Gold as a Hedge for Inflation:
An Event-Study of Abnormal Inflationary Periods in the Past Five Decades

Farhad F. Ghannadian
The University of Tampa

Marta Alicia Dagmar Larsson Vahlberg
The University of Tampa

Historically gold and inflation have had a weak positive correlation; therefore, gold has been considered an inflationary hedge and a "safe haven" in times of high inflation for investors. An event-study of five periods with deviant inflation in the past five decades were examined in this study to determine the abnormal return (AR) of gold in comparison to the U.S. stock market (S&P 500). These findings concluded a deviation in market perception regarding the inflationary hedge that gold has historically adhered to have. Specifically, the recent Russia-Ukraine conflict caused a large shift in investors' sentiment of investing into gold as a hedge, as the event window concluded significant negative abnormal returns. Simultaneously the U.S. experienced economic factors that would historically have caused gold prices to increase, yet the opposite occurred. Although the Ukraine conflict's final outcome is still unknown, early stage-data shows how gold could potentially not be considered a "safe haven" or an inflationary hedge today, given many dynamic factors ruling the world.

Keywords: event-study, gold prices, inflationary hedge

INTRODUCTION

History of Gold

The usage of gold as a medium of exchange and a vehicle for savings has been recorded back to 500 BC; however, it was not until the 19th century that countries started to adapt to what we today know as the "Gold Standard" (Money and gold, 2018). The usage of gold and silver as payment increased significantly in the mid-17th century in the U.S. Around a hundred years later; the gold standard was adopted as the primary form of payment at which the price of gold was fixed at $20.67 per ounce (Bordo, 2018). Nevertheless, during World War II (WWII), the gold standard was briefly terminated due to large gold shortages (Selgin et al., 2021). After WWII, the famous Bretton Woods system was introduced in 1944, and 44 countries established a monetary system. "Those at Bretton Woods envisioned an international monetary system that would ensure exchange rate stability, prevent competitive devaluations, and promote economic growth" (Ghizoni, 2013). The Bretton Wood system was based on a fixed price of gold at 35 dollars per ounce, allowing other countries to trade their gold for dollars. Nevertheless, a large "balance-of-payment deficit" caused the dollars held by the 43 other countries to be greater than the U.S. gold stock.

Because the U.S. could not fulfill its obligation, the Bretton Woods system and the "Gold Standard" were officially permanently abandoned in 1971 (Ghizoni, 2013).

Flight to Gold

Although the "Gold Standard" was abolished, there were some positive aspects of having a fixed price of the dollar against the price of gold. This caused certain individuals to push for a re-establishment of it again. During the gold standard era, inflation was low, international trade was high, and countries experienced high economic growth (Bordo, 2018; Hogan et al., 2021). The flight to gold during uncertain times, especially during high inflation, has been a common strategy for individual investors and central banks in many countries (Milling-Stanley et al., 2019).

As a policy, central banks around the world, still to this day, store gold to diversify their reserves in order to hedge against fluctuations in the Dollar and other currencies. Today, central banks hold a total of 20% of the total gold in the world (Reuters, 2022). Furthermore, individual investors invest into gold to diversify their portfolio as gold has historically had a negative or low correlation to other assets. Thus, causing a lower portfolio beta that can handle market corrections better and diversify their investment portfolios (Milling-Stanley et al., 2019).

Inflationary Times

The Consumer Price Index (CPI) measurement is based on a market-based basket, with oil representing 20% (Kilian and Zhou, 2021; Pettinger, 2022). Thus, oil shocks have had a large impact on both GDP and inflation. Statistically, the Federal Reserve in the U.S. has estimated a correlation of 0.27 between oil prices and CPI, thus a 5% increase in oil causes a 1.35% increase in CPI (Kilian and Zhou, 2021; U.S. Bureau of Labor Statistics). Furthermore, oil prices and PPI, in the U.S. tend to have a stronger correlation of 0.71, due to the great need of oil for production (Federal Reserve Economic Data, 2018).

Since 1971, gold and CPI have had a weak linear correlation. As a result, only 16% of changes in gold is due to changes in the CPI. Therefore, gold has been seen as a long-term protection against high inflation (Reuters (2), 2022). Due to gold's ability to store value has historically protected investors with both price and monetary inflation (Milling-Stanley et al., 2019). During lower inflationary periods of 2% or lower, the price of gold had an average increase of 7.8% since 1970. On the other hand, when inflation has been over 5%, gold has experienced increases of 16.2% (Milling-Stanley et al., 2019). Today in late 2022, this positive correlation between gold and inflation has not been held true. Gold experts think that this is due to the interest rate hikes, at which gold has historically had a negative correlation with interest rates (Milling-Stanley et al., 2019). Therefore, gold has seen an average decrease of 8% in 2022. Although inflation has been high, the Fed's aggressive Federal Funds rate hikes have caused a demand for other "safe" assets such as Government Bonds (Singh, 2022). The strong dollar also contributes to the lack of positive returns of gold, as gold becomes relatively more expensive for foreign investors in a strong dollar environment, thus pushing demand down (Singh, 2022).

LITERATURE REVIEW

Historically, inflation by itself negatively impacts the stock market due to decreased purchasing power, which causes real-term decreases in portfolio holdings. Therefore, the commodity asset, gold, has been seen as a good hedge against inflation if held within a portfolio (Milling-Stanley et al., 2019). The research was conducted to analyze whether this statement is true through an empirical methodology with a root testing approach. The analysis was based on monthly data of CPI and gold between 1968 and 2016 in the U.S. The conclusion drawn by experts is that gold can be a good inflation hedge if the assets within a portfolio are held for a longer time (Naser, 2017). A similar study was conducted in the Chinese market, showing how short-term investors will not see an inflation hedge if they invest in gold. This could be due to the characteristics of modern emerging markets and irrational investors. Yet, long-term investors could potentially use gold as a hedge against inflation; however, it cannot always be considered a "safe haven" for the short term (Dee et al., 2013).

As Dee et. al, have mentioned, the possible cause of the lack of an inflationary hedge when investing in gold could be due to the irrationality of investors. In financial literature, the Efficient Market Hypothesis (EMH) indicates that the market will always correct itself, and the stocks will trade at their intrinsic value. However, Dieupart-Ruel et. al's study shows otherwise. A cognitive study was made where different investors were characterized as: informed (rational vs. irrational) versus uninformed investors, at which the gold price formation showed to be heavily impacted by behavioral finance. Irrational investors are said to bring increased volatility to the price of gold and can cause bubbles and panic selling (Dieupart-Ruel et al., 2013). Furthermore, during 2002 and 2011, gold prices increased drastically, and Baur and Glover analyzed fundamentalists and chartists and how they might have contributed to this increase. Hence, gold was modeled based on real (actual price of gold) and speculative (fundamentalist and chartists expectations) demand to accurately illustrate gold prices. The study showed that fundamentalists and chartists acted based on the price dynamics of gold, especially during 2002-2011. These investor types contributed to the gold bubble (Baur and Glover, 2014).

As a result of gold being historically considered a "safe haven" or a good hedge against inflation, investors have typically purchased gold when inflation has been high. Due to the negative impacts inflation can have on an economy, monetary policy is commonly introduced in times of higher-than-usual inflation. Zhu et. Al., research focused on: The Impact of Monetary Policy on gold Price Dynamics. The U.S.'s quantitative easing (QE) monetary policy was analyzed during 2003-2015 in combination with inflation and inflation expectations. The hypothesis of gold being an inflationary hedge was tested. The study showed that gold stopped being an inflationary hedge, in the U.S, after 2003 and that it can only be considered a hedge in times of high inflation and high inflation expectations.

Conversely, gold cannot hedge against inflation in times of low inflation and low inflationary expectations (Zhu et al., 2018). Furthermore, an event study was conducted on quantitative easing announcements of the U.S. Federal Reserve. The study concluded that these announcements greatly influenced gold prices, especially when the announcement regarded an increase in QE, gold prices increased remarkably (Zhu et al., 2018).

Recent event studies have been conducted to examine the impact of gold prices during the COVID-19 pandemic and the Russia-Ukraine invasion. Selvan and Ramraj studied gold price volatility during the COVID-19 event. Concluding that the volatility of gold increased after bad news announcements at which gold experienced positive returns as investors perceived gold as a "safe haven". Furthermore, an event study of the Russia-Ukraine war and its impact on gold conducted by Diaconasu et. al., concluded that the only "safe haven" asset after the invasion was oil (2022). Additionally, their findings regarding investors' actions before the war were that the impact of the invasion started before the actual event, as investors were anticipating this geopolitical situation. Thus, investors were investing in gold during February, leading to positive abnormal returns (Diaconasu et. al., 2022).

PERIODS OF STUDY

For this study, five deviant inflationary periods were chosen to compare today's (2022) high inflationary period with previous events (Rouse et al., 2021).

Oil Shock of 1978-79

The oil shock of 1978 was mainly driven by a revolution in Iran, which produced 10% of the world's supply of oil (Rouse et al., 2021). Due to the revolution in one of the biggest oil-producing countries, around 7% of oil production declined daily. The revolution caused fear among leaders worldwide, at which countries started increasing their oil reserves due to the threat of escalation (Graefe, 2013). From April 1979 to 1980, the price per barrel of oil doubled. In the meantime, the world economy was strong, at which demand for goods increased rapidly, pushing oil prices higher (MarcroTrends, n.d.).

The rapid increase in oil prices started to impact inflation, increasing from 5% in February 1976 to 7% in March 1979 (U.S. Bureau of Labor Statistics, n.d.). To combat the high inflation, the Federal Reserve decided to increase interest rates slightly as they did not want to exhaust the high economic growth.

Therefore, rates were increased from 6.9% to 10% at the end of 1978. However, their efforts to combat inflation did not work, and the CPI increased to 9% at the end of 1979 (U.S. Bureau of Labor Statistics). Since the careful monetary policy of the Fed did not prove to combat inflation, the Fed decided to appoint a new chairman, Paul Volckers, in August 1979, at which interest rates increased from 11% to 19% in the end of 1981 (Volcker, Paul, 1992; Graefe, 2013: The Federal Reserve, 2003).

The Gulf War 1989-1991

The start of the Gulf War very likely originated from the previous Iranian revolution, at which the president of Iraq wanted Kuwait to forgive their debt originating from the Iran-Iraq war. However, Kuwait rejected their demand, and a new war broke out. In August of 1990, troops and tanks were sent into Kuwait, an oil-heavy country. Due to the fear of oil prices increasing again, this war received high global attention, especially from the United States. George H. W. Bush decided to intervene because of the fears of Iraq winning the war, which would have led to Iraq having one-fifth of the world's oil reserves. Therefore, U.S. troops were sent out to Kuwait to fight against the Iraqi government (Miller Center, 2020).

The Gulf War caused a spike in oil prices that doubled from $34 per barrel to $77 (Sun, 2022). The Fed started to plan ways to combat the higher inflation that typically comes with higher oil prices; however, in the meantime, there were indications that a recession was near. Historically, the Fed never took any aggressive measures and no easing was done as there was a conflict between fighting inflation and dealing with the low economic growth and high unemployment ratios (Silk, 1991). The inflation ratio proved to increase slightly during the year of 1990; however, it declined to its pre-war levels in 1991 due to the slow economic growth in the U.S at the same time (Sun, 2022). Furthermore, the aftermath of the Gulf War proved to have less of an impact on oil prices than its predecessor (oil shocks of 1978) as oil prices declined shortly to its pre-war levels after its peak in September 1990 (MacroTrends, n.d.).

Financial Crisis 2008-2009

The third period of instability occurred during the Financial Crisis of 2008, which almost caused a complete downfall of the U.S. financial system as nearly $11 trillion of wealth was lost among U.S. citizens. This period was full of risk, uncertainty, and multiple moving factors (Rich, 2013). The housing market as well as the stock market, were seeing massive declines. However, the housing market slowed down before the U.S. was in a recession and was not seen as the main reason for the recession. Nevertheless, oil prices were a large contributing factor to the start of the recession in the U.S (Hamilton, 2009). In 2008, one barrel of oil increased from $70 to $140 and caused the inflation rate in the U.S. to increase to 5% (Rouse et al., 2021). "It is also interesting that the observed dynamics over 2007:Q4-2008:Q4 are similar to those associated with earlier oil shocks and recessions. The biggest drops in GDP came significantly after the oil price shock itself" (Hamilton, 2009). The Federal Reserve's policy responded with fiscal stimulus in the form of repurchases of bonds, federal funds rate decreases, and tax cuts. The federal funds rate decreased from 5.25 in September 2007 to 0-0.25 in March 2008, indicating that rates would continue to stay low until 2013 (Rich, 2013). Inflation experienced a high of 5.4% in July 2008, declined to zero in December 2008, and experienced a low of -2% (deflation) in July 2009 (The Federal Reserve).

COVID-19, 2020

The COVID-19 pandemic started in the beginning of 2020 when the WHO announced that they had found a contagious respiratory disease in Wuhan in China (CDC Museum Covid-19 Timeline, 2022). A month later, the demand for oil dropped drastically, starting with a decline from China due to the fast-spreading disease. Fears started spreading worldwide regarding production and supply chains (Saefong and Watts, 2020). The decrease in oil prices continued to spiral as more and more countries were either shutting down or requiring its citizens to stay at home. On March 11, 2020, the WHO announced the COVID-19 disease as a worldwide pandemic (CDC Museum Covid-19 Timeline, 2022). The following month, the price of oil experienced the sharpest drop in history due to quarantines and businesses being closed (Engebretsen and Anderson, 2020).

The U.S. economy did see large impacts due to quarantines and the need for remote work; thus, unemployment ratios in the U.S. increased by 3.1% to 6.4%. Therefore, the U.S. government decided to provide governmental aid to both businesses and citizens for a combined total of $5.2 trillion (Thiess and Bryant, 2022). In order to accurately measure inflation during the pandemic, a COVID basket was created. In March of 2020, the two inflation measures started to show some differences at which the COVID CPI measurements were higher than the original basket; however, they both showed deflation (Works, 202). In mid-2021, inflation in the U.S. started to increase above the 2% inflation target (Ball et al., 2022). In combination, GDP dropped by 8.9% in the second quarter of 2020 (The U.S. Economy and the Global Pandemic, 2021). The Fed responded by dropping the Federal Funds rate to 0-0.25% in order to support spending and avoid a recession (Milstein and Wessel, 2022).

2022, Post-COVID-19, Russia-Ukraine War

The fifth period of potential economic instability was the Russia and Ukraine conflict. Although Russia and Ukraine have conflicted since 2014, it was not until February 24, 2022, when Putin ordered troops into Ukraine, that the rest of the world started to interfere with large sanctions and media coverage regarding the first war in Europe since WWII (Council on Foreign Relations, 2022). Due to the belief of Russia's invasion as being both inhumane and unnecessary, the Western world chose to stand behind Ukraine and help them in this war against Russia. Thirty countries have imposed sanctions against Russia's commodities (specifically oil and gas), banking systems, politicians, and business leaders (U.S. Embassy, 2022).

The impact of this war could be countless and long-term due to the threat of higher commodity prices stemming from the harsh sanctions against Russia. Russia's main exports are crude oil and not crude oil, where 15% and 10%, respectively consist of the total world exports (Neely and Wood, 2022). Thus, after the invasion, oil prices increased to $135 per barrel which was the highest it's been since the financial crisis in 2008 (J.P. Morgan Research, 2022). Moreover, Russia is a large gold extractor, exporting 5% of the world exports (Neely and Wood, 2022). Therefore, gold prices increased after the Russian invasion; however, shortly after, gold experienced a correction at which the price of gold declined (Mining.com, 2022; Turak, 2022).

In the beginning of 2022, the U.S. started to see an economy growing, with consumer spending being the main contributor to the growth (Trading Economics, 2022). With the COVID-19 federal stimulus money and the increase in food and gasoline prices, inflation started to increase (Ellyatt, 2022). After the invasion of Ukraine, the inflationary pressure became real, and the U.S. experienced inflation of 8.5% in March compared to 7.9% in February (Current US Inflation rates: 2000-2022: US Inflation Calculator, 2022). During this time, the Federal Reserve indicated that the federal funds rate would be increasing throughout 2022, in an attempt to decrease the high inflation (Ellyatt, 2022). At the same time, GDP declined -1.4% in the first quarter of 2022. The following quarter also experienced a decline of GDP, with inflation rising at the same time (Cox, 2022).

METHODOLOGY

The data used in this study is based on the natural log of historical monthly returns of the commodity gold and the returns of the S&P 500 (Bloomberg). Due to the nature of this study being based on fluctuating inflationary periods, the real returns of each asset were used at which the inflation ratio of the certain period was accounted to have comparable data.

An event study was conducted based on a predetermined event window at which expected and abnormal returns were calculated (Kothari and Warner, 2006; Campbell et al., 1998). The expected returns were based on the Capital Asset Pricing Model (CAPM), where Beta was calculated through a time-series regression to determine the sensitivity of gold returns in comparison to the market (S&P 500) (Sharpe, 1966).

Cumulative Abnormal Return

Cumulative Abnormal returns (CAR) were calculated by summing the abnormal returns over the different event windows (MacKinlay,1997). To receive the t-statistics, the standard error was calculated by taking the square root of the added variances of the time period examined (Campbell et al., 1998). Cumulative Abnormal Return (CAR) is the sum or the abnormal returns and are calculated as follows:

$$CAR(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} ARi\tau \qquad (1)$$

Variance is calculated by the following formula (MacKinlay,1997):

$$\alpha^2(\tau_1, \tau_2) = (\tau_2 - \tau_1 + 1)\alpha^{2/\varepsilon} \qquad (2)$$

The Null Hypothesis Testing is tested by comparing the CAR to the t-statistics (MacKinlay,1997):

$$CAR(\tau_1, \tau_2) \sim N(0, \alpha^2(\tau_1, \tau_2)) \qquad (3)$$

In order to test the significance of the CAR's during the time-period, the t-statistic should be greater than 1.96 or less than -1.96 (1.645 and -1.645 was also used to test at 90% confidence) in order to reject the Null hypothesis with a 95% confidence interval (Campbell et al., 1998).

RESEARCH QUESTION AND HYPOTHESIS

Does the Market Consider gold as an Inflationary Hedge in Times of Deviant Inflation?

Null Hypothesis: Ho: *The unknown economical condition did not significantly impact real gold returns*

Alternative Hypothesis: Ha: *The unknown economical condition significantly impacted real gold returns.*

RESULT AND DISCUSSION

TABLE 1
CUMULATIVE ABNORMAL RETURNS OF THE FIVE EVENT-STUDIES, SUMMARIZED

Event	Date	12 pre	9 pre	6 pre	3 pre	Event Month	3 post	6 post	9 post (7 post Feb 24, 22)	12 post
Oil Shock	31 Oct 1971	26.9%*	21.7%	16.5%	16.9%*	7.1%	-3.6%	-2.2%	13.1%	34.4%
Gulf War	2 Aug 1990	11.8%	7.6%	-3.7%	5.8%	1.5%	1.1%	1.6%	6.1%	5.8%
Financial Crisis	30 Jun 2008	17.1%	15.2%	4.6%	-16.1%*	4.9%	-7.0%	0.6%	3.8%	-4.0%

COVID-19 Pandemic	11 Mar 2020	14.5%	16.4%	2.61%	8.1%*	1.6%	9.0%*	12.3%	10.8%	-2.4%
Russia-Ukraine Conflict	24 Feb 2022	-24.5%**	-13.3%	-10.1%*	-3.4%	4.8%	-8.4%*	-19.0%*	-21.5%*	

Significant at * 95% CI, ** 90% CI

Oil Shock of 1978-79

The result showed positive Cumulative Abnormal returns (CAR) in the months leading up to the event at which the three and the twelve-month CAR experienced significant positive returns. This result demonstrates that investors were anticipating increases in inflation, much due to the uncertainties in the Middle-East and increases in oil prices (Rouse et al., 2021). Furthermore, shortly after October (1978) oil prices increased drastically in combination with increases in inflation and the Fed Funds rate.

Although the month of the event did not see a significant CAR, its positive return is important for this study. It showed that during the month of October 1978, investors were moving their investments over to the "safer" asset gold. Another reason for its insignificance could be the leading feature of gold, at which investors were anticipating both higher oil prices and higher inflation. Thus, the three months prior to the event month, experienced significant positive abnormal returns.

Due to the price shocks on oil in October 1978, inflation started increasing causing the FED to raise rates. Nevertheless, the efforts did not work, and inflation continued to increase. At the end of 1979, CPI was at 9%. The lack of aggression from the FED's side caused investors to keep investing in gold due to the relatively higher returns one could receive from gold compared to fixed assets (U.S. Bureau of Labor Statistics). In September of 1979, the CAR saw a significant positive return of 22% related to the inflation increases due to the record high oil prices during this period.

The Gulf War 1989-1991

The Gulf War Cumulative Abnormal Returns (CAR's) were not significant in any period and only 4 out of the 25 months examined out of the event-window showed significant abnormal returns. Moreover, the CAR's demonstrated low positive returns, indicating that the price of gold stayed relatively steady during the uncertain time of the Gulf War. Whereas, the market experienced larger swings. For instance, during the month of the event (August 1990) gold showed returns of 3% whereas the S&P 500 experienced a decrease of 10%. Furthermore, oil prices spiked during August of 1990; nevertheless, both inflation and the federal funds rate were slightly decreasing (Silk, 1991; Sun, 2022). This could indicate that during the Gulf War, the U.S. economy did not see as much of a direct impact as during the revolution in Iran. This could have possibly been due to investors anticipations of higher inflation. Moreover, the U.S. citizens were trusting in George H. W. Bush's presence in the Gulf War, and on the home front, less panic was experienced (Miller Center, 2020; MacroTrends, n.d.). Although the stock market experienced high volatility in this era, investors were not rushing to invest into gold.

Financial Crisis of 2008

The Financial Crisis of 2008 saw many fluctuating factors at which the movements in both gold prices and the stock market were high. However, oil prices did experience an increase starting before the crisis, yet increased more drastically in the beginning of 2008 with a peak at the start of July 2008 (Hamilton, 2009). The event month of June 2008 showed non-significant positive abnormal returns. Although they lacked significance, it showed how investors were investing in gold during June, before the peak of the oil prices.

Both the three months prior and the three months post the event month experienced negative abnormal returns, at which the three months before the event saw significant CAR's of -16%. The driving months of

this negative CAR were March and April, which experienced significant (at the 90% CI) negative returns of 7% respectively.

Furthermore, all of the significant abnormal returns post-event month were negative. These findings contradict the nature of increases in gold prices, since March and April (2008) experienced increases in inflation, reaching a level of 5%, and at the same time the federal funds rate was decreasing, which typically leads to increased investments in gold assets. Nevertheless, the period during the 2008 financial crisis was extremely uncertain when the financial market crashed; thus, many investors might have had little funds and little trust in many financial instruments (Rich, 2013).

COVID-19 Event-Study (March, 2020)

The COVID-19 event month did not show significant abnormal returns; however, the three-month CAR prior and post-event-month both demonstrated significant positive CAR's. Although inflation and the federal funds rate stayed quite steady over the period examined (2017-2021), the change in GDP saw drastic fluctuations (Ball et al., 2022; The U.S. Economy and the Global Pandemic, 2021). Equally was the price of oil that also saw a large drop in the beginning of the COVID-19 pandemic (February/March 2020) (Engebretsen and Anderson, 2020). The decrease in GDP and oil prices three months before the event was reflected in the three-month significant positive return of 8% before March. This shows that investors were looking for safer investments in times of uncertain periods to come, which follows the historical patterns of the weak positive correlation between worse economical periods and positive gold returns (Milling-Stanley et al., 2019). However, the low inflation and decreasing oil prices did not follow the same historical pattern. Thus, the conclusion must be that the months before COVID the uncertainty regarding the economy overall was more terrifying; and although oil prices were declining, so were people's freedom of movement due to COVID-19. Moreover, Selvan and Ramraj studied gold prices-volatility during the COVID-19 event. They concluded that volatility did increase as investors where investing in gold as it was perceived as a "safe haven" (2021). Their result can be justified by the CAR's of the eight periods examined at which all but one concluded positive abnormal returns.

Russia-Ukraine Invasion (February, 2022)

During the most recent event month of February 2022, when Russia invaded Ukraine, the abnormal return had a positive but insignificant return. The sharp increase in gold prices was possibly due to the decrease in supply as sanctions were implemented against Russia (U.S. Embassy, 2022). In addition, oil prices started to increase further after the Russian invasion as they are one of the world's largest oil exporters (J.P. Morgan Research, 2022). Therefore, the positive abnormal return during February proved to follow the historical pattern of gold prices increasing when oil prices and inflation increased. Hence, during February, investors were moving their funds into safer assets such as gold.

The CAR's in the periods before the event were all negative, which is an anomaly from the previous periods examined since the U.S was experiencing low interest rates and a slight GDP increase in the quarters leading up to the event (Ellyatt, 2022). In addition, inflation was increasing in the months prior to February 2022, which in terms of historical correlation, would have caused an increase in the price of gold. However, during this period of study, the opposite happened.

The same pattern of negative CAR's was seen after February. This could indicate that investor sentiment changed quickly after the invasion, as CAR's were negatively significant in all three periods examined. The reason behind this abrupt shift could be many; however, the aggressive strategy of the Federal Fund could be a large contributing factor. Thus, interest rates and gold have historically been negatively correlated as investors can receive high returns from risk-free assets with a higher federal funds rate (Milling-Stanley et al., 2019; Singh, 2022). Furthermore, in the beginning of 2022, the Fed started to decline the quantitative easing initiated during the COVID-19 pandemic. This could be a further reason for the negative CAR's of gold during this period (Zhu et al., 2018).

Previous studies have shown that gold is not a short-term inflation hedge due to its volatility (Naser, 2017; Dee et al., 2013). This study likewise shows that gold proves to not be a short-term inflation hedge, as many variables will affect gold either positively or negatively in the short-term. Therefore, investing in

gold in the short-term might cause some unpredicted returns. Furthermore, the efficient market theory was proven to be incorrect when it comes to gold returns; during this period, investors' irrational behavior may have contributed to increased volatility and this can be the reason for the cumulative abnormal returns experienced during the Russia-Ukraine invasion.

It needs to be noted, due to the recent events of the Russia-Ukraine invasion, a long-term impact study could not be done. Therefore, a study should be conducted after the U.S. inflation has decreased and the after-war impacts on gold prices concerning inflation, to establish whether the long-term "safe haven" is still a phenomenon or whether the character of gold has changed.

CONCLUSION

This event study was conducted on five historical periods with deviant inflation to examine the impact on gold prices. Gold as an inflationary hedge is tied back to the Bretton Woods system, at which the fixation of the dollar against gold eliminated inflationary pressures. Nevertheless, investors have since then invested in gold during high inflationary periods as gold has been considered a "safe haven". Thus, the two oldest periods examined, the oil shocks of 1979 and the Gulf War, showed results definitive to the historically positive correlation between gold prices and inflation. Nevertheless, this shift away from the positive correlation started to become less potent during the 2008 financial crisis, as the flight to gold was very short-lived. Furthermore, the result during the COVID-19 pandemic demonstrated how gold prices were deviating from its historical characteristics of having a positive correlation with oil and inflation due to its positive CAR's throughout the event window.

The event-study regarding the Russia-Ukraine conflict demonstrated substantial differences from previous periods and beliefs regarding gold's characteristics. The deviation stems from the significant negative Cumulative Abnormal returns both before and after the event month. Although this period saw high inflation and slow economic growth, the aggressive monetary policy ensured by the Fed of increasing the Fed Funds rate could have contributed to this negative CAR. Other dynamic factors could be responsible for this decrease, such as a strong dollar, an uncertain supply of gold, and other strong asset performances. As previous studies have concluded, gold cannot be considered an inflationary hedge if investing in the short-term. This study shows a similar result; nevertheless, the long-term impact of the Russia-Ukraine invasion is still unknown and will be evaluated in the future. Overall, this study concludes an abrupt shift away from gold (short-term) during high inflationary periods, discovered in the post-Covid-19 era of 2022.

REFERENCES

Ball, L., Leigh, D., & Mishra, P. (2022). Understanding US Inflation During the Covid Era. *Brookings*, pp. 1–116. Retrieved from https://www.brookings.edu/bpea-articles/understanding-u-s-inflation-during-the-covid-era/

Baur, D.G., & Glover, K.J. (2014). Heterogeneous Expectations in the gold market: Specification and Estimation. *Journal of Economic Dynamics and Control*, *40*, 116–133. https://doi.org/10.1016/j.jedc.2014.01.001

Bloomberg (2022). *Bloomberg Anywhere.* Retrieved from https://bba.bloomberg.net/?utm_source=bloomberg-menu&utm_medium=offers

Bordo, M.D. (2018). Gold Standard. *Econlib.* Retrieved from https://www.econlib.org/library/Enc/GoldStandard.html#:~:text=Bordo&text=POST%3A,gold%20at%20the%20fixed%20price

Campbell, J.Y., Lo, A.W., MacKinlay, A.C., & Whitelaw, R.F. (1998). The econometrics of Financial Markets. *Macroeconomic Dynamics*, *2*(4), 559–562. https://doi.org/10.2307/j.ctt7skm5

Centers for Disease Control and Prevention. (2022). CDC Museum Covid-19 Timeline. *CDC.* Retrieved from https://www.cdc.gov/museum/timeline/covid19.html#:~:text=January%2010%2C%202020,%2DnCoV)%20on%20its%20website

Council on Foreign Relations. (2022). *Conflict in Ukraine | Global Conflict Tracker.* Retrieved from
 https://www.cfr.org/global-conflict-tracker/conflict/conflict-ukraine

Cox, J. (2022). U.S. GDP Fell at a 1.4% Pace to Start the Year as Pandemic Recovery Takes a Hit.
 CNBC. Retrieved from https://www.cnbc.com/2022/04/28/us-q1-gdp-growth.html

Dee, J., Li, L., & Zheng, Z. (2013). Is gold a Hedge or a Safe Haven? Evidence from Inflation and Stock
 Market. *International Journal of Development and Sustainability*, *2*(1), 12–27.
 https://doi.org/2186-8662

Diaconașu, D.E., Mehdian, S.M., & Stoica, O. (2022). The Reaction of Financial Markets to Russia's
 Invasion of Ukraine: Evidence from gold, Oil, bitcoin, and Major Stock Markets. *Applied
 Economics Letters*, pp. 1–5. https://doi.org/10.1080/13504851.2022.2107608

Dieupart-Ruel, L., François, A., Grauffel, A., Le-Roy, J., & Vacheret, T. (2013). Effect of behavioral
 Finance on gold Price Trend. *International Journal of Trade, Economics and Finance*, *4*(3), 129–
 133. https://doi.org/10.7763/ijtef.2013.v4.272

Ellyatt, H. (2022). From Soaring Food Prices to Social Unrest, the Fallout from the Russia-Ukraine War
 Could be Immense. *CNBC.* Retrieved from https://www.cnbc.com/2022/04/21/from-food-to-
 inflation-the-russia-ukraine-war-has-a-global-impact.html

Engebretsen, R., & Anderson, C. (2020). The impact of Coronavirus (COVID-19) and the Global Oil
 Price Shock on the Fiscal Position of Oil-Exporting Developing Countries. *OECD*, pp. 1–18.
 Retrieved from https://www.oecd.org/coronavirus/policy-responses/the-impact-of-coronavirus-
 covid-19-and-the-global-oil-price-shock-on-the-fiscal-position-of-oil-exporting-developing-
 countries-8bafbd95/

Federal Reserve Economic Data. (2018). Does Oil Drive Inflation? *FRED Blog.* Retrieved from
 https://fredblog.stlouisfed.org/2018/11/does-oil-drive-inflation/

Federal Reserve Economic Data. (n.d.). *Fred Inflation Graph.* Retrieved from
 https://fred.stlouisfed.org/graph/?g=rocU

Ghizoni, S.K. (2013). Creation of the Bretton Woods system. *Federal Reserve History.* Retrieved from
 https://www.federalreservehistory.org/essays/bretton-woods-created

Graefe, L. (2013). Oil Shock of 1978–79. *Federal Reserve History.* Retrieved from
 https://www.federalreservehistory.org/essays/oil-shock-of-1978-79

Hamilton, J. (2009). Oil Prices and the Economic Recession of 2007-08. *CEPR*. Retrieved from
 https://cepr.org/voxeu/columns/oil-prices-and-economic-recession-2007-08

Hogan, T.L. (2021). How Good Was the gold Standard? In P.C. Earle, & W.J. Luther (Eds.), *The gold
 Standard Retrospect and Prospect* (pp. 1–321). The American Institute for Economic Research.

J.P. Morgan Research. (2022). *The Russia-Ukraine Crisis: What does it Mean for Markets?* JP Morgan.
 Retrieved from https://www.jpmorgan.com/insights/research/russia-ukraine-crisis-market-impact

Kilian, L., & Zhou, X. (2021). *The Impact of Rising Oil Prices on U.S. Inflation and Inflation
 Expectations in 2020-23*. Federal Reserve Bank of Dallas. Retrieved from
 https://www.dallasfed.org/-/media/documents/research/papers/2021/wp2116.pdf

Kothari, S.P., & Warner, J.B. (2006). Econometrics of event studies. Introduction and Background.
 Handbook of Empirical Corporate Finance, pp. pp. 3–36. Amsterdam: Elsevier.

MacKinlay, C.A. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*,
 35(1), 13–39.

MacroTrends. (n.d.). *Crude Oil Prices - 70 Year Historical Chart*. Retrieved from
 https://www.macrotrends.net/1369/crude-oil-price-history-chart

Mann, B., & Whitney, D.R. (1947). On a Test of Whether one of Two Random Variables is
 Stochastically Larger than the Other. *Annals of Mathematical Statistics*, *18*(1), 50–60.

Miller Center. (2020). *The Gulf War*. Retrieved from https://millercenter.org/statecraftmovie/gulf-war

Milling-Stanley, G., Gold, M., Andrade, D., & Tsui, R. (2019). The Role of gold in Today's Global
 Multi-Asset Portfolio. *SPDR Gold Trust.* Retrieved from https://www.ssga.com/library-
 content/pdfs/etf/role-of-gold-in-todays-global-multi-asset-portfolio-sg.pdf

Milstein, E., & Wessel, D. (2022). What did the Fed do in Response to the COVID-19 crisis? *Brookings*. Retrieved from https://www.brookings.edu/research/fed-response-to-covid19/

Mining. (2022). Gold Price Reverses Course as Traders Assess Impact of Ukraine Conflict. *Mining*. Retrieved from https://www.mining.com/gold-price-reverses-course-as-traders-assess-impact-of-ukraine-conflict/

Naser, H. (2017). Can gold Investments Provide a Good Hedge Against Inflation? An Empirical Analysis. *International Journal of Economics and Financial Issues*, *7*(1), 470–475. https://doi.org/2146-4138

Neely, C.J., & Wood, S.J. (2022). Russia's invasion of Ukraine and its impact on stock prices. *Saint Louis Fed Eagle*. Retrieved from https://www.stlouisfed.org/on-the-economy/2022/jun/russia-invasion-ukraine-impact-stock-prices

Pettinger, T. (2022). The Relationship Between Oil Prices and Inflation. *Economics Help*. Retrieved from https://www.economicshelp.org/blog/167245/economics/the-relationship-between-oil-prices-and-inflation/

Reuters. (2022a). *Beyond CPI: Gold as a Strategic Inflation Hedge*. Retrieved from https://www.reuters.com/article/sponsored/beyond-cpi-gold-as-a-strategic-inflation-hedge

Reuters. (2022b). Why Central Banks Buy Gold. *Reuters*. Retrieved from https://www.reuters.com/article/sponsored/why-central-banks-buy-gold

Rich, R. (2013). The Great Recession. *Federal Reserve History*. Retrieved from https://www.federalreservehistory.org/essays/great-recession-of-200709#:~:text=The%20United%20States%2C%20like%20many,and%20Reinvestment%20Act%20of%202009.

Rouse, C., Tedeschi, E., & Zhang, J. (2021). Historical Parallels to Today's Inflationary Episode. *The White House*. Retrieved from https://www.whitehouse.gov/cea/written-materials/2021/07/06/historical-parallels-to-todays-inflationary-episode/

Saefong, M.P., & Watts, W. (2020). Oil Drops Back to 1-year Low as Coronavirus Takes Toll on China Crude Demand. *Market Watch*. Retrieved from https://www.marketwatch.com/story/oil-edges-lower-as-coronavirus-takes-toll-on-china-crude-demand-2020-02-10

Selgin, G. (2021). The Rise and Fall of the gold Standard in the United States. In P.C. Earle, & W.J. Luther (Eds.), *The gold Standard Retrospect and Prospect* (pp. 1–321). The American Institute for Economic Research.

Selvan, S.C.B., & Ramraj, G. (2022). The Impact on gold Spot and Futures Prices Volatility During the COVID-19: An Event Study. *Journal of the Asiatic Society of Mumbai*, *95*(32), 95–100.

Sharpe, W.F. (1966). Mutual Fund Performance. *The Journal of Business*, *39*(1), 119–138. Retrieved from http://www.jstor.org/stable/2351741

Silk, L. (1991). Economic scene; The broad impact of the Gulf War. *The New York Times*. Retrieved from https://www.nytimes.com/1991/08/16/business/economic-scene-the-broad-impact-of-the-gulf-war.html

Singh, H. (2022). This Should Have Been a Great Year for gold. Here's Why It Isn't. *The Wall Street Journal*. Retrieved from https://www.wsj.com/articles/this-should-have-been-a-great-year-for-gold-heres-why-it-isnt-11663526294

Sun, Y. (2022). The impacts of wars on oil prices. *Proceedings of the 2022 3rd International Conference on Mental Health, Education and Human Development (MHEHD 2022)*, pp. 167–170. https://doi.org/10.2991/assehr.k.220704.031

The Federal Reserve. (2003). *Changes in the Intended Federal Funds Rate 1971-1992*. Retrieved from https://www.federalreserve.gov/foia/files/20190829-changes-intended-federal-funds-rate.pdf

The White House. (2021). The U.S. Economy and the Global Pandemic. *The White House*. Retrieved from https://www.whitehouse.gov/wp-content/uploads/2022/04/Chapter3.pdf

Thiess, R., & Bryant, M. (2022). Robust Federal Pandemic Aid Has Sent Over $800 Billion to States. *The Pew Charitable Trusts*. Retrieved from https://www.pewtrusts.org/en/research-and-analysis/articles/2022/11/03/robust-federal-pandemic-aid-has-sent-over-$800-billion-to-states

Trading Economics. (2022). United States consumer Spending 2022 data - 2023 forecast - 1950-2021 historical. *Trading Economics.* Retrieved from https://tradingeconomics.com/united-states/consumer-spending#:~:text=Consumer%20Spending%20in%20the%20United%20States%20averaged%206186.09%20USD%20Billion,the%20first%20quarter%20of%201950.

Turak, N. (2022). Gold jumps to highest level in more than a year as Russia invades Ukraine. *CNBC.* Retrieved from https://www.cnbc.com/2022/02/24/russia-invades-ukraine-gold-jumps-to-highest-in-more-than-a year.html#:~:text=U.S.%20gold%20futures%20were%20down, Meanwhile%2C%20copper%20was%20slightly%20higher.

U.S. Bureau of Labor Statistics. (n.d.). *CPI. U.S. Bureau of Labor Statistics.* Retrieved from https://www.bls.gov/cpi/

U.S. Bureau of Labor Statistics. (n.d.). *Inflation Data*. Retrieved from https://data.bls.gov/pdq/SurveyOutputServlet

U.S. Embassy. (2022). International Sanctions are Working: Russia Feels Economic Pressure. *The U.S. Embassy.* Retrieved from https://ge.usembassy.gov/international-sanctions-are-working-russia-feels-economic-pressure/

US Inflation Calculator. (2022). *Current US Inflation rates: 2000-2022.* Retrieved from https://www.usinflationcalculator.com/inflation/current-inflation-rates/#:~:text=The%20annual%20inflation%20rate%20for,ET

Volcker, P., & Gyohten, T. (1992). Changing Fortunes: The Worlds Money and the Threat to American Leadership (1st Ed.). *Times Books*, pp. 1–416. ISBN: 978-0812922189.

Works, R. (2021). Consumer Inflation During the COVID-19 Pandemic: Monthly Labor Review. *Bureau of Labor Statistics.* Retrieved from https://www.bls.gov/opub/mlr/2021/beyond-bls/consumer-inflation-during-the-covid-19 pandemic.htm#:~:text=As%20the%20pandemic%20grew%2C%20so,a%20 positive%20rate%20of%20inflation.

World Gold Council. (2018). Money and gold. *WGC.* Retrieved from https://www.gold.org/history-gold/gold-as-currency

Zhu, Y., Fan, J., & Tucker, J. (2018). The Impact of Monetary Policy on gold Price Dynamics. *Research in International Business and Finance*, *44*, 319–331. https://doi.org/10.1016/j.ribaf.2017.07.100

APPENDIX

TABLE 2
OIL SHOCK 1978-1979

Months	CAR	# Months	Variance	T-test	Significance 95%	Significance 90%
12 pre	26.90%	12	0.001507	2.001738	Significant	Significant
9 pre	21.70%	9	0.001402	1.931810	Not Significant	Significant
6 pre	16.50%	6	0.002905	1.246571	Not Significant	Not Significant
3 pre	16.90%	3	0.001284	2.728385	Significant	Significant
Event (October 1978)	7.10%				Not Significant	Not Significant
3 post	-3.60%	3	0.038117	-0.106910	Not Significant	Not Significant
6 post	-2.20%	6	0.016116	-0.072180	Not Significant	Not Significant
9 post	13.10%	9	0.011232	-0.410687	Not Significant	Not Significant
12 post	34.40%	12	0.012624	0.884387	Not Significant	Not Significant

TABLE 3
GULF WAR 1989-1991

Months	CAR	# Months	Variance	T-test	Significance 95%	Significance 90%
12 pre	11.8%	12	0.002090	0.744385	Not Significant	Not Significant
9 pre	7.6%	9	0.003090	0.455736	Not Significant	Not Significant
6 pre	-3.7%	6	0.002537	-0.298170	Not Significant	Not Significant
3 pre	5.8%	3	0.001980	0.751244	Not Significant	Not Significant
Event (August 1990)	1.5%				Not Significant	Not Significant
3 post	1.1%	3	0.004028	0.098554	Not Significant	Not Significant
6 post	1.6%	6	0.001891	0.150348	Not Significant	Not Significant
9 post	6.1%	9	0.001270	0.568793	Not Significant	Not Significant
12 post	5.8%	12	0.001044	0.522369	Not Significant	Not Significant

TABLE 4
FINANCIAL CRISIS 2008

Months	CAR	# Months	Variance	T-test	Significance 95%	Significance 90%
12 pre	17.1%	12	0.003427	0.882557	Not Significant	Not Significant
9 pre	15.2%	9	0.004247	0.779720	Not Significant	Not Significant
6 pre	4.6%	6	0.005481	0.251866	Not Significant	Not Significant
3 pre	-16.1%	3	0.001375	-2.500130	Significant	Significant
Event (June 2008)	4.9%				Not Significant	Not Significant
3 post	-7.0%	3	0.007205	-0.479460	Not Significant	Not Significant
6 post	0.6%	6	0.012236	0.022596	Not Significant	Not Significant
9 post	3.8%	9	0.008680	0.134933	Not Significant	Not Significant
12 post	-4.0%	12	0.007726	-0.130020	Not Significant	Not Significant

TABLE 5
COVID-19 PANDEMIC

Months	CAR	# Months	Variance	T-test	Significance 95%	Significance 90%
12 pre	14.5%	12	0.001420	1.108483	Not Significant	Not Significant
9 pre	16.4%	9	0.001603	1.361572	Not Significant	Not Significant
6 pre	2.6%	6	0.001191	0.308874	Not Significant	Not Significant
3 pre	8.1%	3	0.000302	2.685777	Significant	Significant
Event (March 2020)	1.6%				Not Significant	Not Significant
3 post	9.0%	3	0.000387	2.653277	Significant	Significant
6 post	12.3%	6	0.002183	1.075702	Not Significant	Not Significant
9 post	10.8%	9	0.002599	0.706974	Not Significant	Not Significant
12 post	-2.4%	12	0.002652	-0.136620	Not Significant	Not Significant

TABLE 6
RUSSIA-UKRAINE CONFLICT 2022

Months	CAR	# Months	Variance	T-test	Significance 95%	Significance 90%
12 pre	-24.5%	12	0.001713	-1.71233	Not Significant	Significant
9 pre	-13.3%	9	0.001681	-1.08502	Not Significant	Not Significant
6 pre	-10.1%	6	0.000237	-2.67196	Significant	Significant
3 pre	-3.4%	3	0.000355	-1.02878	Not Significant	Not Significant
Event (February 2022)	4.8%				Not Significant	Not Significant
3 post	-8.4%	3	0.000421	-2.37084	Significant	Significant
6 post	-19.0%	6	0.000248	-4.92713	Significant	Significant
7 post	-21.5%	7	0.000212	-5.58149	Significant	Significant