PRECIOUS METALS ROLES IN INVESTMENT PORTFOLIO - COMPARATIVE ANALYSIS OF CZECH, HUNGARY AND POLAND

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Abstract
This article presents research conclusions on the properties and role of precious metals from the perspectives of Czech, Hungarian and Polish investors. BUX, PX-GLOBE and WIG20 indices were used to represent the market. The analysis covers the years 2007-2013 which were divided into the phases of decline, growth and relative stability, depending on how stock indices performed. Gold, silver, platinum and palladium were assigned the role of a safe haven, a diversifier and a hedge.

Key words: *precious metal investment, conditional variance, safe heaven investment, Beta coefficient*

INTRODUCTION

Portfolio diversification and the desire to hedge property are the main reasons why alternative investments have become so popular in recent times. Since the financial crisis of 2007-2008 investors have continuously been combating uncertainty present on trading floors. Uncertain market situation provides a strong rationale for this type of investment while its variety makes investors interested in it in increasing numbers. Among alternative investments, instruments relating to precious metals have proved to be very successful. While it is true that gold has been the symbol of wealth and safety since time immemorial, the high potential of silver and platinum as an investment with rapidly growing value has been highlighted for some time now. The research conducted by well-recognized researchers and financial markets practitioners confirms the benefits of including, for example, gold and other precious metals in an investment portfolio. Furthermore, they are perceived as a tool for portfolio diversification because of low dependence on price volatility. Albeit this subject has been discussed in other studies, yet the research has focused on markets in developed countries. With this in view, the author chose to analyze the issue taking into account Czech, Polish and Hungarian markets, while extending the scope of the research to include platinum and palladium. The goal of the article is to present the research conclusions on the role that can be played by precious metals investment from the perspectives of Czech, Polish and Hungarian investors. The reference point were the primary stock indices of these countries, PX-GLOBE, WIG20 and BUX. The period covered by the study was divided into 3 sub-periods: decline, growth and relative stability phases, depending on stock indices.

1. PRECIOUS METALS AS AN INVESTMENT

In the worldwide literature the subject of the potential of precious metals as an investment has been well discussed and documented [e.g. Jaffe 1989; McCown R.J., Zimmerman R.J. 2006; Can precious metal… 2007]. The properties which are most frequently emphasized as supporting this way of investment is low correlation with securities markets as well as possible protection against inflation [e.g. Worthington A.C., Pahlavani M 2006]. Owing to their low dependence on price volatility, precious metals are also perceived as tools for investment portfolio diversification [McCown R.J., Zimmerman R.J. 2007]. The vast majority of research tends to concentrate on the market and efficiency from an American investor's perspective with some works extending their research to include also the U.K, German or French markets and investors [Baur D.G, Lucey B.M. 2010, Hoang T. H. V. 2011]. A significant number of authors advises adding a precious metal to the investment

portfolio which leads to its diversification, lower risk and a better return rate. The proposed solutions differ only in terms of the suggested share, ranging from 5% to as many as 25% [Lucey B.M. 2011]. Gold enjoys the best reputation, yet silver as well as platinum have their supporters too [Barisheff N. 2006]. Precious metals are selected to be added to the investment portfolio because of the low dependence between the rates of return and the situation on the stock market. This property has been examined and described by independent researchers in different time horizons and in relation to various stock market indices. In his article J.F. Jaffe included the analysis of 4 hypothetical portfolios with the conclusion that adding either gold or shares of companies whose business is connected to gold increases the rate of portfolio return and decreases its risk as measured by standard deviation. The research presented in that article comprised monthly data from 1971 to 1987 and the obtained results also confirmed the lack of correlation of the rates of return. On the other hand, R.J. Mc Cow and R.J. Zimmerman put forward the thesis, using CAPM model, that adding gold or silver to the market portfolio would not raise its systematic risk. In the analysis spanning the period from 1970 to 2003 data on gold and silver was used as well as MSCI US Index, MSCI Worldindex – denominated in local currency, MSCI World US Index – denominated in USD. The authors further proved that investing in gold and silver during the time in question gave protection against inflation. In their collective work, Conover, Jensen, Johnson and Mercer extend their research on the benefits of gold and silver to include the investment potential of platinum. One of their conclusion is that even though the benefits derived from adding precious metals to an investment portfolio may be greater or smaller, nevertheless the benefits were to be observed for most of the 34 years spanning the research. Moreover, the authors analyze the investment results through the prism of monetary policy of the Federal Reserve. One observation thus made was that while maintaining a restrictive policy, the precious metals investments give a higher rate of return than the rate of return on stocks. The paper suggested that precious metals should make up for 25% of an investment portfolio as the benefits would then be the greatest.

1.1 The role of a safe haven, a hedge or a diversifier

Dirk G. Baur and Brian M. Lucey offered a detailed distinction of the role a precious metal can play in an investment portfolio. In their research they divided assets into three types: a safe haven, a hedge and a diversifier. In the article “Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold”, Dirk G. Baur and Brian M. Lucey presented their conclusions from the analysis of the role played by gold in an investor’s portfolio. According to the criteria suggested by them, the authors named gold a safe haven for stocks on the USA, UK and German markets. They also concluded that the yellow metal did not have such properties for bonds. Furthermore, the benefits of having a precious metal in the portfolio can be observed for a limited period of time, e.g. during capital markets collapse and there are no benefits, for example, at the time of stock market rise.

According to the proposed definition, a safe haven is an asset that is uncorrelated or negatively correlated with other assets or portfolios during stock market downturn. This specific property need not be present all the time but only in a situation of market turmoil. In other times the correlation can be positive or negative. If, in bad economic times, there is an asset in the portfolio which is negatively correlated with other assets, that will allow the investor to partially compensate for losses.

On the other hand, a hedge is an asset that is uncorrelated or negatively correlated with other assets or portfolios on average (regardless of times). An asset of a hedge type does not have the properties which could reduce losses in times of economic contraction because its correlation can be positive in times of market unrest and negative during the entire time concerned.

Diversifier, i.e. a tool for diversification, is an asset which has a positive correlation, yet not a complete correlation, with other assets of portfolios on average (regardless of times). Not unlike the hedge, assets of this type need not reduce losses in extreme market conditions. They will, however, hold an average portfolio value over time.

In subsequent studies based on the above division these criteria were made more precise by being further distinguished as a strong/ weak safe haven and a strong/ weak hedge. In addition, other markets

were taken into consideration (e.g. Dirk G. Baur and Thomas K. McDermott examine 53 stock markets) as well as silver.

To the knowledge of the author of this article, none of the works has described the role gold can play in the portfolios of investors from Central and Eastern Europe. In addition, having in mind the growing popularity of other precious metals as an investment, the author extended the research to include also silver, platinum and palladium. Moreover, while classifying metals according to the proposed definitions, the analysis was limited only to a safe haven or a hedge, without making the distinction of a diversifier asset type.

2. MODELING OF FINANCIAL TIME SERIES – METHODOLOGY AND DATA

The specificity of financial time series, in which one can observe, among other things, volatility clustering effect, which is responsible for the variance instability of the rate of return over time, leptokurtosis and fat tailed distributions of data, which entails a higher probability of outliers as compared to normal distribution, or the effect of autocorrelation of the rate of return, makes it necessary to consider these properties when selecting research tools [Piontek 2001, Piontek 2004, Fiszeder 2005 et.al.]. Considering the preliminary nature of the conducted analysis as regards the observed conditional expected values and conditional variance of rates of return series, the ARMA-GARCH model, suggested by numerous authors [*Modelowanie* 2004, Fiszeder 2009, et.al.], was applied in the study. The ARMA model (p,q) (*autoregressive moving average model*) was introduced by Box and Jenkins in 1976 [Box, Jenkins, 1983] and can be used for modeling stationary or non-stationary time series reduced to a stationary time series. The tool consists of an autoregressive AR part and a moving average MA part. It is given by the following formula:

$$Y_t = \varphi_0 + \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \cdots + \varphi_p Y_{t-p} + \varepsilon_t + \theta_0 - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \cdots - \theta_q \varepsilon_{t-q} \quad \ldots. (1)$$

where:

Y_t, Y_{t-1}, Y_{t-p} - response variable values at time t, t-1, t-2, t-p.

$\varphi_0, \varphi_1, \varphi_2, \varphi_p, \theta_0, \theta_1, \theta_2, \theta_q$ – parameters of the model

p, q – lag value

$e_t, e_{t-1}, e_{t-2}, e_{t-q}$ – model residuals at time *t, … t-q,*

The GARCH model introduced by Bollerslev [Bollerslev 1986], can be given by the following formula:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{i-1}^2 + \sum_{i=1}^{p} \beta_i \, h_{t-i} \qquad (2)$$

where:

$p \geq 0$, $q > 0$; $\alpha_0 > 0$, $\alpha_i \geq 0$, i=1,…, q; $\beta_i \geq 0$, i=1,…, p.

For approximation of the distribution of residuals skewed-t distribution was adopted, which is better suited here than normal distribution [Fiszeder 2001].

For a metal to be classified either as a safe haven or a hedge asset the analysis of conditional correlation coefficients was carried out as well as the analysis of synthetic measure of risk, this being Beta for a stock market index.

To evaluate the interdependence between the market index volatility and the precious metals the constant conditional correlations model proposed by Bollerslev [Bollerslev 1990] was used, given by the following formula:

$H_t = D_t \Gamma D_t$ (3)

where D_t denotes conditional variances matrix with elements $\sqrt{h_i}$, $\sqrt{h_j}$…., $\sqrt{h_n}$, and Γ denotes N x N matrix of conditional correlation coefficients $\rho_{i,j,t}$

After having estimated the conditional variance-covariance matrices for the indices and metals it was possible to calculate Beta. In order to do this, the following formula was used:

$$\beta_{i,t} = \frac{h_{i,M,t}}{h_{M,t}}, \quad (4)$$

where $h_{i,M,t}$ denotes conditional covariance of the rate of returns for the i-th security with the stock market index, and $h_{M,\,t}$ denotes conditional variance of the rate of return on the market portfolio [Fiszeder 2005].

The calculation of the coefficients was based on the continuously compounded rate of return at the closing. The characteristic features of the market are illustrated by the primary stock exchange indices in Prague - PX GLOBE, in Budapest – BUX and in Warsaw WIG20. Gold and silver prices were based on afternoon fixings in London (LBM) whereas the prices of platinum and palladium were taken from New York (NYMEX), which were then converted into the currencies of the countries concerned at the average exchange rates as made public by the national banks on the corresponding close-out day. Considering that there are fewer sessions on a stock exchange than on metal markets the dates were harmonized individually for each index with additional observations being removed. The analysis covers the period from 31.08.2007, when USA President George W. Bush announced the government's program to help indebted borrowers, to the end of 2013.

The periods of the index decline, growth or stability were defined for each market. These sub-periods cover the years 2007-2009, 2009-2011 and 2011-2013, with each stock market exchange having different dates depending on a specific situation development.

3. RESEARCH RESULTS

For each country the results were obtained on the basis of the research applying the above procedures. Below, the basic characteristics are presented which were observed in the period from 31.08.2007 to 31.12.2013 and then separately for each of the sub-periods. 1579 observations came from the stock exchange in Budapest, 1589 in Prague and 1584 in Warsaw.

	BUX	**PX GLOBE**	**WIG20**
Mean	-0,0002	-0,0004	-0,0003
Standard error	0,0005	0,0004	0,0004
Median	-0,0002	-0,0001	0,0002
Standard deviation	0,0185	0,0167	0,0167
Variance	0,0003	0,0003	0,0003

Kurtosis	6,5227	12,8285	3,0372
Skewness	-0,0142	-0,5837	-0,2396
Minimum	-0,1265	-0,1568	-0,0844
Maximum	0,1318	0,1102	0,0815

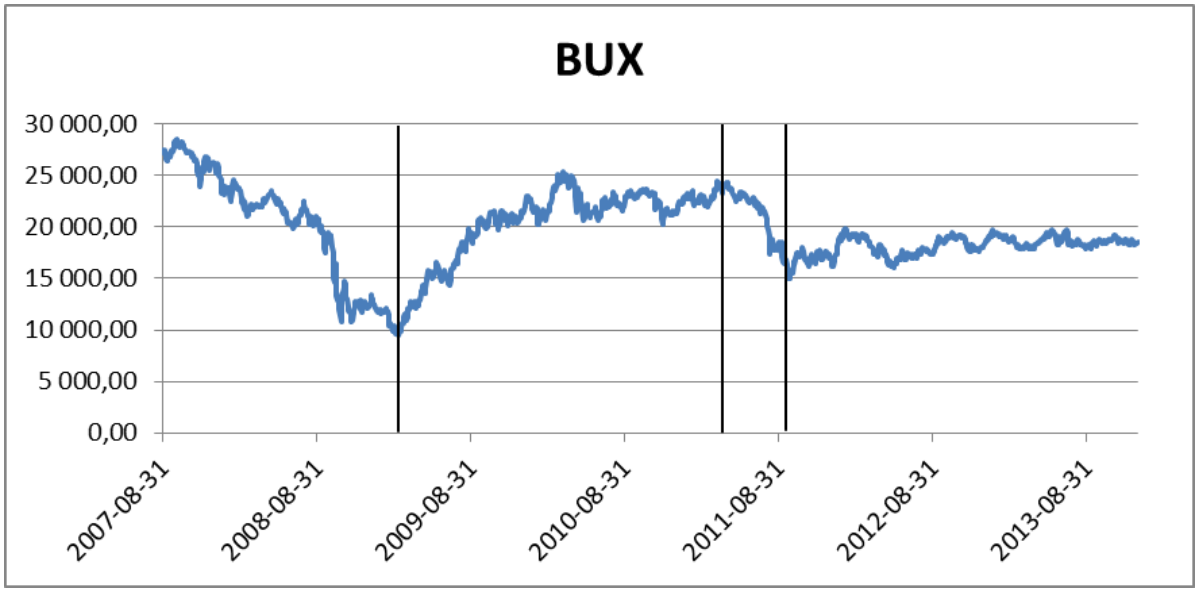
Table 1. Descriptive statistics for the rates of return series on BUX, PX-GLOBE and WIG20 indices from 31.08.2007 to 31.12.2013.

	AU	**AG**	**PT**	**PD**
Mean	0,000357	0,000293	4,58E-05	0,000472
Standard error	0,000327	0,000589	0,000405	0,000537
Median	0,000869	0,0015	0,000658	0,000762
Standard deviation	0,013195	0,0238	0,016342	0,021695
Variance	0,000174	0,000566	0,000267	0,000471
Kurtosis	5,196018	7,736405	4,890414	3,990147
Skewness	-0,33211	-1,02173	-0,67273	-0,50413
Minimum	-0,09241	-0,20464	-0,10196	-0,13575
Maximum	0,1005	0,128324	0,094542	0,127951

Table 2. Descriptive statistics for the rates of return series on Gold, silver, Platinium and Pallad from 31.08.2007 to 31.12.2013.

3.1 Hungary

On each of the graphs below we can see three basic phases: decline, growth and relative stability (trading sideways). The years 2007-2009, 2009-2011, 2011-2013 comprise these phases, with delays of several days.



Source: Author's own research

We can distinguish 4 sub-periods on the Hungarian Stock Exchange during the time in question: 31.08.2007- 12.03. 2009, 13.03. 2009- 2.05.2011, 3.05.2011-26.09-2011 and 27.09.2011-31.12.2013. Since in the period 3 observations were greatly heterogeneous due to extraordinary political decisions[1], this time period will not be taken into consideration in further analysis.

1. Time period 31.08.2007- 12.03. 2009

	BUX	*AU*	*AG*	*PT*	*PD*
$\bar{r}$	-0,28%	0,15%	0,09%	0,02%	-0,07%
σ	2,51%	2,07%	2,85%	2,76%	3,30%
β	1	-0,203	0,104	0,096	0,196

Source: Author's own research

During the period of decline for the BUX index the Beta coefficient for all precious metals was at a relatively low level with higher rates of return. In that time one can notice that gold exhibited the very desired properties, a higher rate of return and lower risk as well as a negative Beta coefficient. Palladium appears to be the weakest with a significant risk, a negative rate of return and the highest Beta.

2. Time period 13.03. 2009- 2.05.2011

	BUX	*AU*	*AG*	*PT*	*PD*
$\bar{r}$	0,17%	0,05%	0,18%	0,06%	0,21%
σ	1,87%	1,55%	2,18%	1,56%	2,14%
β	1	-0,239	-0,011	0,002	0,216

Source: Author's own research

During the growth phase the metals exhibited even smaller interdependency with stock market indices. It may be surprising to note that this time gold, although still having the lowest risk, also had the lowest rate of return. In this period one can observe a strong convergence between the rate of return and risk for gold and platinum. Moreover, the yellow metal maintained negative Beta in relation to the index.

3. Time period 27.09.2011-31.12.2013

	BUX	*AU*	*AG*	*PT*	*PD*
$\bar{r}$	0,03%	-0,05%	-0,09%	-0,02%	0,02%
σ	1,22%	1,43%	1,98%	1,37%	1,79%
β	1	-0,131	0,091	0,034	0,114

Source: Author's own research

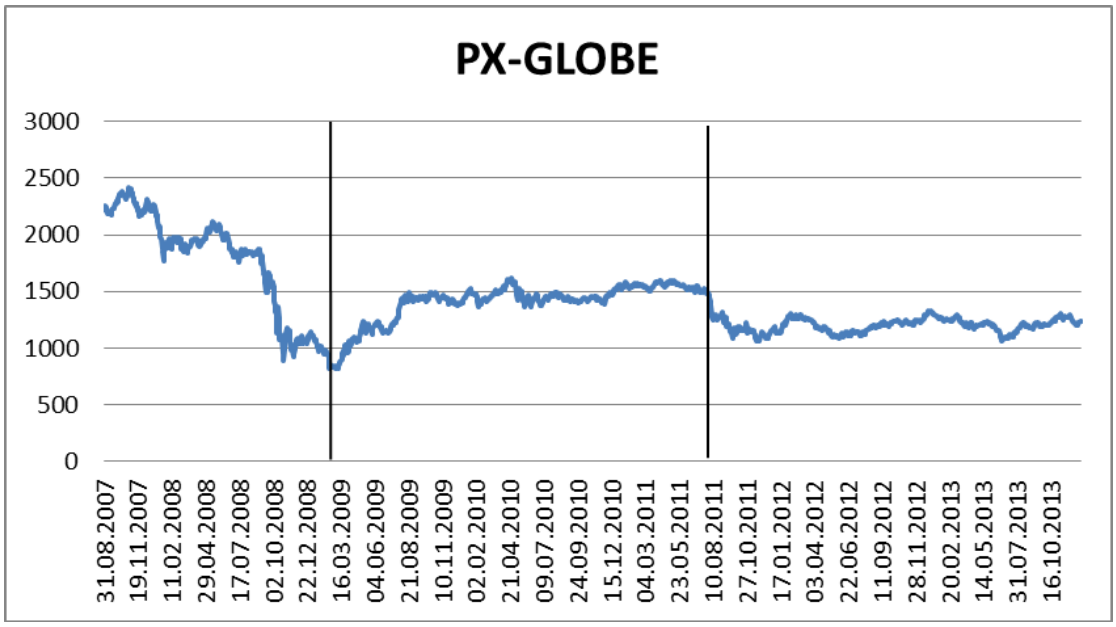
[1] http://www.economist.com/blogs/easternapproaches/2011/11/hungarys-politics, 7.07.2014

In the phase defined as a period of relative stability, 3 out of 4 of the precious metals were faring worse than BUX, with their rates exhibiting greater volatility on average and on top of that delivering negative rates of return. Once again, we can note a negative systematic risk coefficient for gold. In this ranking, palladium turned out to be of interest, as it additionally had the lowest Beta seen so far.

3.2 The Czech Republic

The PX-GLOBE index was selected to represent the Czech market as it covers all companies quoted on the Prague trading floors, unlike the PX index covering only blue chip companies.

In the time period concerned we can distinguish 3 sub-periods: 31.08.2007- 18.02. 2009, 19.02. 2009-31.05.2011 and 1.06.2011-31.12.2013.



Source: Author's own research

While analyzing the graph it can be noticed that the decline at the time of the crises was very significant and it will take much time to return to the level from the year 2007. The increase in the index value can be observed for the years 2009-2011, yet without being as dynamic as in the decline period.

1. Time period 31.08.2007- 18.02. 2009

	PX-GLOBE	AU	AG	PT	PD
$\overline{r}$	-0,27%	0,14%	0,08%	-0,01%	-0,08%
σ	2,61%	1,81%	2,85%	2,66%	3,12%
β	1	-0,018	0,508	0,349	0,412

Source: Author's own research

None of the metals evinces a complete interdependence with the stock market index although silver and palladium exhibit it at a rather high level. Gold demonstrates very good properties in this period.

2. Time period 19.02. 2009- 31.05.2011

	PX-GLOBE	*AU*	*AG*	*PT*	*PD*
$\bar{r}$	0,09%	0,04%	0,13%	0,04%	0,17%
σ	1,37%	1,29%	2,16%	1,33%	2,03%
β	1	-0,315	-0,029	0,051	0,371

Source: Author's own research

In the growth phase the precious metals show big independence, with gold being once again the best example. Platinum also behaves in an interesting way with lower volatility and a small beta. Only palladium has once more a rather high systematic risk.

3. Time period 01.06.2011-31.12.2013

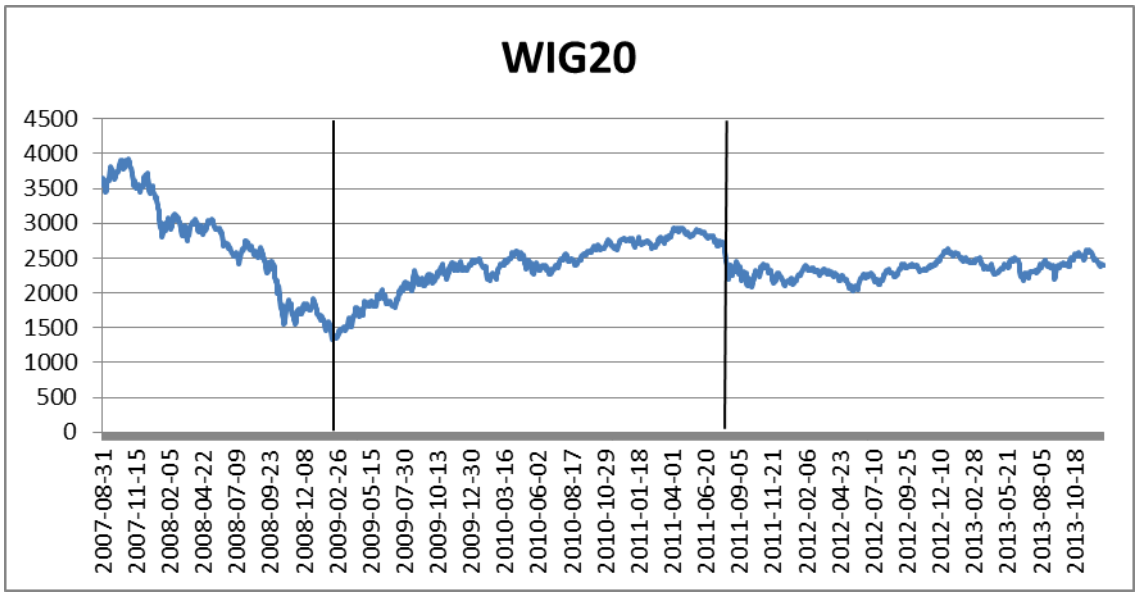
	PX-GLOBE	*AU*	*AG*	*PT*	*PD*
$\bar{r}$	-0,03%	-0,02%	-0,09%	-0,02%	0,00%
σ	1,14%	1,37%	2,04%	1,33%	1,74%
β	1	-0,170	0,153	0,020	0,313

Source: Author's own research

The last period to be analyzed provides interesting data. We observe here a significant increase of the Beta coefficients of the metals and the lowest volatility for the index. This is not the time when investors could easily get a positive rate of return.

3.3 Poland

The WIG20 index was selected to represent the Polish Stock Exchange, since it covers about 80% of the volume traded on the market. Analyzing the quotations graph from the years in question, three sub-periods can quite clearly be distinguished: 31.08.2007- 17.02. 2009, 18.02. 2009- 31.05.2011, 1.06.2011-31.12.2013. On that basis, we can preliminary conclude that the investors in Prague and Warsaw demonstrate convergent behavior.



Source: Author's own research

On the basis of the index performance we can see on the graph, not unlike on the Czech stock market, a very dynamic downturn in the time of the crisis, yet a slightly stronger bounce in the growth period as well. The Polish market was also characterized by a greater volatility in the last sub-period.

1. Time period 31.08.2007- 17.02. 2009

	WIG20	*AU*	*AG*	*PT*	*PD*
$\overline{r}$	-0,27%	0,19%	0,13%	0,04%	-0,03%
σ	2,24%	2,03%	2,91%	2,74%	3,19%
β	1	-0,076	0,276	0,145	0,130

Source: Author's own research

For the Polish market in the decline phase we tend to observe rather small coefficients of systematic risk for all the metals, although 0,276 for silver is a curious exception here. Palladium is the only metal evincing a negative rate of return.

2. Time period 18.02. 2009- 31.05.2011

	WIG20	*AU*	*AG*	*PT*	*PD*
$\overline{r}$	0,13%	0,08%	0,17%	0,09%	0,22%
σ	1,55%	1,02%	2,13%	1,35%	2,09%
β	1	0,082	0,426	0,368	0,728

Source: Author's own research

In the growth phase there was an increase in systematic risk for the metals in relation to the WIG20 market portfolio. In this period investing in silver and palladium was much more favorable than investing in other assets which were taken into account.

3. Time period 01.06.2011-31.12.2013

	WIG20	*AU*	*AG*	*PT*	*PD*
$\overline{r}$	-0,03%	-0,04%	-0,10%	-0,04%	-0,01%
σ	1,32%	1,37%	2,13%	1,28%	1,78%
β	1	0,140	0,474	0,378	0,678

Source: Author's own research

In the last period that was analyzed both the index and all the metals in question had negative rates of return. As regards the risk, in this phase, which was also the case for the PX-GLOBE index, WIG20 exhibited lower volatility than most of the metals, except for platinum. In addition, there were dynamic changes, as was previously observed, with respect to silver and palladium with the highest Beta coefficient.

CONCLUSIONS

On the basis of the conducted research a conclusion can be drawn as to the properties and the role of precious metals in investment portfolios on the Czech, Polish and Hungarian markets. We were able to demonstrate possible market scenarios through identifying the phases of crisis, growth and relative stability. For all the markets in question, approximated through the BUX, PX GLOBE and WIG20 indices, gold was capable of playing the role as a safe haven as it had low correlation with the markets and would be able to partially cover traded losses. Still, the calculated Beta had the smallest value in relation to the Czech market. Also, platinum demonstrated good properties in this context. During the period concerned the average daily rate of return on gold calculated in dollars was 0,036%, which means that converting it into the currencies of the countries concerned led to additional benefits. Investors who would like to invest some of their assets in the yellow ore can do so by the means of structured certificates of the "tracker" type available on the three markets discussed above. Raiffeisen Centrobank AG is the issuer of the mentioned certificates. Palladium could be considered a worthwhile investment only in the growth period, since its rate of return was higher than the one noted at the stock market index. In recent years the interest showed by investors in precious metals has led to significant shifts in the price of silver. Exchange traded funds (ETFs), which invest assets in the physical form of the ore, are particularly responsible for this situation. Silver exhibits none of the properties of a safe haven, yet it can be used to diversify risk and increase the rate of return on the portfolio during good economic times.

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