Evaluation of investing risk in gold, compared with the stock

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ABSTRACT

This study aims to investigate and compare the investment risk between the gold and the stock using Value at Risk (VaR) measure. It is one of the known methods to measure, forecast and manage the risk and has been of interest in recent years to financial institutions. The VaR is a method for assessment and identification of risk, which makes use of standard statistical techniques applied ordinarily in other areas. This investigation is seeking to find an appropriate solution for managing the risk of investment in the stock exchange and the precious metals (gold) and to select an optimal portfolio using the concept of VaR. Finally, the optimal volume of investment in the stocks and the gold is determined.

1. Introduction

Considering the aforementioned issues, it seems necessary to investigate and compare the risk of investment in the gold and the stocks. Therefore, it will be attempted in this study to examine and compare the investment risk in the gold and the stocks using statistical correlation techniques and approaches and applying VaR measure.

The gold as a precious metal has been always of a great attention to the human. This metal has played a leading role in the progress of economic and social aspects of societies for many years. Many factors affect the price of gold, and their resultant has acted variously during different periods. The world wars, increased unrest and geopolitical tensions have been the political factors effective in the price of gold. Among the economic factors affecting the gold price changes, we may suggest to changes in oil price, baking interests and fluctuations in the value of Dollar against all other currencies.

Considering the aforementioned, the main research question is formulated as "how much is the measure and estimate of the risk level of investment in a precious metal (gold) and the stocks in Iran?

Literature Review

Naderi (2013) investigated the swinging effects of futures market of gold coin on its cash market in Iran. They first analyzed statistically the performance of futures contract market and then, tested the research hypotheses, using daily data in the period 2006-2013 and econometric techniques of GARCH models. The results of estimating the econometric models and statistical analyzes suggest that the introduction of trading tolls in the future contracts of the gold coins have caused larger fluctuations in the gold cash market in Iran.

Hung et al (2008) examined the effect of error terms process with fat tail on the accuracy and efficiency of one-day estimate of VaR, using NGARCH, TGARCH and GARCH models on daily prices of five oil; products. The results of this study show that the estimation of HT GARCH at low and high confidence levels for the leptokurtic returns with fat tail is done with a high accuracy. Furthermore, the result achieved though bias testing of relative comparisons of averages indicates that HT GARCH among all other models at high confidence level enjoys the greatest efficiency.

Felix Chan (2009) introduced a new method to forecast VaR with maximum entropy density. In GARCH model, the parameters can be estimated by maximum estimation likelihood with normal density even when the efficiency distribution is abnormal. This indicates that it is possible we gain access to aligned estimates of standard residuals, which may be used to estimate normal distribution using maximum entropy density. This method will provide more accurate prediction of VaR.

In this section, some experimental studies on the prediction of financial variables are suggested. The common point between such studies is the advantage of non-linear methods on linear ones.

Peyrovi&Gorgani (2012) have investigated the determination of optimal amount of investment focused on the relationship between the exchange markets of the gold and the foreign currency with an approach to VaR. For this purpose, the efficiency border of investor was calculated using the data index of the above assets in the period March 2004 to February 2011. The results suggest that the

maximum weight of investment in Dollars is allocated at the lowest level of risk and the minimum weight of investment in BaharAzadi Coin will happen at the highest level of risk, due to higher efficiency.

Moreover, the results related to weight of investment in the Tehran Stock Exchange (TSE) suggests that the investment in this market is not suitable due to high risk and low efficiency.

Fallahtalab and Raei (2003) have investigated the Mont Carlo Stimulation and Random Walking methods to forecast VaR. In this study, we introduce Mont Carlo Stimulation method based on random walking approach in evaluation of VaR. Then, we make use of this method to forecast VaR of TSE index and five sample stocks of this market and compare the results by two methods of historical stimulation and variance-covariance. The results of the study show that the Mont Carlo Stimulation method is reliable particularly at high levels of confidence and has higher qualification in fore casting the VaR if the assets under study.

Arman &Raoofi (2013) carried out an investigation on the evaluation of the predictability of gold prices as well as the comparison of linear and non-linear methods. The results showed that the difference between the prediction of non-linear methods and linear methods of ARMA.

Research Purposes
The main purpose of this study is to investigate and compare the risk of investment in the precious metals (gold) and stocks in Iran.

Research Questions
1- How is the optimum portfolio of the combination of the assets?

Research hypotheses

1- The combined rate of the gold and the stocks is effective in the optimum portfolio combination.

Methodology
This investigation is considered a descriptive-fundamental study in terms of analysis level and it is an applied research in the application of the results. It examines the effects of investigating and comparing the investment risk in the gold and the stocks, using VaR measure. This study was performed on the period 2010-2013. The data collected concerning the coin price in the mentioned period is gathered and the VaR model is used to measure the risk.

The Statistical Population
The statistical population of this study consists of the BaharAzadi gold coin and the stocks (Stock Market). The data so collected in this research include the daily numerical value of the stock market as well as the prices of BaharAzadi coin gained from IRI Central Bank and TSE website, using NovinRahavard software for the period 2010-2013.

Procedures and Design
In this investigation, the sample is firstly selected among the statistical population, considering the predetermined conditions in terms of time and locative aspect (2010-2013) and the Rahavard software and the econometric methods of GARCH time series with t distribution is used to collect data for calculating the risk. Since it requires analyzing the

data, Excel spreadsheet software is used and the Eviews and Stata software is applied to do statistical test. The data analysis is conducted by the econometric method.

Therefore, we continue to explain the following procedures.

An Introduction to the Research Statistical Tests
In the present investigation, the inferential statistics will be applied to achieve the research results. In this type of statistics, a small group the population is selected and the related hypotheses of the researcher about them are examined. Then, to generalize the results from the sample to the population, a series of statistical tests are done. Afterwards, we suggest to the statistical tests used in this investigation.

T-test
The t-test is used to examine the significance of the calculated coefficients, correlation coefficients and regression models. The t-distribution is very similar to z-distribution. However, some differences are found between these two distributions. As an example, Z quantity distribution is normal, while t quantity distribution is affected by the number of the subjects. The t-distribution is applied for small samples; the greater the quantity of the samples, the distribution form is closer to the normal curve. When the sample size reaches 30, it will be equal to normal distribution. According to t-test, if the calculated significance level is less than 5% (significance level equal to 5%). In this case, the calculated values are statistically 95% significant.

Correlation: it is a measure for determining the level of correlation between the two variables; the examination of this issue that whether a changed variable will expose another variable to change or not? The statistical index, which shows the correlation between the variables, is called correlation coefficient that may be determined using the regression, because the correlation coefficient mark is identical to the mark of regression line slope. It means that if the regression line slope is positive, the correlation coefficient will be positive to, and if the regression line slope is negative, the correlation coefficient will be negative as well. Furthermore, if the regression line slope is zero, the correlation coefficient will became zero too.

Unit Root Tests and Durability
Application of traditional and common econometric methods in estimating the model coefficients by using time series data is based on the assumption that the model variables are durable. Identification of the existing random process in a time series is simply possible through the unit root (generalized) tests. To explain the "root unit" more simply, consider firstly the non-random mode. Assume that Yt has an equation as follows (Soori, 2013).

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \cdots + \phi_p Y_{t-p} + \mu$$

This is a differential equation, the response of which is as follows:

$$Y_t = c_1 \lambda_1^t + \cdots + c_p \lambda_p^t + \frac{\mu}{1 - (\phi_1 + \phi_2 + \cdots + \phi_p)}$$

Iλs are called "characteristic roots" which is calculated by the following characteristic equation:

$$\lambda^p - \phi_1 \lambda^{p-1} - \phi_2 \lambda^{p-2} - \cdots - \phi_{p-1} \lambda - \phi_p = 0$$

Now, for simplicity, consider the first-order differential equation:

$$Y_t = \phi Y_{t-1} + \mu$$

The characteristic equation and its root consist of:

$$\lambda - \phi = 0 \qquad \Rightarrow \qquad \lambda = \phi$$

And, the response of equation is

$$Y_t = c_1 \lambda^t + \frac{\mu}{1-\phi} = c_1 \phi^t + \frac{\mu}{1-\phi}$$

Therefore, the characteristic root is equal to φ. However, the characteristic root shall be opposite to (λ=φ≠1), because otherwise the phrase $\frac{\mu}{1-\phi}$ cannot be defined. But if the characteristic root is equal to 1, the response of differential equation is as follows:

$$Y_t = c_2 + \mu t \qquad , \qquad \lambda = \phi = 1$$

If we assume that 1≥φ, as 1>φ and Ø=1 have been defied.
We examine the tests including:

1. Generalized Augmented Dickey Fuller (ADF) test
2. Phillips–Perron (PP) test

The related statistic for Generalized ADF test is as follows:

$$\Delta y_t = \alpha + \beta t + \delta y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \varepsilon_t$$

Phillips &Perron (1998) show that if the test statistic for the test is $=1$, when the u(s) in similar forms are not distributed independently of each other, this statistic will have a different extreme distribution.

Phillips &Perron (1998) suggested a non-parametric method to control serial correlation in order to test the unit root. The PP method does the generalized ADF test with an adjusted t-ratio in a wat that the serial correlation does not affect asymptotic distribution of t-statistic. Thus, the PP statistic is introduced as follows:

$$\hat{t} = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\widehat{\alpha}))}{2 f_0^{\frac{1}{2}} s}$$

Where $\widehat{\alpha}$ is the estimated coefficient of AR(1), t_α is the same ratio of t for α , Se($\widehat{\alpha}$) is the standard error and the s is the regression standard error. Moreover, γ_0 is an estimation of the adaptability of errors variance. The term f0 is an estimation of the spectral density of the error values in zero frequency.

In most of the cases, the theory of being durable and non-durable as well as serial unit root (serial auto-regression) are tested. Adoption of the unit root test (ADF) for the theory of being durable depends on the fact that the null hypothesis based on being a serial unit root is rejected. Most of the unit root tests have a low testing power against durability and accordingly, the null hypothesis is usually conformed. In most cases, this conventional approach rejects the durability of the series by mistake. The most important argument in using the test for durability null hypothesis is that it is believed that controlling the size of this statistic is very difficult when this process is durable; namely, the size of the statistic is calculated larger than the real size.

Results

Now, the basic purpose of this investigation is to compare the investment risk in two markets that is shown by the following diagram.
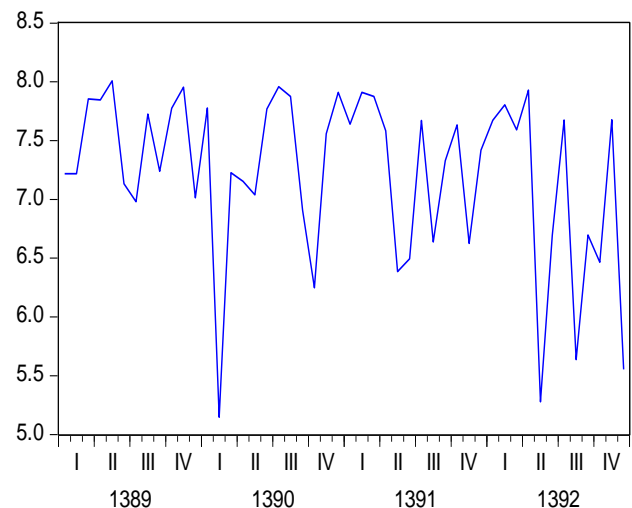

VAR_GOLD
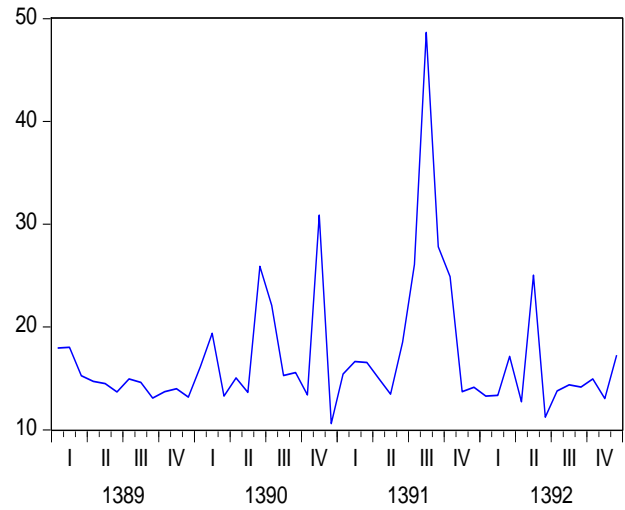
VAR_STOCK

Diagram 5: A comparison between the two markets

As shown in this diagram[*], the level of volatility in both markets is considerably high. The risk in the stock exchange has been always high and sometimes, its value has decreased. However, the opposite is true for the gold market. It is likely interpreted that as the gold market is stable and depends on the world price of the gold, it has little sudden changes and the investment in such market involves in lower risks. On the other hand, the stock exchange suffers a high volatility, because it has no certain mechanism and the general index will decline or rise by the smallest economic and political changes inside the country; this issue will increase the risk in this market. However, we cannot comment on the comparison of the risks of these two markets on the risk diagram. Therefore, the variance of both markets shall be examined that is calculated as follows.

One of the research purposes was that whether the increased investment risk will decrease the investment risk in the stocks or not. To answer this question, the risks of both

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[2] As the price values in both markets and accordingly their numerical value of risk are very different , these two markets cannot be depicted in a diagram and they have examined in two separate diagrams

variables are estimated together, the results of which is shown in the following table:

Table 8: Estimation of the investment risk in the stocks on the investment risk in the gold

Dependent Variable	Independent Variable	Coefficient	Standard Error
Stocks Risk	Gold Risk	-0.013	0.016
Stocks Risk	Intercept	7.43	0.3

The results of this table suggest that the investment risk in the stock exchange and the investment risk in the gold are inversely related; an increase of 1% in the gold risk will bring a decrease of 0.013% in the stocks risk. Furthermore, the stocks risk has an intercept of 7.43 that is higher than that of the gold risk. The equation of the above table is as follows:

(8) VaR_stockt = 7.43 + (-0.013) * VaR_goldt + ε 't

Another purpose of this investigation is to obtain the optimal portfolio through combining the two products; namely, how much capital we can invest in the stocks market and the gold market. To do this, the following equation is written:

The overall form of the optimal portfolio consists of two products as below:

(9) rp = w1 r1 + w2 r2

Where rp is the retrn on the portfolio;

w_1 is the weight or usage rate of the product 1;

r_1 is the returns of the product 1;

w_2 is the weight of the product 2;

r_2 is the returns of the product 2;

And, $w_1 + w_2 = 1$.

As it is said, we are seeking to calculate w_1 and w_2.

In the next stage, we shall calculate the variance of the related portfolio.

(10) $\sigma_{r_p}^2 = \sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2cov(r_1, r_2) * w_1 w_2$

Where $\sigma_{r_p}^2$ is the variance of the portfolio returns;

σ is the variance of the product;

w is the weight or the usage rate of the product; and

$cov(r_1, r_2)$ is the co-variance of the returns of both markets.

Since $w_2 = 1 - w_1$, then we use $1 - w_1$ instead of w_2 and solve the equation 10. To solve this equation, as you can see, we differentiate w_1 from the equation after placing w_2 in order to gain the maximum variance. The rate of w_1 is calculated and is deducted from 1 in order to determine the rate of w_2. The value of the calculated variance and covariance is as follows:

Table 6: the table of variance-covariance

	Returns on the gold	Returns on the Stocks
Returns on the gold	111.52	-3.4839
Returns on the Stocks	-3.4839	32.02

Then, the equation 10 is written as followings:

(11)
$$\sigma_{r_p}^2 = 111.52\, w_1^2 + 32.02\,(1 - w_1)^2 + 2 * (-3.4839) * w_1(1 - w_1)$$

For calculating the rate of w_1, we shall differentiate from this equation in proportion to w_1. The value of w_1 is 0.41. Then, the rate of w_2 is 0.59. the result show that it would be better for the investor to invest 41% of his/her assets in the gold market and 59% in the stocks market.

Therefore, using this portfolio and the variance value gained from the two markets according to the table 9, it can be said that the investment in the gold market has the higher risk than that in the stocks market.

Finally, the VaR for the portfolio is calculated as follows:

$$VAR = \sqrt{VAR_i \times VAR_J \times P_{ij}}$$

$$AR = \sqrt{(\sigma t * 1.96) - 3.7506 \times (\sigma t * 1.96) - 2.667689 \times P_{ij}}$$

Discussion and Conclusion

The results showed that the level of volatility and investment risk in the gold market is higher than that in the stocks market; that is because the gold market variance is very higher than that of the stocks market. On the other hand, the share of the stocks product in the optimal portfolio of the investor is greater than that of the gold product. Then, it can be concluded that the risk in the gold market is very higher than that in the stocks market.

Suggestions

Suggestions of the applied research findings

The users of this study can make use of the model applied in this investigation for further examination of and estimation of different financial markets and comparison of the risks in both markets. In fact, the significance of modeling and estimation and the way to work with this model is particular to the students of financial and accounting majors. However, brokers and activists in the field of financial markets can take advantage of the results of this study and the similar ones. This issue will cause to improve the financial markets and will boom the business. Therefore, indeed, this investigation can be used by the students of financial majors and the activists in such markets.

Suggestions for further studies

The interested people as well as the students and activists of the financial markets are suggested to compare the risk of other markets in order to find an appropriate pattern for investment. There are many financial markets for comparing and examining their performance, including the gold price, coin price, commodity exchange, futures exchange, oil market, gas market, energy exchange, currency market, etc. A comparison between these markets can take a great importance in terms of both modeling and the results. Furthermore, it is suggested that such investigations will be carried out by different economic and financial models in order to compare the models and identify the best and most efficient one.

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