THE EUROPEAN JOURNAL OF APPLIED ECONOMICS

EJAE 2019, 16(1): 41-58
ISSN 2406-2588
UDK: 330.322:339.722(4)
336.76
DOI: 10.5937/EJAE15-19652
Original paper/Originalni naučni rad

GOLD IN INVESTMENT PORTFOLIO FROM PERSPECTIVE OF EUROPEAN INVESTOR

Tijana Šoja

Central Bank of Bosnia and Herzegovina,
Sarajevo, Bosnia and Herzegovina

Abstract:

Gold is a unique asset, highly liquid, but scarce and limited. It is a luxury good and can be considered an investment opportunity. Gold is an asset which does not carry counterparty risk – there is no associated credit risk. Due to these characteristics, gold represents a significant asset, and has a fundamental role in investment portfolios. These circumstances increase the interests of investors to include gold in investment portfolios, especially during times of financial crisis. If an investor decides to include gold in investment portfolio, it is necessary to evaluate the portion of gold in the portfolio considering risk aspect, return and diversification. In this research, a hypothesis was tested and confirmed that gold offers good diversification for the investment portfolio, which implies that gold is a desirable asset in the investment portfolio.

This research is focused on developing an optimal portfolio that combines the Eurozone bond index with the investment grade rating from 1 to 10 years (EG05), the stock index Euro Stoxx50 and gold using the Markowitz methodology. The result showed that optimal portfolio should include gold with a share between 1% to 9%, depending on the risk that the investor is willing to accept.

Article info:

Received: November 23, 2018
Correction: December 28, 2018
Accepted: January 31, 2019

Keywords:
gold,
investment,
portfolio,
crisis.

INTRODUCTION

Throughout history, gold has always had a noticeable reputation and different characteristics: it held the role of a global currency, it was sometimes seen as goods, sometimes as a financial asset and, of course, as jewellery. During the rapid development of the global financial market in the 1980's and 1990's, gold became an increasingly attractive investment. Moreover, the last financial crisis in 2007/8 and the debt crisis in Europe in 2010 increased the interest of investors for gold. Investors want gold in their portfolios for many reasons. Some investors invest in gold in order to realise profit from the

*E-mail: tijana_soja@yahoo.com

growth of the price of gold and take into account the limited supply of gold that can affect the price increase. Other gold investors consider it a strategic asset and a long-term investment because of the specific characteristics of this investment asset.

Financial crises, such as the global crisis 2007/8, increase the demand for safe assets like gold, as it is perceived as an asset that preserves its value and provides a high level of security in times of crisis. In addition, gold plays an important role in improving portfolio performance, portfolio diversification, and could reduce overall portfolio risk. Due to these characteristics, it is argued that gold is a desirable instrument in financial portfolios.

Previous research claim that asset class commodity could be the answer to many problems in investment activity today, and investment problems that the investment world faces. Because of the low correlation between commodity and bonds, equities and inflation, investment in commodity, such as gold, could be an valuable component in investment portfolios (Idzorek, 2006; Conover *et al*., 2010). Gold is also considered an asset which can offer inflation hedge due to its low or negative correlation with inflation and currency devaluation. During times of inflationary pressures, the price of gold generally increases in order to balance inflationary consequences and hold purchasing power (Erb & Harvey, 2013).

Academic studies have also shown that gold is an attractive investment, especially as an investment vehicle to diversify portfolios. Conover *et al*., (2009) but also Daskalaki & Skiadopoulos (2011) have shown that investment portfolios which include precious metals, like gold or silver, demonstrate a better rate of performance than portfolios without them.

Obviously, there is evidence that gold, as a financial asset, has an important role in diversifying investment portfolios and can improve their performance. In such circumstances, it is useful to research the role of gold in European portfolios during and after the financial crisis of 2007/8. It was found that there is a gap in research, which examined the optimal share of gold in investment portfolios during the pre-crisis and post-crisis period, but also research papers that mainly focused on European investors.

The aim of this study is to explore the optimal share of gold in investment portfolios from the perspective of a European investor. The optimal share of gold in the investment portfolio is being examined from a European investor perspective that invests in portfolios which contain three instruments: Eurozone government bonds, shares of European companies, and gold. Previous research has shown that a low correlation between these assets could improve portfolio performance, and we will therefore explore what an optimal share of gold in such an investment portfolio would be.

Bearing this in mind, the hypothesis that gold offers a good diversification for investment portfolios, thus implying that gold is a desirable asset in portfolios, will be examined in this research. The starting point is the assumption that the investor does not have a high-risk appetite, and prefers a lower risk portfolio. The empirical research is focused on the period from January 2000 to December 2017. Monthly data were used for the analyzed instruments, as follows:

- The EG05 index, which includes investment grade government bond maturity from 1 to 10 years,
- The Euro index Stoxx50, representing the top 50 shares of the best-performing companies from eleven Eurozone countries, and
- The price of gold expressed in dollars.

The desired share of gold in investment portfolios is estimated throughout two periods: from January 2000 to December 2017, and during the global crisis from January 2007 to December 2017. For portfolio construction and examining the optimal share of gold in investment portfolios, the modern portfolio theory proposed by Markowitz will be used.

This research is divided into several thematic units: literature review, research methodology, research findings, analysis, and concluding remarks.

LITERATURE REVIEW

The role of gold in investment portfolios and the need to be included in investment portfolios, are interesting and current topics. According to Hillier *et al.* (2006), the existing literature that treats the role of gold in portfolios and the role of gold as an investment, can generally be classified into several areas, thus, gold is analyzed as a form of hedging, as an instrument of portfolio diversification, its connection with macroeconomic factors and gold production and its characteristics. From the perspective of this research, our focus will be on the role of gold in investment portfolios, so gold will be observed as a financial asset.

Usually, investors diversify portfolios through two key assets, *i.e.* stocks and bonds (Idzorek, 2006). However, with increased globalization, research has shown that the correlation among primary assets has observed a steady growth (Idzorek, 2005; Johnson & Soenen, 1997). As a result,, investors did not enjoy a high degree of portfolio diversification and their investments were not protected enough from the financial market turbulence (Ratner & Klein, 2008; Bernhart *et al.*, 2011).

Economic and political crises have influenced investors to include assets with a lower correlation with shares and bonds in portfolios, in order to diversify them. In this context, the idea of including new assets, such as gold, in portfolios with the aim of diversification, is desirable.

Numerous analysts consider gold a good alternative to diversification, due to its low correlation with traditional assets (Idzorek, 2006; Conover *et al.*, 2010). Gold is often perceived as a "safe haven" and as an asset that protects wealth and value in times of inflation, resulting from a low correlation of gold with market trends (Clapperton, 2010; Conover *et al.*, 2009).

During periods of global uncertainty, many investors choose to invest in gold because it is regarded as a safe investment. In addition to this, the rise in the price of gold, which has been present since 1999 through 2012, has led to a 15.4% annual return on gold investment. This is a far greater return than offered by shares in the U.S. (return of 1.5%) and bonds (return of 6.4%) over the same period (Fernando, 2017).

Researchers have a different stance towards gold as an investment option. Some researchers highlight negative attitudes to gold in investment portfolios, while some have a positive view about gold and its role in portfolios. Investors, such as Warren Buffett, believe that gold is a non-productive asset that increases fears among its investors. He considers that the rise in gold prices from 2010 to 2012 was a "balloon", and compares it to the 17th-century Tulipomania, the dot-com crisis in the 1990's and the latest crisis of 2008. Numerous sceptics of gold generally support Buffett's claims (Fernando, 2017).

The World Gold Council–or WGC (2018) highlights that gold is a highly liquid, scarce asset and is no one's liability. Moreover, gold is a luxury good, but also an investment. Because of these characteristics, gold can have a very important, even fundamental, role in investment portfolios. By adding gold to investment portfolios, investors can increase diversification but also enhance risk-adjusted returns. The WGC (2018) found that US dollar institutional investors, by adding 2%, 5% or 10% in gold, have increased returns and reduced volatility. Their analysis also showed that, for most US dollar investors, holdings between 2% to 10% of gold can improve portfolio performance.

The majority of researchers and analysts point out that gold is an attractive asset, and represents a good basis for portfolio diversification. Researchers have shown that portfolios containing precious metals, such as gold and platinum, have recorded significantly better performances than standard stock portfolios without gold (Conover *et al.*, 2009; Daskalaki & Skiadopoulos, 2011; Hillier *et al.*, 2006). Nevertheless, advocates of gold-inclusive portfolios suggest that gold can minimize the standard deviation of the total portfolio risk, reduce volatility, and boost returns (Merk Investments, 2012).

Gold can be the valuable asset for diversification - even a small share of gold in the portfolio, between 1% and 3%, can significantly reduce the overall portfolio risk (Michaud *et al.*, 2011). Research

conducted during the 1980s', such as Sherman (1982), suggest that the 5% share of gold in the stock portfolio resulted in lower risk and higher returns. Lucey *et al*. (2006) examined the structure of portfolios, investors, and their focus on finding optimal portfolios, and demonstrated that the optimal portfolio has 6% to 25% of gold, depending on the period of investment.

Numerous evidence suggest that gold can serve as a safe haven and an asset that provides a high degree of protection against inflation and currency depreciation, as observed over a long period of time (Baur & Lucey, 2010; Conover *et al*., 2009; Ghosh *et al*., 2004; Capie *et al*., 2005; Joy, 2011). Similarly, Pullen *et al*, (2014) demonstrate and confirm that gold represents good protection in periods of financial disasters.

Baur and Lucey (2010) studied constant and time-varying relations between the U.S., the U.K., and German stock and bond returns and gold returns in order to explore gold as a hedge and safe haven. They found that gold, on average, is a safe haven in extreme stock market conditions, but did not found that gold is a safe haven for bonds at any analyzed market.

As we can see from previous research, there is a lot of evidence that gold represents a good basis for diversification portfolios. Furthermore, there are many papers on U.S. portfolios and role of gold, but not those on European investing in EUR financial instruments (bonds and shares). Additionally, there is lack of research on the optimal role of gold in EUR portfolios during and after crisis 2007/8. Considering all the abovementioned, this research will show that gold has a significant role in EUR investment portfolios, and can be used for diversification.

METHODOLOGY

The role and share of gold in portfolios was analyzed for the period from January 2000 to December 2017. The analysis includes the following instruments: Eurozone government bond index (EG05), Euro area stocks (Euro Stoxx50), and gold. All data is on a monthly basis, *i.e*., the analysis includes the value of each instrument at the end of the month. Firstly, a monthly return for each instrument is calculated using the following expression (Bodie, *et al* 2014):

$$R_t = \ln\left(\frac{p_t}{p_{t-1}}\right)$$

Rt represents a return, *ln* is the natural logarithm, p_t is the value in the current period and p_{t-1} is the value in the previous period. Complete portfolio optimization was carried out based on the data on the monthly return of analyzed instruments.

The average of return, necessary for the analysis, is calculated as follows:

$$x = \frac{x_1 + \ldots x_n}{n}$$

The standard deviation as a measure of the dispersion of the return, *i.e*., the deviation of the individual return from the middle value, was calculated using the following expression (Bodie, *et al* 2014):

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^2}$$

For calculating the *VaR* it is important to consider the observation period, as well as the confidence interval. Parameter *VaR* is known as the method of variance and covariance, and the formula for calculating parametric *VaR* is the following (Bodie, *et al* 2014):

$$VaR_{x,a} = -z_a \cdot \sigma \cdot S$$

In the above formula, z_a represent the quantile order α of standardized random variables, S is the value of the position being calculated. VaR was calculated with a confidence interval of 95%. The optimal portfolio is determined using the Markowitz method, or a modern portfolio theory. This theory involves the calculation of correlation and covariation among the instruments included in the portfolio, as well as the calculation of the expected return and portfolio risk.

The expected return of the portfolio is calculated using the following expression (Levišauskait, 2010):

$$E_{r(p)} = \sum_{i=1}^{n} w_1 \cdot E_{i(r)} = w_1 \cdot E_{1(r)} + w_2 \cdot E_{2(r)} + ... + w_n \cdot E_{n(r)}$$

where the following applies:

$E_{r(p)}$ - Expected portfolios return

$E_{i(r)}$ - The expected rate of return on a financial instrument

w_i - The share of the value of the portfolio that is invested in financial instrument i

n - Number of financial instruments in the portfolio

In order to deploy an efficient portfolio, it is necessary to calculate the covariance that measures how two variables move together – whether to move in the same direction, so they have a positive covariance, or move in a different, opposite direction, so they have a negative covariance. Covariance is calculated as follows (Bodie, *et al* 2014):

$$\text{Covariance}\,(A,B) = \frac{\Sigma\,(R_A - \overline{R_A})(R_B - \overline{R_B})}{N}$$

where the following applies:

R_A – Return of instrument A (the same holds for instrument B)

$\overline{R_A}$ – Average return for instrument A (the same hold for instrument B)

For the next step, it is necessary to calculate the correlation between the instruments in order to determine the strength of the relationship between the instruments in a portfolio. The correlation should be used in conjunction with the covariance, and is represented as follow (Bodie, *et al* 2014):

$$\text{Correlation} = p = \frac{Cov\,(A,B)}{\sigma_A\,\sigma_B}$$

where the following applies:

Cov (A,B) – Covariance between instrument A and instrument B

$\sigma_A\,\sigma_B$ - Standard deviation of A and B

The portfolio risk that consists of three securities (A, B and C) can be calculated as follows (Levišauskait, 2010):

$$\sigma_P = (w_A^2 \cdot \sigma_A^2 + w_B^2 \cdot \sigma_B^2 + w_C^2 \cdot \sigma_C^2 + 2\,w_A w_B w_{AB} + 2\,w_A w_C w_{AC} + 2\,w_B w_C w_{BC})^{1/2}$$

where the following applies:

w_A, w_B, w_C - Share of initially invested values of financial instruments A,B and C *(w_{A+} w_B+w_C= 1)*

$\sigma_A, \sigma_B, \sigma_C$ - Standard deviation of financial instruments

RESULTS OF RESEARCH

This research has observed and analyzed during the period from January 2000 to December 2017, and the period from January 2007 to December 2017. All calculations are made for these two periods in Excel.

In the first step, all data are analyzed and demonstrated using descriptive statistics. *Var*, as an initial measure of risk, was calculated. The results are shown in Table 1:

	EG05	EURO STOXX50	Gold
Mean	0.36%	-0.02%	0.82%
StDev	0.81%	5.25%	4.87%
Freq<0	31.94%	46.30%	44.91%
Parametric VaR	-0.97%	-8.66%	-7.19%

Table 1. Descriptive statistics and VaR for the period 01.01.2000 - 31.12.2017
Source: Authors' processing

Descriptive statistics were calculated in Excel. All data are calculated for the period from 01.01.2000 until 31.12.2017. The same date were used for the calculated parametric VaR. It is important to emphasize that parametric VaR assume normal distribution. During the period from January 2000 to December 2017, the average return on the index of government bonds EG05 was 0.36%, the Euro Stoxx50 had a negative return of 0.02%, while gold had the highest return of 0.82%. The standard deviation, as a risk measure, was observed at the highest level with shares at 5.25%, followed by gold at 4.87%. Bonds carry a significantly lower standard deviation; thus, they are considered less risky instruments.

Frequency (*Freq*) shows the number of observations that are less than 0, and demonstrates returns that are less than 0%, divided by total observations. This implies that this data shows a return share that is less than 0% during the analyzed period.

The data show that the lowest returns below 0% in the analyzed period were recorded in bonds (EG05), where the frequency of negative return has a share of 31.94%, while the largest share of negative returns was recorded in the stock index, where this figure is 46.30%.

VaR as a risk measure is at the lowest level in bonds, which is further evidence that it is one of the safest instruments of investment.

Descriptive analysis and VaR for the period from January 2007 to December 2017 was calculated in the same way as a previous analysis. The data are presented in Table 2:

	EG05	**EURO STOXX50**	**Gold**
Mean	0.33%	0.01%	0.69%
StDev	0.85%	5.14%	5.33%
Freq<0	34.09%	46.97%	46.21%
Parametric VaR	-1.07%	-8.44%	-8.09%

Table 2. Descriptive statistics and VaR for the period 01.01.2007-31.12.2017
Source: Authors' processing

During the crisis period, gold again had the highest average return of 0.69%, while the shares again had the lowest return of 0.01%. Bonds, once more, showed the highest degree of security, considering the data on standard deviation, VaR, and the frequency of negative returns.

For the next step, a return correlation is calculated among the analyzed instruments, as shown in Table 3:

	EG05	EURO STOXX50	Gold
EG05	1		
EURO STOXX50	-0.22	1	
Gold	0.08	-0.09	1

Table 3. Correlation for the period 31.01.2000 - 31.12.2017
Source: Authors' processing

Correlation analysis shows almost no correlation amid gold and other financial assets. The difference between the bond index EG05 and gold correlation is only 0.08, while between the stock index EuroStoxx50 and gold correlation it is slightly negative, at -0.09.

The correlation between the analyzed data for the crisis and post-crisis period is shown in Table 4:

	EG05	EURO STOXX50	Gold
EG05	1		
EURO STOXX50	-0.07	1	
Gold	0.09	-0.09	1

Table 4. Correlation for the period 31.01.2007 - 31.12.2017
Source: Authors' processing

In this period, the correlation is almost 0 for all analyzed instruments. Moreover, there is a similar correlation over a longer period of time, as shown in Table 3.

After calculating the correlation, the covariance among the analyzed instruments was taken into consideration. The covariance matrix is shown in Tables 5 and 6:

	EG05	EURO STOXX50	Gold
EG05	0.0078%	-0.0093%	0.0062%
EURO STOXX50	-0.0093%	0.2749%	-0.0221%
Gold	0.0062%	-0.0221%	0.2427%

Table 5. Covariance matrix for the period of 01.01.2000 - 31.12.2017
Source: Authors' processing

	EG05	EURO STOXX50	Gold
EG05	0.0083%	-0.0029%	0.0065%
EURO STOXX50	-0.0029%	0.2620%	-0.0255%
Gold	0.0065%	-0.0255%	0.2871%

Table 6: Covariance matrix for the period of 01.01.2007 - 31.12.2017
Source: Authors' processing

Different portfolios were made using the covariant matrix by taking into consideration the different participation of individual instruments in the portfolio, and with the aim of finding the optimal portfolio using the Markowitz methodology.

An overview of the portfolio offering the minimum standard deviation and the appropriate return for a given level of risk or an effective set is shown in Table 7. When calculating the optimal portfolio, the risk-free rate is fixed at 0% (German Council of Economic Experts – Annual Report 2016/17). In the current low and negative yield environment in EMU, especially in Germany, which are at the moment negative, up to 7 years.

Table 7 shows data for slope, which represents the slope of the capital market line (CML) and demonstrates the point where CML has a tangency in line with the efficient set. The optimal portfolio is the one with the highest slope. At that point, there is a portfolio that has the lowest standard deviation and the lowest risk, and such is acceptable from the risk-averse investor's perspective.

Return	0.25%	0.30%	0.35%	0.39%	0.40%	0.45%	0.50%	0.55%	0.60%	0.65%	0.70%	0.75%	0.80%
Risk	1.53%	1.00%	0.83%	2.3%	0.97%	1.28%	1.71%	2.18%	2.67%	3.18%	3.69%	4.21%	4.73%
Slope	0.1634	0.3012	0.4140	0.17	0.4125	0.3506	0.2928	0.2524	0.2245	0.2045	0.1197	0.1782	0.1692
EG05	70.86%	84.21%	93.31%	33.33%	90.18%	80.24%	69.37%	58.50%	47.62%	36.75%	25.88%	15.01%	4.14%
EURO STOXX50	29.14%	15.79%	5.73%	33.33%	0.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gold	0.00%	0.0%	0.96%	33.34%	9.30%	19.76%	30.63%	41.50%	52.38%	63.25%	74.12%	84.99%	95.86%

Table 7. An overview of different portfolios, and optimal portfolio for a period of 01.01.2000-31.12.2017
Source: Authors' processing in Excel

All the calculations are made in Excel, using the Solver function. At the first step it was calculated portfolio who has the lowest standard deviation or the lowest risk.

For the second step, we chose a different rate of the returns, between 0.2% up to 0.8%, which was the maximum returns that gold had during the analyzed period (from 01.01.2000 until 31.12.2017). We therefore used returns from 0.250% and increased it up to a 5 basis point, as shown in Table 7. When determining the target return, we used Solver function to find the instrument share that offer desirable return. The average portfolio return was calculated considering the average returns of each instrument and their share in portfolios compared with the risk-free rate, which was set to 0%. The slope was calculated just as a ratio between portfolio return and portfolio risk. As we can see, we calculated a different returns rate, and show a share of each instrument in corresponding returns. We also calculated returns and risk in case that portfolio consist the same share of each instrument. In that case portfolio has a returns of 0.357% but the risk of this portfolio is 2.3% which is quite high. The same level of return investor can have with a lower risk, as it is shown in Table 7.

The results demonstrate that, from the standpoint of the risk-averse investor, the acceptable portfolio is one that offers an expected return of 0.3% with a standard deviation of 0.80%, which is represented by the tangent of the efficient set line, as shown in Figure 1:

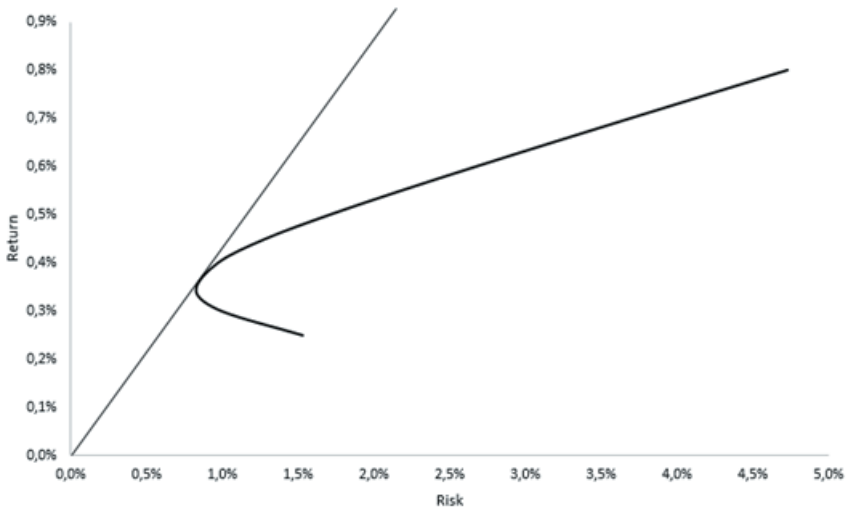

Figure 1. Efficient set for a period of 01.01.2000 - 31.12.2017
Source: Authors' processing

If an investor is risk averse, then the optimal portfolio should contain 93.3% of bonds, 5.7% shares, and the share of gold should be 1%. On the other hand, the portfolio with an expected return of 0.4% and a standard deviation of 1% can be considered an optimal portfolio. It is a portfolio made up with 90.2% of bonds, 0.5% of shares and 9.3% gold. This portfolio has a higher expected return, but also a slightly higher risk.

However, the structure of the portfolio that the investor will adopt depending on investor's risk appetite. This means that a portfolio that includes 9.3% of gold could be considered as optimal. Likewise, if an investor is ready to take on more risk, the possibility exists of including a larger share of gold in the investment portfolio.

The following phase included testing of an optimal portfolio using the same instruments for the period during the global crisis and beyond, from January 2007 to December 2017. The same calculations were used in this case. The efficient set is given in Table 8 and Figure 2:

Return	**0.15%**	**0.20%**	**0.25%**	**0.32%**	**0.34%**	**0.35%**	**0.40%**	**0.45%**	**0.50%**	**0.55%**	**0.60%**	**0.65%**	**0.68%**
Risk	**2.86%**	**2.09%**	**1.38%**	**0,88%**	**2.39%**	**0.96%**	**1.39%**	**2.01%**	**2.68%**	**3.39%**	**4.10%**	**4.82%**	**5.26%**
Slope	**0.0524**	**0.0957**	**0.1810**	**0.3590**	**0.14**	**0.3643**	**0.2880**	**0.2244**	**0.1863**	**0.1624**	**0.1462**	**0.1347**	**0.1293**
EG05	44.11%	59.94%	75.77%	94.96%	33.33%	93.51%	79.60%	65.72%	51.84%	37.96%	24.08%	10.20%	1.87%
EURO STOXX50	55.89%	40.06%	24.23%	4.11%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gold	0.00%	0.00%	0.00%	0.93%	33.34%	6.49%	20.40%	34.28%	48.16%	62.04%	75.92%	89.80%	98.13%

Table 8. Overview of different portfolios and optimal portfolio for a period of 01.01.2007 - 31.12.2017
Source: Authors' processing

Efficient set is shown in Figure 2:

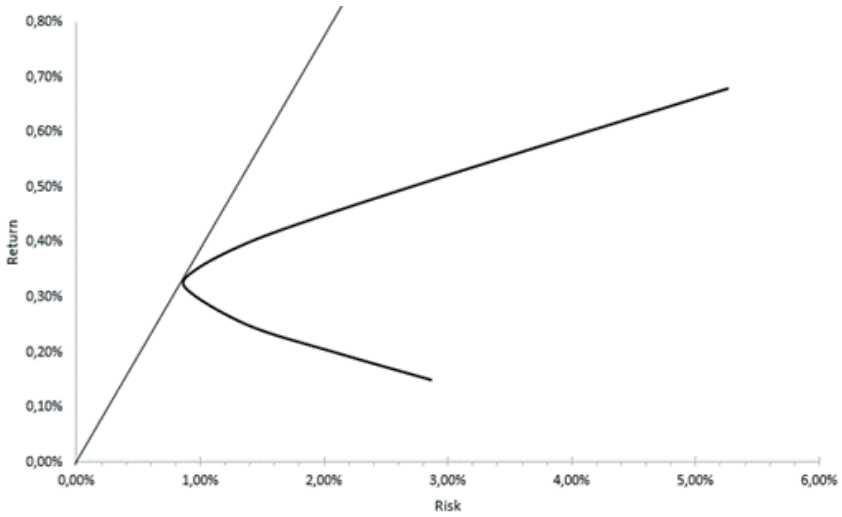

Figure 2. Efficient set for a period of 01.01.2007 - 31.12.2017
Source: Authors' processing

An optimal portfolio comprises 93.5% of bonds, 6.5% of gold, and no stock. This portfolio has an expected return of 0.35% and a risk of 0.96%. If the investor favours a somewhat lower risk, the portfolio can consist of 95% of bonds, 4.1% of shares and 0.9% of gold. These findings confirm that, during the crisis, it was optimal to include gold in portfolios.

CONCLUSION

Economic crises, turbulence, and uncertainties in financial markets emphasize the importance of risk management strategies and portfolio diversification. At the same time, it is evident that the correlation between traditional assets, shares, and bonds is increasing. If these circumstances are considered in combination with poor returns offered by the stock, it can be concluded that investors are more interested in pursuing other investment assets, such as monetary gold.

Previous research has indicated that investors have different attitudes towards the role of gold in the portfolio. Some advocate its inclusion in portfolios, while others consider it is not beneficial. Decisions to include monetary gold in the portfolio will ultimately depend on the investor, investment objectives, and the interest in portfolio diversification.

The purpose of this study was to examine whether gold has an important role in investment portfolios from the perspective of European investors that invest in traditional assets, stocks, and bonds. Three instruments were combined - bonds, stocks and gold, whereas the optimal portfolio was found by Markowitz portfolio theory. The analyzed period was from January 2000 to December 2017, while the observation period was segmented into two periods covering the entire analyzed period, from January 2000 to December 2017, and the period of global crisis and the post-crisis period, from January 2007 to December 2017. This study tested the hypothesis that gold represents a useful instrument for portfolio diversification and, as such, is a desirable instrument in investment portfolios.

Following the research results, it can be concluded that gold represents an important instrument for portfolio diversification and, therefore, shares between 1% and 9% are recommended for inclusion in portfolios. It can also be argued that it is justifiable to include gold in investment portfolios if the portfolio is combined with European bonds and stocks. Gold is a good basis for diversification portfolios, both from the standpoint of the risk-averse investor and from the aspect of the investor prepared to take a higher risk.

REFERENCES

Baur, D., & Lucey, B. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, 45(2), 217-229.

Bernhart, G., Höcht, S., Neugebauer, M., Neumann, M., & Zagst, R. (2011). Asset correlations in turbulent markets and the impact of different regimes on asset management. *Asia-Pacific Journal of Operational Research*, 28(1), 1-23. DOI:10.1142/S0217595911003028

Bodie, Z., Kane, A., Marcus, A. (2014). *Investment*. New York: McGraw-Hill Education.

Capie, F., Mills, T. C., & Wood, G. (2005). Gold as a hedge against the dollar. *Journal of International Financial Markets Institutions and Money*, 15(4), 343-352.

Clapperton, G. (2010). Raising the gold standard. *Engineering & Technology*, 5(15), 66-69. DOI:10.1049/et.2010.1514

Conover, C. M., Jensen, G. R., Johnson, R. R., & Mercer, J. M. (2009). Can precious metals make your portfolio shine? *Journal of Investing*, 18(1), 75-86. DOI:10.3905/JOI.2009.18.1.075

Conover, C. M., Jensen, G. R., Johnson, R. R., & Mercer, J. M. (2010). Is now the time to add commodities to your portfolio? *The Journal of Investing*, 19(3), 10-19. DOI:10.3905/joi.2010.19.3.010

Daskalaki, C., & Skiadopoulos, G. (2011). Should investors include commodities in their portfolios after all? New evidence. *Journal of Banking and Finance*, 35(10), 2606-2626. DOI:10.1016/j.jbankfin.2011.02.02

Erb, C. B., & Harvey, C. R. (2013). The Golden Dilemma. *Financial Analysts Journal*, 69(4), 10-42. DOI:10.2139/ssrn.2078535

Fernandno, N. (2017). *The Role of Gold in an Investment Portfolio: An empirical study on diversification benefits of gold from the perspective of Swedish investors*. *Umeå*: University

German Council of Economic Experts.

Ghosh, D., Levin, E. J., Macmillan, P., & Wright, R. E. (2004). Gold as an inflation hedge. *Studies in Economics and Finance, 22*, 1-25.

Hillier, D., Draper, P., & Faff, R. (2006). Do precious metals shine? An investment perspective. *Financial Analysts Journal*, 62(2), 98-106. DOI:10.2469/faj.v62.n2.4085

Idzorek, T. M. (2005). *Portfolio diversification with Gold, Silver, and Platinum*. Chicago: Ibbotson Associates.

Idzorek, T. M. (2006). *Strategic asset allocation and commodities*. Chicago: Ibbotson Associates.

Johnson, R., & Soenen, L. (1997). Gold as an investment asset: Perspectives from different countries. *Journal of Investing*, 6(3), 91-99. DOI: 10.3905/joi.1997.408427

Joy, M. (2011). Gold and the US dollar: hedge or haven? *Finance Research Letters*, 8(3), 120-131. DOI:10.1016/j.frl.2011.01.001

Levišauskait, K. (2010). *Investment Analysis and Portfolio Management*. Lithuania: Vytautas Magnus University Kaunas.

Lucey, B., Poti,V., Tully, E. (2006). *International Portfolio Formation, Skewness and the Role of Gold*. DOI:10.2139/ssrn.452482

Merk Investments, LLC. (2012). *The Case for Gold: Portfolio Benefits of the Ultimate Currency*. Retrieved October 28, 2018, from https://www.merkinvestments.com/gold/white-papers/downloadcaseforgold-portfolio-benefits.php

Michaud, R., Michaud, R., Ecsh, D., Schroeder, E. (2011). *Gold as strategic assets for European investor*. New York: World Gold Council.

Pullen, T., Bensen, K., & Faff, R. (2014). A comparative analysis of the investment characteristics of alternative gold assets. *Abacus*, 50(1), 76-92. DOI:10.2139/ssrn.1928591

Ratner, M., & Klein, S. (2008). The portfolio implications of gold investment. *The Journal of Investing*, 17(1), 77-87. DOI:10.3905/joi.2008.701958

Sherman, E. (1982). Gold: A Conservative, Prudent Diversifier. *Journal of Portfolio Management*, 8(3), 21-27. DOI:10.3905/jpm.1982.408850

World Gold Council. (2018). Investment Update: IMF report highlights gold's relevance. Retrieved October 28, 2018, from https://www.gold.org/goldhub/research/imf-report-highlights-golds-relevance

APPENDIX

Date	EG05	EURO STOXX50	Gold (in USD)
31.12.2017	638.241	3503.96	1302.8
30.11.2017	641.495	3569.93	1271.72
31.10.2017	640.889	3673.95	1270.34
29.9.2017	637.124	3594.85	1279.75
31.8.2017	638.318	3421.47	1316.96
31.7.2017	635.338	3449.36	1267.9
30.6.2017	633.954	3441.88	1241.61
31.5.2017	636.571	3554.59	1269.86
28.4.2017	633.943	3559.59	1268.28
31.3.2017	631.627	3500.93	1249.2
28.2.2017	633.707	3319.61	1256.37
31.1.2017	629.714	3230.68	1210.59
30.12.2016	636.44	3290.52	1147.5
30.11.2016	632.685	3051.61	1174.94
31.10.2016	637.026	3055.25	1273.76
30.9.2016	643.661	3002.24	1315.87
31.8.2016	642.57	3023.13	1308.17
29.7.2016	642.626	2990.76	1351.28
30.6.2016	640.275	2864.74	1316.13
31.5.2016	635.125	3063.48	1214.88
29.4.2016	631.786	3028.21	1293.53
31.3.2016	634.553	3004.93	1232.44
29.2.2016	633.492	2945.75	1232.07
29.1.2016	630.91	3045.09	1118.21
31.12.2015	624.272	3267.52	1062.19
30.11.2015	627.997	3506.45	1064.17
30.10.2015	624.822	3418.23	1142.11
30.9.2015	620.819	3100.67	1114.9
31.8.2015	616.142	3269.63	1133.72
31.7.2015	619.113	3600.69	1095.8
30.6.2015	611.707	3424.3	1173.76
29.5.2015	618.451	3570.78	1190.58
30.4.2015	621.706	3615.59	1181.44
31.3.2015	624.871	3697.38	1183.88
27.2.2015	623.269	3599	1213.18
30.1.2015	619.8	3351.44	1283.79
31.12.2014	615.374	3146.43	1187.96

28.11.2014	612.503	3250.93	1167.38
31.10.2014	608.391	3113.32	1172.94
30.9.2014	608.153	3225.93	1208.67
29.8.2014	606.714	3172.63	1287.32
31.7.2014	600.64	3115.51	1282.28
30.6.2014	597.679	3228.24	1318.35
30.5.2014	592.667	3244.6	1249.68
30.4.2014	588.373	3198.39	1293.5
31.3.2014	585.007	3161.6	1286.92
28.2.2014	581.198	3149.23	1326.39
31.1.2014	578.525	3013.96	1244.55
31.12.2013	569.519	3109	1204.99
29.11.2013	572.521	3086.64	1253.35
31.10.2013	570.194	3067.95	1323.66
30.9.2013	563.645	2893.15	1331.77
30.8.2013	560.243	2721.37	1395.27
31.7.2013	561.747	2768.15	1308.29
28.6.2013	557.649	2602.59	1234.53
31.5.2013	563.957	2769.64	1387.8
30.4.2013	568.492	2712	1471.96
29.3.2013	558.774	2624.02	1597.5
28.2.2013	556.154	2633.55	1581.4
31.1.2013	553.812	2702.98	1662.51
31.12.2012	555.636	2635.93	1676.23
30.11.2012	553.361	2575.25	1714.98
31.10.2012	547.385	2503.64	1719.35
28.9.2012	543.972	2454.26	1772.25
31.8.2012	537.781	2440.71	1691.85
31.7.2012	533.277	2325.72	1615.73
29.6.2012	527.468	2264.72	1597.45
31.5.2012	527.342	2118.94	1566.84
30.4.2012	526.463	2306.43	1663.81
30.3.2012	526.888	2477.28	1668.15
29.2.2012	526.85	2512.11	1721.9
31.1.2012	519.543	2416.66	1730.91
30.12.2011	509.712	2316.55	1564.91
30.11.2011	493.849	2330.43	1745.59
31.10.2011	504.583	2385.22	1724.48
30.9.2011	511.382	2179.66	1623.79
31.8.2011	509.716	2302.08	1834.99

29.7.2011	495.494	2670.37	1627.05
30.6.2011	495.81	2848.53	1504.72
31.5.2011	496.187	2861.92	1536.23
29.4.2011	492.119	3011.25	1563.7
31.3.2011	490.879	2910.91	1437.78
28.2.2011	493.412	3013.09	1411.88
31.1.2011	492.856	2953.63	1337.14
31.12.2010	494.774	2792.82	1421.4
30.11.2010	494.947	2650.99	1388.53
29.10.2010	504.495	2844.99	1359.4
30.9.2010	505.976	2747.9	1307.6
31.8.2010	509.88	2622.95	1248.45
30.7.2010	503.02	2742.14	1181
30.6.2010	499.319	2573.32	1241.68
31.5.2010	502.363	2610.26	1216,45
30.4.2010	495.374	2816.86	1179.03
31.3.2010	499.629	2931.16	1114.49
26.2.2010	496.943	2728.47	1117.59
29.1.2010	491.722	2776.3	1081.2
31.12.2009	490.316	2964.96	1098.65
30.11.2009	493.412	2797.25	1173.38
30.10.2009	491.131	2743.5	1045.45
30.9.2009	489.72	2872.63	1007.6
31.8.2009	487.214	2775.17	950.94
31.7.2009	485.857	2638.13	954
30.6.2009	480.278	2401.69	930
29.5.2009	475.594	2451.24	975.75
30.4.2009	477.869	2375.34	887.95
31.3.2009	476.288	2071.13	919.9
27.2.2009	471.51	1976.23	942.32
30.1.2009	466.974	2236.98	927.85
31.12.2008	467.308	2447.62	875.43
28.11.2008	462.422	2430.31	817.68
31.10.2008	451.291	2591.76	721.8
30.9.2008	445.312	3038.2	875.55
29.8.2008	441.124	3365.63	831.86
31.7.2008	436.608	3367.82	917.43
30.6.2008	429.084	3352.81	923.56
30.5.2008	433.308	3777.85	885.43
30.4.2008	437.87	3825.02	867.03

31.3.2008	440.356	3628.06	920.96
29.2.2008	443.148	3724.5	973.08
31.1.2008	439.559	3792.8	924.49
31.12.2007	430.095	4399.72	833.05
30.11.2007	431.422	4394.95	782.92
31.10.2007	427.392	4489.79	790.5
28.9.2007	425.132	4381.71	743.75
31.8.2007	424.446	4294.56	673
31.7.2007	419.959	4315.69	665.15
29.6.2007	415.629	4489.77	650.9
31.5.2007	416.385	4512.65	659.45
30.4.2007	419.29	4392.34	680.85
30.3.2007	419.548	4181.03	665.05
28.2.2007	420.04	4087.12	667.89
31.1.2007	416.732	4178.54	650.53
29.12.2006	417.009	4119.94	635.7
30.11.2006	420.368	3987.23	647.5
31.10.2006	418.359	4004.8	604.8
29.9.2006	417.856	3899.41	596.55
31.8.2006	416.63	3808.7	626.28
31.7.2006	413.59	3691.87	633.36
30.6.2006	410.221	3648.92	613.99
31.5.2006	411.224	3637.17	642
28.4.2006	409.208	3839.9	653.23
31.3.2006	410.779	3853.74	582.85
28.2.2006	414.24	3774.51	561.2
31.1.2006	413.913	3691.41	571.95
30.12.2005	415.407	3578.93	517
30.11.2005	413.302	3447.07	494.7
31.10.2005	413.777	3320.15	467.4
30.9.2005	416.944	3428.51	469
31.8.2005	417.7	3263.78	434.53
29.7.2005	414.953	3326.51	430.55
30.6.2005	416.616	3181.54	435.88
31.5.2005	413.095	3076.7	417.1
29.4.2005	409.742	2930.1	436.01
31.3.2005	404.74	3055.73	428.24
28.2.2005	402.807	3058.32	436
31.1.2005	404.033	2984.59	421.5
31.12.2004	401.059	2951.01	438.05

30.11.2004	399.46	2876.39	450.65
29.10.2004	396.423	2811.72	427.04
30.9.2004	393.015	2726.3	418.1
31.8.2004	391.957	2670.79	409.7
30.7.2004	387.505	2720.05	390.2
30.6.2004	384.768	2811.08	394
31.5.2004	384.321	2749.62	395.35
30.4.2004	384.74	2787.48	389.3
31.3.2004	388.056	2787.49	425.1
27.2.2004	384.969	2893.18	397
30.1.2004	379.994	2839.13	401.2
31.12.2003	377.864	2760.66	415.05
28.11.2003	373.375	2630.47	397.75
31.10.2003	374.508	2575.04	383.05
30.9.2003	379.013	2395.87	387.28
29.8.2003	373.316	2556.71	375.55
31.7.2003	373.502	2519.79	355.95
30.6.2003	378.124	2419.51	346.35
30.5.2003	377.63	2330.06	364.55
30.4.2003	371.016	2324.23	339.15
31.3.2003	370.291	2036.86	335.95
28.2.2003	371.142	2140.73	349.75
31.1.2003	366.924	2248.17	368.05
31.12.2002	363.57	2398.65	347.85
29.11.2002	357.251	2656.85	318.95
31.10.2002	355.617	2518.99	317.55
30.9.2002	356.676	2204.39	324.05
30.8.2002	350.043	2709.29	312.75
31.7.2002	346.321	2685.79	302.43
28.6.2002	341.548	3133.39	317.25
31.5.2002	336.716	3425.79	325.25
30.4.2002	336.189	3574.23	308.15
29.3.2002	332.727	3784.05	302.5
28.2.2002	335.481	3624.74	296.65
31.1.2002	334.303	3670.26	281.85
31.12.2001	333.723	3806.13	278.95
30.11.2001	337.01	3658.27	275.05
31.10.2001	338.616	3478.63	279.85
28.9.2001	332.602	3296.66	292.55
31.8.2001	329.468	3743.97	274.45

31.7.2001	326.218	4091.38	266.15
29.6.2001	322.34	4243.91	271.55
31.5.2001	319.845	4426.24	266.6
30.4.2001	318.476	4525.01	263.48
30.3.2001	321.816	4185	257.95
28.2.2001	319.136	4318.88	267.15
31.1.2001	317.688	4779.9	265.2
29.12.2000	315.543	4772.39	272.25
30.11.2000	311.145	4790.08	269
31.10.2000	307.107	5057.46	264.68
29.9.2000	305.635	4915.18	274.25
31.8.2000	302.854	5175.12	277.25
31.7.2000	302.772	5122.8	277.25
30.6.2000	302.037	5145.35	289.15
31.5.2000	300.393	5200.89	272.6
28.4.2000	300.332	5303.95	274.5
31.3.2000	300.485	5249.55	279.73
29.2.2000	296.822	5182.62	293.3
31.1.2000	295.425	4684.48	283.6
31.12.1999	296.306	4904.46	288

Table 9. Raw data, monthly values for all variables
Source: Bloomberg

ZLATO U PORTFOLIO INVESTICIJAMA IZ UGLA EVROPSKOG ULAGAČA

Rezime:
Zlato je jedinstven vid imovine, velike vrednosti, ali, u isto vreme, vid kojeg nema dovoljno na raspolaganju. U pitanju je imovina luksuzne prirode, koja se može smatrati sjajnom prilikom za ulaganje. Takođe, zlato je imovina koja ne nosi rizik druge strane – odnosno, ne uključuje povezani kreditni rizik. Upravo zbog ovih osobina, zlato predstavlja značajan oblik imovine i ima izuzetno važnu ulogu u portfolio investicijama. Navedene okolnosti uvećavaju interese ulagača da uvrste zlato u portfolio investicije, posebno tokom perioda finansijskih kriza. Ukoliko ulagač odluči da to učini, neophodno je proceniti udeo zlata u portfoliju, uzimajući u obzir apskte rizika, povraćaja i diversifikacije. U ovom radu, testirana je, i potvrđena hipoteza na osnovu koje zlato omogućava diversifikaciju za portfolio investicije, što implicira da je zlato poželjan oblik imovine u ovom kontekstu. Istraživanje se fokusiralo na razvoj optimalnog portfolija, koji kombinuje indeks obveznica Evrozone sa investicionim rejtingom 1-10 godina (EG 05), indeks Euro Stoxx 50 i zlato, uz upotrebu metodologije autora Markowitz. Rezultati su pokazali da optimalan portfolio treba da uključuje zlato sa udelom 1-9%, u zavisnosti od rizika koji je ulagač spreman da prihvati.

Ključne reči:
zlato,
investicije,
portfolio,
kriza.