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EMPIRICAL STUDY OF THE RELATIVE STRENGTH IN THE CURRENCY PORTFOLIO CONSTRUCTION

Summary: The relative strength – one of the most useful tools of the technical analysis – is tested in the paper. It is defined as higher upsurge of asset prices and lower reduction than for other assets in the examined period of time. It can be put into use for different assets, however, the majority of authors utilizes it on stock markets. In this study, the currency market is in question. The author creates currency portfolios and checks their profitability with the use of the relative strengths compared with the buy and hold strategy. It turns out that the former lets achieve higher rates of return for all currencies tested in the study. What's more, in some cases, the buy and hold strategy resulted in losses, whereas at the same time, the relative strength technique resulted in profits. When both strategies ended with losses, they were lower in the case of the relative strength technique. The Moving Average Convergence Divergence indicator was applied to find buy and sell signals. The research period is one year. It starts in October 2016 and ends at the end of September 2017. All major currencies were tested from the point of view of the Polish investor.

Keywords: relative value, technical analysis, MACD.

JEL Classification: F3, G1.

Introduction

The theory of finance assumes that investors behave rationally, so that any investor is interested in profit maximization at the certain risk level. According to the Markowitz model [Markowitz, 1952, p. 77-91], the higher the risk, the higher the potential profit. Thus, at the same risk level an investor chooses a higher potential profit. The paper dwells on the relative strength of assets. Its aim is to check if it can be a more profitable strategy than the buy and hold one.

The tested hypothesis is that the relative value strategy can give better results as far as rates of return are concerned than the buy and hold one. Although, the notion “relative strength” is understood in the same way in different scientific sources and in practice, there are various ways of measuring it. In the paper, the Moving Average Convergence/Divergence indicator is used as a tool for discovering buy and sell signals. According to the author’s knowledge, the relative value strategy was not researched for the Polish currency market yet and published in the Polish literature. Foreign studies are mostly devoted to stock markets, although they stress that this kind of strategy can be used on other markets too. The paper starts with the short literature review. The main purpose of the paper is empirical, so the biggest part of it was devoted to the research results presentation. The paper ends with final findings and conclusions.

1. Literature review

The choice based on the relative strength of stocks (their prices rise more and decrease less than others) can lead to better investment results than the random one [Levy, 1967]. There are different methods of its measurement, for instance the Relative Strength Index (RSI). Fred and Tam [2015, p. 221] report that it was created by J. Welles Wilder Jr. in 1978 and lets present the inner strength of prices rises in comparison to their declines in the examined period of time. The literature emphasizes that it is one of the most popular technical analysis indicators and at the same time pays attention to wide possibilities of its usage, mostly on stock markets [Khadke Leena, Sarode Anil, 2013; Nithya, Thamizhchelvan, 2014, p. 20-28]. The concept of the relative value was present in the literature even earlier and it was analyzed in the context of stocks [Levy, 1967, p. 595-610].

Faber [2010] stresses that techniques based on the relative strength are more efficient than those referring to the buy and hold strategy. The research says that the relative value strategy both lets increase absolute rates of return, but simultaneously augments the risk measured both with volatility and with maximum drawdown measures. The author shows it with the example of American stock markets and emphasizes that the weak point of the analyzed strategy is that it considers only long positions within examined groups.

Because of the high popularity of practical usages of relative value indexes, the literature also presents methods of their prediction. Alfaro and Sagner [2010] use the binomial model for this purpose. Fred and Tam [2015] apply methods

from the technical analysis field, similar to the Relative Value Indicator. These are Japanese candlesticks and the Moving Average Convergence/Divergence indicator (MACD).

The role of the relative value on the stock market is also emphasized by Brush and Boles [1983, p. 20-23], Brush [1986, p. 21-28], Chong and Ng [2008, p. 1111-1114]. This concept is explained in every book on the technical analysis and treated as one of the most important ones in the practical study of stock prices behaviour [e.g. Kirkpatrick, Dahlquist, 2015]. The application of indicators based on the relative value can be also found in [Rosillo, de la Fuente, Brugos, 2013, p. 1541-1550]. Chong, Ng and Liew [2014, p. 1-12] show that the simultaneous usage of the MACD oscillator and the Relative Value Index lets generate additional rates of return. MACD (Moving Average Convergence/Divergence) is an oscillator based on two exponential moving averages – the MACD line and signal line. The MACD line is the difference between two exponential moving averages calculated on closing dates. These are usually the 26-day average and the 12-day average. The signal line is usually a 9-period exponential average of the MACD line. A sell signal is when the MACD line goes below the signal line. The buy signal is when the MACD increases above the signal line [Murphy, 1999, p. 220-221].

In the Polish literature, the concept of the relative value was described by Borowski [2014, p. 134-150]. The author shows examples of its uses mostly on the stock market (with regard to indexes too), but also on commodity and futures markets. However, no research on the Polish Zloty is conducted in this book.

Pring [2001, p. 42-46; in: Borowski, 2014] shows that the relative value application can be surely done in the following situations:

- Comparison of the strength of two different instruments from different markets (so called inter-market analysis). This can be for instance the commodities market and the stock market or the precious metals market, and the bond market.
- Comparison of the strength of two different stock markets in various countries, which can be done for example with the use of indexes.
- Comparison of relative changes of prices on commodity markets.
- Comparison of the strength of changes of two different currency rates. At the same time, the author notes that the currency rate may be treated as the relative strength of one currency compared with another one. This approach is applied in this paper.

The literature mostly presents the problem of the relative strength on stock markets. However, in practice they are also applied on other markets, especially by hedge funds. The earlier mentioned fact that strategies based on the relative value contribute to the rate of return increase encourages hedge funds to apply them. At the same time, this group of financial vehicles does not mind the rise of risk because they are risk oriented institutions. Internet webs devoted to portfolio management by hedge funds are full of various proposals concerning the application of strategies based on the relative value and other technical analysis indicators on various markets. It proves that relative value strategies are important from the practical point of view, which is why it is worth extending the existing theory in this field.

2. Research methodology

The author tests the portfolio profitability with the usage of the relative value strategy, comparing it to the buy and hold strategy which is understood here as the purchase of foreign currency at the beginning of the research period and selling at the end. Each tested portfolio has two currencies in it, that is the Polish Zloty and another currency. All major currencies were taken into consideration which are: American Dollar, Euro, Australian Dollar, Canadian Dollar, Japanese Yen, Swiss Franc and British Pound. At the beginning of each investment, the investor has PLN 100 000 and 100 000 of the foreign currency. Next transactions are made at close prices, according to buy or sell foreign currency signals shown with MACD. To be exact, when the buy signal is observed, the foreign currency is purchased. When the sell signal appears, the foreign currency is sold. At the end, the portfolio value is compared with the buy and hold strategy. The research period is one year that is from the beginning of October 2016 to the end of September 2017. The first working day of October was on the 3rd, so the research starts on this day and the last working day of September was the 29th and the research ends with this date. Data were taken from the [www 1] Internet data base. The study is conducted from the point of view of the Polish investor, which is why all portfolios are valued in the Polish Zloty (PLN) at the end. The study is based on close prices.

3. Research findings

Figure 1 presents USD/PLN quotations depicted with Japanese candlesticks, as well as MACD lines which show buy and sell signals which were used to conduct transactions in the conducted study. At the beginning of the research period, the investor has USD 100 000 and PLN 100 000 in his portfolio. When the buy signal is generated, he buys American Dollars and sells them when the sell signal is seen.



Fig. 1. USD/PLN candlestick chart with the MACD indicator

Source: Author's own study.

Table 1 presents the total portfolio value for two examined strategies. For the relative value strategy the final portfolio value at the end of the research period that is on the 29.09.2017 is PLN 504 079,63. For the buy and hold technique it is PLN 464 897, which makes a 7,77% difference. Both strategies were profitable in the examined period.

The second examined portfolio initially consists of PLN 100 000 and EUR 100 000. Figure 2 exhibits EUR/PLN candlestick chart and the MACD indicator showing buy and sell signals.

Table 1. USD–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	USD	PLN	Total portfolio value in PLN
03.10.2016	3,83173	100 000	100 000	383 173
29.09.2017 (relative strength strategy)	3,64897	138142.99	0	504 079,63
29.09.2017 (buy & hold strategy)	3,64897	100 000	100 000	464 897
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	7,77%

Source: Author's own research.

**Fig. 2.** EUR/PLN candlestick chart with the MACD indicator

Source: Author's own research.

As data gathered in Table 2 suggest, the relative value strategy resulted in the total portfolio value of PLN 544 517,41, whereas the buy and hold strategy contributed to the portfolio value of PLN 531 310. Both strategies generated positive rates of return in the analyzed period, but the relative value strategy outcome was 2,21% better.

Table 2. EUR–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	EUR	PLN	Total portfolio value in PLN
03.10.2016	4,29699	100 000	100 000	529 699
29.09.2017 (relative strength strategy)	4,3131	126247.34	0	544 517,41
29.09.2017 (buy & hold strategy)	4,3131	100 000	100 000	531 310
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	2,42%

Source: Author's own research.

The third portfolio in question is built of PLN 100 000 and CHF 100 000. Figure 3 shows buy and sell signals which are dates when Swiss Francs are purchased (buy signal) and Swiss Francs are sold (sell signal).

**Fig. 3.** CHF/PLN candlestick chart with the MACD indicator

Source: Author's own research.

Data gathered in Table 3 describe the considered portfolio. At the end of the period, the portfolio value is PLN 496 856,41, when the relative strength strategy is engaged. For the buy and hold strategy it is PLN 476 866 which is lower than the initial portfolio value (PLN 493 587). To sum up, the relative value strategy leads to profits whereas the buy and hold generates losses at the same period of time. The former is 4,02% better than the latter as far as rates of return are concerned.

Table 3. CHF–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	CHF	PLN	Total portfolio value in PLN
03.10.2016	3,93587	100 000	100 000	493 587
29.09.2017 (relative strength strategy)	3,76866	131839,01	0	496 856,41
29.09.2017 (buy & hold strategy)	3,76866	100 000	100 000	476 866
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	4,02%

Source: Author's own research.

The investor holds PLN 100 000 and GBP 100 000 in the fourth researched portfolio. Buy and sell transactions are conducted at close prices, according to the same rule as in previous studies that is British Pounds are bought when buy signals are observed (Fig. 4) and they are sold when sell signals appear.

**Fig. 4.** GBP/PLN candlestick chart with the MACD indicator

Source: Author's own research.

The final value for the GBP/PLN portfolio is PLN 648 742,24 for the relative value strategy and PLN 588 974 for the buy and hold strategy (see: Table 4). It leads to the conclusion that the former strategy led to the 10,15% better result. Moreover, the buy and hold strategy generated losses in the studied period.

Table 4. GBP/PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	GBP	PLN	Total portfolio value in PLN
03.10.2016	4,92105	100 000	100 000	592 105
29.09.2017 (relative strength strategy)	4,88974	132674,18	0	648 742,24
29.09.2017 (buy & hold strategy)	4,88974	100 000	100 000	588 974
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	10,15%

Source: Author's own research.

The fifth portfolio consists of PLN 100 000 and JPY 100 000. Buy and sell signals shown by MACD (Fig. 5) and summarized in Table 10 are applied to conduct transactions at close prices. Japanese Yens are purchased when buy signals are generated and they are sold on sell signals. As for previous analysis, buy and sell signals are applied to the foreign currency.

**Fig. 5.** JPY/PLN candlestick chart with the MACD indicator

Source: Author's own research.

The total portfolio value at the beginning of an investment is PLN 476 793. At the end of the studied period, it is PLN 468 422 when the relative strength strategy is applied and PLN 424 330 for the buy and hold strategy. Both strategies generated losses, however, they were higher for the latter. The relative value strategy rate of return exceeded the buy and hold one by 9,41% (Table 5).

Table 5. JPY–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	JPY	PLN	Total portfolio value in PLN
03.10.2016	3,76979	100 000	100 000	476 793
29.09.2017 (relative strength strategy)	3,2433	144 427,66	0	468 422
29.09.2017 (buy & hold strategy)	3,2433	100 000	100 000	424 330
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	9,41%

Source: Author's own research.

The sixth analyzed portfolio is built of PLN 100 000 and CAD 100 000. There were 7 buy signals and 7 sell signals in the examined period of time (Fig. 6). Canadian Dollars purchase and sell transactions are made at close prices, according to the rule described earlier for the USD/PLN portfolio.



Fig. 6. CAD/PLN candlestick chart with the MACD indicator

Source: Author's own research.

Table 6 depicts total portfolio values at the beginning of the research period and at the end depending on the strategy applied. Both of them end up with profits, although the one for the buy and hold technique is small. The relative value strategy let generate a 9,79% better rate of return in the studied period.

Table 6. CAD–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	CAD	PLN	Total portfolio value in PLN
03.10.2016	2,92106	100 000	100 000	392 106
29.09.2017 (relative strength strategy)	2,92444	147 327,52	0	430 850,5
29.09.2017 (buy & hold strategy)	2,92444	100 000	100 000	392 444
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	9,79%

Source: Author's own research.

The seventh portfolio consists of PLN 100 000 and AUD 100 000. As previously, transactions are conducted with close prices when MACD buy or sell signals appear (Fig. 7).



Fig. 7. AUD/PLN candlestick chart with the MACD indicator

Source: Author's own research.

The initial portfolio value is PLN 394 169, so the relative value strategy resulted in profits. The final portfolio value for it is PLN 413 149,99 while for the buy and hold it equals to PLN 386 183, which means a loss in the studied period. Therefore, the former strategy made a 6,53% better rate of return than the latter (Table 7).

Table 7. AUD–PLN portfolio valuation on 3.10.2016 and 29.09.2017

Date	Close	CAD	PLN	Total portfolio value in PLN
03.10.2016	2,94169	100 000	100 000	394 169
29.09.2017 (relative strength strategy)	2,86183	144365,66	0	413 149,99
29.09.2017 (buy & hold strategy)	2,86183	100 000	100 000	386 183
The difference between the portfolio value for the relative strength and buy & hold strategy	–	–	–	6,53%

Source: Author's own research.

All in all, the research shows that in all studied cases the relative strength strategy gives better results than the buy and hold one. How much they are better depends on the foreign currency invested? For USD/PLN it is 7,7%, for EUR/PLN – 2,42%, for CHF/PLN – 4,02%, for JPY/PLN – 9,41%, for GBP/PLN – 10,15%, for CAD/PLN – 9,79% and for AUD/PLN – 6,63%. What's more, for 3 currencies (CHF, GBP and AUD) the relative value strategy let generate profits when the buy and hold strategy ended with losses. For one currency (JPY) both strategies led to losses. Nevertheless, the relative value strategy allowed to decrease them. For the rest of currencies (USD, EUR and CAD) both strategies generated profits, however, they were higher for the relative value one. It should be noticed that differences between these two strategies are not enormous.

4. Discussion

The aim of the study was to check if for the currency market including the point of view of the Polish investor and 7 major foreign currencies, the relative value strategy will give better results than the buy and hold strategy. At the be-

ginning, the investor hold PLN 100 000 and 100 000 of the foreign currency. The foreign currency was bought when the MACD gave the buy signal and sold when it showed the sell signal.

The research shown that the relative value strategy income exceeds the one for the buy and hold strategy by 2,42% to 10,15%. Such findings are in accordance with the vast literature on the technical analysis, however, the degree of profit intensification is not as high as in [Faber, 2010], where it is stated that it may be up to 70%. Research findings concerning the Polish Zloty cannot be referenced to other research on this field as there is no such wide research concerning the relative value in the Polish literature.

The research hypothesis turned out to be true. The relative strength strategy lets generate better results on the Polish currency market than the buy and hold technique. This thesis comes in accordance with the existing research on the stock market present in the foreign literature and opens the research field in the Polish one.

Taking both literature findings and author's conclusions into consideration, it is obvious that the relative value strategy lets improve the portfolio result. However, there is no consensus on its intensity. The degree of this improvement depends on how the relative value is measured, that is what technical analysis indicators are applied. Further studies should try to answer the question if it is possible to choose some indicators which give the highest profits from the relative value strategy in comparison to the buy and hold technique.

Conclusions

The study extends the existing literature on the relative value strategy. Firstly – because this problem is mainly analyzed in stock markets. Secondly – because there is no Polish research on the relative strength of the Polish Zloty. Furthermore, the relative value strategy is one of the most popular technical analysis tools in practice, thus it is worth developing the research on its profitability.

As shown, the relative value strategy can be a good method for increasing rates of return compared with the buy and hold one understood in such a way that the investor buys foreign currency at the beginning of the research period and sells it at the end. The strategy based on the relative strength does not require investor's full time engagement, because during one year there are usually no more buy and sell signals than a few ones. Thus, it is not much more time consuming than the buy and hold technique.

To sum up, the relative strength can be used as the tool of profit maximization compared with the buy and hold strategy. In the paper, the MACD indicator was used, that is the author took into consideration when moving averages cut themselves in the way described earlier. Other indicators could have also been used to examine the relative value strategy. Besides, it was possible to use other exponential averages than the ones that were applied here and which are the most typical ones in order to optimize profits. This problem is definitely worth further studies. The reason for choosing this method was that it is the most useful tool of the technical analysis but also because it is not much time consuming from an investor's point of view. Thus, it can be concluded that the relative value strategy helps generate better results than the buy and hold one. Therefore, it is worth conducting further studies to look for some other indicators which can be used in the research as tools of the relative value appraisal and can improve the portfolio value even more than the MACD with typical exponential moving averages used in the study.

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EMPIRYCZNE STUDIUM SIŁY RELATYWNEJ W KONSTRUKCJI PORTFELA WALUTOWEGO

Streszczenie: W artykule podjęto analizę siły relatywnej, jednego z najbardziej użytecznych narzędzi analizy technicznej. Dla potrzeb opracowania należy ją rozumieć jako większy wzrost wartości aktywów i mniejszy ich spadek niż dla pozostałych w badanym okresie czasu. Można ją wykorzystać na dowolnym instrumencie, przy czym większość autorów przeprowadza badania na rynkach akcji. W niniejszym artykule skupiono się na walutach. Autorka tworzy portfele walutowe i sprawdza ich zyskowność w porównaniu ze strategią „kup i trzymaj”. Okazuje się, że ta pierwsza pozwala na realizację wyższych zysków dla każdej z badanych par walutowych. Co więcej, w niektórych przypadkach strategia „kup i trzymaj” prowadziła do strat, a zastosowanie siły relatywnej skutkowało dodatnim wynikiem z inwestycji. Kiedy obydwie strategie generowały straty, były one mniejsze dla siły relatywnej. Sygnały kupna i sprzedaży wychwytywano za pomocą wskaźnika MACD. Okresem badawczym był czas od października 2016 r. do września 2017 r., czyli 1 rok. Wszystkie pary walutowe były testowane z perspektywy polskiego inwestora.

Słowa kluczowe: siła relatywna, analiza techniczna, MACD.