Proceedings of the 2nd International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/95/2024MUR0099

Whether Silver Serves as a 'Safe-Haven' for Crude Oil

Keyu Chen[1,a,*]

[1]*Institute of Economics, Wuhan University, Luoyu Road, Wuhan, China*
a. 2022301052105@whu.edu.cn
**corresponding author*

Abstract: In times of economic turbulence and geopolitical uncertainty, the fluctuations in crude oil prices can be particularly pronounced, posing significant challenges to investors by heightening market risks. This study sets out to explore the multifaceted landscape of risk associated with both crude oil and silver assets, with a specific focus on portfolio volatility. Through meticulous analysis guided by the Sharpe ratio, we aim to delineate an in-depth understanding of the efficient frontier, comparing portfolio performance against that of the S&P 500 index, especially during periods characterized by extreme market volatility. Our empirical investigations underscore that while silver displays certain tendencies towards risk aversion, it does not meet the criteria to be deemed a dependable "safe-haven" asset in the context of crude oil. These findings have significant implications, providing a catalyst for driving innovation and fortitude across interconnected domains. By enhancing our comprehension of portfolio dynamics in turbulent market environments, this research contributes to the advancement of strategies aimed at navigating risks effectively.

Keywords: Sharpe ratios, efficient frontier, crude oil, silver, save-haven.

1. Introduction

Crude oil is a significant energy commodity that is closely linked to other financial markets worldwide [1]. However, due to increased global uncertainty shocks and geopolitical risks, oil prices have experienced rapid declines and sharp rallies from time to time. Extreme market risks in the context of the crude oil market can be transmitted to other markets, triggering systemic risks. Identifying risks in the context of the crude oil market, is of great practical significance for investors and management organizations worldwide [2]. Precious metals, such as gold, are widely recognized as traditional hedge assets due to their ability to resist extreme market risks [3] as one of the most important precious metals, gold has been the subject of in-depth research by scholars.

Scholarly inquiry currently focuses on examining the relationship between crude oil and gold. One aspect under scrutiny is their interdependence. For example, the extraction of gold often requires the use of crude oil, leading to a noticeable positive correlation in their prices [4]. Additionally, gold plays a crucial role as a shock absorber in the crude oil market, providing a stabilizing effect during periods of volatility [5]. Gold's intrinsic properties make it a valuable tool for forecasting the repercussions of oil-related events [6].

The concept of 'safe-haven' attributes inherent in gold was first delineated by Baur and McDermott [7], and subsequent scholarship has delved into this phenomenon with vigor. The term 'safe-haven' refers to gold's capacity to retain or even appreciate. Empirical studies consistently

DOI: 10.54254/2754-1169/95/2024MUR0099

demonstrate that during times of economic uncertainty or market turmoil, gold serves as a reliable refuge for crude oil investors. [8]. This underscores gold's importance as a risk mitigation tool in the volatile energy market.

Despite the extensive research on gold's 'safe-haven' properties, there is a noticeable gap in the literature regarding the exploration of similar attributes in other precious metal commodities. Therefore, this paper aims to address this gap by examining the potential of silver as a 'safe-haven' within the context of the crude oil market, leveraging insights from existing scholarship. To accomplish this goal, the study concentrates on a particular period of high market risk, specifically from January to March 2020, which coincided with the outbreak of the global epidemic and a significant decline in crude oil prices. The chosen timeframe offers an excellent opportunity to examine the response of silver to unfavorable market conditions. Methodologically, the study employs a rigorous approach, selecting ten companies whose primary business involves both crude oil and silver. Subsequently, the text conducts a meticulous analysis of the returns and volatilities of the asset portfolios, culminating in the calculation of their Sharpe ratios [9]. The pivotal comparison lies in juxtaposing these Sharpe ratios with those derived from the S&P 500 index during the same tumultuous period. A higher Sharpe ratio for the asset portfolio would indicate the potential for silver to function as a 'safe-haven' amidst the volatility of the crude oil market. This empirical analysis aims to determine the viability of silver as a risk-mitigating asset during periods of economic uncertainty and market turbulence.

2. Research Method

The investigation employs an asset portfolio optimization model to ascertain the optimal asset allocation ratio between silver and crude oil, intending to determine whether silver can serve as a 'safe-haven' for crude oil. To address this question, we will apply the efficient frontier construction methodology. The construction of the efficient frontier necessitates the determination of the expected returns, volatilities, and correlations of silver and crude oil. Subsequently, by adjusting the relative weights of the assets, multiple portfolios of silver and crude oil can be generated, and The anticipated returns and associated risks for each portfolio can be quantified. Ultimately, by plotting the effective boundaries of these portfolios, the relationship between silver and crude oil and their optimal allocation in the portfolio can be visualized. The benefit of utilizing this model is that it helps investors better understand the correlation and risk characteristics between silver and crude oil. Efficient boundaries are essential for investors to develop effective investment strategies that balance risk and return and maximize their investment objectives. Furthermore, the study of silver and crude oil as safe-haven assets is crucial for investors' risk management and asset allocation in the financial markets.

3. Application and Results

3.1. Data Collection and Selection

To assess whether silver can serve as a 'safe-haven' for crude oil, the survey selected a period when the crude oil market was at extreme risk. The study is analyzing data from January 1, 2020, to March 31, 2020, totaling three months. This time frame was selected to account for several significant events that occurred during this period. Firstly, it includes the outbreak of the epidemic in early 2020, namely the COVID-19 pandemic, which had a profound impact on global health systems, economies, and societies worldwide. Secondly, it encompasses the global economic downturn triggered by the pandemic, characterized by widespread business closures, supply chain disruptions, and heightened economic uncertainty. In addition, this period saw a significant decline in crude oil prices, influenced by a combination of reduced demand due to lockdown measures and geopolitical factors. By

DOI: 10.54254/2754-1169/95/2024MUR0099

analyzing data from this specific time frame, the study aims to examine the interplay between these interconnected factors and their implications on various aspects of the economy and society. For the survey, we selected ten companies that mainly trade crude oil and silver: XOM, CVX, BP, TTE, COP, E, OXY, CNQ, NEM, and GOLD. Additionally, we included AG, PAAS, WPM, HL, SSRM, CDE, FSM, SVM, MUX, and EXK. We obtained the daily closing prices of these 20 companies from the yfinance database. We also screened the closing prices of the S&P 500 for the same period as a reference, following the same process.

3.2. Data Analysis

The survey employed the Sharpe ratio as a gauge of portfolio quality. The Sharpe ratio is a standardized risk-adjusted measure of portfolio returns, thereby allowing for comparisons across different portfolios. It is sensitive to risk due to its combination of returns with standard deviation. To calculate the Sharpe ratio, the daily closing prices of the 20 companies were used to determine their returns. The maximum Sharpe ratio of the 20 companies was then obtained through Monte Carlo simulation using Equation (1). The Sharpe ratio of the S&P 500 was also calculated for the same period. If the Sharpe ratios of the 20 companies are higher than that of the S&P 500 for the same period, it indicates that the asset portfolio obtained from the survey has been successful.

$$SharpeRatio = \frac{wTR\text{-}Rf}{\sqrt{\omega^T \sum \omega}} \tag{1}$$

In this equation, 'w' represents an n-dimensional weight vector that contains the weights of each asset, 'r' represents an n-dimensional vector of expected returns that contains the expected returns of each asset, 'rf' represents the risk-free rate, and 'Σ' represents the covariance matrix.

The survey analyzed the three-month stock movements of crude oil, silver, and the S&P 500, as shown in Figure 1,2. The results indicate that crude oil and the S&P 500 declined more sharply than silver, suggesting that silver may have a safe-haven value in extremely risky market environments. This finding is worth exploring further.

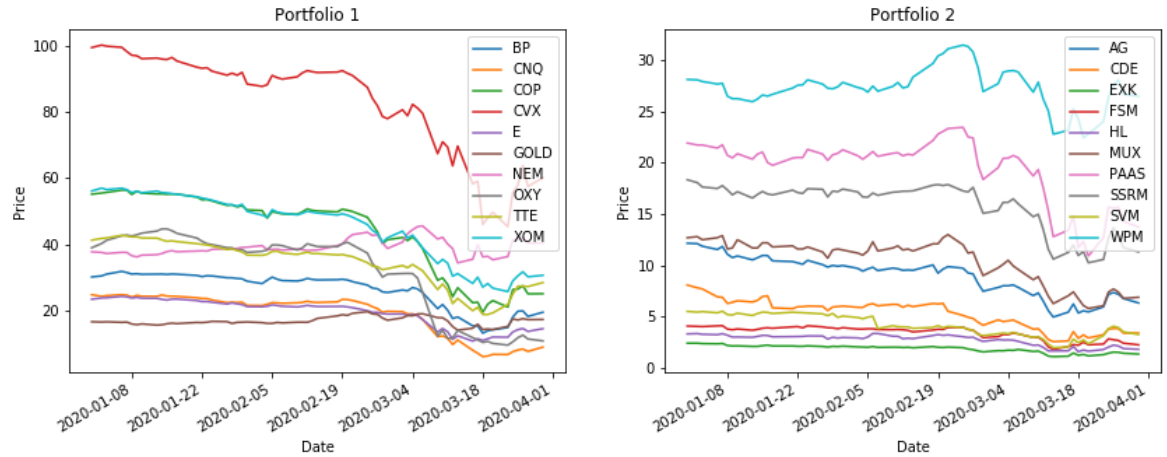

Figure 1: Crude Oil & Silver Company Stock Price Comparison

DOI: 10.54254/2754-1169/95/2024MUR0099

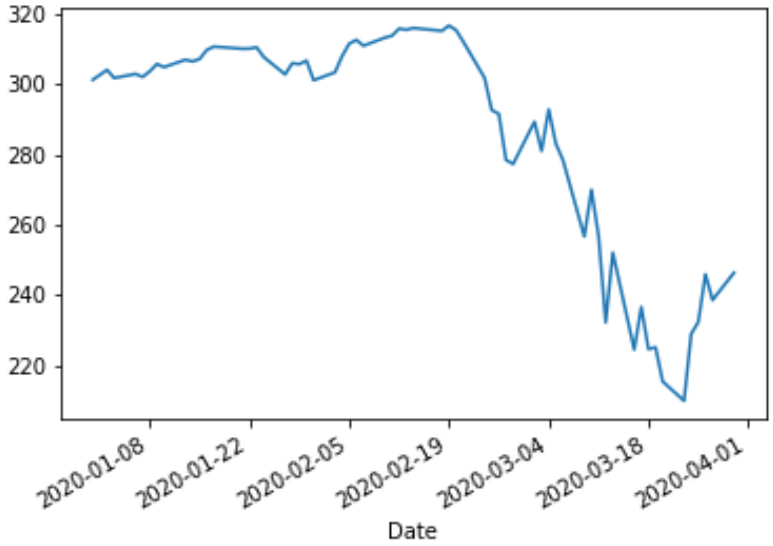

Figure 2: S&P 500 Stock Price

The investigation uses a special kind of simulation called Monte Carlo to figure out what to expect from each asset portfolio. Monte Carlo simulation entails the generation of multiple potential portfolios through the stochastic construction of different weights for the assets. For each generated portfolio, its expected return, volatility, and correlation are calculated, and the Sharpe ratio is computed. The portfolio with the optimal Sharpe ratio is then selected, which is the portfolio that provides the highest expected return for a given level of risk or the lowest risk for a given expected return. This step is designed to determine the best capital allocation strategy to optimize the portfolio. The efficient frontier is plotted, as shown in Figure 3, with the points of maximum Sharpe ratio and minimum volatility marked.

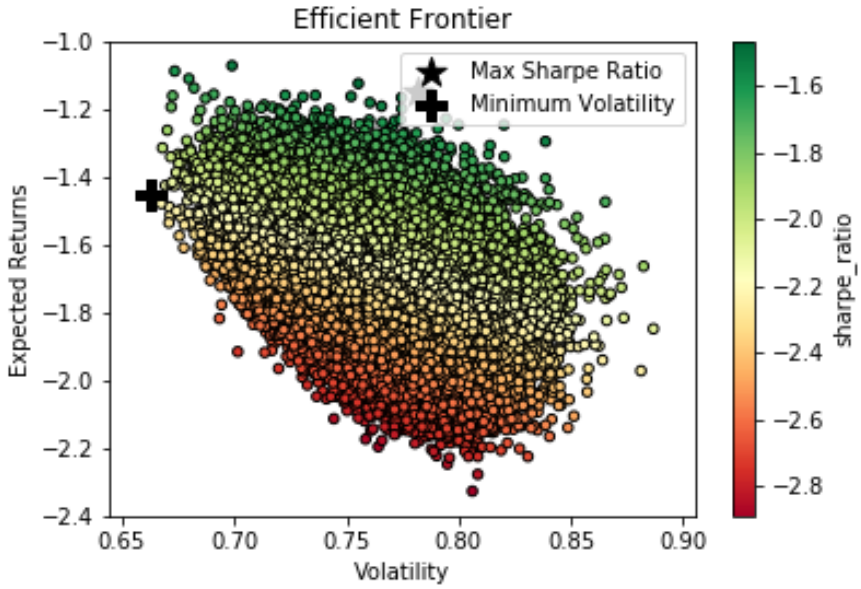

Figure 3: Effective frontier of the assets

The weights of each asset corresponding to the maximum Sharpe ratio are obtained and presented in Table 1.

DOI: 10.54254/2754-1169/95/2024MUR0099

Table 1: Weighting of assets

Assets	Weights
XOM	11.37%
CVX	6.87%
BP	1.86%
TTE	0.01%
COP	1.64%
E	0.47%
OXY	4.27%
CNQ	6.59%
NEM	7.31%
GOLD	6.56%
AG	0.82%
PAAS	0.39%
WPM	11.07%
HL	0.01%
SSRM	9.40%
CDE	2.90%
FSM	11.02%
SVM	6.98%
MUX	9.12%
EXK	1.35%

The study's empirical results provide valuable insights into silver's role as a ‘safe-haven’ asset in extreme market risk scenarios. The calculated Sharpe ratio of -1.4643 for the asset portfolio and -1.2033 for the S&P 500 indicates that the S&P 500 index outperforms the examined asset portfolio. The analysis shows that silver is a less effective risk-mitigating asset compared to the S&P 500.

Figure 4 visually represents the asset return curves for both the three-month asset portfolio and the S&P 500, confirming the quantitative findings. Figure 4 visually represents the asset return curves for both the three-month asset portfolio and the S&P 500, confirming the quantitative findings. The S&P 500 outperforms the asset portfolio.

Despite initial conjectures about silver's potential as a ‘safe-haven’, empirical evidence presents a nuanced perspective. While silver exhibits a gradual decline in its stock price during periods of extreme market risk, this behavior falls short of meeting the criteria expected of a dependable safe-haven asset. Therefore, it appears that silver may not have the strong risk-mitigating characteristics required to be a dependable ‘safe-haven’ in the volatile crude oil market.

These results emphasize the need for thorough analysis and careful consideration when assessing the safe-haven qualities of commodities other than gold. Moreover, this prompts further exploration into the underlying factors that influence silver's performance in adverse market conditions. This contributes to a deeper understanding of silver's role within investment portfolios and risk management strategies.

DOI: 10.54254/2754-1169/95/2024MUR0099

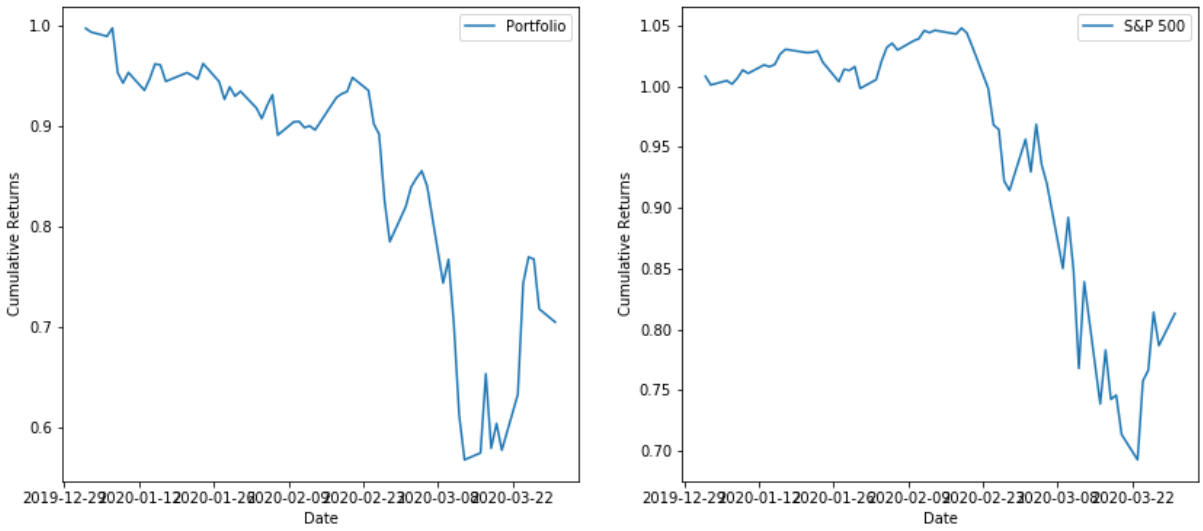

Figure 4: Cumulative rates of Comparative Portfolios and S&P 500

The survey concluded that the Sharpe ratio of the crude oil and silver portfolio was lower than that of the S&P 500 and could not achieve a hedging effect for several reasons. Firstly, the portfolio only considered two commodities, whereas the S&P 500 covers the stocks of companies in different industries, which could indeed have a higher Sharpe ratio. Secondly, as commodities, the price fluctuations of crude oil and silver demonstrate a strong correlation with the market. Studies have shown a strong correlation between the crude oil market and the precious metals market[10], limiting the effectiveness of diversification. Additionally, the correlation structure between assets in financial markets is often complex, and traditional methods may not capture features such as nonlinearities and tail correlations.

Based on the above reasons, the survey can be improved in the following ways: Diversification of research objects is proposed to mitigate risks. Incorporating additional commodities renowned for their hedging properties alongside silver can fortify the portfolio against market volatility. By broadening the scope to include such assets, the survey can offer a more comprehensive evaluation of safe-haven options within the crude oil market.

Additionally, the survey should recommend the use of advanced modeling techniques to explore the dynamic correlations present in asset portfolios. Utilizing emerging models such as DCC-GARCH [11] and SV allows for a more comprehensive understanding of the interactions between different assets, surpassing the constraints of static correlation analyses. These advanced methodologies enable the exploration of complex market dynamics, providing insights into how correlations evolve over time and under different market conditions.

4. Conclusion

This paper examines whether silver can be considered a ‘safe-haven’ for crude oil during the period of January to March 2020, when the outbreak of the epidemic first began and the price of crude oil fell.The empirical results indicate that silver cannot be considered a ‘safe-haven’ for crude oil. Although silver is less volatile than gold, a portfolio comprising silver and crude oil assets exhibits a smaller Sharpe ratio and return than the S&P 500. Therefore, it is recommended that investors choose the S&P 500 as a ‘safe-haven’ portfolio. Although the experiment had unsatisfactory outcomes, it is important to acknowledge that silver still possesses risk aversion properties. When used in conjunction with crude oil under specific market conditions, silver has the potential to serve as a hedge against risk. The results of the experiment suggest that silver may not be as effective as the

DOI: 10.54254/2754-1169/95/2024MUR0099

S&P 500 as a ‘safe-haven’ asset. However, it is important to consider the nuanced role that silver may play in risk mitigation strategies. These findings prompt a reevaluation of silver's utility within diversified portfolios, particularly during periods of heightened market risk.The research in this paper provides insight into the risk aversion properties of precious metals and their implications for asset portfolio construction. In today's unstable global environment, where geopolitics has become a major issue and the price of crude oil fluctuates drastically, it is urgent to find better ways to hedge market risk. This paper also compares the investment strategy with gold and explores their combined potential, guiding investors.

References

[1] *Ji, Q., & Fan, Y. (2010). Research on the Co-movement between the International Crude Oil Market and the Stock Markets of China and the United States Before and After the Subprime Crisis. China Management Science, 18(6), 42-50.*

[2] *Liu, B., Ji, Q., & Fan, Y. (2018). Is Gold a "Safe Haven" for Crude Oil? - Based on the Perspective of Portfolio Returns and Volatility. China Management Science, 11, 1-10.*

[3] *Wang, B. (2023, March 21). Attention on the Hedging Value of Precious Metals. China Gold News, 006.*

[4] *Tiwari, A. K., & Sahadudheen, I. (2015). Understanding the Nexus between Oil and Gold. Resources Policy, 46, 85-91.*

[5] *Kumar, S. (2017). On the nonlinear relationship between crude oil and gold. Resources Policy, 51, 219-224.*

[6] *Shahbaz, M., Balcilar, M., & Ozdemir, Z. A. (2017). Does oil predict gold? A nonparametric causality-in-quantiles approach. Resources Policy, 52, 257-265.*

[7] *Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. Journal of Banking & Finance, 34(8), 1886-1898.*

[8] *Reboredo, J. C. (2013). Is gold a hedge or safe haven against oil price movements? Resources Policy, 38(2), 130-137.*

[9] *Markowitz, H. (1952). Portfolio selection. Journal of Finance, 7(1), 77-91.*

[10] *Yin, L., Liu, Y. (2015). Is Gold a Stable Safe Haven Asset? —Perspective Based on Macroeconomic Uncertainty. International Financial Research, 2015(7), 87-96.*

[11] *Deng, Zhicheng. (2022). Study on the Impact of Uncertainty Shocks in Crude Oil Prices on Precious Metals Prices. Retrieved from https://link.cnki.net/doi/10.27661/d.cnki.gzhnu.2022.001682doi:10.27661/d.cnki.gzhnu.2022.001682.*