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## **The Impact of Russia Ukraine conflict on the oil Prices in Europe. A Difference and Difference Approach**

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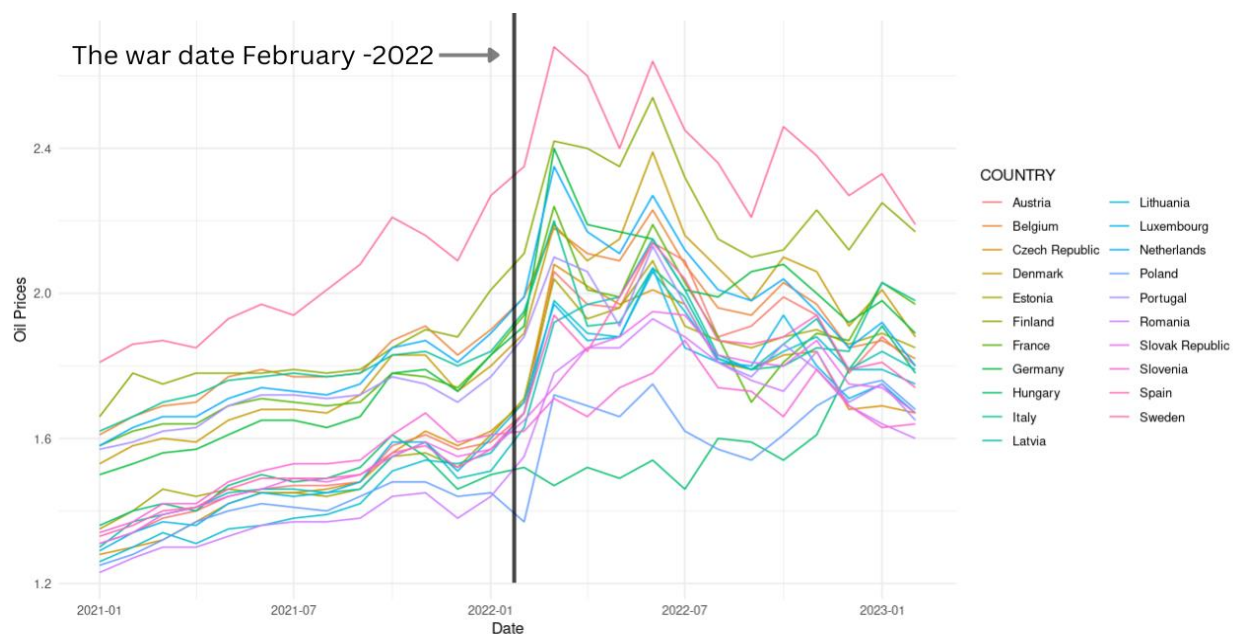
## **Abstract**

This research study is an attempt to analyze the impact of Russia-Ukraine conflict on the oil prices in Europe. For this purpose, monthly Panel data of 21 European countries is used in this study. Difference in Differences model is used to analyze the impact of Russia-Ukraine conflict on oil prices. The Neighbor group consists of 6 Countries that either shares border with Russia or Ukraine and 15 other European countries are taken as non-neighbor group. The results of the study revealed that Russia's invasion on Ukraine has a positive and highly significant impact on the oil prices in Europe. The impact on the oil prices in the neighboring European countries is found to be insignificant.

# 1. Introduction

The war between Russia and Ukraine, lasting for over a year, has significantly affected the costs of energy. This paper aims to investigate how the Russia-Ukraine War is causing changes in energy prices. The goal is to help decision-makers understand these effects better, so they can reduce the impact of the war on energy prices.

One of the critical arenas where this ripple effect is palpable is the energy sector, particularly the price dynamics of oil in Europe. The significance of oil in the daily lives of individuals cannot be overstated; it is the lifeblood that fuels economies, powers industries, and lights up homes. As consumers, we are intimately connected to the fluctuations in oil prices, which can have far-reaching consequences on our daily routines, disposable income, and overall economic stability.

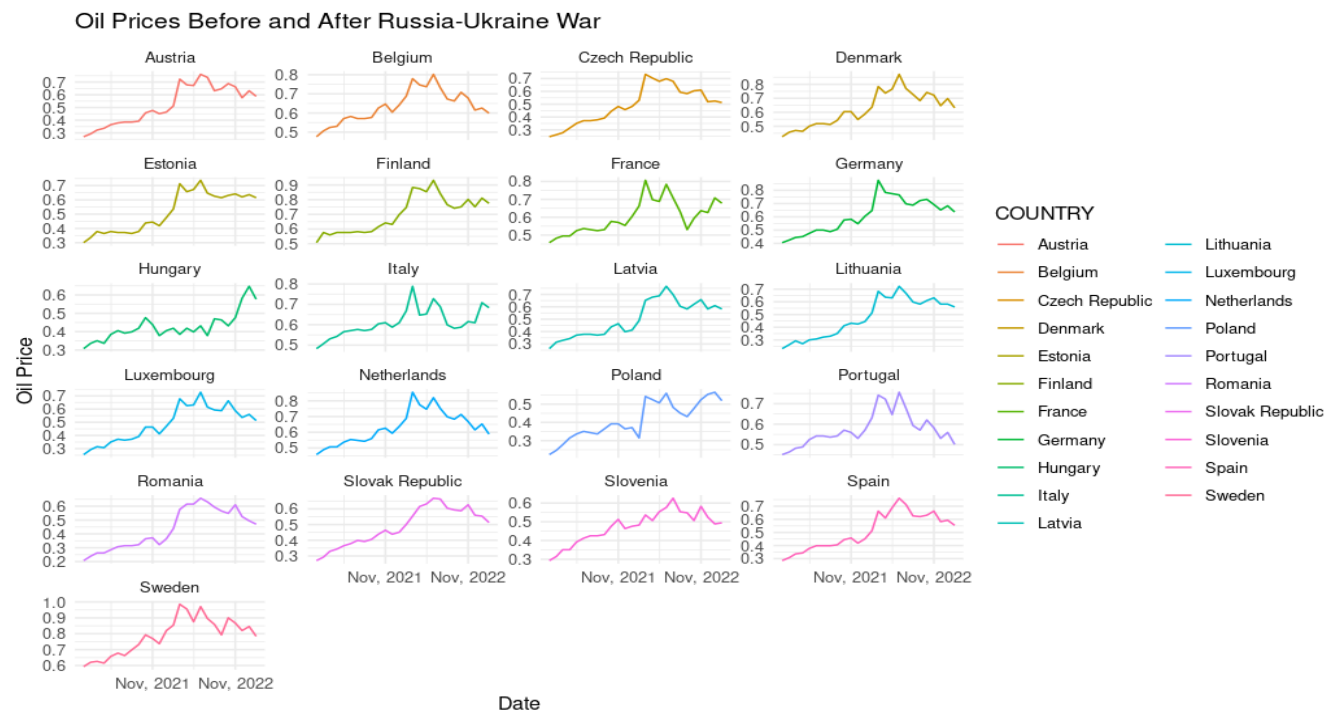


1. Graph demonstrates different prices over a certain time period.

This analysis delves into the impact of the Russia-Ukraine conflict on oil prices in Europe, using data extracted from the International Energy Agency (IEA) Energy Prices website. The specific data set under examination is the "Monthly Oil Prices Excerpt." To provide a nuanced perspective, the dataset is divided into two distinct categories: countries neighboring Russia and those that do not share direct borders. By scrutinizing the trends within these subsets, the aim is to discern whether the conflict has had a discernible impact on each individual country or if neighboring nations engaging in continued oil transactions still are insulated from the war's economic repercussions.

## 1.1 Russia-Ukraine Conflict:

The ongoing conflict between Russia and Ukraine has a significant impact on the oil prices in Europe. Russia is still an important oil supplier in the global oil market, and it exports 60 percent of oil products to OECD European countries (IEA, 2022), which indicates Europe is highly dependent on Russian oil.



2 This graph shows each country's data over specific time periods.

In November 2021, Europe Imported 23 percent of its oil imports from Russia, (IEA, 2022). After a sudden decrease to 20 percent in December 2021, it increased up to 26 percent in February 2022, the highest in the past one year. However, a sudden decrease is seen after the Russia's invasion in Ukraine on 24 February 2022, the total imports from Russia as a percentage of total oil imports decreased to 16 percent in July and 10 percent in December 2022. In the first month of the current year, share of Russian oil in the total oil imports in European countries stood at 7 percent in January 2023 as we can see in the above graph. As a result, European countries are facing a sudden increase in oil prices due to uncertainty in the Global oil market.

According to Jakob Fèveile Adolfsen, Friderike Kuik, Eliza Magdalena Lis and Tobias Schuler (2022), the price of oil, gas and coal increased by 40 percent, 80 percent and, 130 percent in Europe in the first two weeks of Russia's invasion on Ukraine and since then there is price fluctuation across the European countries, which indicates a huge impact has been observed in terms of the sudden increase in prices.

### 1.2 Covid-19 Pandemic:

The Covid-19 pandemic highly effected global oil prices, as the lockdown measures to avoid Human contact had significantly decreased oil demand around the world and thus the oil price fell significantly.

## 2. Motivation

My motivation for looking into this comes from individual experiences, especially in my home country, Pakistan. I have noticed a significant difference in how easy and affordable it was to get anything before the conflict compared to the higher prices later. As oil significantly influences every industry, most daily-use items are dependent on its impact. Even though I am focusing on European countries in this research, my inspiration comes from how things changed back home. As we explore how the conflict affects oil prices in Europe, it is a reminder of how global events can affect our daily lives and the choices we make.

## 3. Research Question:

The primary questions that the study tries to address are as follows.

1. What is the impact of Russia-Ukraine conflict on oil prices in Europe?
2. Does the oil prices in neighboring European countries are affected after the conflict?

## 4. Data Description:

The data set holds monthly Diesel price, Oil imports from Russia. The monthly data ranges from January 2021 to January 2023 and is obtained from International Energy Agency (IEA 2023).

*Table 1 Data Description*

Variable Name	Proxy	Source
Oil Price	Diesel Price (US dollars/liter)	IEA, 2023
<b>Dummy Variables</b>		
Interaction	Invasion=1, Neighbor= 1	
Invasion	Invasion = 1, otherwise 0	
Neighbor	Neighbor=1, otherwise 0	

## 5. Methodology:

In conducting this analysis, the primary source of data used was the International Energy Agency (IEA), an autonomous intergovernmental organization based in Paris. Established in 1974, the IEA offers policy recommendations, comprehensive analysis, and global energy sector data. The dataset obtained from the IEA includes information from 31 member countries and 13 association countries, collectively standing for 75% of the global energy demand.

The overarching goal of this study was to investigate the factors influencing oil prices, specifically examining the impact of war and potential additional contributors. The focus was on understanding how a conflict between two nations could reverberate globally. To achieve this, a basic analysis was initially performed on the data. The dataset was divided into two distinct groups based on the occurrence of an invasion – pre-invasion and post-invasion. Further categorization was made by distinguishing between neighbor and non-neighbor countries. Descriptive analysis, involving the computation of average prices for each group, was conducted to assess the effects on prices. Graphical representations were employed alongside statistical methods such as t-tests to confirm the findings. Notably, log prices were used to normalize the data, easing more effective comparisons across diverse time periods and goods/services.

However, challenges arose in the categorization of neighbor and non-neighbor groups, as not all European countries are direct neighbors to Russia. Overcoming this hurdle required careful consideration and creative solutions to ensure exact data grouping. Despite this challenge, the methodology employed supplies a robust framework for exploring the multifaceted impacts of war on oil prices and its broader implications on the global energy landscape.

### 5.1 Neighbor and non-Neighbor group:

The Neighbor and non-Neighbor groups are as follows:

*Table 2 Data division into neighboring and non-neighboring groups*

<b>Non- Neighbor Group</b>	<b>Neighbor Group</b>
Austria	Estonia
Belgium	Finland
Czech Republic	Hungary
Denmark	Lithuania
France	Poland
Germany	Slovak Republic



Italy	
Latvia	
Luxembourg	
Netherlands	
Portugal	
Romania	
Slovenia	
Spain	
Sweden	

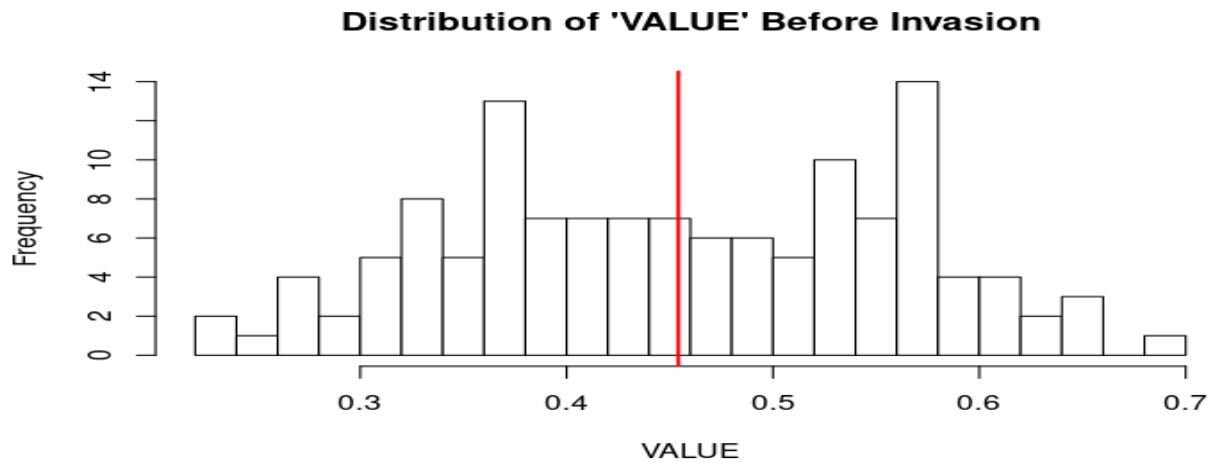
## 6. Results and discussion:

The results of the Two Sample t-test reveal compelling insights into the factors contributing to changes in oil prices between countries neighboring Russia and those that do not share borders. The notable negative t-value of -5.9782 and the associated p-value of 7.479e-09 indicate a significant disparity in mean log prices between the two groups. This discrepancy suggests that the war, coupled with disruptions in oil production and distribution, has played a crucial role in driving up prices. The observed decrease in mean log prices for countries neighboring Russia implies potential challenges in oil access and availability within this group.

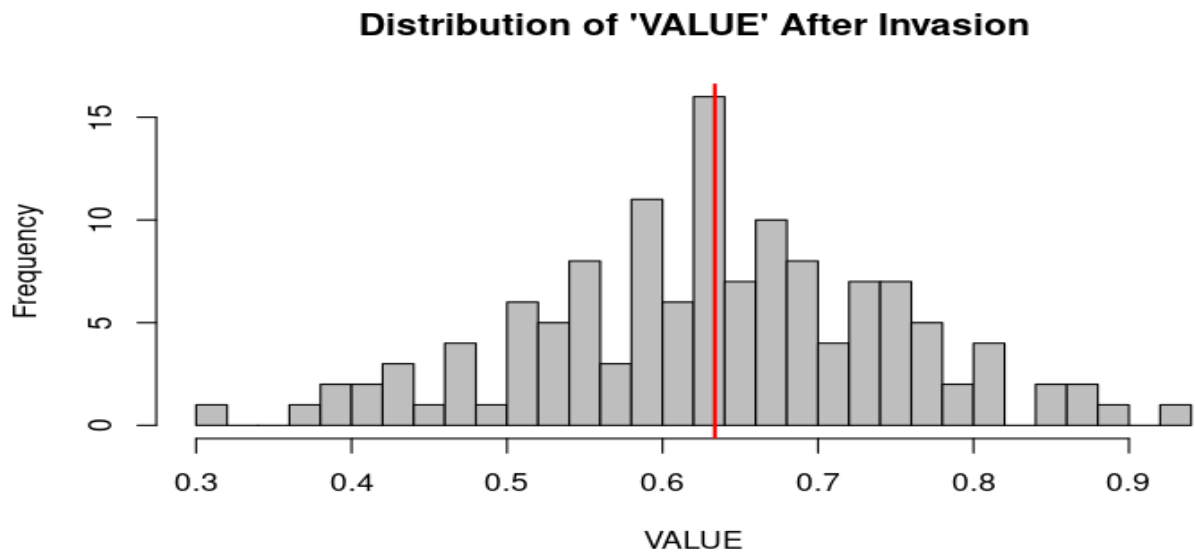
A critical contributing factor to the rise in prices appears from the impact of US and EU sanctions, limiting the purchase of oil from Russia. This limitation stems from geopolitical decisions, resulting in a redirection of oil purchases to alternative, potentially more expensive sources. The consequences of these sanctions are reflected in the reduced mean log prices for the neighboring countries. This nuanced understanding of the factors influencing oil prices highlights the multifaceted nature of global events and geopolitical decisions on the energy market.

### 6.1 Graphical Representation

In the two graphs below is the representation of before and after the invasion, a crucial analysis was conducted using log prices as the standard variable. The decision to use log prices is grounded in the normalization they provide, allowing for a standardized scale and easing comparisons across different time periods. The key focus was on observing any discernible patterns or fluctuations in oil prices surrounding the invasion.



*3 Demonstration of log prices before Russia invasion*



*4 Demonstration of log prices after Russia invasion.*

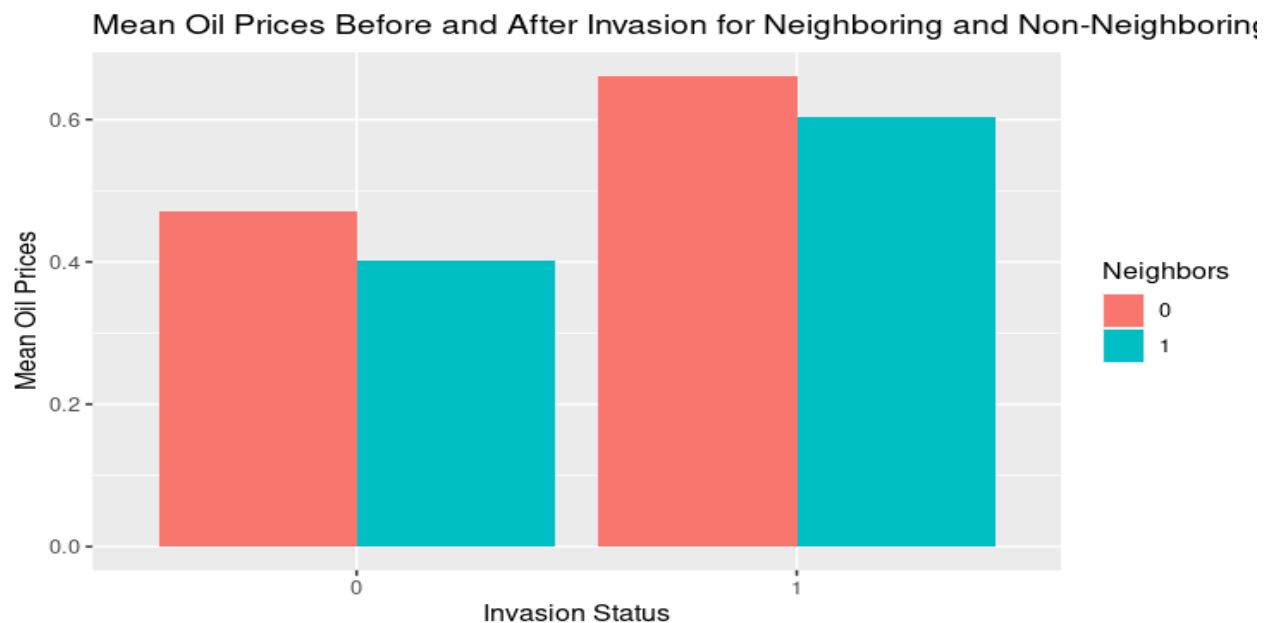
The most significant difference between the two distributions is the shift to the right in the post-invasion distribution. This suggests that there was a significant increase in the number of high-value items after the invasion. The increase in the mean and median values further supports the hypothesis that there is a clear impact of Russia-Ukraine war on energy prices.

## 6.2 Graphical Analysis on Neighbor and Non-Neighbor Countries

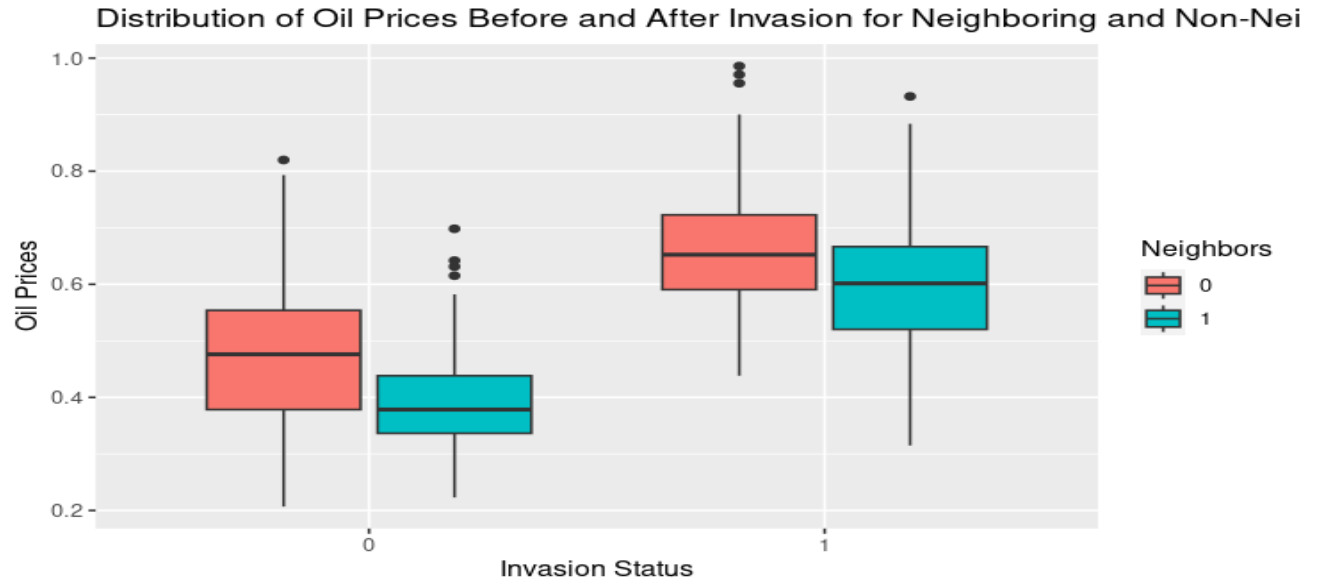
The two graphs below visually compare prices before and after the invasion for both neighboring and non-neighboring countries.

Countries were divided into two groups: Russia Neighbors and those without any borders touching Russia. The main aim was to investigate whether countries bordering Russia have same impact on energy prices, like other European countries. The graphs clearly illustrate a consistent difference between the two groups. Prices were already relatively low in neighboring countries, potentially due to transportation costs.

The reason of hike in prices can be multiple reason like, due to war the production was less and the demand was too high, as most of the European countries rely on Russia for energy sources. Therefore, while there is a distinction in both groups, the countries next to Russia were less affected by the war.



*5 impact on groups due to invasion*



6 boxplot showing the difference in mean prices of two groups

### 6.3 Descriptive Statistics:

This section explores empirical results of the model.

General summary of Data set which includes all 21 countries.

Table 3 General summary of prices of all countries

Min	0.2070
1st Qu.	0.4318
Median	0.5596
Mean	0.5479
3rd Qu.	0.6471
Max	0.9858

Table 4 summary of before and after invasion

	Price Before Invasion	Price After Invasion
Min	0.2070	0.3148
1st Qu.	0.3646	0.5822
Median	0.4447	0.6313
Mean	0.4508	0.6450
3rd Qu.	0.5423	0.7129
Max	0.8198	0.9858

The summary statistics for prices before and after the invasion reveal notable shifts in the market. The mean and median prices both increased after the invasion, suggesting a general upward trend in price levels. The quartile values provide insights into the distribution of prices, with 75% of post-invasion prices falling below the 3rd quartile, indicating a considerable proportion of the data clustering at lower values. The range, represented by the difference between the minimum and maximum prices, highlights the overall variability in the data. The minimum and maximum values before and after the invasion indicate a widening price range, potentially reflecting increased market volatility or the influence of external factors. This statistical overview lays the groundwork for a deeper exploration of the factors driving these price changes, such as geopolitical events or economic conditions, to gain a more comprehensive understanding of the market dynamics surrounding the invasion.

## 6.4 Test.

### 6.4.1 Welch Two Sample t-test

*t.test(before\_invasion\_data\$Log\_price, after\_invasion\_data\$Log\_price)*

The Welch Two Sample t-test indicates a highly significant difference in log prices before and after the invasion ( $t = -19.694$ ,  $p < 2.2e-16$ ). The 95% confidence interval for the difference in means suggests a substantial decrease, ranging from -0.2135 to -0.1748. The sample estimates show a notable increase in mean log prices after the invasion, with mean values of 0.4508 before and 0.6450 after.

### 6.4.2 t.test on Neighbor and Non-Neighbor Groups

Data is divided into equal groups of 6 each country.

*Table 5 data divided into equal sets for t.test*

Non- Neighbor Group	Neighbor Group
Netherlands	Estonia
Belgium	Finland
Portugal	Hungary
Luxembourg	Lithuania
France	Poland
Germany	Slovak Republic

*t.test(filtered\_data\$Log\_price[filtered\_data\$NEIGHBORS == 1],  
filtered\_data\$Log\_price[filtered\_data\$NEIGHBORS == 0], var.equal = TRUE )*

The Two Sample t-test provides convincing evidence that there is a significant difference in mean log prices between the two groups (neighbor and non-neighbor countries). The negative t-value and the confidence interval below 0 indicate a lower mean log price in the group of countries neighboring Russia.

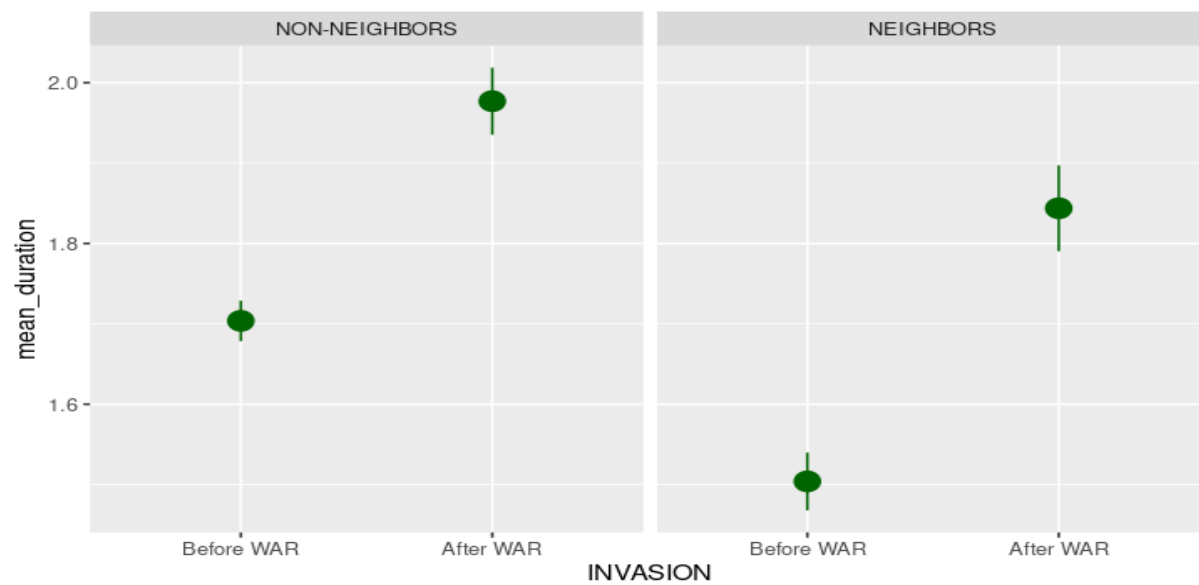
## **7. Conclusion and Recommendations:**

As it is seen that the oil prices are highly affected by global events, this research work was an attempt to study the economic implications of Russia-Ukraine conflict in terms of oil prices in Europe. The study addressed primary research question, which was to see, if there is any impact of the on-going war in Ukraine on the oil prices in Europe. The study revealed oil prices in Europe are significantly affected by the conflict because of Europe's high reliance on Russian oil. As a result of sanctions on the Russian Oil by US and his allies including Europe, resulted in shortage of oil supply and thus, oil prices increased. The present study suggests minimizing dependence on Russia for its energy demands to avoid any uncertainty in the future. The present study also analyzed the ongoing war in Ukraine and its implications on oil prices in neighboring European countries. However, the empirical estimate of the study shows that oil prices in neighboring European countries are less affected by the on-going war in Ukraine. Furthermore, reducing the dependence on oil for electricity generation will also play a vital role in reducing oil prices.

## **8. Limitations of the study:**

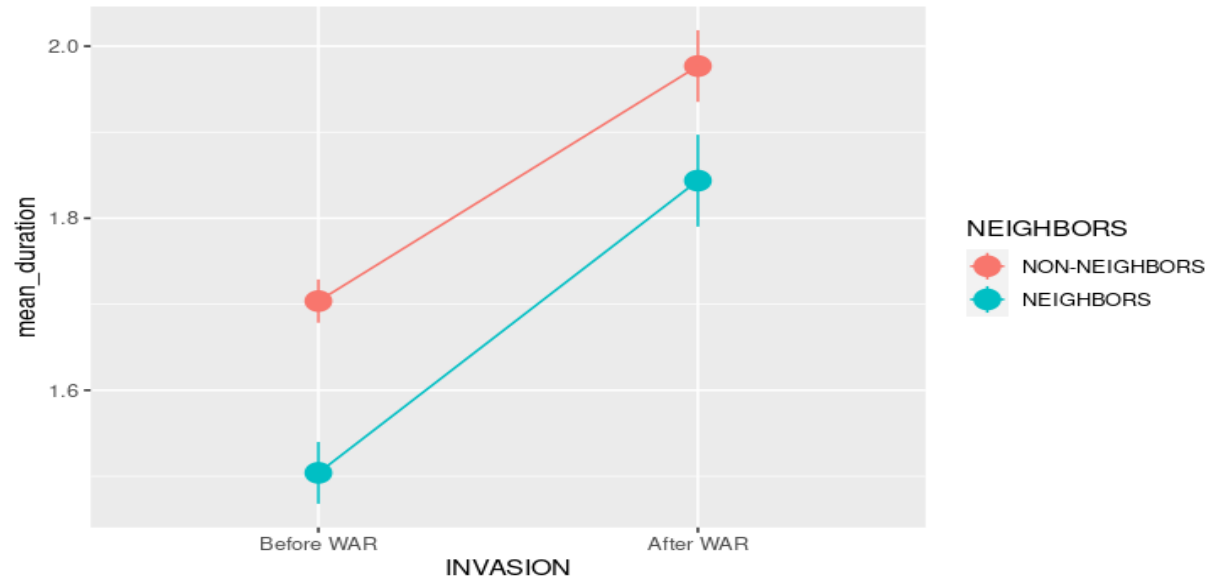
The data used in this study is limited to only 21 European countries thus adding more countries in the study will give more reliable results to analyze the impact of War on oil prices in Europe. Using other models will also give robust estimates, respectively.

## 9. Graphs



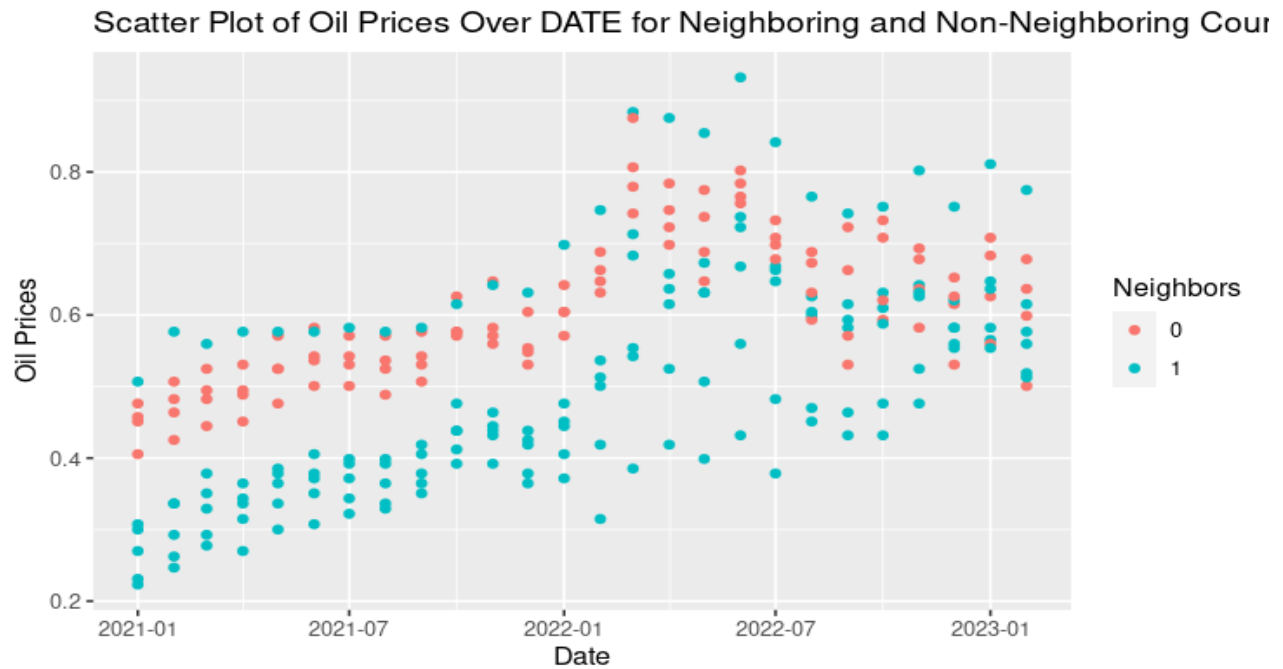
6. Graphical representation of diff and diff model

### Point Range.



7. shows the range difference of mean before and after invasion.

## Scatter plot representation of all data



8 scatterplot showing clear difference between both groups.

## 10. References

1. [International Energy Agency \(Dataset Source\)](#)
2. [Humanities and Social Sciences Communications](#)
3. [European Council | Council of the EU](#)
4. [ScienceDirect](#)