The Russo-Ukrainian war and the US Stock Market

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Introduction

Events such as armed conflicts and all out war have seen a significant decrease in the years following the end of the cold war. In Europe especially, no cross-border conflict has taken place since the end of the Yugoslav war, which can be considered a civil war. With this context in mind, it seemed that war in mainland Europe was nothing more than a dark distant past long left behind. This notion was shattered with the advance of Russian troops into Ukraine. Russia itself calls the war a "Special Military Operation" as to not seem as the aggressor but rather the liberator of ethnic Russians living in Ukraine. With the creation of the European Union and closer cooperation and ties between the countries of Europe a conflict like this seemed almost impossible. This event however is merely the culmination of Russian aggression when dealing with ex-Soviet countries that try to break into the broader European cooperation sphere. Seeing as the invasion of Ukraine was preceded by the annexation of Crimea back in 2014. Even before that in 2008 Russia invaded Georgia using the ethnic Russian population as pretext for the invasion.

This terrible event presents an interesting research question, how do people react to war, more specifically how do financial markets react. Since the end of the Second World War, the global economy has been growing. This is especially true for the United States of America. After the roaring 1920s the U.S. stepped into a period known as the Great Depression which can be considered to be one of the causes for the advent of WWII. Following the Great Depression, the U.S. moved almost instantly to wartime production kickstarting the astonishing growth we are experiencing to this present day. With the main economic rivals of the U.S. namely the ex-colonial powers of the United Kingdom, France and the heavily industrialized Germany being left in tatters after the war the U.S. emerged as the leading economic power of the world.

With a structure and laws that favor investment in the financial markets, returns over the post war period have been amazing averaging out to 7% adjusted for inflation per year. With very few events causing severe downturns in the market. Most notable being the 2008 financial crisis which caused the S&P 500 to lose almost half its value. Even more recently the Covid-19 pandemic has caused the market to decline

by almost 30%. Outside events such as wars, geopolitical instability and even natural disasters, can cause the market to fluctuate and decline.

During the cold war different events affected the stock market. One of those was the Cuban missile crisis. In 1962 the USSR was secretly installing missile bases in Cuba. That prompted a U.S. blockade of the island that lasted nearly a full month until the missile bases were removed. This event caused the market to decline, the Dow Jones Industrial Average declined by more than 5% and only recovered after the resolution of the crisis. During the 1970s also a combination of events contributed to the stock market declining by more than 40%. Namely an economic recession and the 1973 oil crisis. The oil embargo was facilitated by Arab members of the OPEC group targeting countries that had supported Israel in the war against a coalition of Arab states.

One of the most infamous events in American history is the attack on the twin towers in New York on September 11th 2001. Where a group of 19 militant members of the Al-Qaeda extremist group, hijacked four commercial planes and planned to attack the Pentagon, New York and Washington D.C. The fear and panic stemming from these attacks caused the stock market to close until the 17th of September. The general market declined by more than 10%. The panic and insecurity caused by the September 11 attacks prompted the United States to declare the so called "War on terror" where a United States led coalition of nations invaded Iraq in 2003 with the pretext that Iraq had in its possession weapons of mass destruction such claims where later on proven to be false. The war on terror however did not begin with the invasion of Iraq, earlier in 2001 the U.S. invaded the nation of Afghanistan, in hopes to dismantle the group responsible for the attack on the twin towers Al-Qaeda. Years later these invasions have only made the Middle East region more unstable prompting new extremist groups to emerge.

Events however to move swing the market downwards, certain events can have the opposite effect. Technological breakthroughs and innovations in a certain field can improve specific stock returns. For example if a pharmaceutical company can manage to pass clinical trials and get approved to produce and distribute a new type of drug to the general market, its returns will increase. Similarly with the invention and adoption of the internet during the 1990s tech company stock returns

grew exponentially. Despite the fact, that a lot of these companies did not have the fundamentals or the correct business model to succussed. Which in turn led to the bursting of the Dot Com bubble in the early 2000s.

When examining different markets the causes of market crashes are similar if not the same as the events that cause the US. market to shift. The magnitude of the stock price movement however varies greatly. After the Russian invasion of Ukraine the Russian market MOEX has fallen by more than 40%.

When looking outside the stock market and into the broader economy, events such as a new deposit of oil or natural gas can greatly impact the future of a country. Such was the case for Middle Eastern countries such as Saudi Arabia, the United Arab Emirates and even Norway which completely transformed their economies and increased the living standards in these countries. Such discoveries however can have the opposite effect when not managed correctly. One such example is the South American country of Venezuela where bad government policy has condemned the nation to impoverishment. Policies such as government handouts, employment by state owned enterprises without proper planning and an unstainable wealthfare system. Without any regard in using the newly acquired wealth to build strong institutions.

For the financial industry event studies apply the two-way fixed effect methodology. More frequently a methodology as outlined and implemented in (Pacicco et al., 2018) is used. In this study however we are looking to identify the effect of the event on the entire market, or entire industry using panel data. To measure the impact also cumulative returns are calculated.

With the advent of the war energy price have increased dramatically, which in turn had led to an increase in inflation all around the world not only the U.S., in July of 2022 the inflation rate for U.S. was 8.5%. The FED has taken action to try to slow down the rising inflation by increasing the interest rate. The interest rate has risen 3 times up to the 14th of July which is the timeframe of this analysis and 8 times in total for the whole of 2022. With money becoming more expensive a slowdown of returns is expected the following but that is outside the scope of this analysis. Industries that we anticipate swings to are the energy industry since the profits for such companies are expected to increase in the near future given the upswing in oil prices, a downturn

in consumer discretionary companies is expected, when considering the high rate of inflation as a result of the war. For the general market wars tend to make expectations worse so a drop in returns is expected.

Two-way fixed effects models are increasingly being used to identify the impact of an event on a panel data framework. The methodology is relatively new however its popularity is growing, studies include (Bailey et al., 2017) studying the effects the war on poverty had on children's opportunities and, (Suhonen & Karhunen, 2019) where university reform in Finland is examined to observe the effects on higher education accessibility. In this analysis also the two-way-fixed effect methodology is implemented. However, since the event takes place at the same time for all affected groups the two-way-fixed effects methodology is equivalent to the Difference-in-Difference approach.

Literature review

Event studies focusing on finding the root cause that led to specific changes have existed for a very long time. One of the oldest recorded and most famous event studies, was conducted by John Snow (Snow, 1856), who broke new ground in epidemiology. Studying cholera outbreaks in Victorian era London and changing the way the scientific community at the time perceived how maladies spread and infect humans.

One of the most famous event studies in finance is the work of Eugene Fama regarding the adjustment of stock prices to new information (Fama et al., 1969). Where the effects of stock splits are examined and measure the effects the event has on stock returns. The study found that the abnormally high returns are a result of dividend hike and an increase in earnings, during the period preceding the split. Following these finding the study concluded that the market is efficient and reacts only to information that is available.

Another event study in finance this time focusing on the events earnings reports have on stock returns was published in 1968 by William H. Beaver (Beaver, 1968). In this paper the author concluded that earnings reports not only changed the behavior of individual investors by observing changes to the price of the security but also of the expectations of the general market shifted, this conclusion was drawn by compiling data for the volume of trades and changes to the price.

Warner and Brown argued for the use of daily stock returns when using the event study framework (Brown & Warner, 1985). They used simulations to pinpoint any potential problems that might arise when using daily returns such as nonnormality and bias in the estimator. On the first point of nonnormality they conclude that it had no effect on the event study framework. No significant loss of model performance was noticed when using daily data instead of monthly.

Newer research is also very prevalent with a paper published in 2020 diving into the impact the COVID-19 pandemic had on various sectors of the Chinese stock market (He et al., 2020). In the paper cumulative abnormal returns were used to calculate the impact on different sector of the stock market. Their analysis shows that the prices of stocks in most sectors declined and continued to decline after the breakout. Some outliers were present such as the agriculture and manufacturing industries that show an uptick in price. Given the nature of the companies that are part of the Chinese market namely a lot of them are owned by the government the result might be skewed.

Event studies are however widely used outside of finance to determine the effects a certain policy has. The methodology however as expected is different, as stated before the most widely used methodology is the Difference-in-Difference methodology. An interesting study showing the versatility of the methodology is the research by (Venkataramani et al., 2020) where the authors cross-examine how the opioid usage increases when economic opportunity fades. In order to approximate the loss of economic opportunity car plants were used a proxy, 30 communities where chosen and examined for a period from 1999 to 2019 also measuring the overdoses reported before and after the closure of the car plants whilst splitting them in respective age groups. The findings are startling five years after a plant closure opioid overdose deaths increased in comparison to the control sample by 85%. Opioid mortality in the control sample showed no statistically significant results.

In a 2006 paper the Difference-in-Difference methodology was employed to estimate the effects of increased access to divorce has on domestic violence (Stevenson & Wolfers, 2006). A panel methodology was used with observations from different states with different adoption timing of the divorce law. After the introduction of the law the study concluded that there was a decline in the number of domestic violence incidents in the states that adopted the law.

The versatility of the methodology is evident using a fixed-effects estimation a paper from 2015 (Smith, 2015) attempts to find links between poverty and resource rich countries using a panel of different countries from 1950 and their respective GDP per capita. This is an attempt to rebut the current sentiment of the natural resources course, where resource rich countries tend to be "poor", with ineffective institutions. Using this approach the author challenges the resource curse theory finding results that contradict existing literature. Positive effects on growth are noticed which also spill over into education and public health. However, the author also states that in general countries in the sample have failed to diversify their economies, democratic institutions have also taken a hit with political freedoms being curtailed. In conclusion then the findings of the paper seem to back the original research.

Event studies can be implemented for major geopolitical events to measure the effect they have on the general economy. One such study is the 2018 paper by Holger Breinlich (Breinlich et al., 2018), where the authors set out enrich existing literature by looking at the effects Brexit will have on the general economy and general expectations following the 2016 referendum by looking at the stock market. In the paper they conclude that expectation were for the economy to slow down or even enter a recession. The depreciating pound sterling also affected stock price movement downward after the referendum. As a secondary investigating question the authors also examined the effect, Theresa May's speeches had on investor sentiment, they however found that they had little effect because the speeches had very little new information.

Event effects can also be measured through volatility analysis. When high volatility is observed potential returns are higher because of the higher risk premium, on the same note losses can also be exaggerated. The most common method for modeling volatility is the GARCH methodology. This methodology was used in an event study context in the paper by Bruce Morley (Morley, 2023), the effects of direct democracy on the stock market are examined, by using referendums as events and measuring the volatility around the event. The study found that referendums had a positive effect on returns whilst at the same time reducing volatility. The shortcoming with the proxies and methodology used in the study is the fact that because Switzerland was used as the country for analysis more than one referendum can take

place at the same date. That makes it difficult to distinguish between the effects a single referendum can have. Also no control for trading volume was implemented.

Estimation method

To estimate the impact an event has, the main methodological approach used is the panel event study framework. The models are derived from the Difference-in-Difference methodology. The model allows for dynamic leads and lags, to be estimated. The Two-way fixed effects estimator has come under criticism for its application in time varying treatment period. However, this is avoided in this particular case because the event being examined is the same for all the cross-sectional variables i.e., the war starts on the same date all around the world. The model specification looks like:

$$y_t = a + \sum_{j=2}^{j} \beta_j \, lead_j + \sum_{\kappa=1}^{\kappa} \gamma_k \, lag_k + \lambda_t + \varepsilon_t \qquad (1)$$

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

$$\left(lead \, J \right)_t = 1 \big| t \leq Event - J \big| \qquad (2)$$

$$\left(lead \, j \right)_t = 1 \big| t = Event - j \big| \; for \, j \in \{1, \ldots, J - 1\} \qquad (3)$$

$$\left(lag \, k \right)_t = 1 \big| t = Event + k \big| \; for \, k \in \{1, \ldots, K - 1\} \qquad (4)$$

$$\left(lead \, K \right)_t = 1 \big| t \geq Event - K \big| \qquad (5)$$

Different groups of company returns will be analyzed, based on the industry these companies are part of, using the two-way-fixed effect estimator as stated above. We expect that the broader market will not have been influenced from the event and will try to identify different industries that have been most effective. These include the energy and consumer discretionary sector, on the same note we expect the financials industry will not show any effects coming from the war.

Data

For conducting the analysis panel data was used. It includes daily cumulative returns for all the unique tickers in the S&P500 except 4, from the 7th of October 2021 to 14th of July 2022. Which is 96 trading days before the war and 96 trading days after the war. Cumulative returns were calculated to make the effects visible as opposed to base returns. There are 11 distinct sectors when breaking down the S&P 500 as stated by the taxonomy developed by Standard&Poors. Ranging from Consumer Staples which include companies such as Costco and General Mills to Utilities with companies such as American Electric Power and American Water Works. Below some descriptive statistics for the entire market and grouped by all the different sectors

Table 1. 1 Descriptive Statistics for the entire market

Statistics	Cumulative Returns
Median	1,803591468
Min	-73,96807988
Max	139,4512654
STD	18,20771201
Skew	0,459696819
Kurt	3,777515987

Table 1. 2 Descriptive statistics per industry

Industry	Median	Min	Max	STD	Skew
Communication Services	-6,854642	-73,9681	24,75503	16,42544	-1,19064
Consumer Discretionary	-0,991937	-69,0485	79,29774	19,09592	-0,05319
Consumer Staples	6,4816262	-26,6424	59,37466	11,00697	0,601639
Energy	21,348793	-15,6601	139,4513	27,34562	1,051307
Financials	0,9341361	-43,8257	43,76286	13,379	-0,46806
Health Care	0,8485781	-64,6784	70,37793	18,98125	-0,0437
Industrials	-0,132612	-49,4977	36,09786	13,66078	-0,43788
Information Technology	0,1568241	-73,6613	74,33259	18,77825	-0,20166
Materials	4,4244147	-32,4065	104,6211	18,89631	1,255765
Real Estate	3,9194854	-33,1052	40,87858	10,5144	-0,15619
Utilities	6,8313973	-23,9625	45,66777	10,50691	0,505238

Some interesting observations to we can make, the Energy sector presents the largest increase in cumulative returns, the communication services is the sector with the largest drop off, interestingly the Materials industry has the highest skewness.

Table 1. 3 Descriptive Statistics post event

Industry	Median	Min	Max	STD	Skew
Communication Services	-14,74638	-73,9681	24,75503	18,91538	-0,72317
Consumer Discretionary	-11,07977	-69,0485	79,26063	20,33339	0,486369
Consumer Staples	9,1277016	-26,6424	59,37466	13,11001	0,323308
Energy	42,341726	-7,29765	139,4513	25,86131	0,716304
Financials	-6,253779	-43,8257	43,76286	15,921	0,109889
Health Care	-3,231667	-64,6784	70,37793	23,98974	0,162555
Industrials	-6,114402	-49,4977	36,09786	15,46742	-0,04121
Information Technology	-7,590405	-73,6613	61,51845	18,91297	-0,25529
Materials	0,9574716	-32,4065	104,6211	24,75876	1,068773
Real Estate	0,7776089	-33,1052	40,87858	12,44128	0,103257
Utilities	12,950401	-23,9625	45,66777	11,9292	-0,07389

Post event statistics highlight a general downward trend after the war, with the industries most affected being the Communication Services and Consumer Discretionary. The Energy industry presents a clear upswing in returns post event with the median cumulative return rising to 42%.

Analyzing the effects of the conflict

Before commencing with the analysis, we expect the effects of the conflict to not be noticeable on the broader market. Mostly to be focused on specific sectors, such as the Energy and Consumer Discretionary sectors. Because of the effects of inflation and energy shortage. Firstly, looking into the broader market

Graph 1. 1. Market cumulative returns
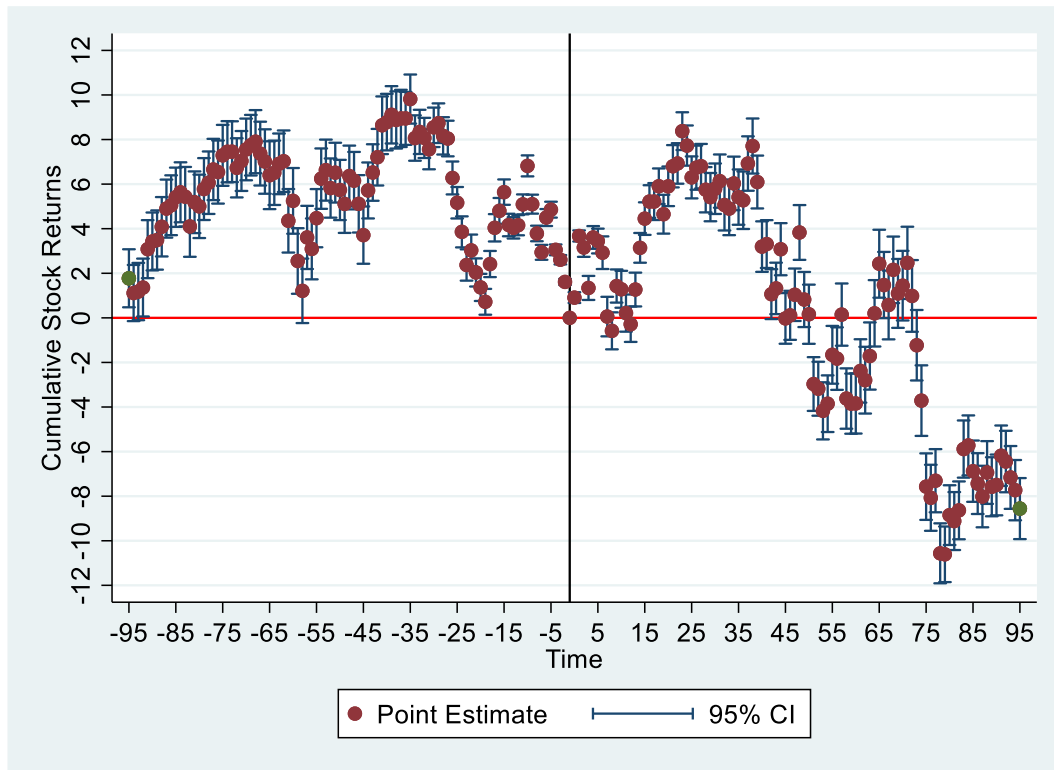
When looking at the cumulative returns for the entire market it becomes obvious that the Russo-Ukrainian conflict does not have any effect on the cumulative returns of the entire market. Which means if an investor had created a portfolio containing all the stocks available on the S&P500 he would see no change in the returns as a result of the war. Though it is clear that the market cumulative returns have decreased from 2% to -9%. This is the baseline for the analysis of every other sector of the S&P.

Next when examining the Communication Services sector, a downward trend line can be discerned.

Graph 1. 2 Communication Services sector
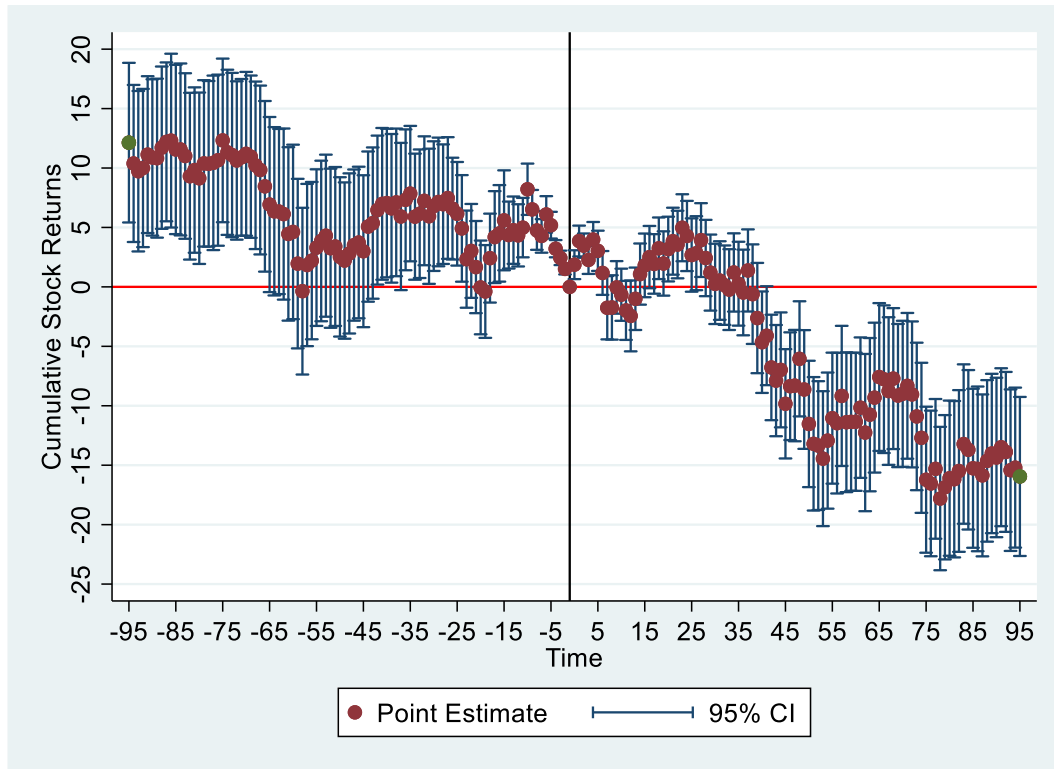
After the start of the war a declining trend can be observed, this can be attributed to the inflation which was caused by the conflict as consumers have started to cut back on unnecessary expenses the shift in behavior is reflected on the earnings of the companies. The returns of the Communication Services sector are considerably lower than the general market reaching close to negative -16% at the end of the examination period while the market was close to -9%.

The next sector to analyze is the Consumer Staples sector, no difference in returns should be attributable to the conflict.

Graph 1. 3 Consumer Staples sector
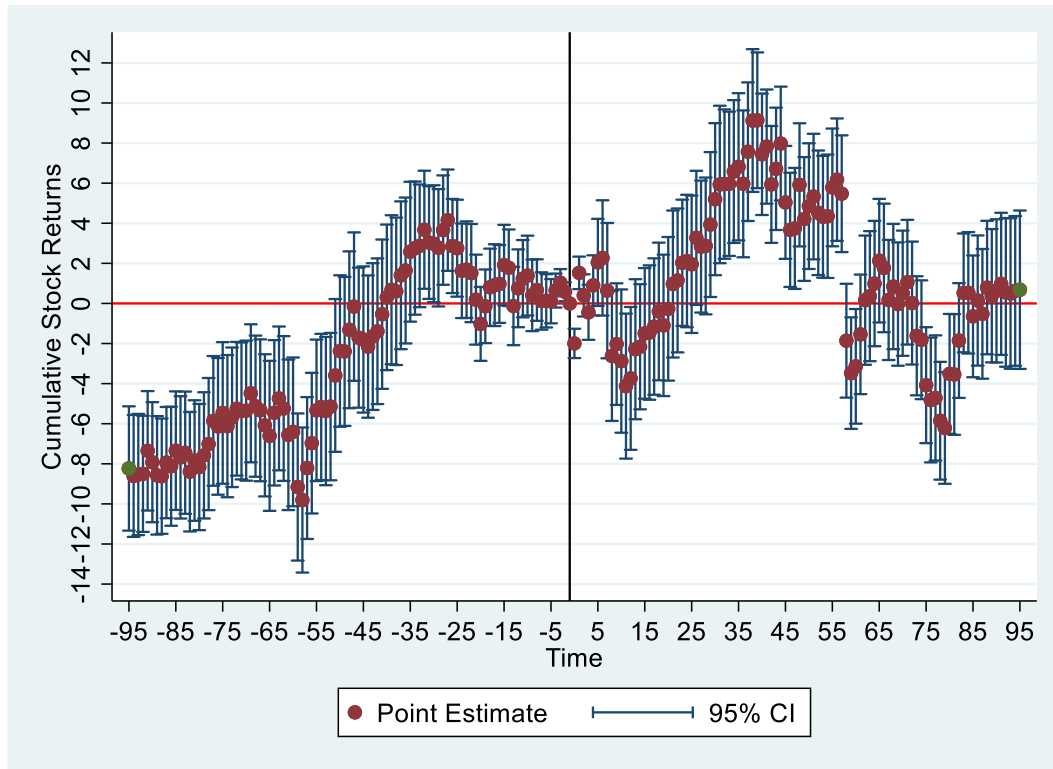
A different trend to that of the market can be observed with the sector starting at -8% and going up to 0%, at one point achieving close 8% returns, however there is no substantial evidence that the war has any effect on the returns of this sector.

Regarding the Consumer Discretionary sector, a decrease in cumulative returns should be observed seeing the nature of companies that form this sector mostly companies that sell non-essential goods such as Amazon, Ebay etc. So as the inflation effects become more apparent the revenues of these companies should decrease which in turn, makes investors pull their money out of this sector.
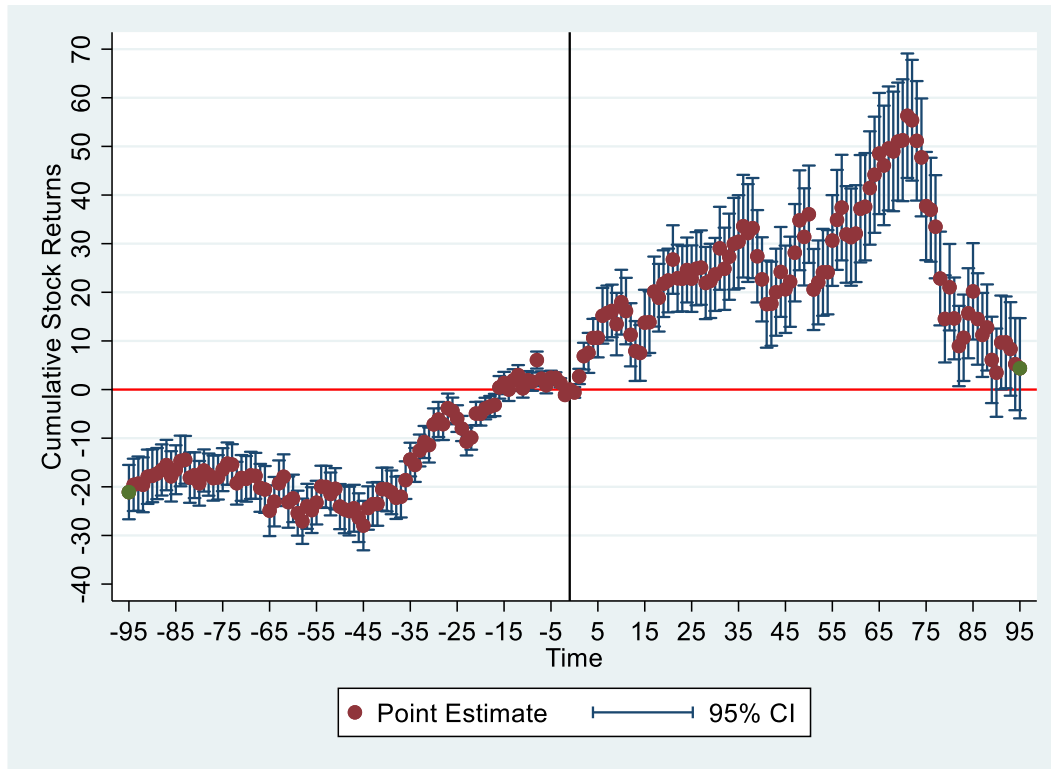
Graph 1. 4 Consumer Discretionary
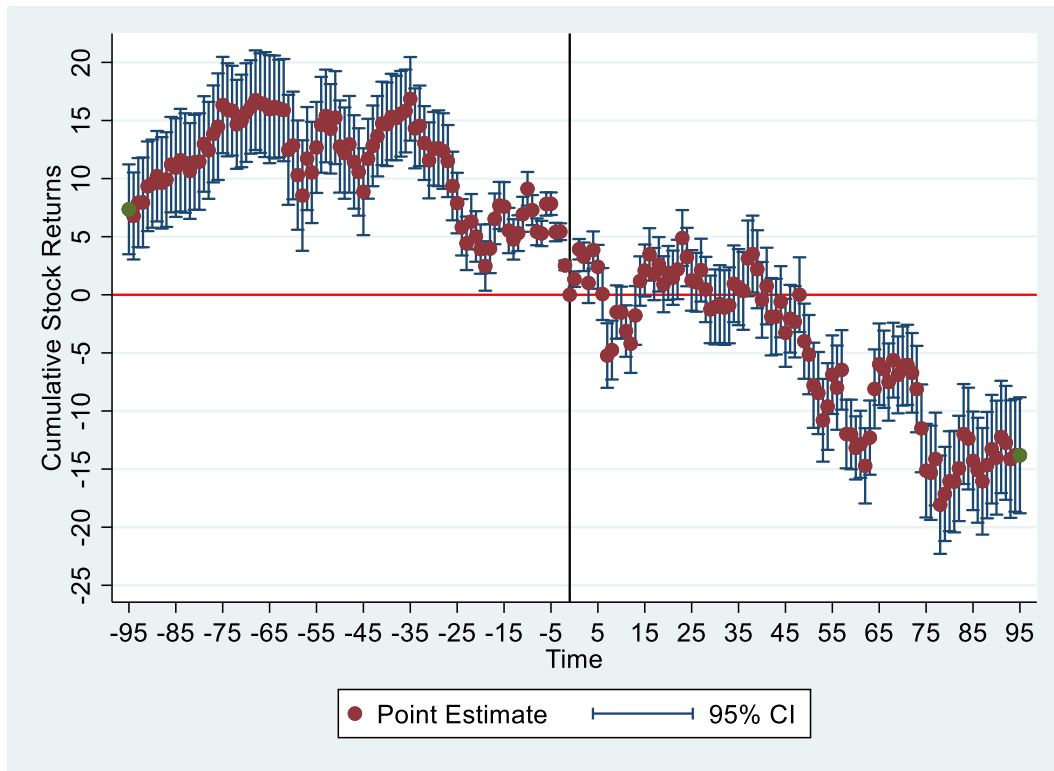
The inflation effects caused by the war are immediately obvious on this sector cumulative returns are down to -12% meaning a portfolio made entirely of stocks from this sector has gone down by nearly 20% since the start date.

Next the sector where we expect to see very prominent differences, the energy sector.

Graph 1. 5 Energy sector

Immediately after the war starts cumulative returns rise quickly reaching a maximum of 55%. Another notable observation is the fact that the trend of the energy sector is the complete opposite of the trend of the general market, as far as the market overall went down the cumulative returns for the energy sector went up.

The next sector up for analysis is the Financial sector, we expect there will be no major shift attributed to the Russo-Ukrainian conflict, the returns and the sector in general will follow the market trend.

Graph 1. 6 Financials sector
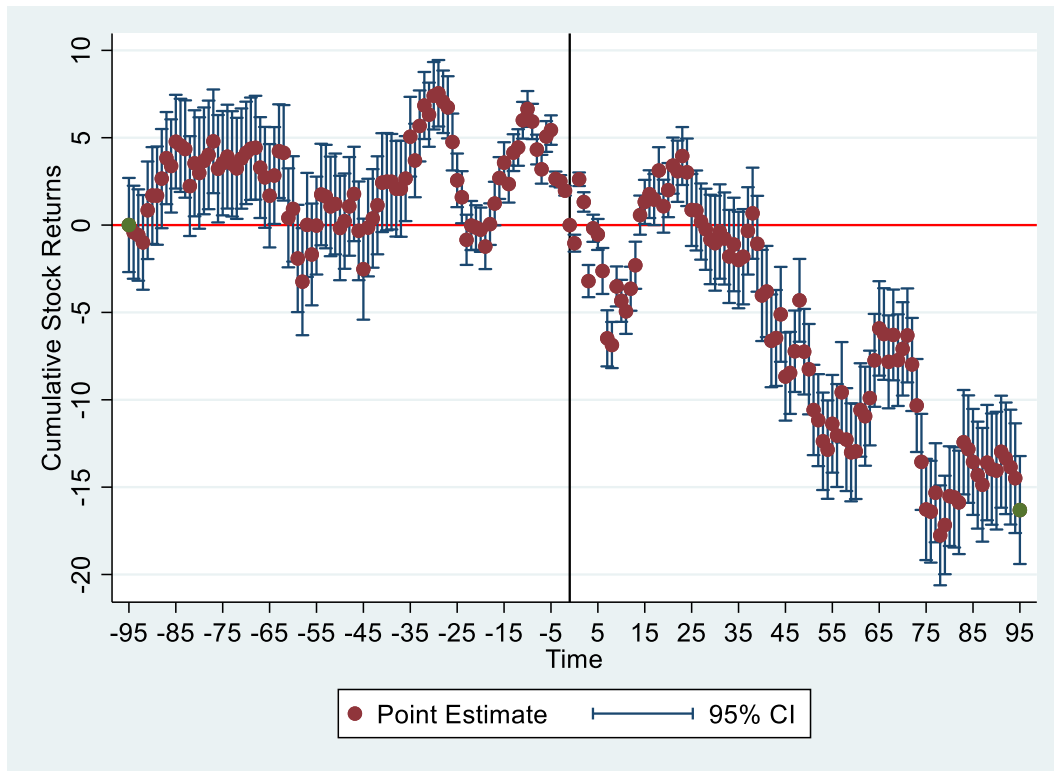
As expected, the effects the war had cannot be directly observed on the financials sector, if we were to isolate only a period of 10 days prior and 10 days past the war then maybe such conclusion can be drawn however when looking at the whole-time frame it is impossible to attribute the downward shift in returns to the war.

The health care sector is another sector where we expect to see no adverse effects on the returns, since the whole sector is not directly linked with production or the distribution of goods.

Graph 1. 7 Health Care sector
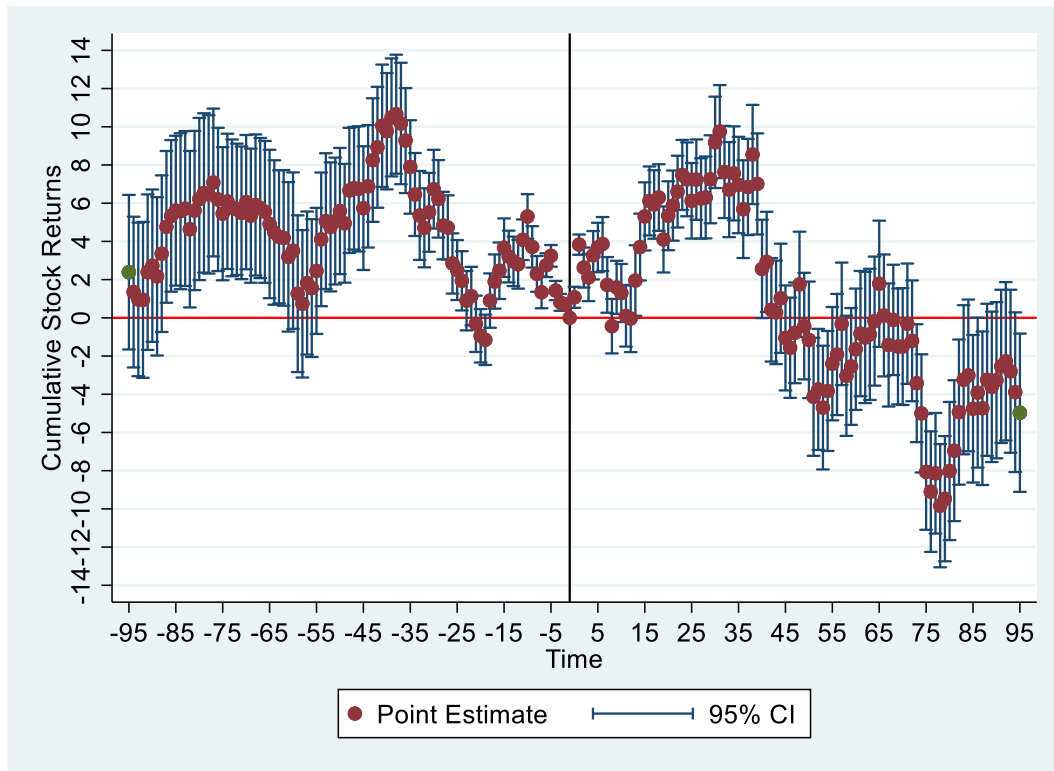
As expected, the war has no effects on the sector. All the variation noticed can be attributed to the general market.

A sector where we would expect to see a general downward trend after the start of the conflict is the industrial sector, mostly because of the increase in material and energy prices. However, that effect might be mitigated by the fact that defense contractors are part of the industrial sector such as Howmet Aerospace and Boeing.

Graph 1. 8 Industrial Sector
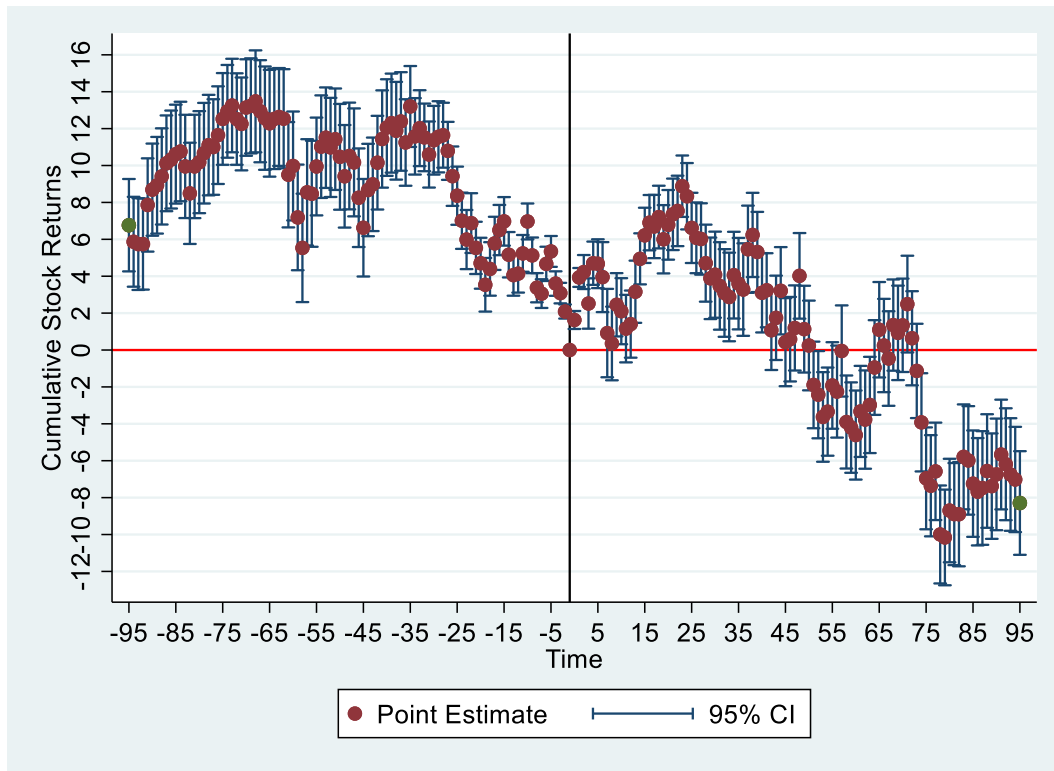
The general downward is present however the evidence is not comprehensive enough to attribute the fall of cumulative returns to the conflict seeing as immediately after the start of the war the trend shifts to be upward, later on a mean reversion process to 0 can be observed.

Another sector where we expect no major change because of the war is the information technology sector.

*Graph 1. 9 Information Technology sector*
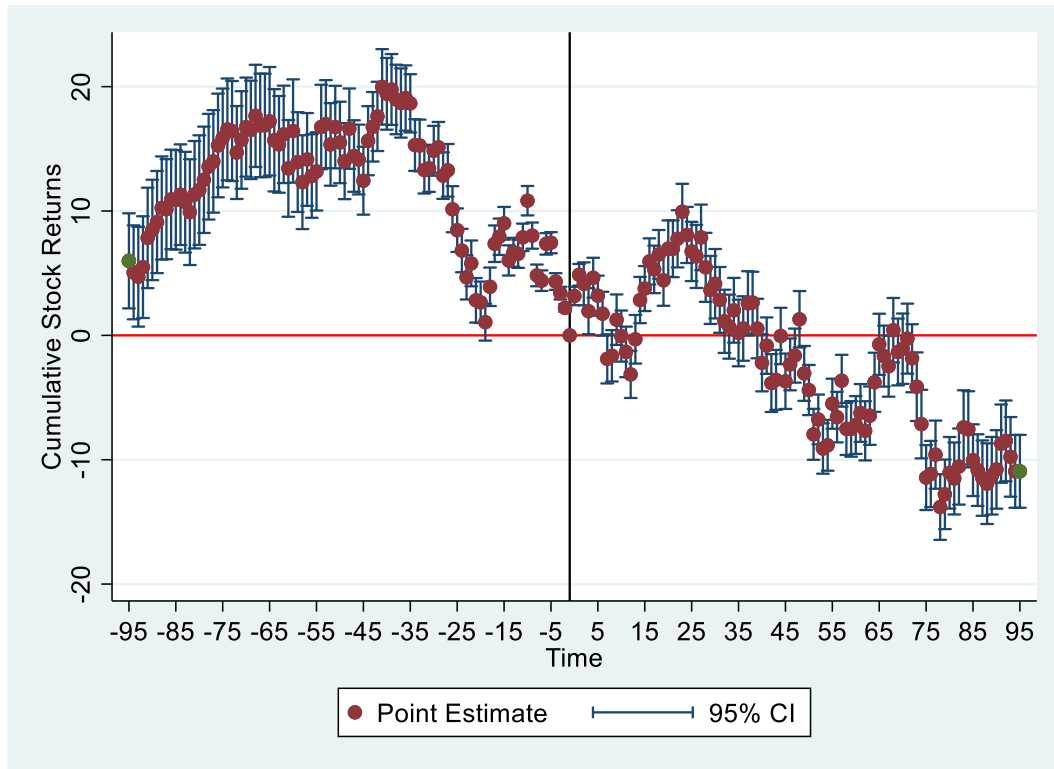
The downward trend present can mostly be attribute to the general market sentiment rather than the beginning of the war.

Next sector for analysis is the materials sector, with the increase on both material and energy prices we would expect to see a general increase to the returns of the whole sector.
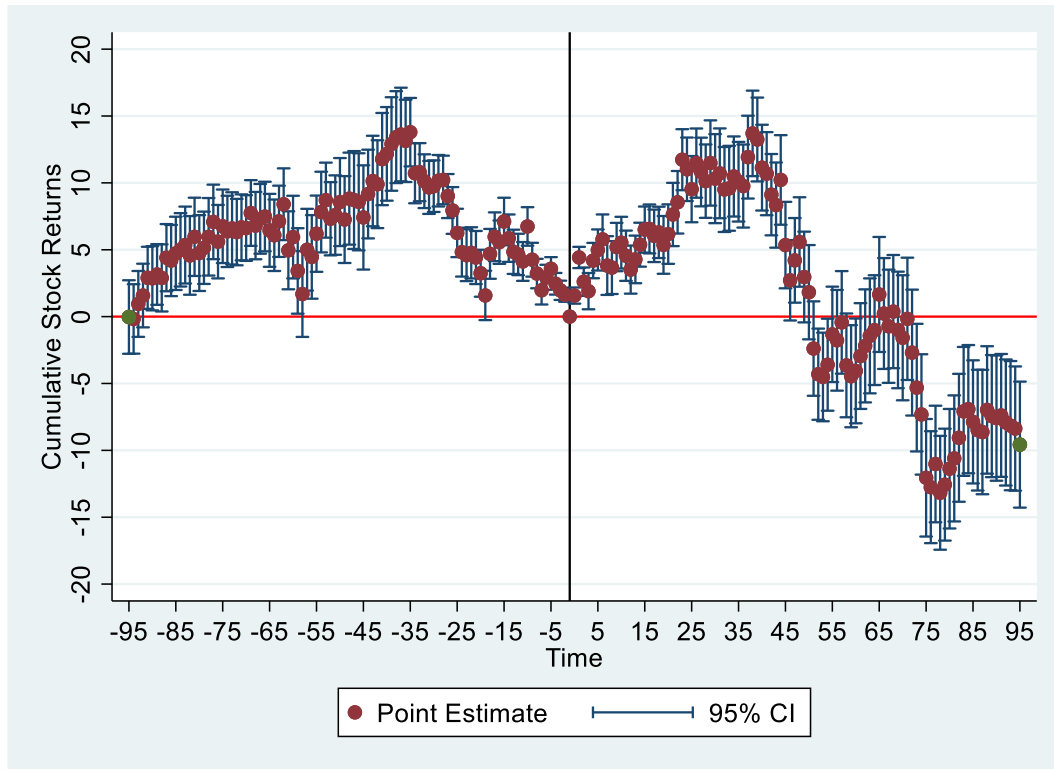
Graph 1. 10 Materials sector
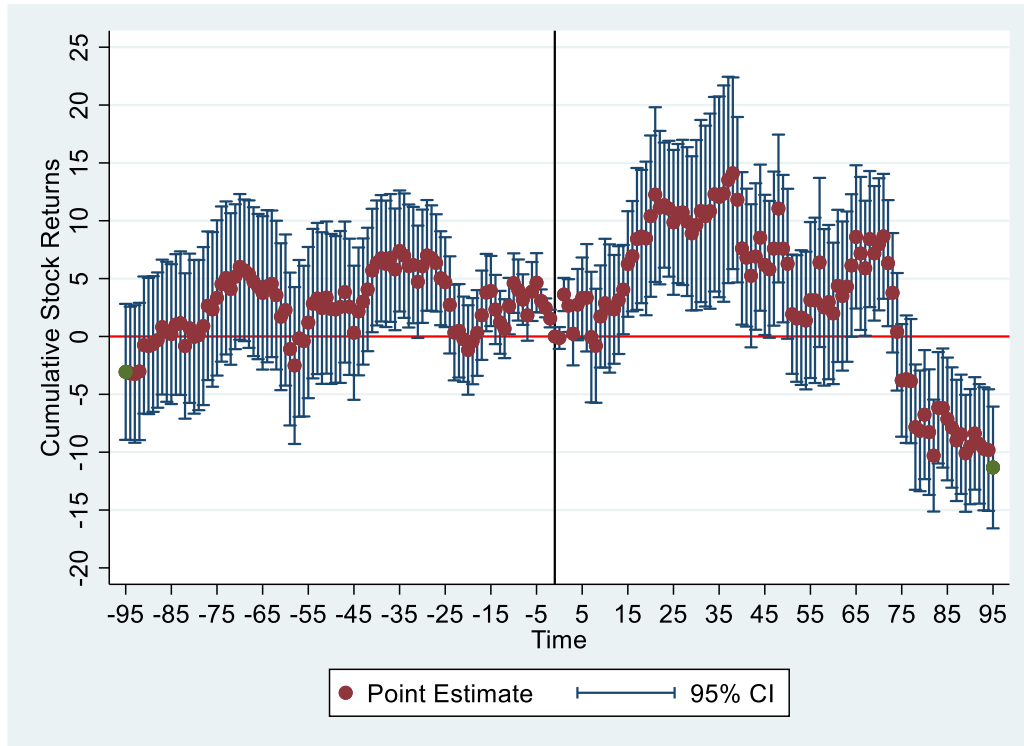
When examining the results an upward trend immediately after the war is present however the results are not conclusive enough.

Next up, the Real Estate sector, another sector where we expect no noticeable effects.

Graph 1. 11 Real Estate sector

No immediate effects from the war are noticeable, the major drop in returns we observe can be attributed to the rate increase implemented by the FED, to combat the inflation that came as a byproduct of the rising energy prices which are in fact caused by the Russian offensive, however stating that the sector was affected directly by the conflict would not be entirely correct.

The last sector to be analyzed is the Utilities sector. Based on the increase in energy prices observed we should observe investors pumping money into companies in this sector anticipating the higher profits.

Graph 1. 12 Utilities sector
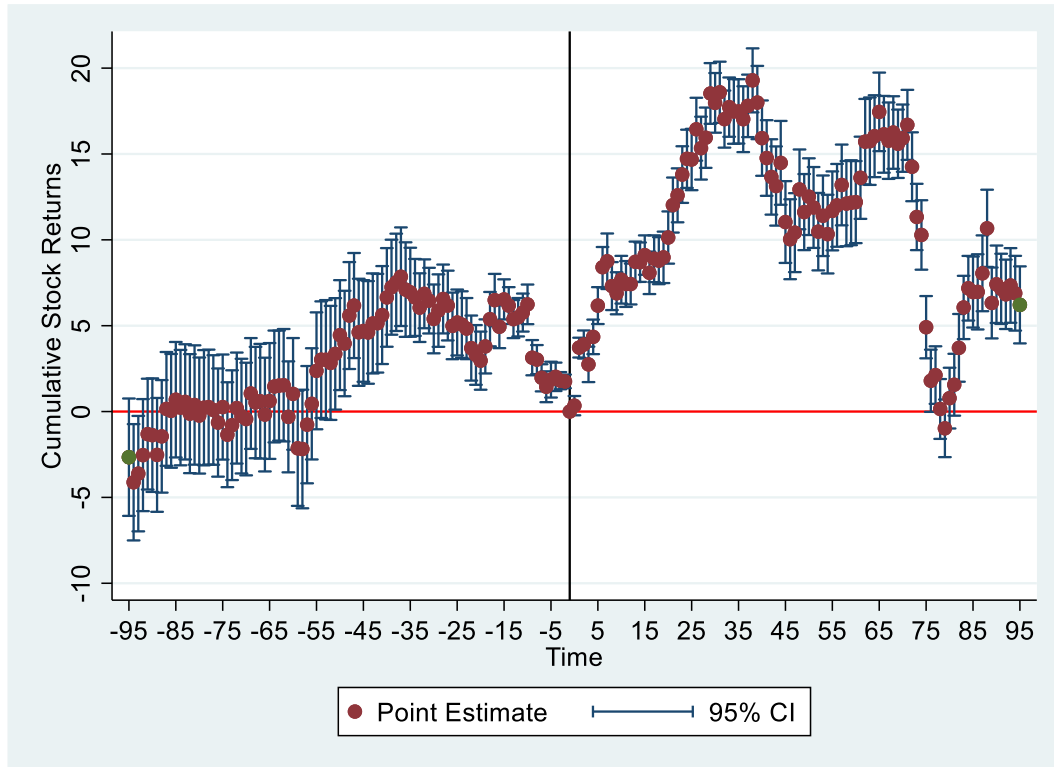
And indeed, an upward trend is noticeable, however seeing as the trend started appearing before the advent of the war no conclusions can be drawn from this. One could say however that the war fanned the flames as right after the start of it cumulative returns show a massive increase from close to 0% a few days prior to almost 20% about two months later.

Conclusions

In conclusion it is obvious the war has had major effects in the everyday life of every person which has spilled over into different aspects of the financial system. With the rising energy and goods prices affecting investor behavior, returns have started to drop in some industries such Communications Services whilst at the same time we observe an increase in the Energy industry. The entire market however had generally positive returns until May mostly being kept up by the Energy and Utilities Sector. After that period however and with the FED increasing interest rates again in May the market has slipped dramatically.

The Financials sector is an interesting example of the side effects the war has, because the fall in returns cannot directly be attributed to the conflict but the measures being taken to combat the rampant inflation that was caused by the war making borrowing more expensive for financial institutions hampering their ability to generate greater profits as a result that causes investors to leave the industry and focus on other more profitable ones. The Consumer Discretionary industry has done better than anticipated when considering the nature of companies, it is comprised by, companies that focus on non-essential goods. As expected, sectors such as Health and Information Technology have been affected from other events and general market trends rather than the conflict itself.

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