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# Investment in Commodities as Hedging and Safe-Haven Tools during the Periods of Stock Market Volatility

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## Abstract

This research sought to investigate the assumption that commodities operate as hedging and safe-haven for stocks -during various periods of stock market

volatility. In this regard, market test regression models and daily data from 21/03/2009 to 19/03/2020 were used. The researcher was able to test both hypotheses of commodities as hedging and safe-haven simultaneously using these three models. According to the market test model results, "periods of relatively high and low volatility," gold coin futures contracts are viewed as a strong safe-haven for Changes in Tehran stock exchange returns, yet they lack the property of hedging. According to the results of the market test model "Low return periods," gold commodities and other petroleum products serve as safe-haven.

Furthermore, "during times of crisis," commodities such as polymer, copper, and gold (cash and futures) had a consistent relationship with the stock market returns. They can be regarded as a strong safe haven for Changes in stock returns. Gold, in general, provided a safe-haven property for the stock index returns in all market test models, and it can serve as a stabilizing force for financial systems by reducing the casualties caused by extreme negative market shocks. The findings indicated that commodities can be used as risk management tools during economic and financial crises. Regarding hedging, the commodity market performed poorly compared to the stock market. Hedging does not always represent a safe haven for the stock market return, and vice versa.

JEL Classification: G01, G11, G14, G15

**Keywords:** Commodity, Stock Index, Hedge, Safe Haven, Crisis

## Introduction

Investments are mundane things that involve everyone in some way. For many, personal income is maintained through investment, bank deposits, real assets, or financial assets. Therefore, most investments are carried out without conscious effort or begin focusing after a significant event occurs. Recently, the economy (including Iran's) has been in severe distress, and the current state of the world has created political and economic uncertainty, which can cause novice investors to be skeptical. Thus, conducting long-term research in this area aids in making sound decisions, and having insight allows individuals to persevere in the face of adversity, bad news, and general uncertainty (Pirttiala, 2015).

Commodity markets have undergone significant transformations. Investors have recognized commodities as an alternative asset class in recent years. The

strong growth of commodity investments indicates an increasing interest of investors in commodity markets (for example, 48% share of Iran's commodity market from the total value of capital market transactions in 2018). It is interesting to underline that this approach changes very late and not in the same intensity for the different sizes of investors since, for small investors, investing in commodities is still something unusual. Despite increasing popularity, alternative investments still need to be familiar to most investors (Low et al., 2016). Recent changes in commodity markets raise new questions about the benefits of investment and diversification. In 2006, Gorton and Rouwenhorst published a comprehensive study on commodity properties, showing promising investment characteristics of commodities. They found that between 1959 and 2004, commodities outperformed stocks both in terms of higher returns and lower volatility. Commodities were also shown to have a negative correlation with stocks and bonds and a positive correlation with inflation. Since then, the debate regarding the properties of commodities has developed among researchers, with some authors questioning the alleged benefits.

On the other hand, stock markets are highly volatile, prompting investors to focus on commodity investments (Conover et al., 2010). During various periods of stock market volatility, investors look for alternative investments to act as a safe haven for their stock portfolio. The phenomenon known as flight-to-quality occurs when investors Herding shift is an unavoidable objective for flight-to-quality, and investors shift their investments toward lower-risk securities (Maller et al., 2010). Therefore, understanding the benefits that commodities could give to an investment portfolio (such as hedges, safe havens, and improving their portfolio performance) might alleviate investors' concerns.

Numerous studies have investigated the advantages of investing in commodities over the stock market and other traditional assets to determine whether they react differently to normal and abnormal market conditions. These studies yielded significant benefits in terms of commodity investment. However, their findings suggested considerable uncertainty about these benefits' stability and overall application for stock investors. Prior to the 2008 financial crisis, the majority of studies examined the benefits of commodity diversification (for example, Gorton and Rouwenhorst, 2006; Jensen et al., 2000). They concluded that there was a negative or very low correlation between commodity prices and stock returns and a positive correlation with the inflation rate. Thus, investors outperformed when using commodities in their portfolios. Several other recent studies have revealed an increase in the correlation between commodities and stocks (such as Delatte & Lopez, 2013;

Buyuksahin & Robe, 2014). The reasons for this increase, such as the financialization of commodity markets, the state of the global economy, various financial crises, and changes in monetary policies, were examined, and the benefits of commodity diversification were questioned. Accordingly, the question of whether commodity diversification is still beneficial arises.

Given Iran's stock market's severe volatility and unprecedented returns (Tehran et al.), “Because of sanctions, Exchange rate fluctuations and High inflation rates," the main question is whether investing in commodities serves as hedging or a safe haven during various periods of stock market returns volatility. This study aimed to provide an answer to that question. The characteristics of various commodities and stock returns were investigated in this study; in addition, it intended to investigate whether “the properties of various commodity classes” have hedging and safe-haven effects concerning stock market investment portfolio strategies. The findings can be used as a reference for investors to make appropriate and precise decisions, for economists and policymakers to make appropriate stock market management policies, and to contribute to the emerging experimental literature on the relationship between commodities and the stock market.

The paper is organized as follows. Section 2 and Section 3 review the literature relevant to the study, including safe haven and hedge characteristics of Commodities. Section 4, method and empirical models are discussed in detail. Section 5 reports the empirical results of the analysis. Moreover, Section 6 concludes the study.

## Theoretical Foundations

### Advantages of Investment in Commodities

Why would an investor include commodities in his/her portfolio of stocks and bonds? The nature of economies is cyclical, and markets operate based on high and low prices over a long period of time. When the negative aspects of the traditional asset's1 volatilities are taken into account from the beginning; alternative investments become more appealing to investors. Asset classes that are not easily influenced by public market events serve as savings hedges (Pirttiala, 2015). In summary, numerous studies have been conducted on the benefits of investing in commodities, i.e., for a portfolio consisting of other assets such as a stock portfolio (Including Aygul, 2016; Franch & Shehabi, 2016; Daigler, Dupoyet & You, 2017), and the majority of them emphasize

[1]. stocks and bonds

several aspects: ((diversification, hedging, and safe-haven)). The effects of hedging and safe-haven were investigated in this study.

**Hedging**

Immunization is referred to as hedging. When it comes to financial markets, it means protecting or insuring capital against potential losses. Stock portfolio managers, investors, and private corporations use immunization techniques to reduce potential risks. Hedging, also known as immunization, is a strategy for investing assets that can reduce the risk of price changes in other assets (or portfolios) (Hood & Malik, 2013).

New assets should not be wholly related to previous cases (other assets in the portfolio) to avoid unfavorable price movements. Furthermore, they also must not have low positive correlation coefficients; otherwise, their hedging effects will not be substantial. In light of this, new assets should have as low a correlation as possible with other assets in the portfolio. In order to be more precise, the correlations must be slightly positive, zero, or negative. Therefore, a negative correlation between two assets results in substantial hedging, whereas a low correlation (lack of correlation) results in weak hedging (Hood & Malik, 2013; Baur & Lucey, 2010).

Commodities are fundamentally different from financial assets. As a result, there are at least two reasons why it is plausible that commodities will be negatively correlated with stocks. First, commodity prices are primarily determined by current economic activity instead of longer-term economic prospects. Second, contrary to stocks, commodities tend to have positive exposure to event shocks (Kat & Omen, 2006). Investors in the stock market anticipate protection from price volatility in their investments. Thus, most studies investigated whether commodities hedged investors against this volatility to reduce investment risk. The majority of studies on commodity hedging were conducted, including Bodie & Rosansky (1980); Becker & Finnerty (2000); Jensen et al. (2000); Greer (2005); Erb & Harvey (2006); Gorton & Rouwenhorst (2006); Demidova-Menzel & Heidorn (2007); Conover & et al (2010); Baur & Lucey (2010); Cheung & Miu (2010); Silvennoinen & Thorp (2013); Wang et al. (2013); Hood & Malik (2013). Gorton and Rouwenhorst (2006) found that commodity futures offer the same return and Sharpe ratio as U.S. stocks. In addition, commodity futures that have low or negative correlations with equities imply potential hedge property for commodity futures. On the other hand, Silvennoinen and Thorp (2013) found that the commodity futures correlation dynamics with the U.S. stock market increased from close to zero in the 1990s to 0.5 in 2009, discouraging investors

from adding commodities to their stock portfolios.

Different perspectives may be related to different time horizons, mindsets, and differences in various examined markets. This study investigated a new market (Iran's stock market). Besides, unlike many other studies that used commodity indices, this study considered individual commodity hedging.

**Safe-Haven**

Financial markets have grown steadily in recent decades regarding volume and value. The same can be said for various financial instruments and their complexities. Furthermore, as markets and assets became more interdependent, there was a potential need for a relatively safe and straightforward asset, i.e., a safe haven.

Safe-haven is defined by Kaul and Sapp (2006) as an ideal place to transfer money during times of uncertainty. An asset is defined as a safe haven for an asset or a collection of assets in the event that they are not affected like them during stressful periods of time. A strong (weak) safe-haven in an asset with a negative correlation (lack of correlation) with other assets, but only during extreme stock market crashes (Baur & Lucey, 2010).

Although safe-haven and hedging are similar concepts, there are some distinctions between them. Bauer and McDermott (2010) identified an important distinction between these two concerts. During regular times, hedging is maintained, whereas a safe haven is only considered during extraordinary times, such as financial crises.

If an asset is used to hedge other assets, it does not imply that it is a safe haven, and vice versa. Hedging against stocks is accomplished through the use of assets. They may follow stocks during a crisis because, during this time, investors may sell various assets simultaneously (it can be explained via collective behavior or contagion theory (Calvo & Mendoza, 2000; Boyer et al., 2006)). However, some assets may have a negative correlation during a crisis but have a positive correlation with other assets during regular times. This asset's value does not depreciate in these circumstances, so it serves as a safe haven (Baur & Madermott, 2010).

Clearly, hedging is helpful for modifying portfolios. Safe-haven assets are valuable but may be more beneficial because they function as semi-automatic stabilizers. Their existence promotes financial market stability and flexibility because the profit from a safe-haven asset reduces adverse shocks in the asset classes, as well as having a positive impact on market sentiment and reducing the severity of the crisis period (Ciner et al., 2010; Baur & Lucey, 2010).

The study of asset market relationships during intense situations is consistent with behavioral finance, particularly the prospect theory. Kahneman and Tversky devised this theory (1979). It implies that investors react differently to loss and profit. They are more concerned with sustaining a loss than making a profit (Ciner et al., 2010). This is also related to the literature on flight-to-quality, which includes studies attempting to determine whether, in the event of a severe stock market crash, investors avoid stocks and bonds or not (Gulko, 2002; Hartmann et al., 2004). Financial crises have always plagued the global economy throughout history. During these crises, investors may suffer significant losses; as a result, they seek a class of assets that can compensate for their losses (Franch & Shehabi, 2016). For instance, after the 2008 global financial crisis, demand for gold increased exponentially. It represents flight-to-quality characteristics when global market uncertainty increases, increasing prices. The price of gold fell again in 2015, but it was still higher than before the crisis (Low et al., 2016).

Several experimental studies have been conducted to determine the relationship between commodities (particularly high-priced metals) and stock markets during financial distress. Including: Baur & Madermott (2010); Baur & Lucey (2010); Wang, Lin & Li (2013); Hood & Malik (2013); Lucey & Li (2015). Gold was generally considered a safe haven during the extreme stock market crash. According to Low, Yao, and Faff (2016), these effects are unique to most developed markets. Similarly, as global volatility increased, similar results revealed that gold has hedging properties for developed countries. Based on the evidence, they concluded that investors in developed markets react differently to negative shocks than investors in developing markets. Along with gold, this study examines other commodities.

## Literature Review

Commodities are distinguished from traditional assets through multiple characteristics. One of the most noticeable characteristics is the lack of correlation between stocks and Commodities. They provide immunity due to their positive relationship with inflation, as opposed to stocks, which perform poorly during periods of high inflation. Commodity markets were characterized by a high level of dynamism, as evidenced by increased transaction volume and total financial turnover. Increased capital flow causes commodities to correlate more with other financial assets, removing their diversification benefits (Belousova & Dorfleitner, 2012). According to Daigler, Dupoyet, and You (2017), the correlation between stock and commodity markets is still

weak, even though it has increased in recent years.

- Several studies concluded that commodities cannot be used as hedging tools (Cao et al., 2010; Li, Zhang & Du, 2011; Wang et al., 2013).

- Other studies revealed that commodities have a negative relationship with the stock market and can be used in hedging strategies (Kat & Oomen, 2006; Gorton & Rouwenhorst, 2006; McCown & Zimmerman, 2006; Cheung & Miu, 2010; Chong & Miffre, 2010; Büyüksahin et al., 2010; Ciner et al., 2010; Belousova & Dorfleitner, 2012; Pirttiala, 2015; Aygul, 2016; Franch & Shehabi, 2016; Daigler, Dupoyet & You, 2017; Shakil et al., 2018; Ozdemir, & Ozdemir, 2021). However, the results will vary depending on the circumstances. Recent studies, for example, found that as correlation increased, particularly after the 2008 financial crisis, the benefits of using commodities decreased (Delatte & Lopez, 2013; Büyükşahin & Robe, 2014). According to Bhardwaj and Dunsby (2013), the relationship between stocks and commodities is a business cycle that increases during the poor economic performance.

Therefore, previous literature revealed a conflict regarding whether commodities are used as a hedging tool during regular times and as safe havens during extreme shocks. Hence, they seek further studies on the relationship between commodities and classes of traditional assets over time. Therefore, the researcher proposed the following two hypotheses, which are explained below:

Hypothesis 1. Commodities act as hedging took (assets) in the stock market investment portfolio strategies. In other words, commodity and stock index prices are not linked under normal stock market conditions.

Hypothesis 2. Commodities act as safe-haven took in the stock market investment portfolio strategies. In other words, during periods of poor returns for stock prices (low returns) or abnormal volatility (low and high volatility) in stock markets or during severe crises, commodity prices and stock index prices are not linked.

## Research Methodology

### Research Variables

Research variables and observations constituent the historical prices of commodities and stock Index (TEDPIX). Following these observations, commodity returns and the stock Index were calculated daily.

$$r_t = \ln(P_t/P_{t-1}) \quad (1)$$

The research subject concerns the relationship between stock and commodity markets and the advantages of investing in the commodity market (concerning hedging and safe-haven). In light of that, to conduct research, the researcher required access to data from the stock index, plus cash and futures1 Prices of commodities. Thus, they used the data on the Iran Mercantile Exchange, Iran Energy Exchange, and Tehran Stock Exchange websites. In addition, on account of the significant volume of transactions and inconsistency of supply of several commodities at the Mercantile Exchange, in terms of commodity group groups were selected that could be examined in terms of volume. Plus, in terms of commodities, a commodity was selected that enjoyed appropriate, sufficient, and consistent data (under the assumption that they display the performance of other commodities in the respective sections to some extent).

The research period was selected from 21/03/2009 to 19/03/2020 (11 years total) due to the start of activity of the Iran Mercantile Exchange in 2008-09. As a result of the research's access to the relevant data, this time interval was selected.

**Materials, Analysis Tools, and Data Analysis**

The Eviews econometrics software was employed to categorize the data, calculate historical returns, as well as all descriptive statistics, and analyze the relationship between commodity and stock returns.

**Econometrics Models (Regression)**

To assess the effects of hedging and safe-haven of commodities on portfolio strategies of the stock market, market test models (regression model, among return of commodities as dependent variable, and stock index as regressor variable) were used as follows:

**Market Testing Model (1)**

Selection of relatively high and low volatility periods regardless of whether a

[1]. Following the previous studies, this research used both cash and futures prices. Moreover, currently, in the Iran Mercantile Exchange, most commodities are traded per cash prices, and merely a few have derivative transactions (which were commissioned a short while ago). This restriction in access to futures prices was another motivation to use cash prices.

financial crisis is the cause. According to Hillier, Draper, and Faff's (2006)developed market model, if the stock market's volatility exceeds two standard deviations in a single period, that period is considered a high-volatility period. Similarly, a time interval with a stock market return volatility of less than two standard deviations will be chosen as a period with low volatility. Dummy variables acting as proxy variables are used to demonstrate both of these scenarios.

$$R_{j,t} = \beta_{j,0} + \beta_{j,1}R_{Stock,t} + \beta_{j,2}D(Vol2\sigma)R_{Stock,t} + \beta_{j,3}D(R_{Stock}2\sigma)R_{Stock,t} + u_{j,t} \quad (2)$$

$$h_{j,t} = \gamma + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} \quad (3)$$

In equation (2), $R_{j,t}$ is the commodity return at the period of t, and $R_{Stock,t}$ is the return of the stock market index at the period of t. and $\beta_{j,t}$ are equation parameters (A variable coefficient that has a different value in different regimes). $D(Vol2\sigma)$ is a dummy variable, which shows that stock market returns are in a high volatility period and can be modified by 1 when the stock market return volatility goes beyond two standard deviations concerning the mean market volatility. Otherwise, it equals zero. $D(R_{Stock}2\sigma)$ is a dummy variable, demonstrating that stock market return is in a return decrease period and can be modified by 1 when stock market returns volatility is at least two standard deviations below the mean market returns volatility. Otherwise, it will equal zero. Equation (3) shows the conditional variance of the GARCH (1,1) model, which is employed to calculate heteroscedasticity in the time series data, plus the simultaneous equations between models are calculated using the maximum likelihood estimation (MLE) method.

This model can be used to test commodity hedging assumptions. If $\beta_{j,}$ one coefficient is positive and approaches 1; then the correlation is high and positive. Thus, there is a relationship between commodities and the stock market. Contrariwise, if $\beta_{j,1}$ is negative and approaches -1, then commodities and stock markets manifest negative and high correlation, which indicates the influence of commodities in the stock market. Moreover, this model can test the hypothesis of a safe haven of commodities. If $\beta_{j,}$ two coefficients are significant and zero; then commodities have weak safe-haven effects during extreme stock market volatilities. If $\beta_{j,2}$ is significantly negative, commodities manifest strong safe-haven effects. Furthermore, if $\beta_{j,}$ three coefficients are significant and zero, commodities have weak safe-haven effects at the

extremely low return periods of the stock market. If $\beta_{j,3}$ is significantly negative, commodities manifest the effects of a strong safe haven.

**Market Testing Model (2)**

This study used the following models to explain the relationship between stock and commodity markets in order to promote the tests described above (Baur & Madermott, 2010). In the above model, two short-term shocks are considered to examine whether commodities show the effects of safe-haven (for strategies of investments portfolio of the stock market) during these two stock market shocks.

- Low Return Periods: One viewpoint holds that when stock markets experience extremely low returns, investors seek out other investment tools as a safe haven. Thus, the following model is used, which divides the distribution of stock returns by creating a zero threshold:

$$R_{j,t} = \beta_{j,0} + \beta_{j,t} R_{Stock,t} + u_{j,t} \quad (4)$$

$$\beta_{j,t} = \lambda_{j,1} + \lambda_{j,2} D(R_{stock}) \quad (5)$$

$$h_{j,t} = \gamma + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} \quad (6)$$

$R_{j,t}$ is the commodity return at the time of t, $R_{stock,t}$ is the stock index return at the time of t, $\beta_{j,0}$ and $\beta_{j,t}$ are equation parameters (A variable coefficient that has a different value in different regimes), $u_{j,t}$ is an error term, and $D(r_{stock})$ is a dummy variable that takes the period of negative stock index returns. When return distribution in the stock market is adjusted below the threshold, the dummy variable is modified by 1; otherwise, by zero. Equation (4) depicts the relationship between the returns of these two classes using an econometric model (commodity and stock index). Equation (5) displays the method to calculate $\beta_{J,t}$ using two $\lambda_j (j = 1,2)$ factors and one dummy variable, which includes the negative range of returns of a stock index. Accordingly, to comprehend what will occur if this relationship is unstable and influenced by the unique and intense market situation.

In the case of extremely low returns of stock markets, if $\lambda_{j,}$ one coefficient in equation (5) is significant and zero, the commodities show the effects of weak hedging. If $\lambda_{j,1}$ is significantly negative, commodities manifest strong hedging effects. Moreover, the two coefficient is significantly zero; commodities show the effects of a weak safe haven. In the case of λj, two

is significantly negative (contains a nonlinear relationship), and the commodities display strong safe-haven effects.

- Market Crisis Period: Finally, a less statistical and more desired method can identify and define specific periods (such as financial-economic crises, bull and bear markets, and specific recession periods) and use dummy variables, which amounts to 1 if the returns overlap with the predefined periods; otherwise, it will be zero. This research measured the effect of sanctions. Data were divided into two periods before and after the sanctions (the data when the U.S. announced its withdrawal from the Joint Comprehensive Plan of Action (JCPOA) is determined as the point of division, i.e., 08/05/2018).

$$R_{j,t} = \beta_{j,0} + \beta_{j,t} R_{Stock,t} + u_{j,t} \quad (7)$$

$$\beta_{j,t} = \lambda_{j,1} + \lambda_{j,2} D(\text{Sanction}, 2018) \quad (8)$$

$$h_{j,t} = \gamma + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \quad (9)$$

If $\lambda_{j,}$ two coefficients in equation (8) are zero or negative, commodities show the effects of a safe haven during the crisis period. If the two coefficients are positive, commodities show a relationship during the crisis period. Thus, they lack safe-haven effects. The D dummy variable indicates sanctions imposed on Iran in 2018 (Sanction, 2018). Given that this research selected the period of sanctions (the beginning of sanctions) as the crisis period, and since in Iran, the effects of sanctions on the relationship between commodities with the stock market are similar to the effect of sanctions on the relationship between commodities and inflation1, thus, a positive and direct relationship demonstrates the safe haven of commodities. This means that if $\lambda_{j,}$ two coefficients in equation (8) are positive, commodities show the effects of a safe haven during the crisis period.

[1]. Demidova Menzel and Heidorn (2007) expressed that commodities are real assets that raise the price parallel to inflation. Therefore, they can be used as a hedging against inflation.

# Results

## Descriptive Statistics of Research Variables [1]

Table 1. Research Variables

| Stock | Futures | Energy | Petrochemical | Metals |
|---|---|---|---|---|
| Stock Index | Gold Coin Future | Petroleum Products | Polymer | Gold |
| | | Other Petroleum Products | Chemical | Copper |
| | | | | Aluminum |

Table (2) shows that all returns have a positive average. Gold (cash and futures) is the only commodity that can be assumed to resemble a stock market because it has the same returns and volatility as a stock index. The other commodities are much riskier than the stock index since they have higher volatility (with lower average return), indicating that commodities are "alone" a risky place to invest.

Table 2. Descriptive Statistics of Returns of Daily Data in Three Markets, i.e., Cash, Futures, and Stock

| Market | Commodity | Mean | Standard Deviation | kurtosis | Skewness | Sample Size |
|---|---|---|---|---|---|---|
| Spot | Polymer | 0.063 | 2.643 | 50.364 | -0.471 | 2869 |
| | Chemical | 0.102 | 4.775 | 18.918 | -0.109 | 2869 |
| | Average | (0.082) | (3.709) | (34.641) | (-0.29) | - |
| | Gold | 0.110 | 1.784 | 155.458 | 7.443 | 2869 |
| | Aluminum | 0.080 | 23.125 | 673.985 | 0.021 | 2869 |
| | Copper | 0.094 | 1.621 | 98.444 | 3.742 | 2869 |
| | Average | (0.095) | (8.843) | (309.296) | (3.735) | - |
| | Petroleum Products | 0.073 | 3.782 | 110.477 | 0.642 | 2869 |
| | Other Petroleum Products | 0.072 | 8.188 | 527451 | -0.512 | 2869 |
| | Average | (0.0725) | (5.985) | (318.964) | (0.065) | - |
| Derivative | Gold Coin Future | 0.121 | 2.466 | 29.882 | 2.570 | 2464 |
| Stock | Stock Index | 0.116 | 1.585 | 25.273 | 3.082 | 2869 |

Reference: Research Findings

[1]. Gold (996-998 fine), copper (copper wire), aluminum (aluminum bar), polymer (polyethylene), chemical (methanol), petroleum products (solvent), and other petroleum products (bitumen).

Table 3. Results of Unit root test of research variables (Returns)

| Variables | Augmented Dickey-Fuller test statistic | |
|---|---|---|
| | Level I (0) | |
| | t-statistic | Prob. |
| Polymer | -5.43 | 0.0000 |
| Chemical | -9.12 | 0.0000 |
| Gold | -23.34 | 0.0000 |
| Aluminum | -6.53 | 0.0000 |
| Copper | -5.74 | 0.0000 |
| Petroleum Products | -6.15 | 0.0000 |
| Other Petroleum Products | -6.89 | 0.0000 |
| Gold Coin Future | -12.2 | 0.0000 |
| Stock Index | -7.99 | 0.0000 |

Reference: Research Findings (significant at 1%)

Table 4. Results of heteroscedasticity test (ARCH effect test)[1]

| | | | |
|---|---|---|---|
| F-statistic | 4/134 | Prob. | 0.0016 |
| Obs*R-squared | 4/131 | Prob. | 0.005 |

Reference: Research Findings

## Research Hypotheses Testing

According to the dynamic conditional correlation diagrams, the conditional correlation between the returns of commodity groups and stocks is positive for some periods and negative for others. These findings support the need for additional research to determine which commodities, and when, serve as a safe haven in the relationship with the stock market.

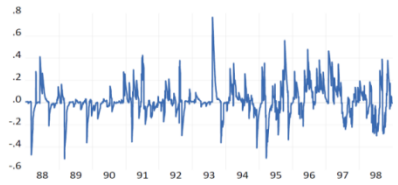


Fig. 1. Dynamic Conditional Correlation of Petrochemical Product Groups with Stock

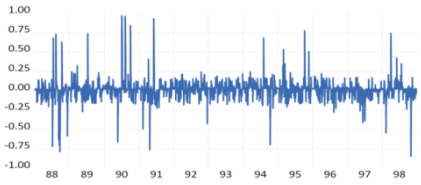


Fig. 2. Dynamic Conditional Correlation of Metal Product Groups with Stock

[1]. Confirming the existence of heteroscedasticity

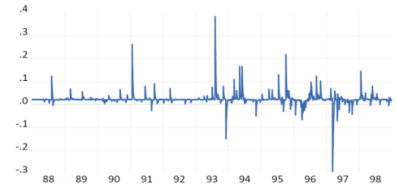


Fig 3. Dynamic Conditional Correlation of Energy Product Groups with Stock

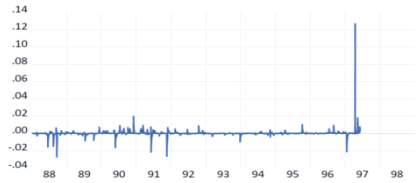


Fig. 4. Dynamic Conditional Correlation of Gold Coin Future with Stock

Table 5. Results of Estimating Hedging and Safe-Haven of Market Test Model (1)

| Stock Index | | | |
|---|---|---|---|
| Commodity | Hedge | Safe Haven | |
| | | $\beta_{j,2}\ (D_1 * R_{Stock,t})$ | $\boldsymbol{\beta_{j,3}\ (D_2 * R_{Stock,t})}$ |
| Polymer | 1.881 | -1.994 | -0.535 |
| Chemical | 1.103 | -1.072 | -0.910 |
| Gold | 0.429 | -0.421 | -0.293 |
| Aluminum | -7.414 | 7.508 | 6.599 |
| Copper | -0.420 | 0.446 | 0.859 |
| Petroleum Products | 0.126 | -0.134 | -0.003 |
| Other Petroleum Products | -4.751 | 4.379 | 4.407 |
| Gold Coin Future | 16.97* | -16.90* | -17.53* |

Reference: Research Findings (*: Symbol of Statistical Significance)

The results of Table (5) show that almost all of the coefficients calculated by the econometrics model are insignificant, except for the Gold Coin Futures Contract, which indicates the absence of hedging concerning the positive and significant stock return coefficients in the normal condition of the stock market, and it shows a strong safe-haven because the coefficients are negative and significant during the abnormal stock market condition[1].

[1]. It can be argued that there are negative and insignificant relationships in other commodities, which are regarded as weak safe-haven or hedging (Hosseinzadeh, 2019)

Table 6. Results of Estimating Hedging and Safe-Haven of Market Test Model (2) "Low Return Periods"

| Stock Index | | |
|---|---|---|
| Commodity | Hedge | Safe Haven |
| | | $\lambda_{j,2}\mathbf{D}(\mathbf{R_{stock}})$ |
| Polymer | 0.21 | 0.105 |
| Chemical | 1.06 | -0.063 |
| Gold | 2.73 | -0.045* |
| Aluminum | -7.406 | 0.045 |
| Copper | -0.419 | -0.029 |
| Petroleum Products | 0.149 | 0.025 |
| Other Petroleum Products | -5.29 | -0.516* |
| Gold Coin Future | 16.96* | -0.079 |

Reference: Research Findings (*: Symbol of Statistical Significance)

Table (6) shows that the coefficients of gold commodities and other petroleum products are negative and significant, indicating that these commodities are a strong safe haven in an adverse stock market condition. Chemical commodities, copper, and gold coin futures have negative and insignificant coefficients.

Table 7. Results of Estimating Hedging and Safe-Haven of Market Test Model (2) "Market Crisis Period"

| Stock Index | | |
|---|---|---|
| Commodity | Hedge | Safe Haven |
| | | $\lambda_{j,2}\ \mathbf{D}(\mathbf{Sanction, 2018})$ |
| Polymer | 1.643 | 0.002* |
| Chemical | 1.164 | -0.003* |
| Gold | 0.115 | 0.038* |
| Aluminum | -7.430 | 0.0009 |
| Copper | -0.453 | 0.003* |
| Petroleum Products | 0.135 | -0.0003 |
| Other Petroleum Products | -4.604 | -0.049* |
| Gold Future | 16.97* | 0.011* |

Reference: Research Findings (*: Symbol of Statistical Significance)

Table (7) shows that the coefficients of polymer, copper, and gold commodities (cash and futures) are positive and significant, implying that these commodities are a strong safe haven for the stock market. Chemical commodities and other petroleum products have negative and significant coefficients, indicating that they are not a safe haven for the stock market. Other coefficients are not statistically significant.

## Conclusion

This study sought to answer the question, "Does investing in commodities during different volatility periods in the stock market serve as hedging or a safe haven?"

As a result, to respond in this regard, this study used market test regression models and examined daily data from the stock and commodity markets from 21/03/2009 to 19/03/2020. The researcher tested both hypotheses of hedging and safe-haven by commodities using these models simultaneously. This study is one of the first to investigate the relationship between commodities and the stock market (Stock Index) regarding hedging and commodities as a safe haven for the stock market. The findings are summarized below:

- According to the findings of the market test model (1), gold coin futures contracts are regarded as a strong safe haven for the stock market, but they lack hedging characteristics. Thus, for investors who added gold to their stock portfolio, gold profits can offset the likely loss during abnormal market conditions.

- According to the results of the market test model (2), during periods of low market return, gold commodities, and other petroleum products had an inverse relationship with the stock market returns, indicating the strong safe-haven nature of these commodities during times of low market return. Polymer, copper, and gold commodities (cash and futures) have a monotonic relationship with the stock market returns during the crisis (sanctions). It denotes that during periods of high inflation, when stocks may perform poorly or slowly, these commodities have the potential to cover the risk of inflation and can be regarded as a strong safe haven for this market1.

Gold represented a safe-haven characteristic for the stock market returns in all market test models, and it can serve as a stabilizing force for the financial systems by reducing the casualties against the extreme adverse shocks in the market. Nonetheless, it cannot adequately protect the stock market during regular times. 2 (Consistent with: Shakil & et al, 2018; Ciner & et al, 2013;

[1] Per the results by Baur and McDermott (2010), all assets move in the same direction during adverse uncertainty periods. Periods of sanction in Iran can be categorized as this class.

[2] These findings are consistent with Safialdini and Rahnamye Roodposhti's (2018) findings. They contended that in the case of determining the regime, gold is a strong safe haven for the stock exchange only in the short term, while in the case of failure to determine the regime, it is regarded as a weak safe haven. However, the results contradict Hosseinzadeh's findings (2019). This contradiction could be attributed to the study's use of a different time interval, method of determining different regimes, or long-term cycles (monthly).

Creti & et al, 2013). In general, the finding showed that commodities cannot be considered strong hedging during normal stock market conditions because they can negatively correlate with the stock market and only function as a safe haven in exceptional circumstances. Commodities can thus be used as risk management tools during economic and financial crises, and in terms of hedging, the commodity market performed poorly compared to the stock market.1 (Consistent with: Baur & McDermott, 2010; Wang, Lin & Li, 2013; Franch & Shehabi, 2016). According to the findings, hedging is only sometimes a safe haven for the stock market and vice versa.

Based on the research findings, stock market investors are advised to consider the various volatility periods in the stock market when implementing hedging and commodity diversification strategies in their portfolios. Accordingly, they can make the best decision in terms of investment type in light of the various political and economic conditions. Subsequent studies can be conducted to expand on this research by employing different types of other commodities, a portfolio of commodities, or other nonlinear methods.

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[1] Baur and McDermott (2010) believe that the effect of a safe haven does not exist in emerging markets (instead of searching for an alternative asset to disappear their concerns, the investors in these markets can quickly reduce the stock concerning the average). That is, investors in emerging markets, such as Iran, are not among the key players who determine the global price of gold, and their actions have no bearing on the global price of gold. As a result, the assumption that Iranian capital market investors have a proportionate influence on the global gold price appears irrational (Safialdini & kamelniya, 2012). Therefore, it is only reasonable to pay attention to the price of gold in the domestic markets of each country.

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