



Interdepartmental Postgraduate Program in Economics

DISSERTATION

How Russo – Ukrainian War Affected Commodity Returns

Student

Savlidis Vladimiros (mec23006)

Supervisor

Prof. Theologos Dergiades

University of Macedonia, Thessaloniki, March 2024

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to my supervisor, Theologos Dergiades, for his support, guidance and valuable advices that he offered throughout my undergraduate and postgraduate studies, as well as my master thesis. His assistance was priceless.

Also, I would like to thank all my friends and family, who believed in me and stood by me during these 2 years of my postgraduate studies.

TABLE OF CONTENTS

TABLE OF GRAPHS.....	4
TABLE OF TABLES.....	5
1. INTRODUCTION.....	6
2. LITERATURE REVIEW.....	8
3. METHODOLOGY.....	10
4. DATA.....	12
5. EMPIRICAL RESULTS.....	14
5.1 <i>Panel Event Study on Commodity Returns</i>	15
5.2 <i>Robustness</i>	22
6. CONCLUSIONS.....	31
7. REFERENCES.....	32
APPENDIX.....	35

ABSTRACT

This study investigates the impact of the Russo-Ukrainian war on commodity returns across 6 sectors: industrial metals, precious metals, energy, grains, softs, and livestock. Employing panel data analysis and the panel event study method in Stata with eventdd command, I analyze monthly returns to assess the effects of the conflict on commodity markets.

Contrary to initial expectations, my findings indicate minimal immediate effects of the war on commodity returns, with returns exhibiting stable negativity during all the conflict period.

However, through a robustness analysis utilizing cumulative monthly returns, a distinct pattern emerges. In post-war, I observe a significant increase in returns, particularly obvious in the energy and grains sectors, as well as the entire commodity market during almost the first 6 months following the conflict, because of high demand and low supply from sanctions and limited exports from ukrainian ports. This suggests that while the direct impact of the war on commodity returns may be limited, the cumulative effects reveal a more nuanced picture, highlighting the heightened volatility and potential opportunities in specific sectors in the aftermath of geopolitical turmoil.

In short, by integrating panel data analysis with cumulative returns assessments, I provide valuable insights into the differential impacts of the Russo-Ukrainian war on various commodity sectors, informing suppliers and policymakers alike.

Keywords: Russo-Ukrainian war, commodity returns, panel data analysis, panel event study method, cumulative returns, geopolitical events.

TABLE OF GRAPHS

Graph 4.1 Monthly Returns of the entire Commodity.....	14
Graph 4.2 Monthly Returns of Industrial Metals.....	14
Graph 4.3 Monthly Returns of Precious Metals.....	14
Graph 4.4 Monthly Returns of Energy.....	14
Graph 4.5 Monthly Returns of Grains.....	14
Graph 4.6 Monthly Returns of Softs.....	14
Graph 4.7 Monthly Returns of Livestock.....	14
Graph 5.1 All Commodities Returns.....	15
Graph 5.2 Industrial Metals Returns.....	16
Graph 5.3 Precious Metals Returns.....	17
Graph 5.4 Energy Returns.....	18
Graph 5.5 Grains Returns.....	19
Graph 5.6 Softs Returns.....	20
Graph 5.7 Livestock Returns.....	21
Graph 5.8 Cumulative Returns for the entire sector.....	24
Graph 5.9 Cumulative Returns for Industrial Metals.....	24
Graph 5.10 Cumulative Returns for Precious Metals.....	24
Graph 5.11 Cumulative Returns for Energy.....	24
Graph 5.12 Cumulative Returns for Grains.....	24
Graph 5.13 Cumulative Returns for Softs.....	24

Graph 5.14 Cumulative Returns for Livestock.....	24
Graph 5.15 Cumulative Returns for the entire sector.....	25
Graph 5.16 Cumulative Returns for Industrial Metals.....	26
Graph 5.17 Cumulative Returns for Precious Metals.....	27
Graph 5.18 Cumulative Returns for Energy.....	28
Graph 5.19 Cumulative Returns for Grains.....	29
Graph 5.20 Cumulative Returns for Softs.....	30
Graph 5.21 Cumulative Returns for Livestock.....	31

TABLE OF TABLES

Table 4.1 Descriptive Statistics for the entire commodity sector.....	13
Table 4.2 Descriptive Statistics for every commodity sector.....	13
Table 5.1 Descriptive Statistics for the entire commodity sector.....	23
Table 5.2 Descriptive Statistics for every commodity sector.....	23

1. INTRODUCTION

It seems that, after the horrors of World War II, people do not appear to have grasped that using military force to settle conflicts can only have terrible effects on society. Nevertheless, in 2022, this kind of conflicts not only pounding on the door in Europe but around the world as well, with the nuclear countries of our planet being protagonists on the international chessboard. It is well known that the world had took an important taste of large-scale military conflicts following historical events such as the terrible World War II consequences as mentioned before, but also during Cold War era that followed, which was a competition between western (USA) and eastern bloc (Soviet Union) and marked by the nuclear arms race between the US and the USSR (Sempa, 2002). Superpowers' owning of nuclear weapons increased a belief of many analysts to conclude that another devastating war was now a long past nightmare. However, as history has often established, stormy events leave their influence, and the periodic cycle of global upheavals continues to shift the society in which we live.

A major example of how economic crises can overlap with geopolitical events and lead to military reactions is the Great Depression of 1929–1939 (Garraty, 1986). The Great Depression struck the United States as it sought to deal with the aftermath of the 1920s. Some argue that the outbreak of World War II was partly caused by the economic problems of the period. In a fascinating reversal of events, the US quickly moved from a financial crash during the Great Depression to military developing, setting the stage for an ongoing economic growth, which holds until today (Garraty, 1986).

While heated disputes like the Vietnam War and the Turkish invasion in Cyprus occurred during the Cold War era, new challenges emerged in the decades that followed. All of these conflicts, though, would pale in comparison to the tragedy of the Russian invasion of Ukraine in 2022. While the Russian media refer to it as a "special military operation," the Western media call it an "invasion".

This event is unique to be analyzed not only because of its military component but also because it happened at a time when the world was still recovering from the COVID-19 pandemic and Russia's provocative move abruptly interrupted expectations of an economic rebound and led us to a second wave of political-economic chaos.

The annexation of Crimea by Russia in 2014 marked the beginning of a crisis with far-reaching effects and it is the origin of the Russian-Ukrainian war. It's important to remember that Russia has already displayed its political and military power in nearby areas. Another example of Russia portraying itself as the savior of Russian minority in impacted areas is also seen in the 2008 conflict with Georgia¹.

Many instances of financial difficulties were caused by the start of the Russian invasion in 2022. The enacting of sanctions by the West, followed by Russia's political and economic responses, caused inflation and high prices and high demand for some commodities, which not only affected the countries directly but also had an effect on international markets. This riot mostly affected the petroleum, natural gas and agricultural commodities, since Russia and Ukraine are major exports for these commodities, with effects that went beyond their national boundaries.

An examination of the intricacies of the Russo-Ukrainian war reveals that the interdependence of world events affects national trajectories. This conflict highlights the need for diplomatic efforts and international cooperation to address the obstacles such crises face due to their complex geopolitical and economic implications.

So, main question of this thesis is: **Have Russo – Ukrainian War affected commodity returns?** This topic is important considering it connects economic impact of commodity returns global, resource dependence, as Ukraine is a significant producer of commodities such as grains, metals, and energy products, such as Russia and of course investment and policy strategies.

I will break down the conflict's many aspects in the research that follows, looking at its historical causes, its geopolitical ramifications, and the conflict's far-reaching economic effects. The rest of thesis is structured as follows; Section 2 reviews the Literature Review on empirical applications of DiD and Panel Event Study approaches, as well as cases from this particular topic. Section 3 provides information on the empirical methodology concerning the econometric models, and estimation techniques. Section 4 describes the data, and their graphical representation. The empirical results and robustness are in Section 5, and the final conclusions are in Section 6. Section 7 provides references and appendix.

¹ <https://www.history.com/this-day-in-history/5-day-long-russo-georgian-war-begins>

2. LITERATURE REVIEW

The panel event research approach has been used for many years. Many analysts have attempted to determine how a certain event affects many entities concurrently, at different periods, both before and after that event by using this technique. Specifically, because panel data makes it easier to use time series and cross-sectional data in an analysis, its application in event studies has grown. MacKinlay (1997) established the framework for panel event studies with his pioneering publication "Event Studies in Economics and Finance".

With regard to Panel Event Study as an econometric method, Schmidke, Hetschko, Schöb, Stephan, Eid, Lawes (2021) "The effect of the COVID-19 pandemic on the mental health and subjective well-being of workers: an event study based on high frequency panel data" is relatively recent research that makes use of panel data analysis. The COVID-19 epidemic and the two lockdowns were evaluated by the authors using individual monthly panel data from December 2018 to December 2020 to estimate how these lockdowns affected the mental health and general well-being of German workers. They also noted that social well-being suffered from the epidemic, albeit to a lesser degree, and that women did not seem to lose more well-being than males.

In their insightful study entitled "Development without energy? Assessing future scenarios of energy consumption in developing countries", Jan Christoph Steckel, Robert J. Brecha, Michael Jakob, Jessica Strefler, Gunnar Luderer (2013) launched an integrated investigation of the economics of energy. Using a panel data approach, the researchers meticulously investigated the complex dynamics of energy consumption in developing countries. Their focus extended to assessing the effects of policy interventions on cross-border investment specifically in the renewable energy sector.

About specific topic, we can find quite important papers about how Russo – Ukrainian war affected commodity returns, but considering this is a recent event, many analysts are still in progress to estimate reliable results. One important study worth noting is Kai Gehring's (2020) study "External Threat, Group Identity, and Support for Common Policies - The Effect of the Russian Invasion in Ukraine on European Union Identity". This study is not about the Russian invasion of Ukraine in

24th February 2022 but it is about the Russian annexation of Crimea in 2014. Specifically, using the DiD method, Ghering defined the 2014 Russian invasion as a sudden exercise of the Russian military threat to the member states of the Eastern European Union and more so to the Baltic countries bordering Russia. Using low vs. high threat member states in a DiD model, Ghering found a significant positive shift towards EU identity. Control group were the low threat countries before 2014 while treatment group were high threat Latvia and Estonia. While he found a significant shift of countries in the heart of the EU, he observed that the Russian invasion of Ukraine did not affect the EU's identity for the Russian minority.

About the Russian invasion of Ukraine in 2022 Kamel Si Mohammed, Muhammad Usman, Paiman Ahmad & Urangoo Bulgamaa (2022) referred in their paper "Do all renewable energy stocks react to the war in Ukraine? Russo-Ukrainian conflict perspective" how renewable energy markets reacted to the war, using event study, comparing this effect with traditional energy sources. With daily data from 3-8-2021 to 30-3-2022 they showed that investors find green energy more tempting due to risk-return profiles and most money was invested to address climate change.

Sun, Song & Zhang (2022) in their paper "The effects of 2022 Russian invasion of Ukraine on global stock markets: an event study approach" evaluated empirically using panel event study the stock market reactions to the Russian invasion. What they showed is that depending on how deeply a country or industry is involved in the war, the repercussions on stock markets vary between them. Businesses in European Union countries are areas close to the battlefields saw a sharp decline in returns while businesses in countries not so close to the war were not greatly affected. Finally, they also concluded that Russian oil and gas companies were affected to a fairly high degree by the conflict

Another interesting paper is that of Bierman & Leromain (2023) entitled "The indirect effect of the Russo – Ukrainian war through international linkages: early evidence from the stock market". Their study examined how investors' expectations were affected by firms' global linkages with both Russia and Ukraine after the escalation of the conflict. Using the event study focusing on the Russian invasion of Ukraine on 24 February 2022 they found that cumulative returns of companies involved in significant trade with Russia were much lower. The impact on aggregate returns is

particularly noticeable for firms that are more dependent on Russian commodities. The conclusion they came to is that the average impact on third country stock market performance was 0,8 % and European nations bore the brunt of the losses.

Lo, Marcelin, Bassène, Sène (2022), in their paper “The Russo-Ukrainian war and financial markets: the role of dependence on Russian commodities”, estimated how the war affected financial markets subject to a dependence on Russian commodities. Their results indicated a significant negative effect on major financial markets with a greater effect on volatility than on returns. Furthermore, they showed that developed markets are more affected than emerging markets and the effect increases with the dependence on Russian fuel commodities.

Another paper about this conflict is “The Russia-Ukraine conflict and volatility risk of commodity markets” from Fang and Shao (2022). Specifically, authors proposed a new index to measure the intensity of the Russia–Ukraine conflict. They showed that this conflict influences commodity markets through both economic and financial channels, finding results conducive to understanding the dynamic impact and transmission mechanism of the Russia–Ukraine conflict on commodity risk.

Final study about this topic is paper named “Impact of Russian-Ukraine war on clean energy, conventional energy, and metal markets: Evidence from event study approach” from Umar, Riaz and Yousaf (2022). Here, authors examined the impact of Russo-Ukrainian war on energy markets and metal markets using the event study approach. What they found is that the impact of war was more prolonged on many clean energy indices, Gas oil, Gasoline, heating oil, Nickel, and Palladium in the post-event era.

3. METHODOLOGY

Main methodological approach of this paper is a panel event study framework. As stated in the Abstract, this research builds upon the findings of Clarke & Schythe's (2021) study, "Implementing the Panel Event Study," which details their use of the STATA software's eventdd command to execute the panel event study approach.

This tool significantly facilitates the estimation, analysis, and visualization of event study models in various scenarios.

As mentioned above, Panel Event Study models “are a generalized extension of ‘difference-in-differences’ designs or two-way fixed effect models, allowing for dynamic leads and lags to the event of interest to be estimated, while also controlling for fixed factors (often) by area and time” (Clarke & Schythe, 2021). The use of the Two-way fixed effects estimator in time-varying treatment periods has faced backlash. However, this issue is circumvented in this case as the event being analyzed remains constant across all cross-sectional variables, with the war initiating on the same day worldwide. The panel event study specification can be written as:

$$y_t = a + \sum_{j=2}^J \beta_j (lead_j)_{gt} + \sum_{k=1}^K \gamma_k (lag_k)_{gt} + \mu_g + \lambda_t + \varepsilon_t \quad (1)$$

Here λ denotes the time fixed effects μ denotes group fixed effects, ε are the errors and the leads and lags are denoted a:

$$(lead J)_t = 1 | t \leq Event - J | \quad (2)$$

$$(lead j)_t = 1 | t = Event - j | \text{ for } j \in \{1, \dots, J - 1\} \quad (3)$$

$$(lag k)_t = 1 | t = Event + k | \text{ for } k \in \{1, \dots, K - 1\} \quad (4)$$

$$(lead K)_t = 1 | t \geq Event - K | \quad (5)$$

Different sectors of commodities will be analyzed in this case, examining the returns of every commodity sector and how my event of interest (meaning war) affected those returns. We should expect to observe high prices for commodities and because of these high prices, we expect high returns for the first months, for the reason that demand became higher and supply became lower causing deficit. In this thesis, the general form of the event study model including all leads and lags available is:

$$\text{returns}_{st} = \alpha + \beta_{12}(\text{Lead}_{12})_{st} + \dots + \beta_1(\text{Lead}_1)_{st} + \gamma_0(\text{Lag}_0)_{st} + \dots + \gamma_{12}(\text{Lag}_{12})_{st} + \mu_s + \lambda_t + \varepsilon_{st}$$

We can also formally test the joint significance of all the lead terms simultaneously with the hypothesis: $\mathbf{H}_0 : \beta_{12} = \beta_{11} = \dots = \beta_1 = 0$ $\mathbf{H}_1 : H_0$ does not hold.

4. DATA

As mentioned, my analysis is based on panel data , meaning a combination of both cross – sectional and time – series data. Hence, my panel data includes monthly returns from 6 different commodity sectors (Bhardwaj & Dunsby, 2014²) + 1 sector with all commodity returns 12 months before and 12 months after the event, meaning from February 2021 to February 2023. The data were collected from FRED ECONOMIC DATABASE (Federal Reserve Bank of ST. Louis) and from World Bank. Commodity sectors based from paper above are as follows³:

- **ALL COMMODITIES:** It concerns the monthly returns of all commodities for the period of interest
- **INDUSTRIAL METALS:** It concerns the monthly returns of aluminum, copper, nickel, zinc, tin and lead
- **PRECIOUS METALS:** Here, we have monthly returns of gold, silver and platinum to analyze.
- **ENERGY:** Energy sector contains monthly returns from crude oil, heating oil, natural gas and gasoline.
- **GRAINS:** Here we have monthly returns of corn, wheat, rice, barley, soybean oil and soybean meal.
- **SOFTS:** This sector includes monthly returns of cocoa, coffee, sugar, cotton and tea
- **LIVESTOCK:** Finally, livestock sector includes monthly returns of beef, lamb, poultry and lean hogs.

In the next page there are descriptive statistics for the entire commodity sector and the rest of all different sectors.

² Commodities were collected based on this paper.

³INDUSTRIAL METALS ENERGY, GRAINS and only cotton from SOFTS, such as only lean hogs from LIVESTOCK data were collected from FRED. PRECIOUS METALS and the rest of GRAINS and LIVESTOCK data were collected from World Bank

Table 4.1 Descriptive Statistics for the entire commodity sector

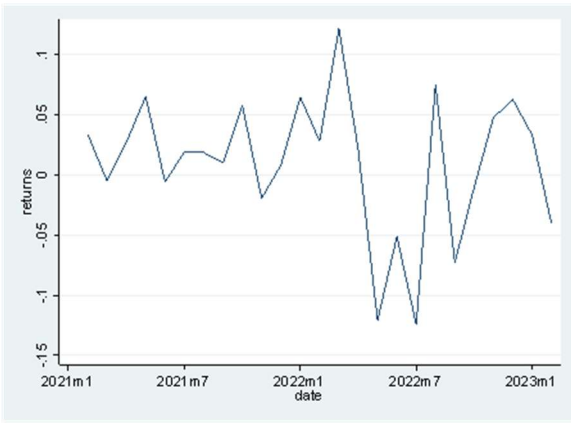
Statistics	Returns
Median	0.0013202
Mean	0.0104001
Min	-0.0768717
Max	0.0823849
Variance	0.0014561
STD	0.0381591
Skewness	0.135992
Kurtosis	2.942295

Note: First column shows statistic tests, and the second column shows re results (in returns).

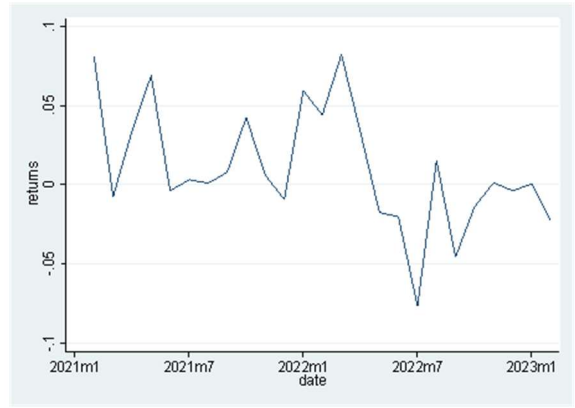
Table 4.2 Descriptive Statistics for every commodity sector

Sectors	Mean	Median	Min	Max	Variance	STD	Skewness	Kurtosis
Industrial Metals	0.00960	0.01877	-0.1243	0.1215	0.00338	0.0581	-0.6937	3.37233
Precious Metals	-0.00274	0.01646	-0.08754	0.6656	0.00194	0.44146	-0.19368	1.70892
Energy	0.025111	0.011888	-0.10989	0.3279	0.11537	0.10741	0.78914	3.6042
Grains	0.11569	0.004916	-0.08086	0.1233	0.00205	0.04537	0.25978	3.26429
Softs	0.00982	0.131908	-0.66594	0.7585	0.0009	0.30614	-0.19445	3.267522
Livestock	0.0057018	-0.00331	-0.08119	0.1182	0.00235	0.04848	0.40584	2.508233

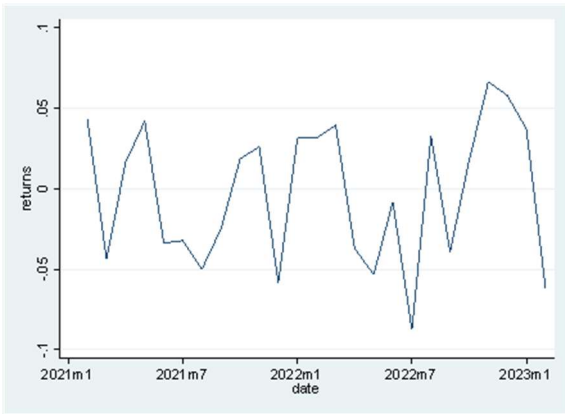
Note: Rows show sectors and columns show statistics. **Median** provides insight into the central tendency of returns, helping to assess the typical value without being overly influenced by extreme outliers. **Mean** offers the average value of returns, useful for evaluating long-term performance or expected returns. **Min** indicates the lowest recorded price or return within a given dataset, highlighting potential downside risks or historical lows. **Max** reflects the highest recorded price or return within a given dataset, illustrating potential upside opportunities or historical highs. **Variance** measures the volatility of returns, aiding in risk assessment and portfolio management. **STD (Standard Deviation)** quantifies the spread of asset prices or returns around the mean, providing a standardized measure of risk and volatility. **Skewness** indicates the asymmetry of the distribution of asset prices or returns, offering insights into potential non-normalities and risks associated with extreme movements. **Kurtosis** illustrates the "tailedness" of the distribution of asset prices or returns, helping to identify the likelihood of extreme events and tail risks.



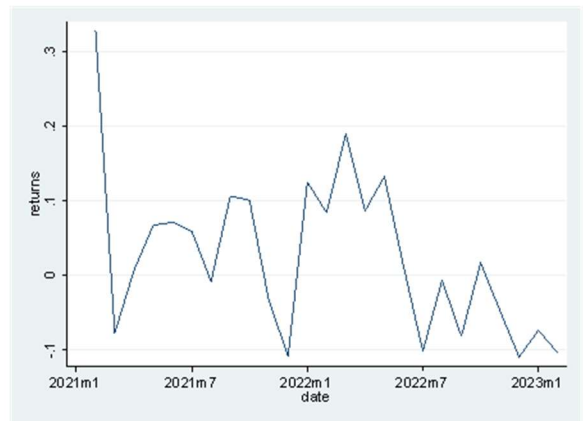
Graph 4.1 Monthly Returns of the entire Commodity Sector



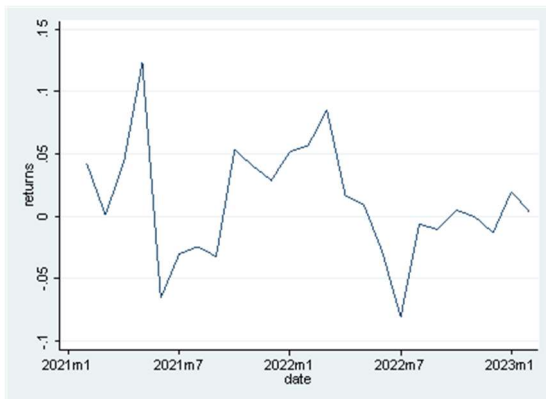
Graph 4.2 Monthly Returns of Industrial Metals



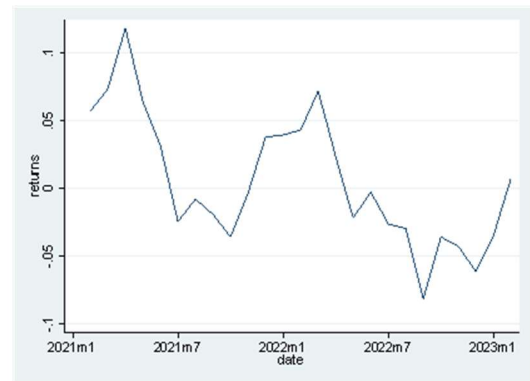
Graph 4.3 Monthly Returns of Precious Metals



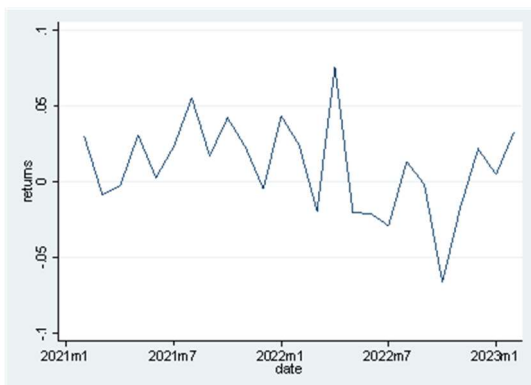
Graph 4.4 Monthly Returns of Energy



Graph 4.5 Monthly Returns of Grains



Graph 4.6 Monthly Returns of Softs



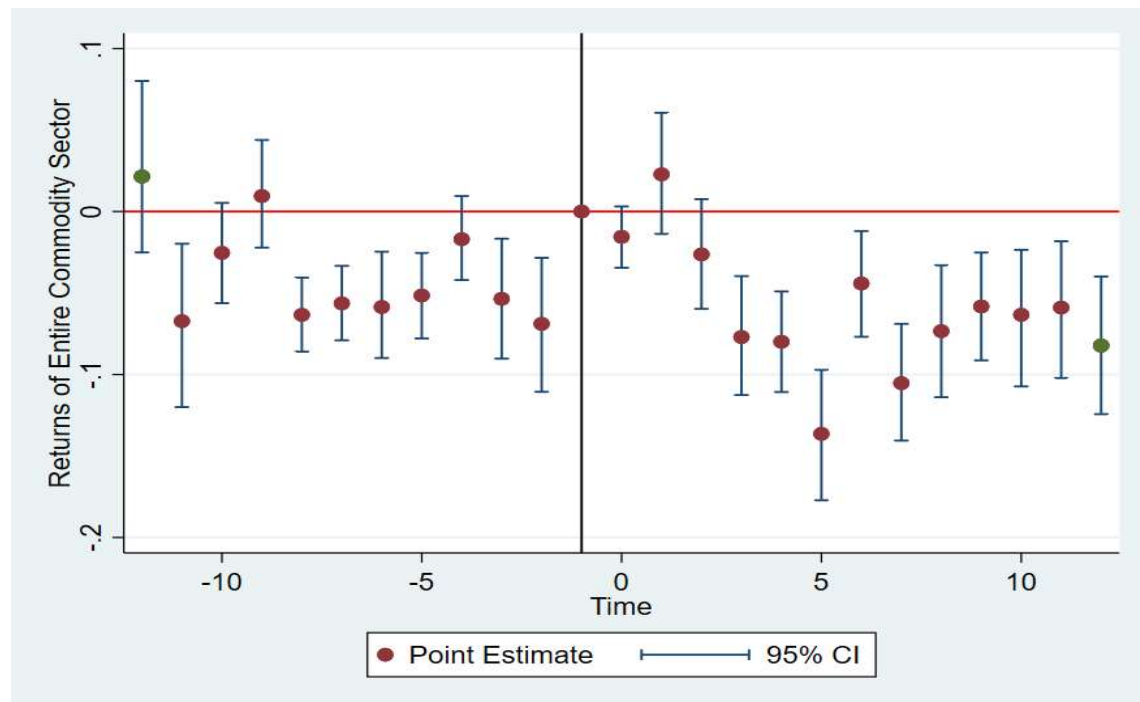
Graph 4.7 Monthly Returns of Livestock

What we see in the graphs is that after the war, the returns on commodities, especially on the entire sector, industrial metals and livestock, falls dramatically and then gradually comes back. Interesting is that, in energy and grains, returns in the time event become higher.

5. EMPIRICAL RESULTS

5.1 Panel Event Study on Commodity Returns

I anticipate that the effects of the conflict will not be apparent across the board until we start the analysis. Most of our attention will be directed toward particular industries, such the grains and energy sectors, due to the consequences of oil scarcity and inflation. We begin by examining the commodity industry as a whole.



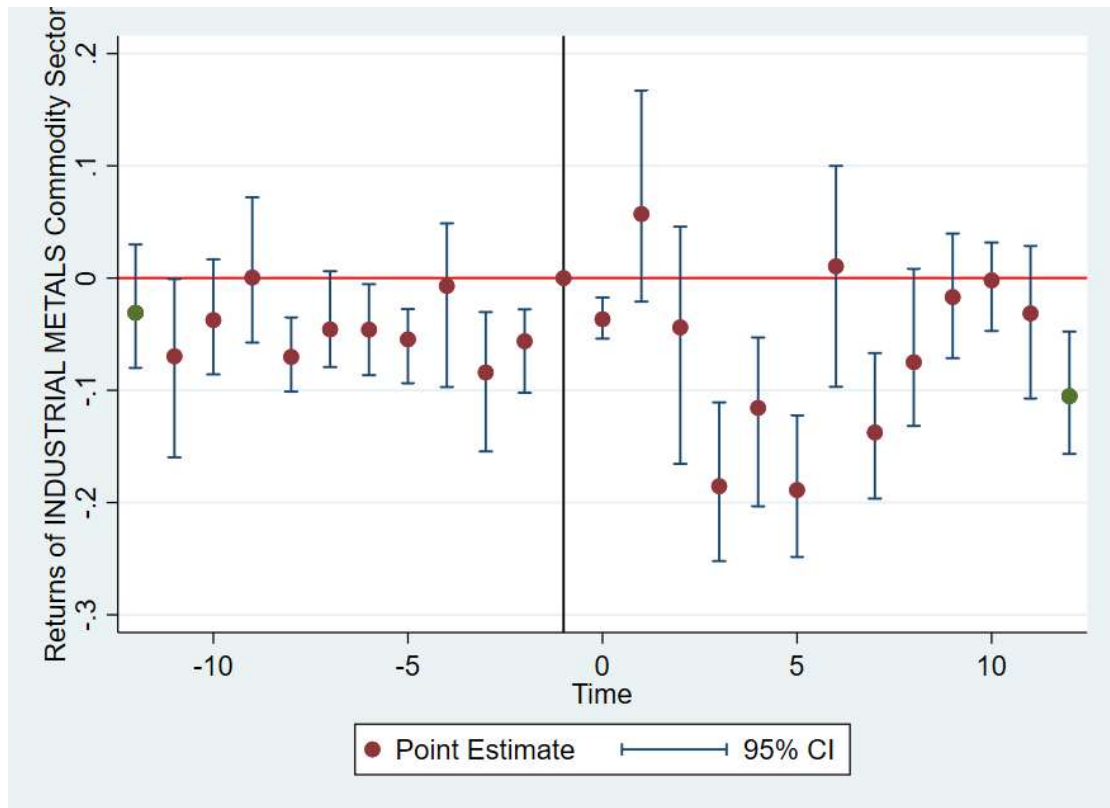
Graph 5.1 All Commodities Returns

The pattern of negative returns depicted in Chart 5.1 shows the sharp decline in commodity performance within the specified time frame. Each data point represents the returns of various commodities, ranging from crude oil, gold and silver to agricultural commodities and other vital goods for commercial and industrial purposes.

Despite the ongoing Russo-Ukrainian Conflict, it is evident that the market remains relatively unaffected. Both prior to and after the conflict, we can observe consistently negative returns, with the lowest point being close to a -10.5% decline. As we move forward, it is essential for investors, regulators, and industry stakeholders to work together in developing strategies to mitigate market risk and promote market stability.

Hence, we cannot conclude that the war affected the entire sector market.

Next, I move on to examine the Industrial Metal Sector. We do not expect any outlier results here either.

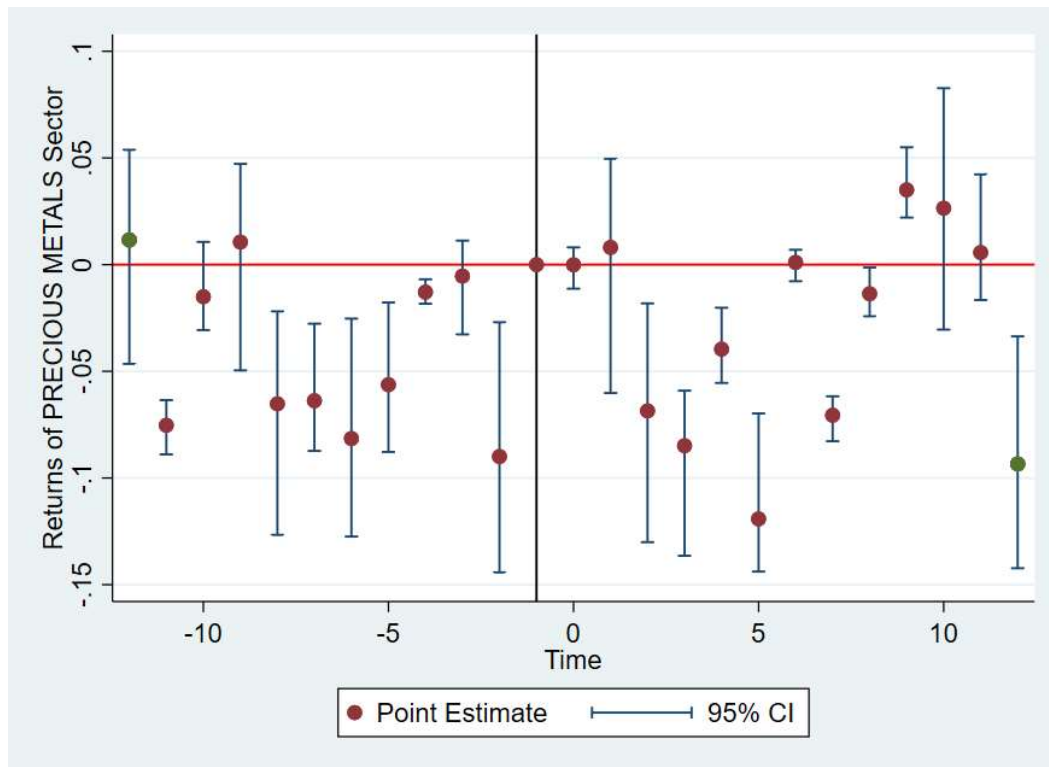


Graph 5.2 Industrial Metals Returns

Intriguing concerns about market dynamics and economic trends are raised by the finding of negative returns in industrial metals data. Industrial metals such as zinc, copper, and aluminum are generally seen as crucial to world trade, and the state of the economy as a whole is reflected in the demand-supply dynamics of these metals and their pricing. However, negative returns in this industry, point indicate a departure from the average.

Negative returns in industrial metals could also have an impact outside of the financial markets, suggesting difficulties in the infrastructure, construction, and manufacturing sectors. These developments would require careful observation by investors and policymakers, since they may indicate more significant economic challenges or structural changes in the industrial landscape.

The next sector analyzed is the Precious Metals Sector, in which is expected to have been affected by war.



Graph 5.3 Precious Metals Returns

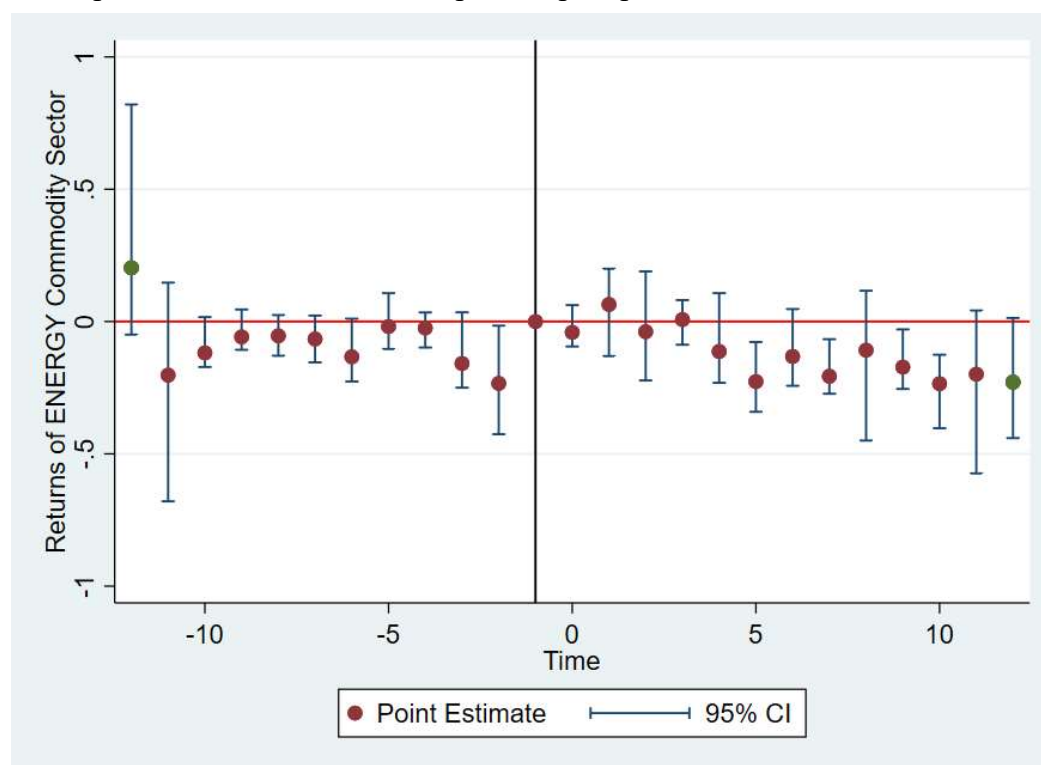
We can see the result points being sparsely placed in the chart. But once again, we observe no extreme differences between 12 months before and 12 months after the war, which is quite interesting. Most of the returns are in the negative area. When negative returns are seen in precious metals data, it might be a significantly unusual behavior and should be carefully examined. Gold, silver and platinum, are frequently viewed as safe-haven investments and are sought after amid uncertain economic or market conditions. Numerous factors, including inflation, currency changes, geopolitical concerns, and investor attitude (if he is risk seeker, risk averse or risk neutral, affect these commodities' prices.

In my analysis, negative returns in precious metals data could indicate a break from this conventional event. It can indicate a change in investor preferences or the nature of the market. For example, if after the war, economy starts growing or there are higher interest rates, this could make precious metals less desirable as alternative assets, which would drive down prices.

Generally, negative returns on precious metals may also be a reflection of more general macroeconomic trends, including a drop in inflation expectations or a decrease in the demand for safe-haven assets as a result of better market mood. It is important to keep in mind, though, that brief swings in the price of precious metals are normal and do not always portend a longer-term trend.

Hence, we cannot conclude that the war affected the sector of precious metals.

Another sector I consider quite important to analyse is the energy sector. We expect to see important differences between pre and post period returns from the war.



Graph 5.4 Energy Returns

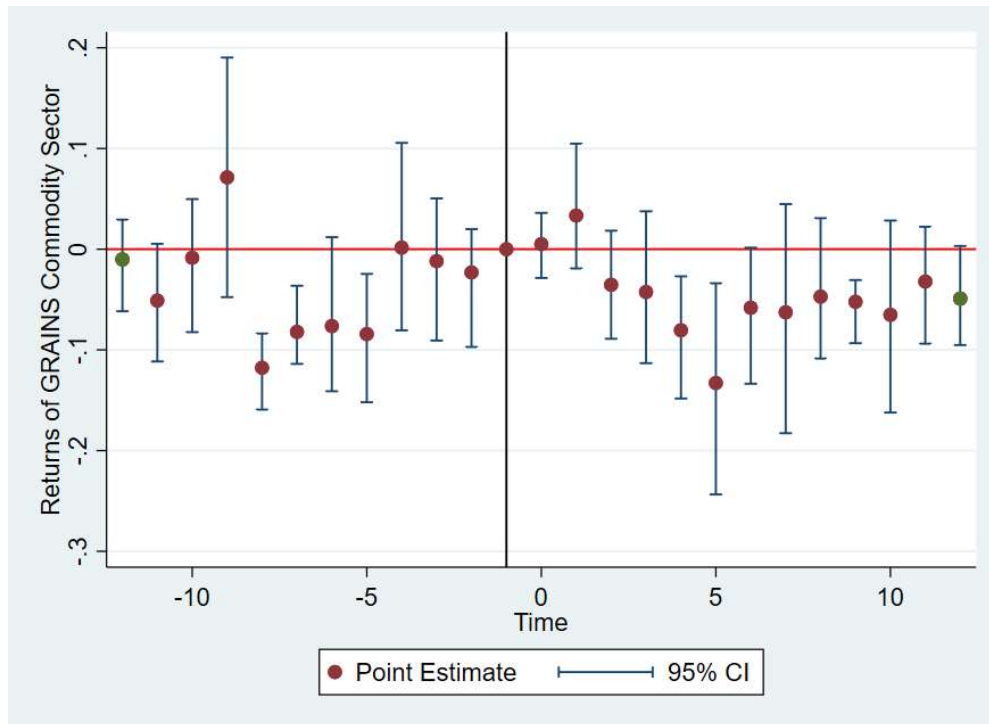
Surprisingly, something unexpected is shown in graph 5.4, i.e., negative energy sector returns both before and after the outbreak of the war. This means that there was either oversupply or reduced demand, but this is also worrying as fuel is a commodity essential for both poor and rich households. However, it is worth noting that when studying fuel prices in panel event study, I noticed an extraordinary increase in prices after the war for all other months in my analysis (see appendix).

The Russian-Ukrainian war can have significant repercussions on energy markets, leading to negative returns for investors. The conflict can disrupt energy supply routes, particularly natural gas pipelines that traverse Ukraine, thereby causing uncertainty and supply disruptions. Investors may react to this geopolitical tension by selling off energy assets, anticipating increased market volatility and supply risks.

Furthermore, the conflict can reinforce concerns about broader geopolitical instability, leading to risk aversion and downward pressure on energy prices. Additionally, sanctions imposed on Russia, the explosion of Nord Stream 2, help from the US with LNG exports to Europe or disruptions to energy infrastructure in the region can exacerbate the situation, further impacting energy market performance.

Overall, the Russian-Ukrainian war introduces a complex dynamic into energy markets, but not highlighting the interconnectedness of geopolitical events and financial outcomes in the global economy, and cannot prove that returns affected from the war. In short, these results don't follow main conviction, and should be re-examined.

The agricultural sector (grains) is the next one to be under analysis. After Russia took over Mariupol and Odessa port under Russian control, the whole world was in very difficult position because Ukrainian grains couldn't leave the sea. So, we also expect important differences from returns before and after the conflict.



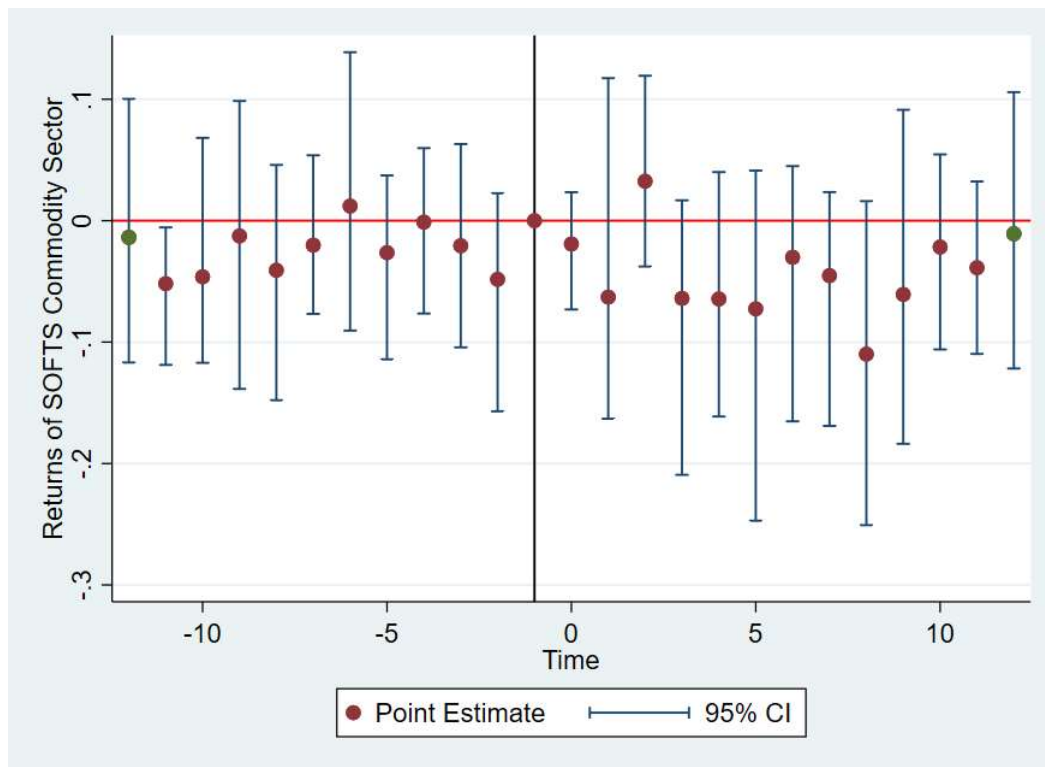
Graph 5.5 Grains Returns

And indeed, we see positive returns at first but negative returns after, although we have negative returns even before the conflict with exception May 2021. In this section, negative returns of agricultural exports could be because of Covid-19 Pandemic, for the reason that, for almost 2 years of lockdown, exports decreased fiercely. Once again, examining prices we have extremely high differences between leads and lags of the war (see appendix).

The Russian-Ukrainian war could have a profound impact on agricultural markets, potentially leading to negative returns for suppliers. Ukraine is a major exporter of agricultural commodities such as wheat, corn and barley, and any disruption in its agricultural sector due to the conflict could affect global markets. Uncertainties related to the conflict, such as disruptions to transport routes, export bans or reduced planting and harvesting activities, may lead to supply shortages and a surge in agricultural commodity prices.

As it seems, geopolitical tensions, such as war in our case, can affect commodity returns in agricultural markets. In addition, war can lead to wider economic impacts, affecting global trading patterns, currency valuations and commodity demand. Market participants should closely monitor developments in the region and assess their potential impact on agricultural markets in order to make informed investment decisions. Hence, we cannot conclude that the war affected the sector of grains.

Another sector to examine, is sector of soft commodities, such as cocoa, coffee, tea, cotton and sugar. We expect either close results to grains or not much of an important change.



Graph 5.6 *Softs Returns*

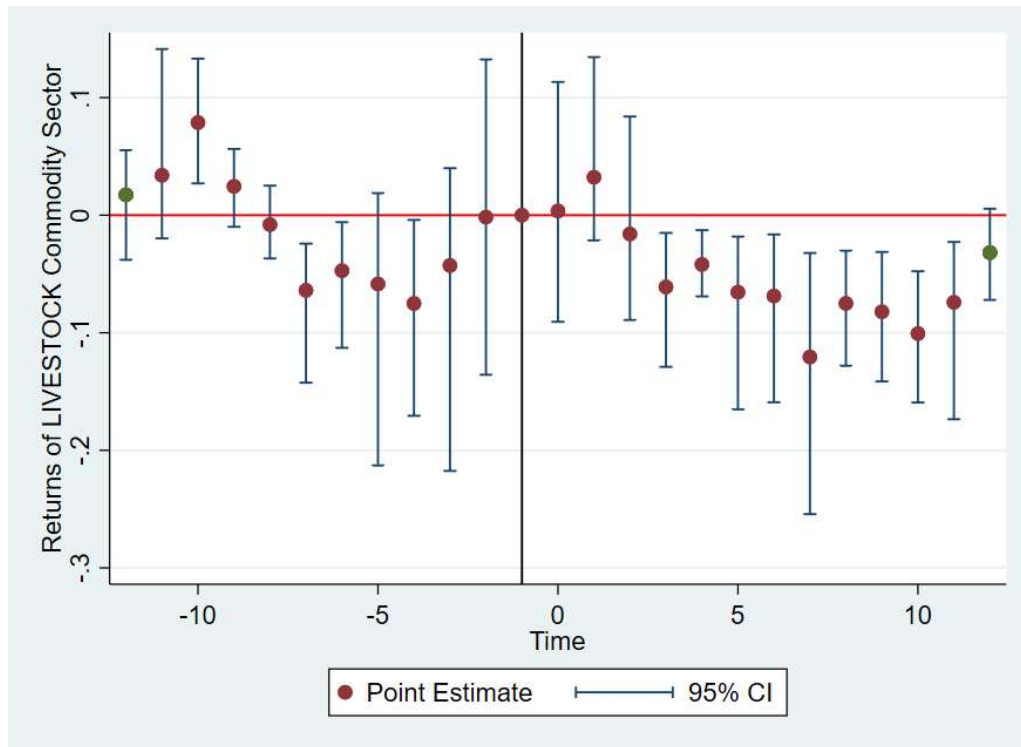
As expected, the majority of returns are negative before and after the conflict, with exception 2 months after the event, in which we observe a positive returns in soft commodities. Once again, these results may be affected not only because of war, but also because of Covid-19 Pandemic and its lockdowns worldwide.

The Russian-Ukrainian war can exert significant pressure on soft commodities markets, potentially leading to negative returns. Our soft commodities, meaning coffee, sugar, cocoa, and cotton and tea are susceptible to disruptions in global trade routes and supply chains, particularly if the conflict disrupts production or transportation in key regions.

Ukraine and Russia are not major producers of soft commodities, but the conflict can still have indirect effects on global markets. This is why we observe low returns. If these commodities came exclusively from Ukraine, results would be much more different.

Additionally, any escalation of the conflict may prompt concerns about broader economic stability, potentially reducing consumer demand for soft commodities. Hence, we cannot conclude that the war affected the sector of softs.

Finally, the last part of my analysis involves the examination of the livestock sector. In this particular sector, we expect nothing important, but almost negative results for sure for the same reason as for softs.



Graph 5.7 Livestock Returns

As we can see in graph 5.7, we have positive returns at the beginning, meaning in February to March of 2021, but after that once again few months before war and after the war, except March and April 2022, we have negative returns. The Russian-Ukrainian war may have only a little impact livestock markets, while neither Russia nor Ukraine are major players in the global livestock trade.

Our geopolitical tension can lead to market uncertainty and risk aversion among investors, causing downward pressure on livestock prices. Additionally, disruptions to trade routes or supply chains in neighboring regions can affect livestock transportation and export capabilities, further exacerbating market volatility.

Moreover, concerns about economic stability stemming from the conflict may dampen consumer demand for meat products, influencing livestock prices negatively, but this is also a concern because, livestock is essential for households. Hence, we cannot conclude that the war affected the sector of livestock.

5.2 Robustness

The estimation of commodity returns holds significant importance in my analysis. However, a single snapshot of monthly returns may not capture the full dynamics of commodity price movements. To attain a more comprehensive understanding and evaluate the robustness of these returns, the analysis of cumulative returns emerges as a valuable tool.

Monthly returns show the percentage difference in a commodity's worth from one month to the next. Monthly cumulative returns add up these monthly returns over time, giving a bigger picture of whether the overall value has gone up or down.

In this section, I embark on an exploration of cumulative returns as a means to evaluate the robustness of commodity returns. I aim to demonstrate how the analysis of cumulative returns enhances the understanding of commodity price dynamics, facilitates the identification of trends, and enables the assessment of risk-adjusted performance.

By calculating cumulative returns, I seek to uncover patterns, anomalies, and underlying relationships that may remain obscured in isolated monthly return data. I aim to present cumulative returns alongside traditional monthly return metrics so as to provide a more comprehensive and nuanced understanding of commodity price dynamics, thereby empowering analysts, and policymakers to make informed decisions in the complex world of commodity markets.

In summary, returns focus on the performance of an investment within individual periods, while cumulative returns provide a comprehensive view of the overall performance from the beginning to the end of the investment period. Once again, commodity prices increased after the war; therefore, we expect higher returns during the first months after the war outbreak.

Below, I will analyze cumulative returns for each sector as follows:

- ❖ All Commodities
- ❖ Industrial Metals
- ❖ Precious Metals
- ❖ Energy
- ❖ Grains
- ❖ Softs
- ❖ Livestock

In the next page there are descriptive statistics for the entire commodity sector and the rest of all different sectors for cumulative returns.

Table 5.1 Descriptive Statistics for the entire commodity sector

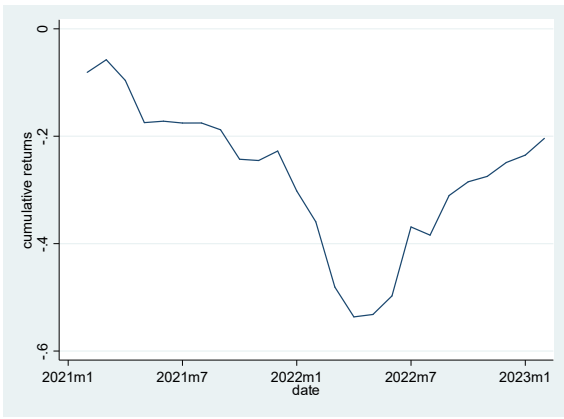
Statistics	Returns
Median	0.2741764
Mean	0.2016458
Min	-0.2721438
Max	2.250923
Variance	0.1324863
STD	0.3639867
Skewness	1.709039
Kurtosis	7.651383

Note: First column shows statistic tests, and the second column shows re results (in returns).

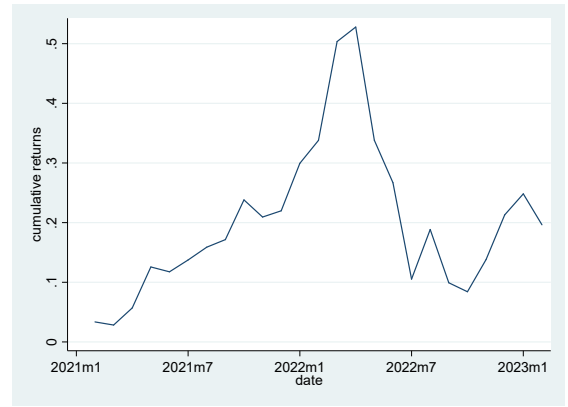
Table 5.2 Descriptive Statistics for every commodity sector

Sectors	Mean	Median	Min	Max	Variance	STD	Skewness	Kurtosis
Industrial Metals	0.2017737	0.159301	-0.08153	0.8991	0.0325	0.18051	1.3272	5.12707
Precious Metals	-0.0652	-0.05727	-0.26800	0.112	0.00690	0.08310	-0.2363	3.150
Energy	0.71338	0.5820	-0.12177	2.2509	0.27085	0.52043	1.0083	3.44472
Grains	0.24732	0.26253	-0.27214	1.0919	0.11677	0.34173	0.43750	2.5061
Softs	0.20649	0.160443	-0.13569	0.8797	0.05463	0.23374	0.91789	3.06493
Livestock	0.32297	0.28609	-0.23630	1.0618	0.06684	0.25855	0.57242	3.5590

Note: Rows show sectors and columns show statistics. **Median** provides insight into the central tendency of returns, helping to assess the typical value without being overly influenced by extreme outliers. **Mean** offers the average value of returns, useful for evaluating long-term performance or expected returns. **Min** indicates the lowest recorded price or return within a given dataset, highlighting potential downside risks or historical lows. **Max** reflects the highest recorded price or return within a given dataset, illustrating potential upside opportunities or historical highs. **Variance** measures the volatility of returns, aiding in risk assessment and portfolio management. **STD (Standard Deviation)** quantifies the spread of asset prices or returns around the mean, providing a standardized measure of risk and volatility. **Skewness** indicates the asymmetry of the distribution of asset prices or returns, offering insights into potential non-normalities and risks associated with extreme movements. **Kurtosis** illustrates the "tailedness" of the distribution of asset prices or returns, helping to identify the likelihood of extreme events and tail risks.



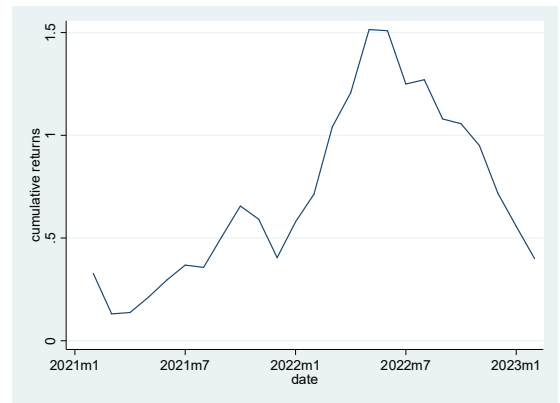
Graph 5.8 Cumulative returns for entire sector



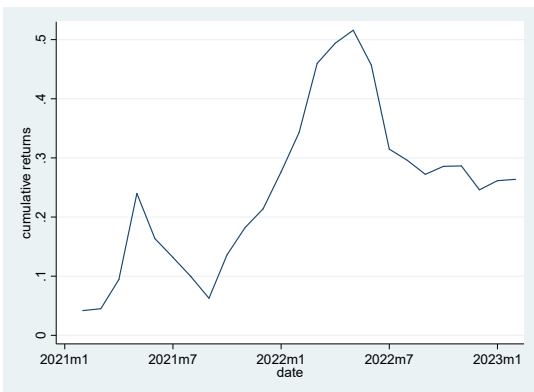
Graph 5.9 Cumulative returns for Industrial Metals



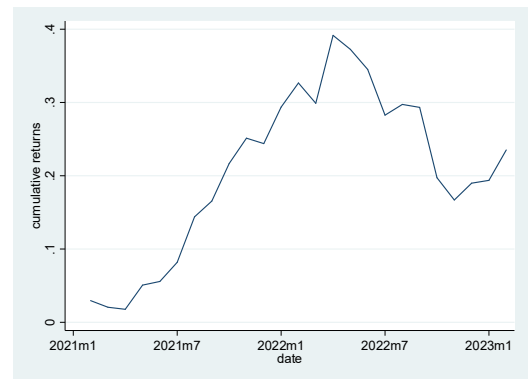
Graph 5.10 Cumulative returns for Precious Metals



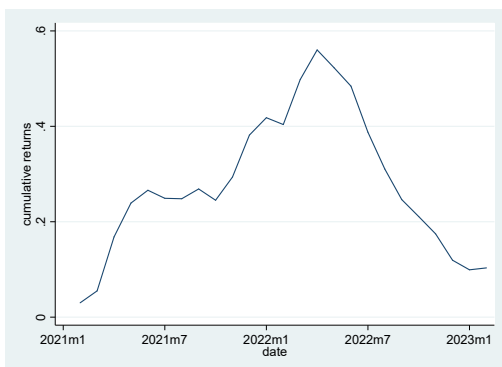
Graph 5.11 Cumulative returns for Energy



Graph 5.12 Cumulative returns for Grains



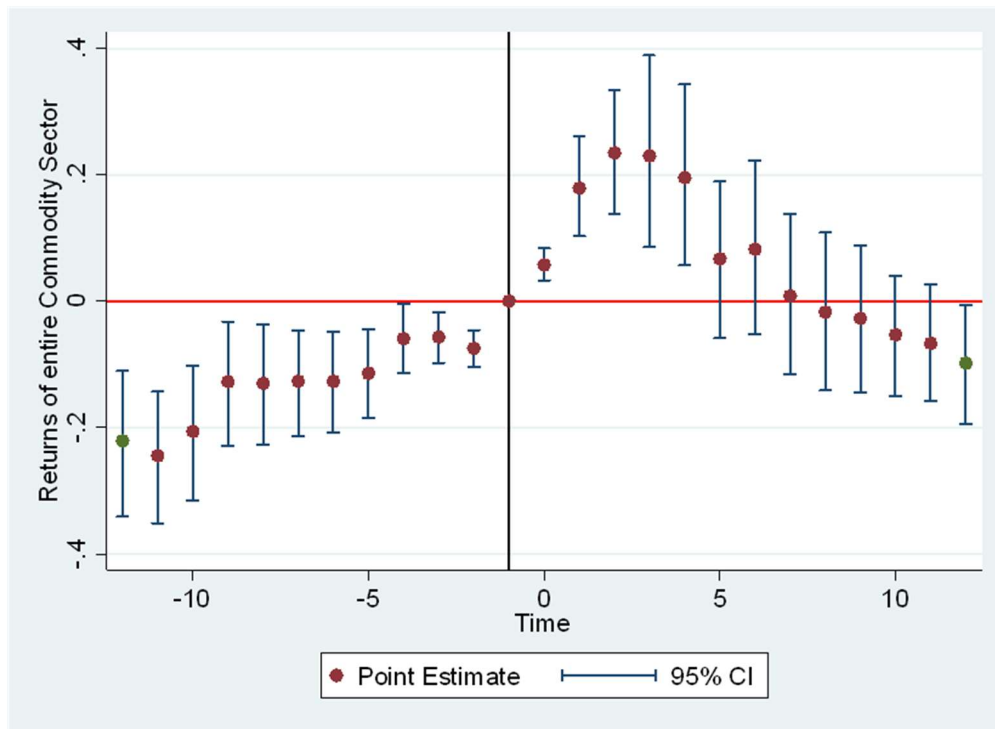
Graph 5.13 Cumulative returns for Softs



Graph 5.14 Cumulative returns for Livestock

Here, we can observe that now graphs are closer to our theory. After the war, returns become extremely high with respect to pre-war. However, precious metals sector and entire market show a down slope of returns.

Firstly, I analyze monthly cumulative returns for the entire commodity sector.



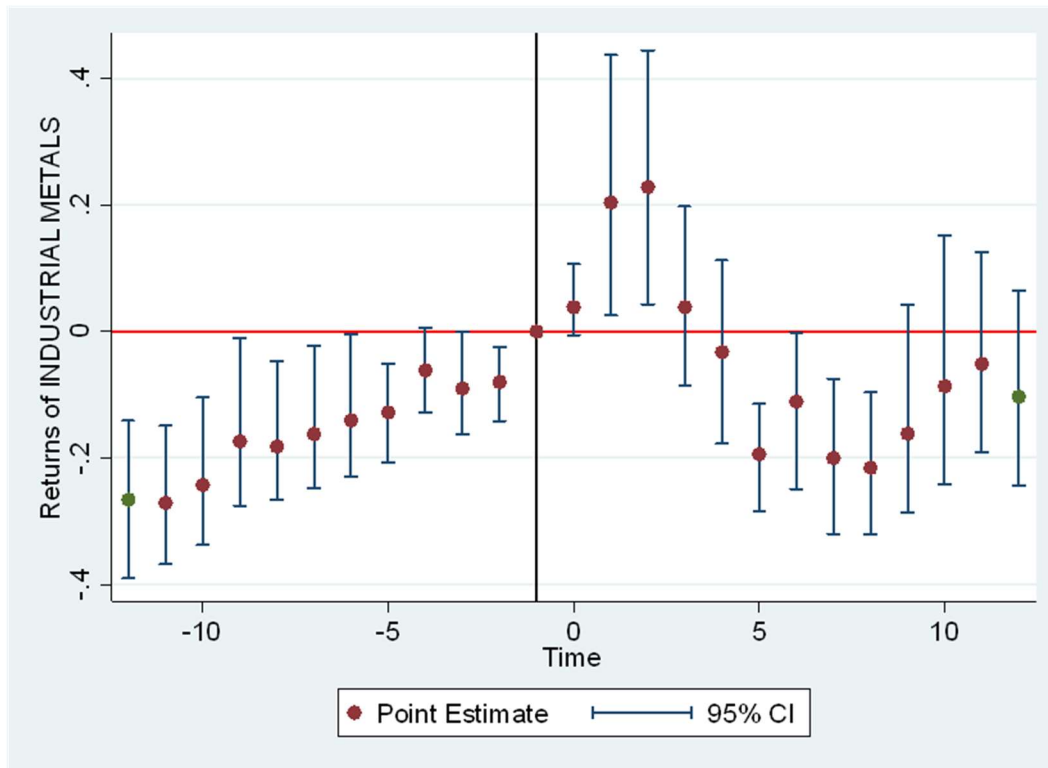
Graph 5.15 Cumulative Returns for the entire sector

We can easily observe that now, although we have stable negative returns prior to the war, the data changes in the first six months after the onset of the conflict. Cumulative Returns reach to +20%, meaning that in the entire commodity sector, inflation caused high commodity prices, as demand exceeded supply, causing deficit. The Russian-Ukrainian war appears to be the cause of notable gains in the commodity sector data over the first 6 months, which highlight the intricate relationship between commodity markets and geopolitical developments.

Geopolitical uncertainties frequently cause investors to gravitate toward safe-haven commodities like gold and oil, which increases demand and pushes prices higher. Amidst the Russian-Ukrainian conflict, investors may have turned to commodities as a haven due to apprehensions about supply disruptions and increased financial market volatility.

Furthermore, worries about possible interruptions to international trade routes and supply chains may have contributed to price surges for particular commodities like metals, agricultural products and energy sources. Hence, we can conclude that the war affected the sector of entire commodity market, especially for the first 6-7 months.

Next sector to be analyzed is Industrial Metals Sector. Here we can expect quite different result from monthly returns in section 5.1, however not important high/low returns.

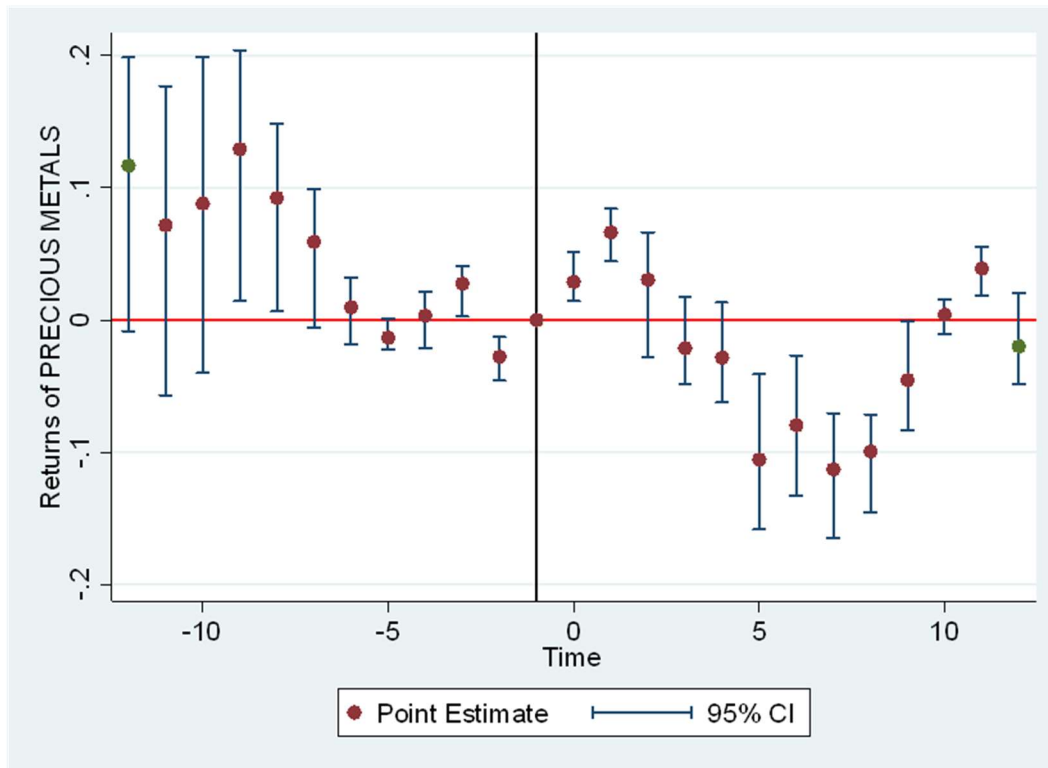


Graph 5.16 Cumulative Returns for Industrial Metals

Data from the industrial metals commodity sector showed negative returns before the outcome of the war. However, what we see is that by June 2022, we have positive returns, which means that once again due to increased demand, a shortage was created and this caused prices to rise so that the demanded quantity was reduced to reach a new equilibrium.

Additionally, the aftermath of the conflict may have spurred efforts to repair infrastructure and boosted interest in industrial metals, which could have enhanced the sector's performance. And for this reason, for almost 4 months after the war, cumulative returns are positive and then again, they become negative for all the rest period. Hence, we can conclude that the war affected the sector of industrial metals, only for 4 months after the conflict.

Next sector to be analyzed is Precious Metals Sector. Here we can expect important changes after the conflict, if we can consider that gold is one of the safest assets to invest.



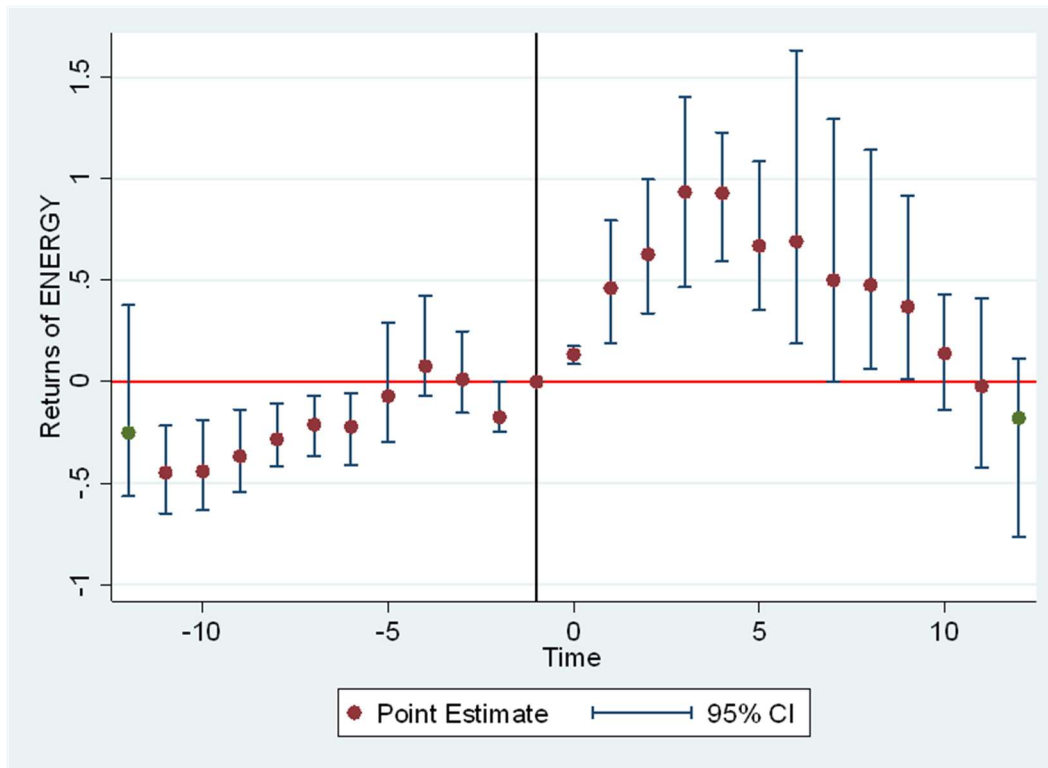
Graph 5.17 Cumulative Returns for Precious Metals

Results in graph 5.17 are not as predictable as we expected, but for few months after war, theory holds. We can see that before the conflict, precious metals' cumulative returns were higher than they were after the conflict. This means that, investors probably were uncertain of how war will affect market and increased their demand for safe assets such as gold. Plus, when war started, cumulative returns became positive, showing that investors increased their trust to these assets.

The observed positive returns in the precious metals commodity sector data before the Russian-Ukrainian war, followed by negative returns after the war, reflect the intricate relationship between geopolitical events and precious metals markets. This pattern highlights the importance of understanding the nuanced dynamics of geopolitical events and their impact on investor behavior and asset prices in commodity markets.

Hence, we can conclude that the war affected the sector of precious metals.

The energy sector is to be analysed next. Here, we expect extremely different results from monthly returns. The reason is that Russia is an important exporter of oil and natural gas, especially to Europe and Asia.



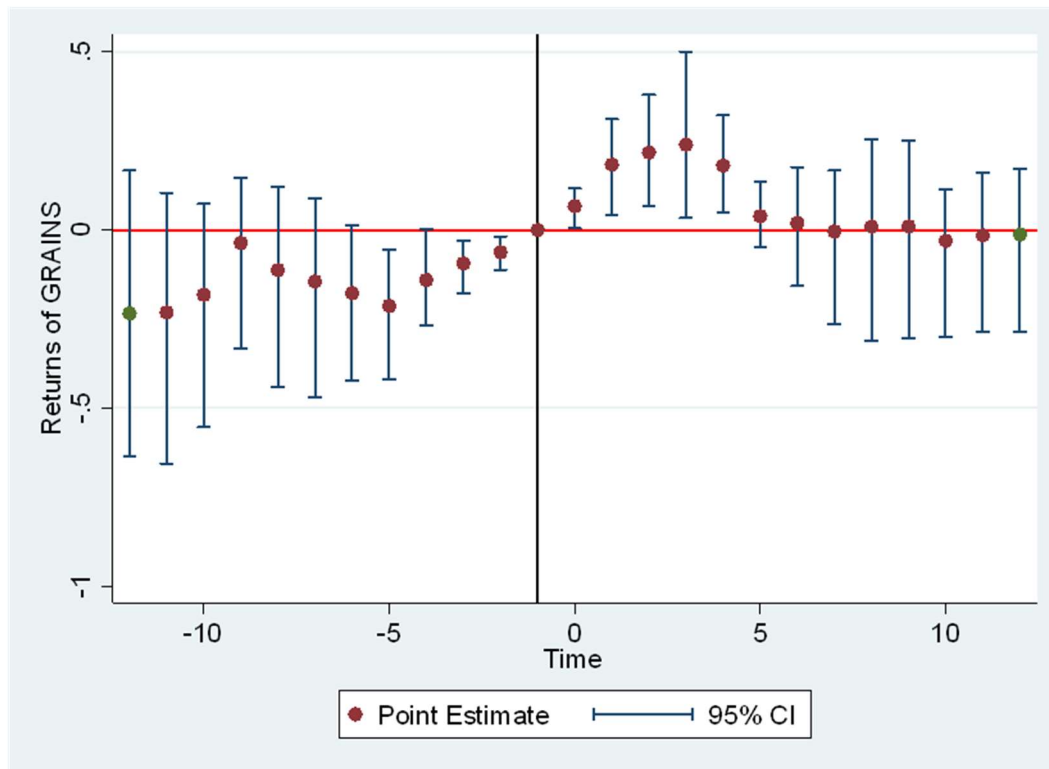
Graph 5.18 Cumulative Returns for Energy

And indeed, as we can see cumulative returns for energy sector were negative before war but for sure positive after the war reaching almost +90%. The reason is because negative returns seen in energy commodity sector components before the Russian-Ukrainian war were likely to have been driven by concerns about potential disruptions to global energy supply chains and heightened geopolitical tensions that affected market sentiment.

However, the post-war positive returns were due to increased demand for oil, gasoline and natural gas as both Europe and the US cut off all cooperation with an embargo to Russia on russian gas exports, causing fuel shortages in particular in European countries such as Greece. Fuel costs shot through the roof as a result, and this fact still has an important impact on us until today. This sector has the most obvious affection from the war.

Hence, we can conclude for sure that the war affected the sector of energy, for a long time after the conflict.

Another sector that probably will show significant results, is grains section commodity if we consider that, after Russia overtook Ukrainian port in Odessa, Putin canceled all ukrainian grain product exports to the rest of the world and such decision could only cause high demand for grains. Graph 5.19 shows the results.

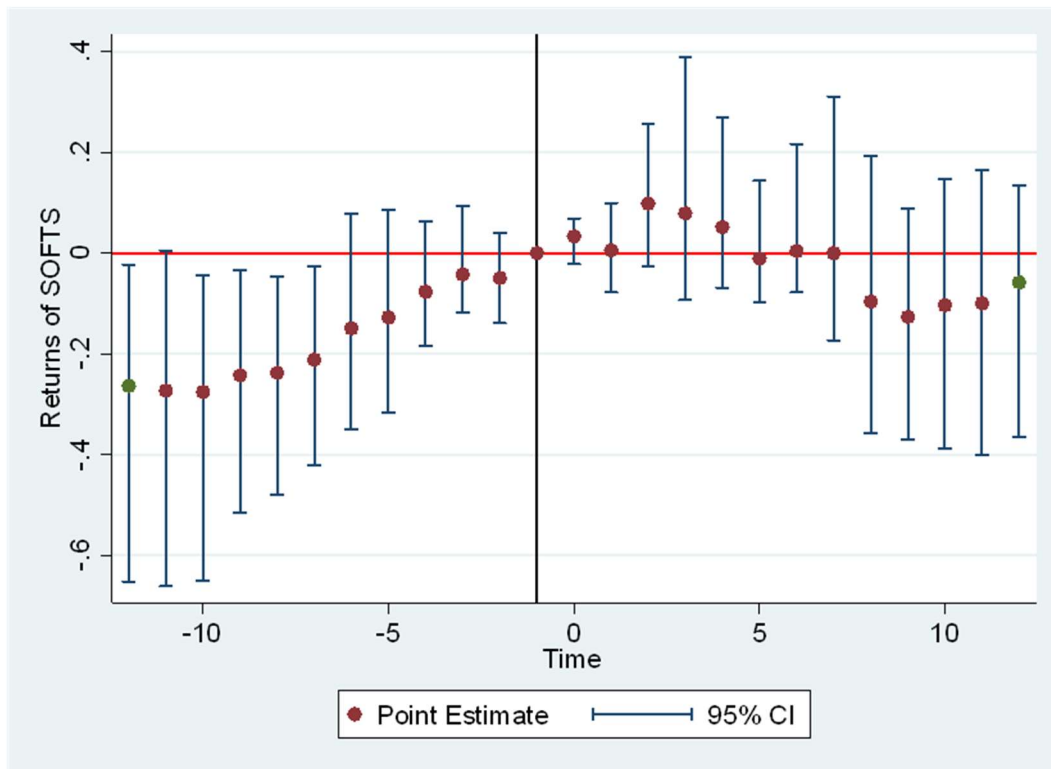


Graph 5.19 Cumulative Returns for Grains

As we can see, cumulative returns of grains commodity sector before war were negative and became positive for 6 months after the conflict, reaching almost 10%. The grains commodity sector saw losses before the Russian-Ukrainian war due to supply worries and market instability from possible disruptions in grain-producing areas.

After a war in Ukraine, grains experience positive returns due to various reasons. Reconstruction efforts following the conflict led to high demand for grains to support recovery. Wartime disruptions in supply chains may also deplete existing grain reserves, creating a supply shortage and higher prices. Additionally, improved stability after the war increases investor confidence in agricultural markets, attracting investments and further boosting prices. These factors combine to generate positive cumulative returns for grains in Russo – Ukrainian post-conflict. Hence, we can conclude that the war affected the sector of grains, for at least 6 months after the conflict.

Another sector to be estimated is softs commodity sector, in which we expect similar results with grains commodity sector. Graph 5.20 shows the results.

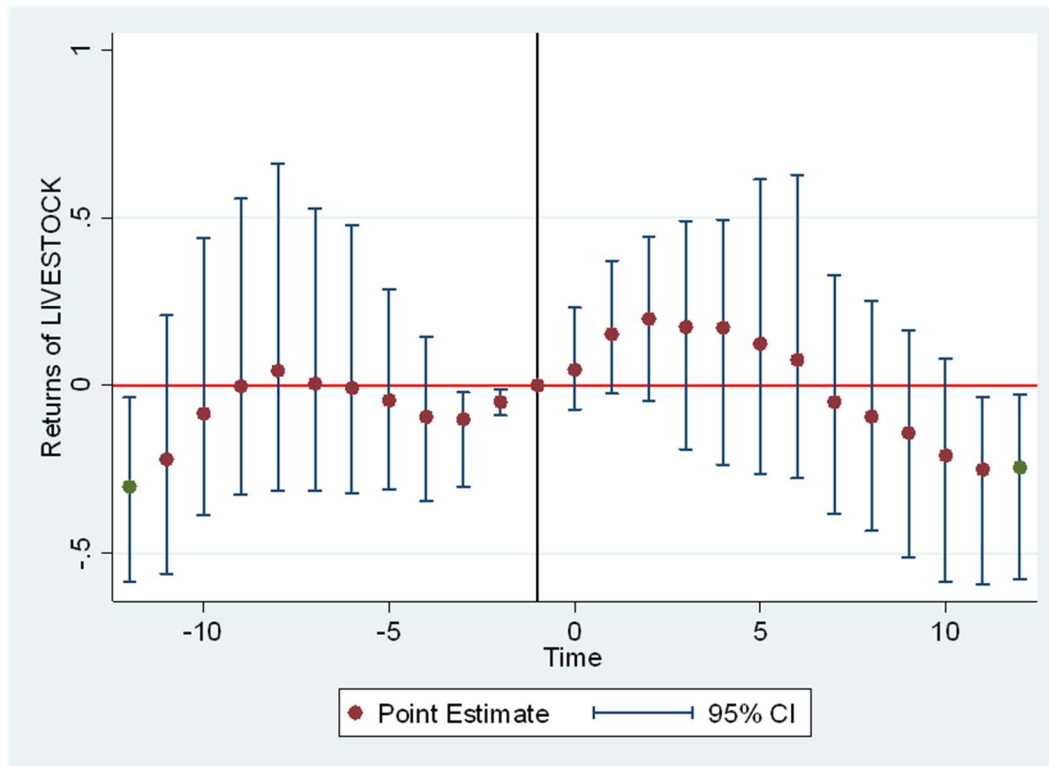


Graph 5.20 Cumulative Returns for Softs

As expected, our event of interest, meaning Russo – Ukrainian war affected cumulative returns for softs almost exactly as it affected cumulative returns for grains. We can observe that for 12 months before the war (February 2021 – January 2022) we had negative cumulative returns for softs commodity sector. After the conflict cumulative returns became quite positive reaching again almost 10%, and the reason is again high demand for this kind of commodities, meaning coffee, cocoa, tea, sugar and cotton.

Furthermore, we can also observe that after September 2022, cumulative returns become once again negative. Seeing the bigger picture, we cannot conclude that the affection of softs from war, is so obvious.

And the last sector to be analyzed is livestock commodity sector. As mentioned above, since neither Russia or Ukraine are important exports of livestock, we expect no such big results pre and post war. Results are in graph 5.21



Graph 5.21 Cumulative Returns for Livestock

As expected, we cannot prove that Russo – Ukrainian conflict affected cumulative livestock returns. We observe negative and positive cumulative returns both before and after the war, all close to zero with no outlier.

The livestock commodity sector data shows both negative and positive returns before and after the Russian-Ukrainian war, indicating resilience to geopolitical events compared to other sectors, such as energy, grains and precious metals sector. Factors such as stable gross production and consumer demand contribute to the sector's stability, despite market sentiment being influenced by geopolitical tensions. Understanding sector-specific dynamics is crucial for analyzing the impact of geopolitical events on commodity markets. Hence, we cannot conclude that the war affected the sector of livestock but as we see, cumulative returns became higher after the conflict.

6. CONCLUSIONS

In this study, I conducted a thorough analysis of the impact of the Russian-Ukrainian war on commodity returns in six sectors. Using a dataset with monthly data for 28 commodities over 24 months surrounding the conflict's start (12 months before and 12 months later), I utilized a panel event study framework, specifically using the event study with the `eventdd` command in Stata, to explore the dynamic relationship between the war and commodity returns.

My study uncovered industry-specific trends in how commodity returns reacted to the crisis between Russia and Ukraine. Initially, my analysis of monthly returns produced unreliable results. As a result, I adjusted my approach by examining monthly cumulative returns, which provided a more robust foundation for making conclusions.

In the energy, broader commodities, and grains sectors, I noticed a consistent pattern of positive returns in the first six months following the conflict's outbreak. This was due to factors like increased uncertainty, leading to price spikes, and rising demand in anticipation of potential supply disruptions. However, beyond the initial post-conflict period, cumulative returns showed a trend towards stability and eventually turned negative. This shift suggests a potential normalization of market conditions and the resolution of initial supply concerns, resulting in a decrease in commodity prices.

On the other hand, the livestock and precious metals sectors did not display significant changes in returns linked to the Russian-Ukrainian conflict. This could indicate that these sectors are less directly impacted by geopolitical events or that other factors play a more significant role in determining their pricing trends.

Although this study focuses on the initial aftermath of the Russian-Ukrainian conflict, there are still opportunities for more research. Subsequent investigations might delve into longer-term impacts past the 12-month period analyzed here and take into account factors like geopolitical shifts, macroeconomic circumstances, and policy reactions. By enhancing my comprehension of how geopolitical occurrences influence commodity markets, researchers can offer useful perspectives for investors, policymakers, and market stakeholders operating within a more interconnected world economy.

7. REFERENCES

- Clarke, D., & Schythe, K. T. (2020). Implementing the Panel Event Study.
- MacKinlay, A. C. (1997). Event Studies in Economics and Finance.
- Brown, S. J., & Warner, J. B. (1985). Using Daily Stock Returns: The Case of Event Studies, 3–31.
- Mitchell, M. L., & Mulherin, H. J. (1994). The Impact of Public Information on the Stock Market.
- Fama, E.F. et al. (1969) “The adjustment of stock prices to new information,” *International Economic Review*, 10(1), p. 1. Available at: <https://doi.org/10.2307/2525569>.
- Schmidtke, J., Hetschko, C., Schöb, R., Stephan, G., Eid, M., & Lawes, M. (2021). The Effects of the COVID-19 Pandemic on the Mental Health and Subjective Well-Being of Workers: An Event Study Based on High-Frequency Panel Data.
- Steckel, J. C., Brecha, R. J., Jakob, M., Strefler, J., & Luderer, G. (2013). Development without Energy? Assessing Future Scenarios of Energy Consumption in Developing Countries, 1–11. <https://doi.org/10.1016/j.eneco.2013.05.022>
- Biermann, M., & Leromain, E. (2023). The Indirect Effect of the Russian Ukrainian War through International Linkages: Early Evidence from the Stock Market.
- Gehring, K. (2019). External Threat, Group Identity, and Support for Common Policies – the Effect of the Russian Invasion in Ukraine on European Union Identity. <https://doi.org/10.2139/ssrn.3511287>
- Mohammed, K. S., Usman, M., Ahmad, P., & Bulgamaa, U. (2022). Do all renewable energy stocks react to the war in Ukraine? Russo-Ukrainian Conflict Perspective. *Environmental Science and Pollution Research*, 30(13). <https://doi.org/10.1007/s11356-022-24833-5>
- Petersen, M. A. (2008). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, 22(1), 435–480. <https://doi.org/10.1093/rfs/hhn053>
- Stuart, E. A., Huskamp, H. A., Duckworth, K., Simmons, J., Song, Z., Chernew, M. E., & Barry, C. L. (2014). Using propensity scores in difference-in-differences

models to estimate the effects of a policy change. *Health Services and Outcomes Research Methodology*, 14(4), 166–182. <https://doi.org/10.1007/s10742-014-0123-z>

- Sun, M., Song, H., & Zhang, C. (2022). The Effects of 2022 Russian Invasion of Ukraine on Global Stock Markets: An Event Study Approach. <https://doi.org/10.2139/ssrn.4051987>
- "5-day long Russo-Georgian War begins, (2008)", Available at <https://www.history.com/this-day-in-history/5-day-long-russo-georgian-war-begins>
- "'Russia is no longer a strategic partner of the EU", say MEPs", (2015), Available at <https://www.europarl.europa.eu/news/en/press-room/20150604IPR62878/russia-is-no-longer-a-strategic-partner-of-the-eu-say-meps>
- "EU strengthens sanctions against actions undermining Ukraine's territorial integrity", (2014), Available at <https://www.internationaltradeupdate.com/2014/04/28/eu-strengthens-sanctions-against-actions-undermining-ukraines-territorial-integrity/>
- Damodar N Gujarati, Dawn C. Porter (2006) "Essentials of Econometrics 4th Edition", McGraw-Hill Education
- John A. Garraty, "The Great Depression" (1986)
- Francis Sempa, "Geopolitics from the Cold War to the 21st Century", 2002
- Lo, G.-D., Marcelin, I., Bassène, T., & Sène, B. (2022). The Russo-Ukrainian War and financial markets: The role of dependence on Russian commodities. *Finance Research Letters*, 50, 103194. <https://doi.org/10.1016/j.frl.2022.103194>
- Fang, Y., & Shao, Z. (2022b). The Russia-Ukraine conflict and volatility risk of commodity markets. *Finance Research Letters*, 50, 103264. <https://doi.org/10.1016/j.frl.2022.103264>
- Umar, M., Riaz, Y., & Yousaf, I. (2022). Impact of russian-ukraine war on clean energy, conventional energy, and metal markets: Evidence from event study approach. *Resources Policy*, 79, 102966. <https://doi.org/10.1016/j.resourpol.2022.102966>
- Bhardwaj, G., & Dunsby, A. (n.d.). How Many Commodity Sectors Are There, and How Do They Behave?

APPENDIX

In appendix I show for observation how Russo – Ukrainian War affected commodity prices for each sector

