

THE EFFECTIVENESS OF INVESTING IN PRECIOUS METALS, CURRENCY RATES AND STOCK INDICES IN THE ERA OF SIGNIFICANT INFLATION IN THE 21ST CENTURY

Adrianna MASTALERZ-KODZIS

University of Economics in Katowice; Adrianna.mastalerz-kodzis@ue.katowice.pl,
ORCID: 0000-0001-9099-3576

Purpose: The aim of the work is to show the profitability of selected investments on the Polish capital market, taking into account inflation at the beginning of the 21st century. The subject of the research are selected exchange rates, precious metals and stock indices.

Design/methodology/approach: Selected quantitative methods were used in the work, including the methodology of descriptive statistics, financial engineering and financial mathematics.

Findings: In the difficult period of the first 30 years of the 21st century, there are investments that allow you to make a profit, but they involve high risk.

Research limitations/implications: There are many investment opportunities on the Polish capital market, including investing on the stock exchange, in precious metals. However, major economic and political changes in the first 30 years of the 21st century imply great uncertainty and the risk of financial loss.

Practical implications: Investing is part of the economic activity of many entities on the market. Therefore, the analysis of investment profitability is a current and important research problem and is applicable in economic practice.

Social implications: Both individual and collective investors are interested in effective investing. Banks also want to invest funds and achieve the highest possible profits. Therefore, the analysis of investment opportunities is important for various economic entities, but also for households.

Originality/value: The article presents a comparison of various investments in terms of their profitability and risk in the first 30 years of the 21st century.

Keywords: long-term investing, investing in precious metals, investing in currency rates, investing on the stock exchange, investment risk.

Category of the paper: research paper.

1. Introduction

Investing is a complex, difficult process that requires knowledge, methodology, experience and also intuition. The decision-maker is often required to achieve above-average profits regardless of the economic and political situation. This is sometimes impossible. However, the search for effective investment methods is still a current task, because profitable investment of financial resources and their constant multiplication is one of the problems of the modern economy (Begg et al., 2007; Dorosz, 2014; Partridge, 2022; Petzel, 2021; Stevart et al., 2019; Taylor, 2009 Wojewoda, 2023).

Choosing how to invest capital is difficult and may turn out to be crucial due to the environmental conditions and economic conditions. The appropriate choice of investment depends on many factors, including the size of financial resources and the investor's attitude to risk. Risk-averse and risk-averse investors will choose low-risk investments, for example savings deposits in banks, while investors who are more risk-averse will buy, for example, precious metals.

Investors willing to take risk will reach for shares on the stock exchange. The greater the expected benefits from an investment, the greater the investor's risk. Therefore, it is worth considering different investments or diversifying them to reduce the risk of possible financial losses.

The key question that the author asks himself is whether there is a significant relationship between the effectiveness of investing in currency rates, metals, or securities offered on the stock exchange. Is diversification of portfolio components necessary, how does diversification affect investment risk, does it significantly reduce it? Introducing many components to a portfolio increases the costs of its maintenance. Do the benefits obtained through diversification therefore cover the costs?

There are many research works on most popular investment strategy applied to the Polish capital market, as well as many works on optimal investment strategies using less popular investment methods (Mastalerz-Kodzis, 2014, 2015, 2016; Mastalerz-Kodzis, Pośpiech, 2015; Pośpiech, Mastalerz-Kodzis, 2015). This work focuses on investing in three areas: precious metals, currencies and securities from the Warsaw Stock Exchange.

2. Research methodology – effective rate of return taking into account inflation

The effective interest rate is an indicator that takes into account the total income from capital with total interest, or the total cost of capital with interest paid. The factor that is taken into account when calculating the effective interest rate is the capitalization of interest. This indicator is used to determine the increase in capital value per year (Bieszk-Stolorz, 2022; Tarczyński, 1999).

Effective interest is also known as the effective interest rate. This term means the exact interest rate for the entire year. It indicates the amount that the bank client will have to pay as interest for taking out the loan or how much he will be able to earn on his savings saved as a deposit.

The nominal interest rate is a specific interest rate that determines how much borrowers will have to pay to the bank and how much people with deposits will gain. The nominal rate is often attractive to the bank's client.

The effective interest rate includes not only the nominal amount, but also all possible additional costs, such as the initial fee, all administrative fees and the monthly fee. For this reason, it is also called the real or actual interest rate. It is definitely higher than the nominal value and is also very variable.

The offer of Polish banks includes a promotion that is beneficial to the customer, ensuring, for example, 6 percent of revenues throughout the year. However, it is crucial to determine the period over which the offered interest will be capitalized. There are several types of effective interest rate settlement periods: daily, calculated on all days of the year, monthly, quarterly, half-yearly, continuous, i.e. infinite.

Which type of settlement period will be the best solution for a given person depends primarily on his or her own needs, capabilities and contract terms. However, the tables available on the websites of various banks show that the best option is to choose a continuous interest rate.

Formula for the effective interest rate per year:

$$r_e = \left(1 + \frac{r}{m}\right)^m - 1 \quad (1)$$

where:

r_e - effective annual interest rate,

r - nominal annual interest rate,

m - number of capitalizations per year.

When calculating the final value of capital, we must take into account any changes in interest rates.

Let us assume that over the next n years the annual interest rate was equal to $r^{(1)}, r^{(2)}, \dots, r^{(n)}$ whereas in a situation where interest was capitalized in periods shorter than one year, in the calculations we assume

$$r^{(i)} = r_{ef}^{(i)} \quad (2)$$

In the described case the value of the initial capital K_0 after n years will be equal to

$$K_n = K_0 \prod_{i=1}^n (1 + r^{(i)}) \quad (3)$$

The interest rate that meets the above condition is called the average interest rate over n years and is denoted by \bar{r} .

The rate \bar{r} can be determined from the equation:

$$K_0 (1 + \bar{r})^n = K_0 \prod_{i=1}^n (1 + r^{(i)}) \quad (4)$$

It is expressed by the formula:

$$\bar{r} = \left[\prod_{i=1}^n (1 + r^{(i)}) \right]^{\frac{1}{n}} - 1 \quad (5)$$

Real interest rate r' (taking into account inflation), r_i is the inflation rate

$$r' = \frac{r - r_i}{1 + r_i} \quad (6)$$

For a small inflation rate, there is an approximate equality

$$r' \approx r - r_i \quad (7)$$

The relationship between interest rates r , r' and r_i written in the form

$$1 + r = (1 + r_i)(1 + r') \quad (8)$$

is sometimes called the Fisher formula (Irving Fisher, American economist, 1867-1947).

By denoting by $r_i^{(1)}, r_i^{(2)}, \dots, r_i^{(k)}$ inflation rates in k consecutive periods (subperiods), we can calculate the total inflation rate in k periods from the formula

$$r_i = \prod_{j=1}^k (1 + r_i^{(j)}) - 1 \quad (9)$$

and the average inflation rate in k periods from the formula

$$\bar{r}_i = \left(\prod_{j=1}^k (1 + r_i^{(j)}) \right)^{\frac{1}{k}} - 1 \quad (10)$$

If an investor wants to multiply profits and take advantage of a loan, it is also worth using the formula for the effective interest rate of the loan. Then, it is worth calculating the effective cost of the loan, which consists of the sum of interest paid, which should be divided by its amount. To calculate its height yourself, use the formula:

ESPK – effective loan interest rate, where:

$$ESPK = \frac{\sum_{i=1}^n \frac{O_i}{\left(1+\frac{r}{n}\right)^i}}{K} \quad (11)$$

where:

K - loan amount,

r - annual interest rate used to calculate the present value of interest,

O_i - interest installments,

n - number of interest payment periods per year.

When deciding to take out a mortgage or cash loan, or to open a deposit, it is worth being aware that not only the regular interest rate affects the amount of costs that the client will incur. The element that should primarily attract the attention of a future borrower is the effective interest rate, which will realistically indicate the amount of all costs that will have to be incurred or that can be gained by having a deposit. Therefore, in order to properly understand the content of the contract signed with the bank, it is important to familiarize yourself not only with the definitions of unclear terms, but above all with the bank's offer itself and the details contained in the signed contract.

3. Research results - Analysis of investment profitability -

3.1. Subject of research

The following assets are analyzed: currencies, precious metals, and leading stock market indices. Currencies - leaving cash is beneficial when the amount of money in circulation decreases, leaving people and businesses with less cash than they expected, which usually leads to an economic recession. Cash allows you to limit overall losses and buy assets at low prices (Figure 1).

There is a visible relationship between exchange rates, however, the Swiss franc is the least susceptible to the geopolitical situation, the euro and US dollar are strongly correlated. The British pound, also due to Brexit, is not attractive for investment reasons.

The financial crisis in 2009-2011 was very visible for all currency rates. The exchange rates of the Euro, Swiss franc and US dollar are positively correlated, but the exchange rate of the British pound sterling behaves slightly differently. Currency rates may be related to geopolitical changes or geopolitical diversification of capital investments. The introduction of exchange rates as a component of the investment portfolio reduces geopolitical risk.

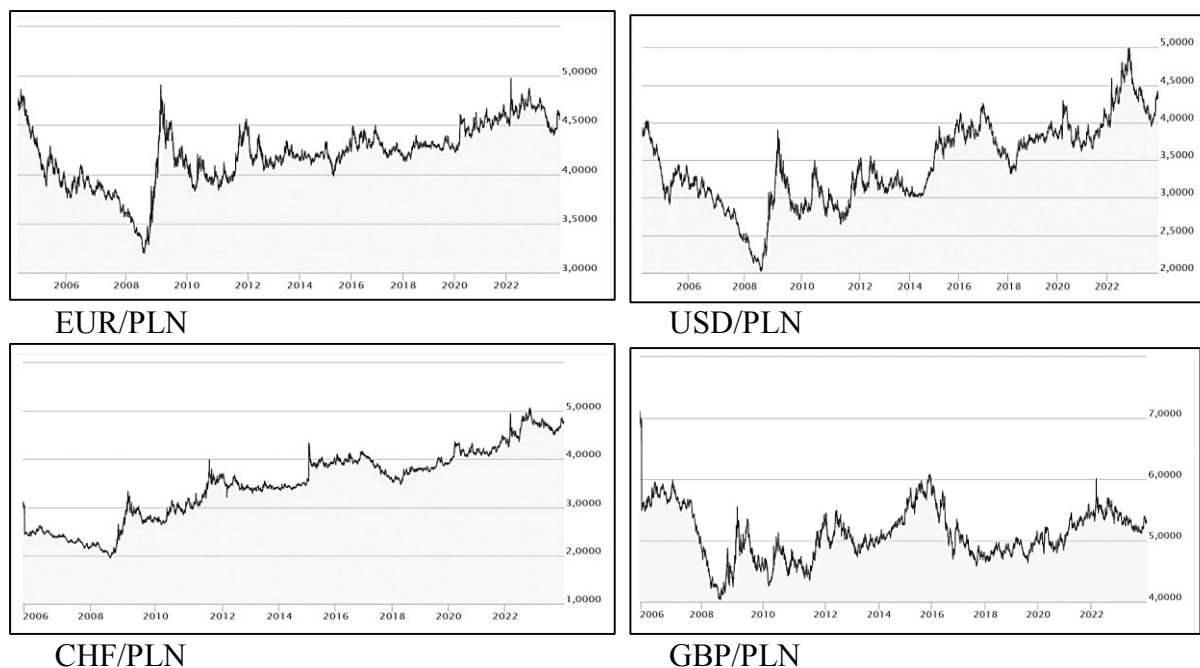


Figure 1. Exchange rates depending on PLN in the 21st century.

Source: <http://notowania.pb.pl/instrument>

Investing in precious metals allows you to protect yourself against inflation and currency crises. As paper money loses its value, precious metals remain valuable (Figure 2).

In the 21st century, the prices of precious metals have changed significantly. This was caused by the economic and political situation in the world. The Covid-19 pandemic and the military situation in Europe also had a significant impact on metal prices. It is impossible to clearly indicate a metal in which the investment would be 100% profitable, the price of which increased in the first three decades of the 21st century. However, looking at charts 1, it seems that the safest investment was to invest funds in gold.

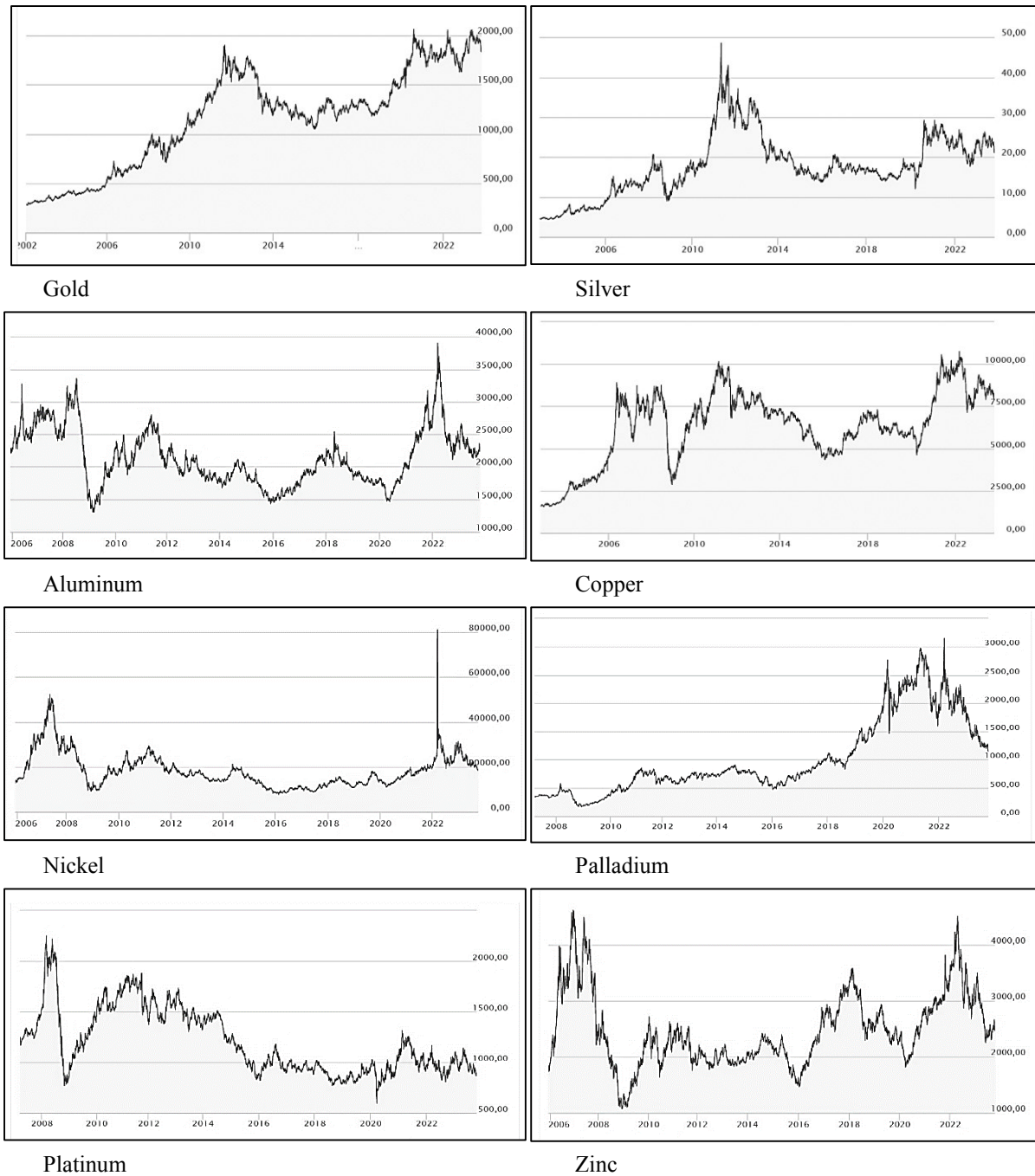


Figure 2. Prices of selected metals in the 21st century.

Source: <http://notowania.pb.pl/instrument>

Third - Stocks exchange shares (Figure 3). Methodical stock investing is beneficial at a time when living standards are rising, the economy is growing, unemployment is falling, interest rates are low, the financial system is healthy, and credit is readily available.

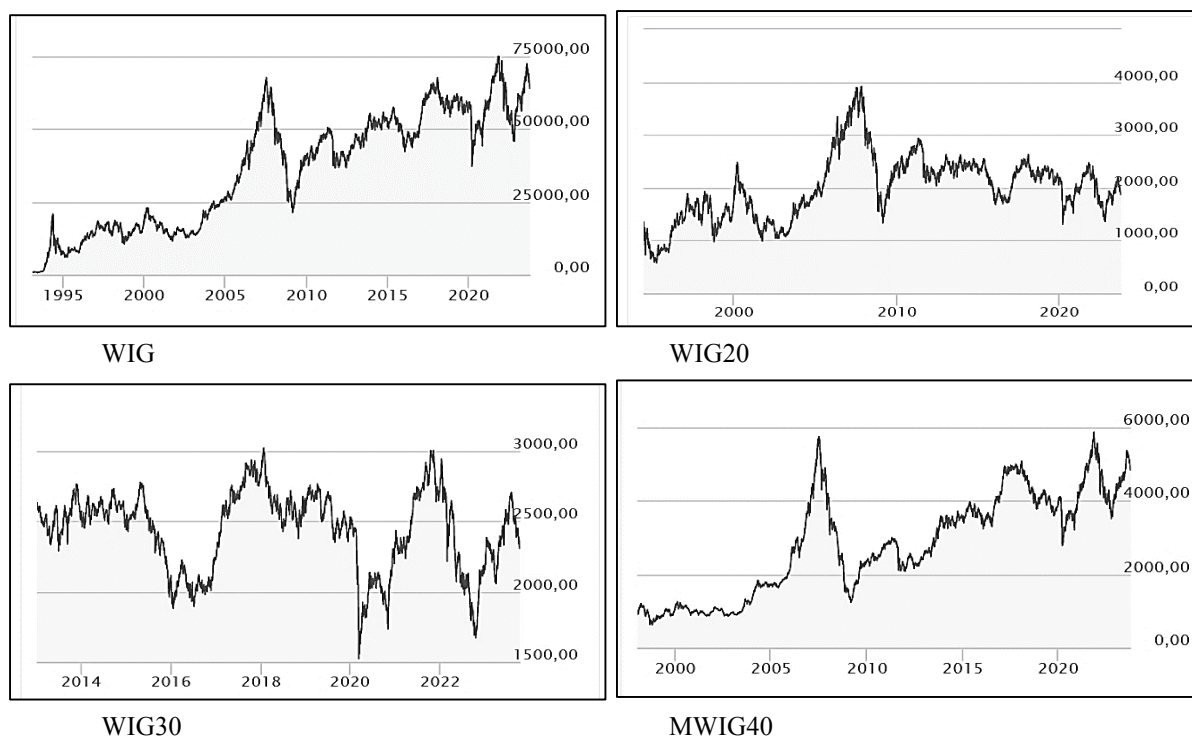


Figure 3. Stocks exchange shares index in the 21st century.

Source: <http://notowania.pb.pl/instrument>

Various stock indices were considered:

- WIG - The oldest stock index, calculated from the first trading session. The basic index values are calculated on the basis of share prices of all listed companies if at least 10% of shares worth EUR 1 million are in free circulation.
- WIG 20 - stock exchange index of the 20 largest joint-stock companies listed on the Warsaw Stock Exchange. The base date for the index is April 16, 1994, and the base value is 1,000 points. This is a price type index
- WIG30 - stock exchange index of the 30 largest and most liquid joint-stock companies listed on the Warsaw Stock Exchange, which was introduced on September 2013.
- MWIG40 - stock exchange index of medium-sized companies listed on the Warsaw Stock Exchange, which replaced the MIDWIG index after the session on March 16, 2007. It consists of a fixed number of 40 companies.

Depending on the composition of the index and its complexity, the charts vary. indexes show a certain general tendency on the stock exchange for a given group of companies. They are a synthetic measure showing price developments in a given period. There is a strong positive correlation between the WIG and MWIG indices. WIG30 and WIG20, on the other hand, are characterized by greater volatility over time.

3.2. Results of empirical analyses on the Polish capital market

Table 1 shows investment results - annual rates of return without taking into account inflation. There are very large differences in profitability depending on the value.

Table 1.

Investment efficiency without taking into account inflation, average annual rate of return, percentage value

Investment period/ average annual rate of return	01.2005- 01.2024	01.2010- 01.2024	01.2015- 01.2024	01.2020- 01.2024	01.2021- 01.2024	01.2022- 01.2024	01.2023- 01.2024
Exchange rate EUR/PLN	0,06	0,98	0,93	0,85	0,75	0,33	-1,09
Exchange rate USD/PLN	3,51	6,08	7,41	8,78	10,53	17,57	25,00
Exchange rate CHF/PLN	2,47	4,85	3,81	5,92	6,84	7,32	-6,00
Exchange rate GBP/PLN	-1,43	0,61	0,00	2,13	0,00	-2,78	-15,00
Gold	15,57	6,43	6,48	11,54	8,89	5,88	-5,00
Silver	12,03	3,81	3,09	13,33	-5,95	-5,77	27,78
Aluminum	0,53	1,59	3,27	11,67	15,56	-21,05	-12,00
Cooper	12,13	3,71	0,95	13,00	19,44	-12,00	-30,91
Nickel	0,29	-0,36	1,31	6,67	6,25	-38,13	-5,00
Palladium	7,89	16,67	4,76	-8,33	-20,00	-33,33	-68,75
Platinum	-0,53	-2,55	1,39	7,14	-3,33	-15,38	50,00
Zinc	1,75	0,00	2,92	2,27	1,45	-10,00	14,29
WIG	10,09	12,09	5,09	5,17	4,92	-3,33	45,83
WIG20	6,32	3,33	-0,93	25,00	23,08	-2,17	46,67
WIG30	X	X	0,51	-3,70	11,76	-11,67	43,75
MWIG	6,65	8,21	11,64	1,88	0,79	-12,93	-28,33

Source: own study based on data taken from: www.bankier.pl, www.gpw.pl, www.mennica.com.pl, www.nbp.pl.

When considering investment effects, the level of inflation should also be taken into account. As a result of the Covid-19 pandemic and the Russian-Ukrainian war, the level of inflation in the country has significantly affected the return on investment. Table 2 shows average rates of return after taking into account the level of inflation. Inflation, especially during the Covid-19 pandemic, significantly reduced the profitability of investments. The tables mark the stocks with the highest and lowest profits.

Table 2.

Investment efficiency taking into account inflation, average annual rate of return, percentage value

Investment period/ average annual rate of return	01.2005- 01.2024	01.2010- 01.2024	01.2015- 01.2024	01.2020- 01.2024	01.2021- 01.2024	01.2022- 01.2024	01.2023- 01.2024
Exchange rate EUR/PLN	-1,94	-2,02	-3,07	-15,15	-11,25	-8,67	-7,09
Exchange rate USD/PLN	1,51	3,08	3,41	-7,22	-1,47	8,57	19,00
Exchange rate CHF/PLN	0,47	1,85	-0,19	-10,08	-5,16	-1,68	-12,00
Exchange rate GBP/PLN	-3,43	-2,39	-4,00	-13,87	-12,00	-11,78	-21,00
Gold	13,57	3,43	2,48	-4,46	-3,11	-3,12	-11,00
Silver	10,03	0,81	-0,91	-2,67	-17,95	-14,77	21,78
Aluminum	-1,47	-1,41	-0,73	-4,33	3,56	-30,05	-18,00
Cooper	10,13	0,71	-3,05	-3,00	7,44	-21,00	-36,91
Nickel	-1,71	-3,36	-2,69	-9,33	-5,75	-47,13	-11,00
Palladium	5,89	13,67	0,76	-24,33	-32,00	-42,33	-74,75
Platinum	-2,53	-5,55	-2,61	-8,86	-15,33	-24,38	44,00

Cont. table 2.

Zinc	-0,25	-3,00	-1,08	-13,73	-10,55	-19,00	8,29
WIG	8,09	9,09	1,09	-10,83	-7,08	-12,33	39,83
WIG20	4,32	0,33	-4,93	9,00	11,08	-11,17	40,67
WIG30	X	X	-3,49	-19,70	-0,24	-20,67	37,75
MWIG	4,65	5,21	7,64	-14,13	-11,21	-21,93	-34,33

Source: own study based on data taken from: www.bankier.pl, www.gpw.pl, www.mennica.com.pl, www.nbp.pl.

Table 3.

Investment efficiency annual rate of return taking into account inflation and credit costs

Investment period/ average annual rate of return	01.2005- 01.2024	01.2010- 01.2024	01.2015- 01.2024	01.2020- 01.2024	01.2021- 01.2024	01.2022- 01.2024	01.2023- 01.2024
Exchange rate EUR/PLN	-6,94	-9,02	-13,07	-37,15	-31,25	-25,67	-22,09
Exchange rate USD/PLN	-3,49	-3,92	-6,59	-29,22	-21,47	-8,43	4,00
Exchange rate CHF/PLN	-4,53	-5,15	-10,19	-32,08	-25,16	-18,68	-27,00
Exchange rate GBP/PLN	-8,43	-9,39	-14,00	-35,87	-32,00	-28,78	-36,00
Gold	8,57	-3,57	-7,52	-26,46	-23,11	-20,12	-26,00
Silver	5,03	-6,19	-10,91	-24,67	-37,95	-31,77	6,78
Aluminum	-6,47	-8,41	-10,73	-26,33	-16,44	-47,05	-33,00
Cooper	5,13	-6,29	-13,05	-25,00	-12,56	-38,00	-51,91
Nickel	-6,71	-10,36	-12,69	-31,33	-25,75	-64,13	-26,00
Palladium	0,89	6,67	-9,24	-46,33	-52,00	-59,33	-89,75
Platinum	-7,53	-12,55	-12,61	-30,86	-35,33	-41,38	29,00
Zinc	-5,25	-10,00	-11,08	-35,73	-30,55	-36,00	-6,71
WIG	3,09	2,09	-8,91	-32,83	-27,08	-29,33	24,83
WIG20	-0,68	-6,67	-14,93	-13,00	-8,92	-28,17	25,67
WIG30	X	X	-13,49	-41,70	-20,24	-37,67	22,75
MWIG	-0,35	-1,79	-2,36	-36,13	-31,21	-38,93	-49,33

Source: own study based on data taken from: www.bankier.pl, www.gpw.pl, www.mennica.com.pl, www.nbp.pl.

Of course, taking into account credit costs and inflation significantly reduces the profitability of the investment. You can also use a loan when investing. Taking into account inflation and the cost of credit, the investor mostly makes losses

4. Summary

In the introduction to this article, the author asked a number of questions. The first question asked by the author was: is there a significant relationship between the effectiveness of investing in currency rates, metals, or securities offered on the stock exchange? Looking at the results of the analyses, it can be stated that depending on the precious metal, currency, and stock exchange index, the investment result is different. Therefore, it is worth taking securities from different groups in the investment process: metals, currencies, and stock exchange.

The second question: Is diversification of portfolio components necessary, how does diversification affect investment risk, does it significantly reduce it? Introducing many components to the portfolio increases the costs of maintaining it. Do the benefits obtained

thanks to diversification therefore cover the costs? Certainly, considering the values of the rates of return of securities, diversification reduces the risk when creating a portfolio while simultaneously increasing its maintenance costs.

In times of significant changes in the economy, armed conflicts, and global diseases, it is difficult to find a safe investment. Investing your savings in gold does not always result in a profit.

Investing is an art. When starting the investment process, you need to determine the size of the investment, its time horizon and the acceptable level of risk. The selection of investment securities depends on the level of risk. As empirical analyses have shown, the profitability of long-term investments depends on the security and period. Investments in precious metals were not always characterized by lower risk than stock market investments shown in the study on stock market indices.

In the analyzed period, the smallest price changes were characterized by exchange rates, which, however, during significant inflation becomes a major investment problem, reducing the effectiveness of investments. However, it should be emphasized that the period studied was very specific, both in Poland and in the world. The effects of the coronavirus pandemic and the Russian-Ukrainian conflict have a negative impact on both world economies and their capital markets. There is a very high risk of failure or even bankruptcy of business and investment activities. Therefore, searching for safe investments in the long term is a current and important problem in the economy, it is an important and necessary element of an efficient and effective management process.

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