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ALTERNATIVE INVESTMENTS IN PRECIOUS METALS

INWESTYCJE ALTERNATYWNE W METALE SZLACHETNE

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Summary: The alternative investments industry has become an important part of the global economy and financial system, in which one can consider hedge funds, precious metals and other commodities or art investments. This paper analyses the potential benefits from adding precious metals (gold, silver, platinum) and also copper to portfolio investments from the perspective of investors from the Czech Republic, Hungary, Poland, and Slovakia, compared to those of German Stock Exchange. The PX, BUX, WIG, SAX and DAX indices were used to represent the market. The analyses cover the period 2007-2018 to compare the different performance of stock exchange indices at that time. The authors compare diversified portfolios using the Sharpe, Treynor and Jensen coefficients and beta coefficient. The beta coefficient, in most considered periods, of precious metals is at a low positive or even negative level. This may show that precious metals can be considered as alternative investments. However, one has to remember that each of these metals is characterized by different investment characteristics such as return rate of risk and volatility.

Keywords: alternative investments, precious metals, beta coefficient.

Streszczenie: Inwestycje alternatywne stały się jednym z ważnych czynników światowej gospodarki oraz systemu finansowego. Zaliczyć do nich można fundusze typu *hedge*, metale szlachetne, inne rynki towarowe, jak również inwestycje w sztukę. Poniższy artykuł analizuje potencjalne korzyści z dodania metali szlachetnych (złota, srebra, platyny), jak również miedzi do portfela inwestycyjnego dla inwestora pochodzącego z Czech, Węgier, Polski oraz Słowacji, w porównaniu z wynikami dla inwestora mieszkającego w Niemczech. Indeksy PX, BUX, WIG, SAX oraz DAX reprezentują poszczególne rynki finansowe. Autorka analizowała tendencje na rynkach finansowych w latach 2007-2018, a ponadto zdywersyfikowane portfele, używając współczynników Sharpe'a, Treynora i Jensena oraz współczynnika beta. Współczynnik beta w większości rozważanych okresów cechował się bardzo niskim pozytywnym lub nawet negatywnym poziomem. To może sugerować, że metale szlachetne mogą być rozważane jako inwestycje alternatywne. Jednakże należy pa-

miętać o tym, że każdy z rozważanych metali charakteryzuje się innymi poziomami stóp zwrotu, a także zmiennością.

Słowa kluczowe: inwestycje alternatywne, metale szlachetne, współczynnik beta.

1. Introduction

Precious metals are naturally occurring rare metallic elements that have important economic value. Precious metals are mainly regarded as investments and industrial commodities.

Precious metals such as gold and silver are widely used for investment purposes and jewellery. For gold, 90% of world production is treated as investment and jewellery, but only 10% is applied in industries. Silver is applied in numismatics, electronics, photography and medicine. The majority of platinum production is utilized by the automotive, chemical and electronic industries (World Gold Council, 2019).

The supply of gold is highest in jewellery and as an investment, but also it is used in technology and by Central Banks. In the first quarter of 2019, jewellery used 530.3 tons, investment – 298.1 tons, Central Banks – 145.5 tons, and technology – 79.3 tons (World Gold Council, 2019).

The world production of silver is 38 220 metric tons. The top silver producing country in the world is Mexico, with 5 600 metric tons, then Peru with 4 500 metric tons and China with 2 500 metric tons. China is also one of the leading consumers of silver in the world, especially for solar applications.

Platinum is a soft, heavy, white colored precious metal. It is most commonly used in catalytic converters for automobiles and is also prominently used in jewellery. The worldwide demand for platinum in 2018 amounted to nearly 7.8 million ounces. With such a high demand, the production of platinum is important in order to meet the demand. The estimated global platinum production in 2018 was 160 metric tons. The global mine production of platinum in South Africa was 110 metric tons in 2018. The mine production of platinum in Russia amounted to 21 metric tons, and 14 metric tons in Zimbabwe (Statista, n.d.).

Chile, the world's leading copper producer by far, produced an estimated 5 800 metric tons of copper in 2018. In second place is Peru, with an estimated copper mine production of 2 400 metric tons in 2018. The world's third-largest copper producer from mines is China. In 2018, China produced an estimated 1 600 metric tons of copper from mines, which is over three times less than Chile's production (https://www.statista.com/statistics/264626/copper-production-by-country/).

Usually, precious metals offer investors an opportunity to invest in hard assets that are likely to see increasing long-term demand in the current environment of high and rising government debt burdens, 'loose' monetary policy, and political uncertainty (McGlone, 2014).

This paper investigates the diversification benefits of precious metals and copper for the Central and Eastern Europe investor when this asset class is included into a portfolio of stocks. The authors analyzed the potential benefits from precious metals investments through the prism of investors from the Czech Republic, Hungary, Poland, and Slovakia, compared to the results obtained results in German Stock Exchange, taking into consideration the performance of the main stock exchange indices. The aim of the studies is to identify the role precious metals can play in investors' portfolios in selected markets. The diversified portfolios were compared using the Sharpe, Treynor and Jensen coefficients and beta coefficient.

There are a lot of researchers examining the role of precious metals as a hedge or safe haven during highly volatile market conditions. Gold has been found to possess safe haven properties during extreme volatility in stock markets (Baur and Lucey, 2010).

The effects of common precious metals have been tested thoroughly in previous studies, against stock markets, bond markets, currencies, as well as exchange rates (Baur and Lucey, 2010; Baur and McDermott, 2010; Ciner, Gurdgiev, and Lucey, 2013; Joy, 2011; Pullen, Bensen, and Faff, 2014; Capie, Mills, and Wood, 2005; Lucey and Li, 2013; Pukthuanthong and Roll, 2011).

Low, Yao, and Faff (2015) found that gold and silver present safe haven abilities in countries like the US, Germany, France, and Australia, with the effect being relatively strong in extreme market conditions. Platinum works in selected countries such as those in Europe and also in Australia.

Other precious metals such as silver exhibit safe haven properties during periods that gold does not (Lucey and Li, 2013). Aside from precious metals, investments in precious stones have been shown to be effective diversifiers.

Conover, Jensen, Johnson, and Mercer (2009) found that adding a 25% allocation to the equities of precious metals firms directly improves portfolio performance. Overall, their evidence suggested that investors could improve portfolio performance considerably by adding a significant exposure to the equities of precious metals firms.

Sharma, Dey, and Aggarwal (2013) investigated the relationship between the Dow Jones Precious Metal Index (DJGSP) and the market indices of the largest economies of the world, which included the U.S., the U.K., Germany, Sweden, Spain, Brazil, Hong Kong, Australia, Norway, and Canada for the five-year period from April 2007 to April 2012. Their results showed that market indices of seven out of ten economies, when used together, better predicted the movements in the DJGSP. They also found that, when individual market indexes were regressed with DJGSP, the DJGSP was highly correlated with Brazil's market index and was least correlated with the U.S. market index.

Walczak-Gańko (2016) presented the effectiveness and roles of precious metals in investment portfolios from the point of view of Austrian, Slovakian and Slovenian investors. The results showed that gold can be regarded as the asset type defined as

a safe haven on all markets in the periods under study. In the Slovakian and Slovenian markets, silver exhibited similar properties. For the Austrian market, silver can be regarded as a diversifier. Platinum was a safe haven for investors on the Slovenian market and a diversifier for those operating on the Austrian and Slovakian markets. Palladium played the role of a diversifier in a portfolio with the Austrian index, while being a safe haven for Slovenian and Slovakian investors.

Hillier, Draper, and Faff (2006) investigated the investment role of precious metals in financial markets by analyzing the daily data for gold, platinum, and silver from 1976 to 2004. They analyzed the S&P 500 Index and the MSCI Europe /Australasia/ Far East (EAFE) Index, which was used as an alternative. All three precious metals had low correlations with stock index returns, which suggested that these metals provided diversification within broad investment portfolios. The data also revealed that all three precious metals had some hedging capability, particularly during periods of "abnormal" stock market volatility. Financial portfolios that contain precious metals performed significantly better than standard equity.

In all the mentioned studies there was consideration of how including precious metals affect the portfolios of developed economies but there is a lack of such research in countries of Central and Eastern Europe, namely the Czech Republic, Hungary, Poland, and Slovakia. This article is trying to fill that gap.

2. Methodology and data

In the research, analysis was carried out on the main stock exchange indices, the SAX from Slovakia, DAX – Germany, PX – Czech Republic, WIG – Poland and the BUX – Hungary, as well as of gold, silver, copper and platinum in the period from 01.01.2007 to 31.12.2018. This period was chosen to capture the time just before the 2008-2009 financial crisis and the post-crisis conditions. Based on the recorded past closing prices continuously compounded returns were calculated. The precious metals rates come from the Thomson Reuters database and are given in US dollars; the indices data come from the web-portal stooq.pl. The time series for observations of the index and metals for the country concerned were date-adjusted after considering holidays during which there was no trading. All the calculations used daily percentage logarithmic returns defined as $r_t = 100 \cdot \ln \frac{P_t}{P_{t-1}}$, where P_t denotes price of an asset at time t. The basic descriptive statistics for the stock exchange indices and precious metals are presented in the table below.

Table 1 presents descriptive statistics for the rates of return series on the gold, silver, copper, platinum and the SAX, DAX, PX, WIG, BUX indices from 01.01.2007 to 31.12.2018. The mean value is close to zero, And in some cases it is positive, and for some instruments it is negative. Volatility measured by standard deviation is moderate for all considered instruments. Kurtosis is high for the SAX and PX indices.

Table 1. Descriptive statistics for the rates of return series on the gold, silver, copper, platinum and SAX, DAX, PX, WIG, BUX indices from 01.01.2007 to 31.12.2018

01.2007--12.2018	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
GOLD	–6.66173	9.23472	0.022243	0.990088	0.052053	7.64156
SILVER	–17.05870	9.78557	0.005203	1.692249	–0.546900	7.63574
COPPER	–8.43411	11.21422	–0.001570	1.711327	0.055004	3.51355
PLATINUM	–10.27160	8.22312	–0.011280	1.402655	–0.486480	4.59911
SAX	–14.81010	11.88026	–0.007150	1.123749	–1.175500	23.88725
DAX	–7.43346	10.79747	0.014646	1.370322	–0.009500	6.33886
PX	–16.18505	12.36405	–0.015840	1.377604	–0.596650	18.43995
WIG	–8.28882	6.08374	0.003817	1.196555	–0.479030	4.52329
BUX	–12.64890	13.17775	0.014588	1.503270	–0.081370	8.72678

Source: own calculations.

The beta coefficient indicates whether the investment in asset or portfolio is more or less volatile than the market. If the beta is less than 1 this means the investment is less volatile than the market, so can be treated as a safer one. When the beta is more than 1 this means that the investment is more volatile and riskier than the market. The beta is calculated from the formula:

$$\beta = \frac{Cov(r_i, r_M)}{Var(r_M)}, \tag{1}$$

where: r_i – returns of stock i, r_M – return of market index.

The analyses compared the diversified portfolios by using the Sharpe, Treynor and Jensen coefficients.

The Sharpe ratio is used to help investors understand the return of an investment compared to its risk. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. The greater the value of the Sharpe ratio, the more attractive the risk-adjusted return.

The formula for Sharpe Ratio is (Sharpe, 1966):

$$S = \frac{R_p - R_f}{\sigma}, \tag{2}$$

where: R_p – return of portfolio, R_f – risk-free rate, σ – standard deviation of the portfolios excess return.

The Treynor ratio also known as the reward-to-volatility ratio, is a performance metric to set down how much excess return was made for each unit of risk taken on by a portfolio (Fama, 1972):

$$T = \frac{R_p - R_f}{\beta_p}, \tag{3}$$

where: R_p – return of portfolio, R_f – risk-free rate, β_p – beta of the portfolio, $\beta_p = \sum_{i=1}^{n} x_i \beta_i$.

Jensen's measure is a risk-adjusted performance measure that represents the average return on a portfolio or investment, above or below that predicted by the capital asset pricing model (CAPM), given the portfolio's or investment's beta and the average market return (Jensen, 1968):

$$J = R_p - \left[R_f + \beta\left(\overline{r_M} - R_p\right)\right], \tag{4}$$

where: R_p – return of portfolio, R_f – risk-free rate, β – beta of the portfolio, $\overline{r_M}$ – mean return of market index.

3. Results and discussion

This part presents the research results with the use of the methodology mentioned above on the markets of the Czech Republic, Hungary, Poland, Slovakia and Germany. The time period is divided into sub-periods according to the behaviour of the main stock exchange indices as the SAX from Slovakia, DAX – Germany, PX – Czech Republic, WIG – Poland and the BUX – Hungary, as well as of gold, silver, copper and platinum. The main period is from 01.01.2007 to 31.12.2018. All the considered metals had 5% weights in the portfolio, because the potential investor should not invest all the money in metals and should keep the diversification benefits.

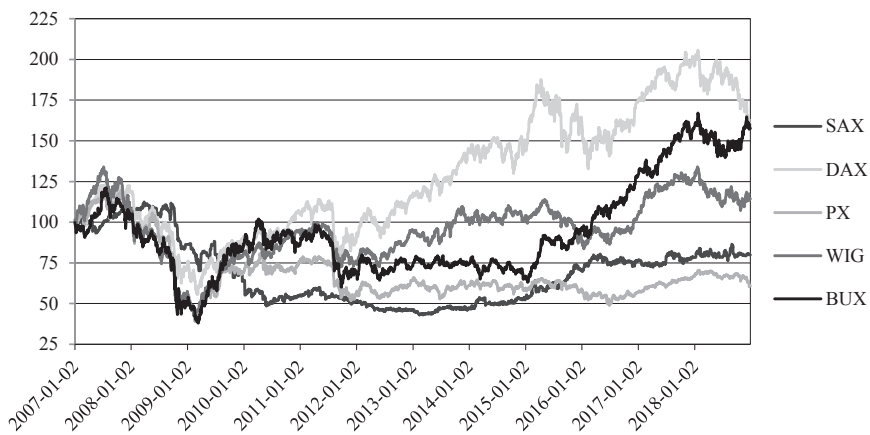

Fig. 1. The SAX, DAX, PX, WIG and BUX normalized quotations indices during 02.01.2007 – 31.12.2018

Source: own elaboration.

From Figure 1 and Figure 2 one can divide the considered period into three sub-periods. The sub-periods are: 01.2007-12.2010, the second 01.2011-12.2014, and the third 01.2015-12.2018.

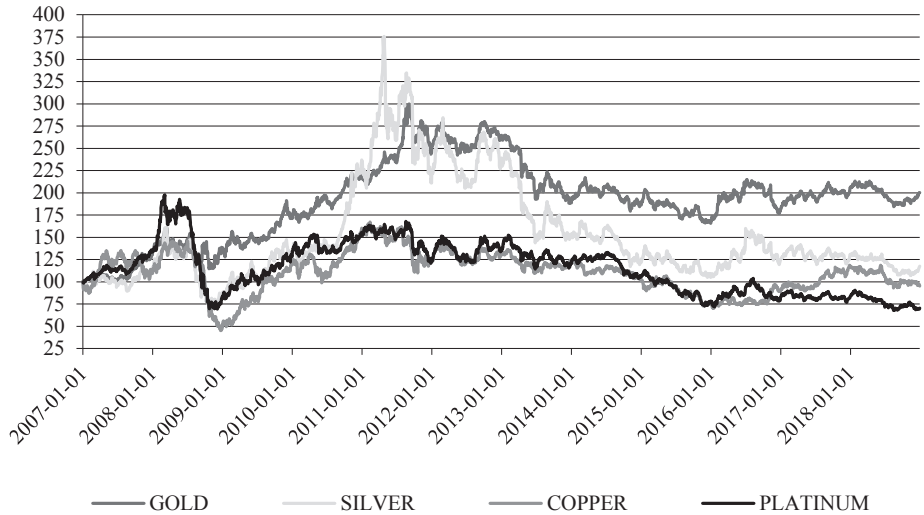

Fig. 2. The gold, silver, copper and platinum normalized quotations during 02.01.2007-31.12.2018
Source: own elaboration.

Tables 2, 3, 4 and 5 show the Sharpe, Treynor and Jensen coefficients for the considered main period and three sub-periods.

Table 2. The Sharpe, Treynor and Jensen coefficients for the period 01.2007-12.2018

01.2007-12.2018	Sharpe	Treynor	Jensen
SAX + Metals	–0.003820	–0.015800	–0.000810
SAX	–0.010720	–0.012050	0
DAX + Metals	**0.007222**	**0.019352**	**0.001300**
DAX	**0.011469**	**0.015716**	0
PX + Metals	–0.019220	–0.051400	–0.006230
PX	–0.024700	–0.034030	0
WIG + Metals	–0.027130	–0.094200	–0.018207
WIG	–0.020540	–0.024580	0
BUX + Metals	–0.027210	–0.080070	–0.020520
BUX	–0.011650	–0.017510	0

Source: own calculations.

Table 3. The Sharpe, Treynor and Jensen coefficients for the period 01.2007-12.2010

01.2007-12.2010	Sharpe	Treynor	Jensen
SAX + Metals	0.029533	**0.127495**	0.048810
SAX	–0.048612	–0.061469	0
DAX + Metals	**0.041615**	0.119799	**0.049023**
DAX	**0.002644**	**0.004357**	0
PX + Metals	0.020331	0.066623	0.042877
PX	–0.022697	–0.044901	0
WIG + Metals	0.016483	0.061416	0.030494
WIG	–0.023391	–0.036457	0
BUX + Metals	0.011293	0.039319	0.030913
BUX	–0.022985	–0.046601	0

Source: own calculations.

Table 4. The Sharpe, Treynor and Jensen coefficients for the period 01.2011-12.2014

01.2011-12.2014	Sharpe	Treynor	Jensen
SAX + Metals	–0.046114	–0.234283	–0.035767
SAX	–0.008266	–0.008305	0
DAX + Metals	**–0.026223**	**–0.064945**	**–0.035461**
DAX	**0.026538**	**0.033785**	0
PX + Metals	–0.063273	–0.149154	–0.038004
PX	–0.042621	–0.045208	0
WIG + Metals	–0.071236	–0.326065	–0.054126
WIG	–0.019579	–0.020268	0
BUX + Metals	–0.078769	–0.217707	–0.050488
BUX	–0.045613	–0.057817	0

Source: own calculations.

Table 5. The Sharpe, Treynor and Jensen coefficients for the period 01.2015-12.2018

01.2015-12.2018	Sharpe	Treynor	Jensen
SAX + Metals	**–0.007749**	**–0.024867**	–0.012339
SAX	0.031156	**0.033840**	0
DAX + Metals	–0.008197	–0.025883	**–0.007345**
DAX	0.007186	0.008201	0
PX + Metals	–0.038962	–0.131658	–0.022719
PX	–0.017595	–0.014217	0
WIG + Metals	–0.051369	–0.149087	–0.030285
WIG	–0.019289	–0.017184	0
BUX + Metals	–0.035113	–0.105821	–0.034955
BUX	**0.049034**	0.050334	0

Source: own calculations.

Table 6. The beta coefficients for the SAX and metals portfolio for the considered periods

Periods	GOLD	SILVER	COPPER	PLATINUM	SAX
01.2007-12.2018	0.013038	0.023425	0.010562	0.032445	1
01.2007-12.2010	0.066726	0.087459	0.056396	0.080950	1
01.2011-12.2014	**–0.044590**	**–0.062330**	**–0.047930**	**–0.053750**	1
01.2015-12.2018	**–0.007550**	0.013693	0.000749	0.044004	1

Source: own calculations.

Table 7. The beta coefficients for the DAX and metals portfolio for the considered periods

Periods	GOLD	SILVER	COPPER	PLATINUM	DAX
01.2007-12.2018	**–0.04794**	0.078398	0.518561	0.238460	1
01.2007-12.2010	**–0.02417**	0.093427	0.717950	0.336107	1
01.2011-12.2014	**–0.01323**	0.123852	0.448533	0.236728	1
01.2015-12.2018	**–0.14038**	**–0.009150**	0.190057	0.037060	1

Source: own calculations.

Table 8. The beta coefficients for the PX and metals portfolio for the considered periods

Periods	GOLD	SILVER	COPPER	PLATINUM	PX
01.2007-12.2018	**–0.005300**	0.166923	0.386095	0.245777	1
01.2007-12.2010	0.022514	0.192517	0.413962	0.293356	1
01.2011-12.2014	**0.003548**	0.204185	0.411301	0.209053	1
01.2015-12.2018	**–0.187120**	**–0.050830**	0.178921	0.026317	1

Source: own calculations.

Table 9. The beta coefficients for the WIG and metals portfolio for the considered periods

Periods	GOLD	SILVER	COPPER	PLATINUM	WIG
01.2007-12.2018	**0.004805**	0.027563	0.187940	0.091670	1
01.2007-12.2010	**0.007036**	0.066015	0.338571	0.146212	1
01.2011-12.2014	**–0.036570**	**–0.048060**	**–0.025040**	**–0.005330**	1
01.2015-12.2018	0.057983	0.020032	0.013787	0.056231	1

Source: own calculations.

Table 10. The beta coefficients for the BUX and metals portfolio for the considered periods

Periods	GOLD	SILVER	COPPER	PLATINUM	BUX
01.2007-12.2018	**–0.010040**	0.123248	0.342331	0.184462	1
01.2007-12.2010	0.017568	0.150566	0.399699	0.231081	1
01.2011-12.2014	**–0.017160**	0.147227	0.290482	0.158290	1
01.2015-12.2018	**–0.106780**	**–0.021090**	0.200920	0.046184	1

Source: own calculations.

From Table 3 one can observe that during the crises, putting metals into the portfolio improves the investment. The portfolio achieves better results. When comparing Tables 4 and 5 for the post-crisis periods, one can see that adding metals into portfolio does not improve the results of the portfolio, one cannot observe the diversification benefits.

Moreover, Tables 3, 4, 5 show that for all the considered portfolios the most developed is that of the German economy. Only for the period 01.2015-12.2018 one can observe a better performance of the SAX stock index. The Sharpe, Treynor and Jensen coefficients are highest for the DAX index.

In Tables 6, 7, 8, 9 and 10 there are beta coefficients for the considered precious metals and for the stock exchanges in Slovakia, Germany, the Czech Republic, Poland and Hungary. If the beta coefficient is negative or near zero (the bold numbers) one can say that this metal can be recognized as a hedge instrument for the discussed stock exchange. In almost all cases only gold can be considered as a hedge instrument. For the Warsaw Stock Exchange and Bratislava Stock Exchange, for the period 01.2011-12.2014, gold, silver, copper and platinum can be considered as a hedge instrument. Moreover, all the precious metals are not more volatile and riskier than the market.

Table 11 shows the correlation coefficients for the considered instruments for the period 01.2007-12.2018, also including all the sub-periods (Tables 12, 13, 14). Table 11 shows that the correlation coefficient is negative for gold for the BUX, PX and DAX. This only proves that gold can be considered as an alternative instrument for investors from Central and Eastern Europe. Table 13 shows that for Slovakia and Poland, all the metals have a negative correlation coefficient with the stock exchange index, which only confirms the conclusions obtained from the negative beta coefficient. One can consider those instruments as an alternative investment. What is unexpected, is that during the period of crisis (2007-2010) it is only for the German Stock Exchange one can observe the negative correlation coefficient with gold.

Table 11. The correlation coefficients for the considered instruments for the period 01.2007-12.2018

	Gold	Silver	Copper	Platinum
Silver	0.761419	1		
Copper	0.124480	0.207881	1	
Platinum	0.414326	0.438694	0.409339	1
BUX	**–0.015240**	0.109485	0.300711	0.197694
SAX	0.014799	0.015555	0.006936	0.025994
WIG	0.005807	0.019489	0.131407	0.078200
PX	**–0.007370**	0.135886	0.310804	0.241388
DAX	**–0.066350**	0.063484	0.415231	0.232963

Source: own calculations.

Table 12. The correlation coefficients for the considered instruments for the period 01.2007-12.2010

	Gold	Silver	Copper	Platinum
Silver	0.779730	1		
Copper	0.126089	0.204534	1	
Platinum	0.422584	0.480367	0.426703	1
BUX	0.029220	0.155425	0.353428	0.265710
SAX	0.069215	0.056305	0.031101	0.058052
WIG	0.008997	0.052387	0.230143	0.129243
PX	0.036537	0.193904	0.357151	0.329126
DAX	**–0.03267**	0.078371	0.515881	0.314057

Source: own calculations.

Table 13. The correlation coefficients for the considered instruments for the period 01.2011-12.2014

	Gold	Silver	Copper	Platinum
Silver	0.756343	1		
Copper	0.168401	0.241797	1	
Platinum	0.392011	0.411462	0.46657	1
BUX	**–0.02323**	0.103703	0.267291	0.173175
SAX	**–0.04784**	**–0.0348**	**–0.03496**	**–0.04661**
WIG	**–0.04041**	**–0.02764**	**–0.01881**	**–0.00476**
PX	0.004017	0.120317	0.3166	0.19131
DAX	**–0.01798**	0.087592	0.414382	0.260009

Source: own calculations.

Table 14. The correlation coefficients for the considered instruments for the period 01.2015-12.2018

	Gold	Silver	Copper	Platinum
Silver	0.734519	1		
Copper	0.061098	0.180676	1	
Platinum	0.427367	0.408939	0.308966	1
BUX	**–0.14488**	**–0.01783**	0.161501	0.039357
SAX	**–0.01084**	0.012246	0.000637	0.039677
WIG	0.068278	0.014694	0.009618	0.041586
PX	**–0.19986**	**–0.03382**	0.113208	0.017653
DAX	**–0.21176**	**–0.0086**	0.169835	0.035109

Source: own calculations.

4. Conclusions

For centuries, gold and silver have been perceived to be important hedging mechanisms against economic uncertainty.

The effectiveness and roles of precious metals in investment portfolios differ for the considered countries. Through analyzing data from 2007-2018, the authors showed that gold, and in some cases silver, have the potential to play a diversifying role in investment portfolios. During the crises, putting metals into the portfolio improves the investment.

For post-crisis periods, one can observe that adding metals into the portfolio does not improve results (a comparison of the diversified portfolios using the Sharpe, Treynor and Jensen coefficients). Thus one cannot observe the diversification benefits. The highest value of the Sharpe, Treynor and Jensen coefficients can be seen for German Stock Exchange.

During the period 01.2011-12.2014, for Poland and Slovakia the authors observed that gold, silver, copper and platinum can be considered as a hedge instrument (negative beta coefficient and negative correlation); in almost all the cases only gold can be considered as a hedge instrument.

One can see that the correlation coefficient is negative for gold with BUX, PX and DAX, which only proves that gold can be considered as an alternative instrument for investors from Central and Eastern Europe. It can also be seen that for Slovakia and Poland, during the period 01.2011-12.2014, all the metals have a negative correlation coefficient with stock exchange index, which only confirmed the conclusions obtained from the negative beta coefficient. One can consider those instruments as an alternative investment. What is unexpected is that during the period of crisis (2007-2010) only for the German Stock Exchange one can observe the negative correlation coefficient with gold.

Considerable work remains to be done in the area of alternative investments. Possible areas of investigation include the diversification benefits of such commodities as energy products. Research might be also more interesting if one includes more different scales of precious metals in the portfolio.

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