U.S. crude oil price data and consumption of petroleum products data). The time period of data is from the year 1991 to 2020 monthly level data. It contains 359 observations.

[10]I have used the ARIMA model to predict the crude oil price and run order (p,d,q) = (2, 0, 0). We can see that the crude oil price will not increase compared to the previous price in forecasting. It will take some time to cover-up.