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# Investment in variable WIG20 portfolio and “buy and hold” strategy

**Summary:** Passive equity investing is nowadays identified with investing in a portfolio reflecting the variable portfolio of the stock market index. Previously, it was understood differently, as the application of the equity “buy and hold” strategy. The article compares the results of the application of these two passive investment

strategies. The underlying stock portfolio was the WIG20 portfolio, and the hypothetical investment lasted from late 2010 until the end of 2018. In this period the strategy of “buying and holding” stocks from the WIG20 portfolio was better than the strategy of adjusting the portfolio to the variable WIG20 portfolio.

**Key words:** stock market indices, portfolio adjustments, WIG20, “buy and hold” strategy, rate of return

## Inwestycja w zmienny portfel WIG20 a strategia „kup i trzymaj”

**Streszczenie:** Pasywne inwestowanie w akcje współcześnie jest utożsamiane z inwestowaniem w portfel odwzorowujący zmienny portfel indeksu rynku akcji. Wcześniej rozumiano je inaczej, jako stosowanie strategii „kup i trzymaj” akcje. W artykule porównano wyniki zastosowania tych dwóch pasywnych strategii inwesty-

cyjnych. Bazowym portfelem akcji był portfel WIG20, a hipotetyczne inwestycje trwały od końca 2010 do końca 2018 r. W tym okresie strategia „kup i trzymaj” akcje z portfela WIG20 była lepsza od strategii dostosowywania portfela do zmiennego portfela WIG20.

**Słowa kluczowe:** indeksy rynku akcji, korekty portfela, WIG20, strategia „kup i trzymaj”, stopa zwrotu

JEL G11, G12, G19, O16

**The issue of changes (adjustments) in equity market index portfolios is not emphasised in the literature and other sources. It is discussed during presentations of individual indices (Bień, 2001; Mayo, 1997), as part of the description of an index adjustment factor (in the case of market-weighted indices) or an index divisor (in the case of**

**price-weighted indices).**

In professional press and Internet publications, the topic of index modifications is addressed in the context of the impact of a specific change in the index portfolio on investors’ decisions and, secondarily, on market share prices. The determination of the impact of index portfolio adjust-

ments on the viability of long-term passive investments, consisting of the faithful imitation by investors of the structure of index portfolios has not yet been the subject of scientific research. The purpose of this article and the presented study is to reduce the scope of the gap thus identified. This objective was achieved by comparing the investment in the share portfolio, adjusted each time after changes in the WIG20 index portfolio with the investment with a fixed portfolio structure in subsequent years, in line with the buy and hold strategy. It was assumed that hypothetical investments would last for 8 years, from the end of 2010 to the end of 2018. The study used data from websites publishing stock market information and simple statistical tools.

### Stock market indices

More than 100 years have passed since the introduction of the first regularly reported stock market indices, which are simple arithmetic averages, the Dow Jones Transportation Average and the Dow Jones Industrial Average. During this time there has been a dynamic and comprehensive quantitative, qualitative, and methodological development of these indicators. Alongside price type indices, total return indices have been introduced, and then have been used more often. Currently, it is not uncommon to quote a price type index and its total return type equivalent. On the Warsaw Stock Exchange, these are primarily WIG20 and WIG20TR. In some sources, a share index or a stock market index is defined (Gęsicki, Gęsicki, 1995; *Encyklopedia zarządzania*, 2019; *Wielki słownik języka polskiego PWN*, 2019) or described (Jajuga, Jajuga, 1996) as a price type index, in many (Bień, 2001; Dulinić, 2001; Kamiński, Mosiejko, 2010), however, the approach is full, including price and total return type indices. It should be noted that the term “price type indices” cannot

be interpreted literally. This is due to the corrections to the prices of shares or portfolios of such indices made after events such as splits (divisions) and reverse splits (connections) of shares that occurred, and for some indices also after large equity issues or the awards of equity dividends.

Stock market indices are used not only in investment analyses, particularly in technical analysis (Murphy, 2017) but also in financial theories and models. Rates of return on these indices appear as substitutes for rates of return on the market share portfolio or, more broadly, on the market investment portfolio (Panfil, 2009), i.e. as reference portfolios (Sławiński, 2006). In this way, they were used in the CAPM model (Sharpe, 1964; Czapkiewicz, Masłoń, 2008), and consequently in the currently leading company valuation model – DCF (Fierla, 2008; Paździor, 2013). The time when an investor holds shares of a company valued according to the DCF model is long, usually infinite. This is in line with the buy and hold strategy. Meanwhile, the reference portfolio, which is the stock market index portfolio, is subject to adjustments. Copying it by the investor requires an appropriate rebalancing of the portfolio. Therefore, it is important to answer the questions of whether, and if so to what extent, the rates of return on a corrected stock market index portfolio differ from the rates of return on an investment based on the buy and hold strategy. The study requires that the duration of the hypothetical investments analysed was not short, measured by days or weeks, but long, at least several years.

If there were significant differences in the rates of return in the past, another question would arise: is one of the key elements of the DCF model (and a number of other financial models) methodologically correct? The answer to this last question will be possible in the future on the basis of further in-depth analyses.

## Scope of the study

The article presents the results of the study concerning two related indices provided by the Warsaw Stock Exchange, taking into account, collectively, changes in the portfolio of these indices in the period covering most of the second decade of the 21st century. These are indices of the leading companies on the Polish stock exchange market: WIG20 and WIG20TR. The former is a price type index, the latter its equivalent of the total return type. WIG20 has been quoted since April 16, 1994, and WIG20TR since 2012, but its historical values have been made available for the dates from the end of 2004. (*Indeksy Giełdy Papierów Wartościowych w Warszawie*, 2013). The share portfolios of both indices are identical at all times, changes (adjustments) in their composition are made at the same dates and to the same extent. The main, deepest adjustment is the annual one, carried out after the third Friday of March. Quarterly adjustments take place after the third Fridays of the third months of subsequent quarters. Extraordinary adjustments are also possible (*Charakterystyka indeksu WIG20*, 2010). As the WIG20 portfolio and the WIG20TR portfolio are identical at all times, the name “WIG20 portfolio” will be used hereinafter.

The initial date included in the study is December 31, 2010, the final date is December 28, 2018. These are the dates of the last sessions on the Warsaw Stock Exchange in 2010 and 2018. The choice of the period was not random. In December 2010, the end of a strong bull market on the Polish stock exchange market, which took place after the peak of the 2008-2009 financial crisis, was approaching. WIG20 during this boom, which lasted more than 2 years, grew by more than 100%. In the following years, until the end of 2018, the stock market situation was volatile, free of bull and bear market bringing

about large (respectively an increase of not less than 100% and a decrease of at least 50%) changes in the WSE’s main stock market indices. At the same time, after 2010, there were no stock market debuts of very large (by Polish standards) privatised companies, which previously forced major changes in the WIG20 portfolio. Last such debuts took place at the end of 2009 (PGE) and in 2010 (PZU, Tauron). In subsequent years, adjustments to the portfolios of these indices were caused by reasons typical of stock exchanges, which have been operating much longer than the Warsaw Stock Exchange reactivated in 1991. It was therefore considered that at the end of 2010 the WIG20 and WIG20TR indices reached a state that can be described as mature. This was not the case in previous years. After all, out of 20 companies whose shares were initially (April 16, 1994) in the WIG20 portfolio, only one remained – mBank (formerly BRE).

## Viability of investments in the variable WIG20 portfolio

The WIG20 and WIG20TR indices at the end of 2010 and 2018 and their changes are presented in Table 1. Within 8 years, the price type index (WIG20) was down by 17%, while its return type equivalent (WIG20TR) grew by over 14%. Different directions of changes and the scale of the difference (exceeding 31 percentage points) clearly illustrate the importance of dividends for investors allocating funds in the shares of leading companies of the Warsaw Stock Exchange, which is indicated in the literature (Nowak, 2012). It is because of the dividends that, despite the drop in the WIG20 in 2011-2018 by more than 2% per year on average, investors faithfully imitating the index portfolio would make profits. Assuming no transaction costs and income tax and immediate reinvestment of granted gross dividends in the shares of companies from the

**Table 1 WIG20 and WIG20TR indices at the end of 2010 and 2018 and their changes from the end of 2010 to the end of 2018**

Specification	WIG20	WIG20TR
index at the close of the trading session of 31.12.2010 (pts)	2,744.17	3,515.01
index at the close of the trading session of 28.12.2018 (pts)	2,276.63	4,018.80
change in the index over 8 years (%)	-17.0	14.3
average annual* index change (%)	-2.3	1.7

\* the average annual index change was determined as a geometric mean Source: Own elaboration based on data from [www.gpw.pl](http://www.gpw.pl) (access: 1.12.2019).

WIG20 portfolio (which in fact was not and is not possible) according to the current structure of this index portfolio, they would earn 1.7% per year on average. As a result, after 8 years, their assets would be worth more than 14% more than at the end of 2010, despite a significant drop in share prices as reflected in the WIG20 reduction.

Between 2011 and 2018, the WIG20 portfolio underwent multiple adjustments. Out of the set at the end of 2010, 13 companies remained (65% of the initial state) at the end of 2018. Changes in the list of companies are not the only corrections to the index portfolio. Also, the shares in the capitalization and the number of shares of these 13 companies in the WIG20 portfolio were changing. It should be noted that 13 “old” companies still dominated WIG20, as their share in the index capitalization at the end of 2018 was as much as 82%. In turn, the share of 7 “new” companies in the WIG20 capitalization at the end of 2018, amounting to 18%, was almost twice as low as their share in the total number of companies in the index portfolio (35%). Also, the set of leading companies in the index capitalization changed slightly. Out of the top six at the end of 2010, only PGE moved lower, to the end of the top ten. The remaining ones, at the end of 2018, occupied the first five positions of the list according to the capitalization; they only changed places, where KGHM fell from 1st to 5th.

### Buy and hold investment characteristics

To achieve the objective of the study, it is necessary to answer the question of what results would be achieved by keeping the share portfolio unchanged with subsequent adjustments of the WIG20 portfolio, i.e. using the buy and hold investment strategy. It is therefore assumed that, from the closing of the last trading session in 2010 to the end of the last trading session in 2018, the investor had a share portfolio corresponding to the structure of the WIG20 portfolio at the end of 2010. As TVN shares were listed for the last time on the Warsaw Stock Exchange on September 22, 2015, it was assumed that the investor sold the shares of that company on that day at the closing price.

The investor applying the buy and hold strategy received proceeds from dividends and the mentioned sale of shares withdrawn from the stock exchange listing. For comparison with WIG20, which is a price type index (not including dividends), the proceeds from dividends were omitted. The amount obtained for TVN shares sold in 2015 has been included. The WIG20TR index is an income type index, so it includes proceeds from dividends and reinvestments of these amounts. For comparison with WIG20TR, it was thus assumed that the proceeds from dividends and the sale of TVN shares were reinvested during the years of their acquisition in such a way as to maintain a constant structure of the number (rather than value) of shares of 20, and then, after



the withdrawal of TVN, 19 companies in the portfolio. However, the adjustments following the split and reverse splits have been taken into account. As a result, such adjustments of the number of shares did not affect the structure of the share port-

**Table 2 Composition of the WIG20 portfolio at the end of 2010, share prices from the WIG20 portfolio and capitalisation of that portfolio at the end of 2010 and at the end of 2018 (according to closing prices)**

specification	Number of shares (thousand) in the WIG20 portfolio 31.12.2010	Share price (PLN) 31.12.2010	Capitalisation (million PLN) 31.12.2010	Share price (PLN) 28.12.2018	Capitalisation (million PLN) 28.12.2018
<b>Asseco Poland</b>	64,049	53.00	3,394.6	46.12	2,953.9
<b>BRE/mBank</b>	12,725	304.00	3,868.4	424.4	5,400.5
<b>BZWBK/Santander Polska</b>	21,662	214.90	4,655.2	360.00	7,798.3
<b>CEZ</b>	22,761	120.60	2,745.0	89.70	2,041.7
<b>Cyfrowy Polsat</b>	88,907	16.50	1,467.0	22.56	2,005.7
<b>Getin*</b>	314,248	11.50	3,613.9	0.68	53.4
<b>GTC</b>	124,744	24.50	3,056.2	8.19	1021.7
<b>KGHM</b>	136,410	173.00	23,598.9	88.88	12,124.1
<b>Lotos</b>	60,797	36.35	2,210.0	88.50	5,380.5
<b>PBG</b>	10,055	213.00	2,141.7	0.09	0.9
<b>Pekao</b>	106,927	179.00	19,139.9	109.00	11,655.0
<b>PGE</b>	574,143	23.19	13,314.4	10.00	5,741.4
<b>PGNIG</b>	1 623,685	3.57	5,796.6	6.91	11,219.7
<b>PKN ORLEN</b>	309,999	45.80	14,198.0	108.15	33,526.4
<b>PKO BP</b>	508,581	43.35	22,047.0	39.47	20,073.7
<b>PolimexMostostal**</b>	464,286	4.00	1,857.1	2.81	26.1
<b>PZU***</b>	36,106	355.50	12,835.7	43.90	15,850.5
<b>Tauron</b>	932,734	6.57	6,128.1	2.19	2,042.7
<b>TPSA/Orange Polska</b>	603,102	16.35	9,860.7	4.79	2,888.9
<b>TVN****</b>	149,465	17.10	2,555.9	19.92	2,977.3
<b>In total</b>	-	-	158,484.1	-	144,792.6
Change in capitalisation (%)	-	-	-	-	-8.6
Average annual ***** change in capitalisation (%)	-	-	-	-	-1.1

\* the 4:1 reverse split of Getin shares carried out in December 2018 is included. As a result of the reverse split, the number of Getin shares decreased four times

\*\* the 50:1 reverse split of PolmexMostostal shares carried out in October 2015 is included. As a result of the reverse split, the number of PolmexMostostal shares decreased 50 times

\*\*\* the 1:10 split of PZU shares carried out in mid-2015 is included. As a result of the split, the number of PZU shares increased ten times

\*\*\*\* the last listing of TVN shares on the Warsaw Stock Exchange was on 22.09.2015; the closing price and the capitalisation of TVN, given in the last two columns of the table apply to this date, and not 28.12.2018

\*\*\*\*\* the average annual change in capitalisation was determined as a geometric mean

Note: companies whose shares were in the WIG20 portfolio both at the end of 2010 and at the end of 2018 have been highlighted in bold. This distinction is also used in Tables 3 and 4.

Source: own elaboration based on data from [www.gpw.pl](http://www.gpw.pl) (access: 01/12/2019) and [www.money.pl](http://www.money.pl) (access: 01/12/2019) and [www.bankier.pl](http://www.bankier.pl) (access: 01/12/2019).

folio and thus the results of the study.

The composition of the fixed (with the structure as of the end of 2010) WIG20 portfolio and the share prices including capitalizations after trading sessions on December 31, 2010, and December 28, 2018, are presented in Table 2.

A full assessment of the viability of a long-term investment in shares requires taking into account not only the changes in the prices of the assets but also the dividends received. If the share portfolio is changed in accordance with the adjustments to the index portfolio, a total

return index is used for this purpose. In the present case, it is WIG20TR. However, if the buy and hold strategy is used, additional calculations are necessary. The data on dividends per one share of companies in the WIG20 portfolio at the end of 2010, granted and paid out in 2011-2018, are presented in Table 3.

Table 4 is a summary of the initial (as of December 31, 2010) capitalisation of companies from the WIG20 portfolio with their final value (as of December 28, 2018), assuming that the hypothetical investor applies the buy and hold strategy,

**Table 3 Dividends per one share of companies in the WIG20 portfolio of 31.12.2010 granted and paid out in 2011-2018 in PLN**

company	2011	2012	2013	2014	2015	2016	2017	2018	total
Asseco Poland	1.80	2.19	2.41	2.60	2.90	3.01	3.01	3.00	20.92
BRE/mBank	0.00	0.00	10.00	17.00	0.00	0.00	0.00	5.15	32.15
BZWBK/ Santander Polska	8.00	8.00	7.60	10.70	0.00	13.00	5.40	3.10	55.80
CEZ	8.15	7.48	6.69	6.05	6.01	6.50	5.33	5.53	51.74
Cyfrowy Polsat	0.00	0.00	0.00	0.26	0.00	0.00	0.32	0.00	0.58
Getin	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10
GTC	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.27
KGHM	14.90	28.34	9.80	5.00	4.00	1.50	1.00	0.00	64.54
Lotos	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	2.00
PBG	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
Pekao	6.80	5.38	8.39	9.96	10.00	8.70	8.68	7.90	65.81
PGE	0.65	1.83	0.86	1.10	0.78	0.25	0.00	0.00	5.47
PGNIG	0.12	0.00	0.13	0.15	0.20	0.18	0.20	0.07	1.05
PKN ORLEN	0.00	0.00	1.50	1.44	1.65	2.00	3.00	3.00	12.59
PKOBP	1.98	1.27	1.80	0.75	0.00	0.00	0.00	0.55	6.35
Polimex Mostostal	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
PZU*	26.00	22.43	49.70	17.00	47.00	20.8	14.0	25.0	221.93
Tauron	0.15	0.31	0.20	0.19	0.15	0.00	0.00	0.00	1.00
TPSA/Orange Polska	1.50	1.50	0.50	0.50	0.50	0.25	0.00	0.00	4.75
TVN**	0.04	0.10	0.64	0.00	0.30	-	-	-	1.08

\* to maintain the comparability of dividends granted and paid out by PZU, for the years 2016-2018 dividends per one share before the split were given, i.e. 1 share corresponding to 10 shares after the split; in fact (per one share after the split) the dividends were respectively: PLN 2.08, PLN 1.40, and PLN 2.50

\*\* regarding TVN, only dividends granted and paid out during the period of listing on the Warsaw Stock Exchange, i.e. until 2015 inclusive, are taken into account

Source: own elaboration based on data from [www.money.pl](http://www.money.pl) (access: 01/12/2019) and [www.bankier.pl](http://www.bankier.pl) (access: 01/12/2019).

**Table 4 Table 4 Initial and final capitalisation of the share portfolio of companies with the fixed structure of the WIG 20 portfolio, including reinvestment of dividends and money for the sold TVN shares (as of the end of 2010)**

Specification	Capitalisation (million PLN) 31.12.2010	liczba akcji (thousand PLN) 28.12.2018	Share price (PLN) 28.12.2018	Capitalisation (million PLN) 28.12.2018	Change in capitalisation during investment (%)
Asseco Poland	3,394.6	90,153	46.12	4,157.9	22.5
BRE/mBank	3,868.4	17,911	424.4	7,601.5	96.5
BZWBK/ Santander Polska	4,655.2	30,491	360	10,976.6	135.8
CEZ	2,745.0	32,038	89.7	2,873.8	4.7
Cyfrowy Polsat	1467.0	125,142	22.56	2,823.2	92.5
Getin	3,613.9	110,581	0.68	75.2	-97.9
GTC	3,056.2	175,585	8.19	1,438.0	-52.9
KGHM	23,598.9	192,006	88.88	17,065.5	-27.7
Lotos	2,210.0	85,576	88.5	7,573.4	242.7
PBG	2,141.7	14,153	0.09	1.3	-99.9
Pekao	19,139.9	150,506	109	16,405.2	-14.3
PGE	13,314.4	808,142	10	8,081.4	-39.3
PGNIG	5,796.6	2,285,438	6.91	15,792.4	172.4
PKN ORLEN	14,198.0	436,343	108.15	47,190.5	232.4
PKO BP	22,047.0	715,860	39.47	28,255.0	28.2
Polimex Mostostal	1,857.1	13,070	2.81	36.7	-98.0
PZU	12,835.7	508,215	43.9	22,310.6	73.8
Tauron	6,128.1	1,312,882	2.19	2,875.2	-53.1
TPSA/Orange Polska	9,860.7	848,904	4.79	4,066.2	-58.8
TVN*	25,55.9	-	-	-	-
In total	158,484.1	-	-	199,599.7	25.9

Note: the last listing of TVN shares on the Warsaw Stock Exchange was on 22.09.2015. After that date, the investor's portfolio included only shares in the remaining 19 companies. The stability of the portfolio structure refers to the number of shares (including split and reverse split adjustments), not the value of the shares.

Source: own elaboration based on data from [www.gpw.pl](http://www.gpw.pl) (access: 01.12.2019) and Tables 2 and 3.

including reinvestment of dividends and proceeds from the sale of TVN shares withdrawn from the stock exchange listing.

The reinvestments of dividends and proceeds from the sale of TVN shares (disregarding splits and reverse split adjustments) increased the number of shares in each of the 19 companies remaining in the investor's portfolio by 40.8%. The final value (as of December 28, 2018) of the shares in individual companies was calcu-

lated by dividing the number of shares in the investor's portfolio at the end of 2018 by the closing price of the last stock exchange session in 2018. The capitalisation of the portfolio of all shares is the sum of the market value of the shares in 19 companies.

The investments lasting for eight years in the shares of individual companies in the WIG20 portfolio at the end of 2010 yielded very different results. The shares of 3 of the companies removed from the

portfolio (PBG, Polimex Mostostal, and Getin) generated huge losses. Very high losses, exceeding half of the capital employed, were related to the investments in the shares in GTC (removed from the WIG20 portfolio) and TPSA (Orange Polska) and Tauron (remaining in the WIG20 portfolio). More than 100% profit was generated by the investments in the shares in Lotos, PKN ORLEN, PGNiG, and BZWBK (Santander Polska), while over 50% of the profit was generated by the shares in BRE (mbank), Cyfrowy Polsat, and PZU. The shares in all seven of the listed companies generating high profits to investors were in the WIG20 portfolio both at the beginning and the end of the period under review.

### Comparison of investment viability

The investor holding a portfolio of shares in the structure of the WIG20 portfolio from the end of 2010 for eight years, at the end of 2018, would have shares (and money for the sold TVN shares) worth 8.6% less than at the beginning. An exchange loss would be severe, but twice less than the exchange loss, which was 17% of the invested amount, incurred by the investor applying rebalancing, i.e. changing the structure of the share portfolio after adjustments to the WIG20 portfolio composition. On average, the shares of the investor applying the buy and hold strategy would lose 1.1% of their value annually. Meanwhile, the average annual exchange loss of the investor changing his portfolio in line with the WIG20 adjustments would significantly exceed 2%. More than 1 percentage point of difference in favour of the buy and hold strategy in the era of low interest rates is a significant figure.

However, the aim of investing in a portfolio of shares is not to maximise the return on each company's shares, but (with a certain risk ceiling) to achieve the best possible return on the portfolio

as a whole (Haugen, 1996). The total rate of return (gross, as well as other rates of return provided) on the 8-year buy and hold investment in the WIG20 structured share portfolio at the end of 2010 was 25.9%. On average, this gave a profit of 2.9% annually. These are significantly higher values than the rates of return on the 8-year investment in the stock portfolio changed after each WIG20 portfolio adjustments, amounting to 14.4% (for 8 years) and 1.7% (on average annually).

The viability of the 8-year investment, lasting from the end of 2010 to the end of 2018, in shares with the fixed (except for TVN shares withdrawn from the stock exchange) structure of the WIG20 portfolio, i.e. in line with the buy and hold strategy, higher than the viability of the investment consistent with the strategy of adapting the portfolio to the changing structure of the WIG20 portfolio, may be considered surprising. After all, adjustments to the portfolios of the indices of the leading companies, which include WIG20 and WIG20TR, should lead to the replacement of the shares of weakening companies for the shares of companies at the growth stage, and, to a large extent, companies at the dynamic growth stage.

In the reviewed period, the shares of weakening companies were removed from the WIG20 portfolio. The shares of Getin, GTC, PBG, and Polimex Mostostal were excluded from the portfolio. However, these 4 companies are the companies with the smallest capitalization in the WIG20 portfolio at the end of 2010. Their total share in the initial capitalisation of the WIG20 portfolio (6.7%) was as much as 3 times lower than the share in the number of companies (20%). Meanwhile, larger companies bringing large losses to investors (Tauron, TPSA/Orange Polska, PGE) remained in the WIG20 portfolio, and their share in the capitalisation at the

end of 2010 was 18.5%, so it was higher than the share in the number of companies (15%).

The criteria used in the ranking resulting in adjustments to the WIG20 portfolio also had serious consequences. These criteria are the value of free float shares and the value of trading in shares in the recent past, accompanied by the limitation of the maximum share of an individual company in the capitalisation of the index to 15%. (*Charakterystyka indeksu WIG20*, 2010). As a result, in the years 2011-2018, the WIG20 portfolio included shares of larger, previously fast-growing companies, popular among investors. Among 7 “new” companies (in 2018 against the end of 2010), they included Alior, CCC, CDProjekt (whose shares were included in the WIG20 portfolio only in March 2018, and to the end of 2018 their price was stable), LPP and Eurocash, and, with some reservations, JSW. After entering the WIG20 portfolio, most of them experienced very serious barriers to development, including problems related to limited demand and rising debt-financed overinvestment. Their share prices no longer increased dynamically, often starting to become cheaper, and the dividends were still not granted or the dividend rates were low. This phenomenon surprised many analysts, while it was a natural consequence of the change in the characteristics of companies whose shares were included in the WIG20 portfolio during adjustments. In the first decade of the 21st century, the shares in companies recently privatised or partially privatised through IPOs dominated here. In the second decade, these were either private companies from the outset or introduced to the public market many years earlier.

In addition, the rate of return on the variable WIG20 portfolio was adversely affected by adjustments in the number of shares of individual companies remain-

ing in the portfolio. The second highest rate of return among all companies in the WIG20 portfolio at the end of 2010 was brought by PKNORLEN (see Table 4). Meanwhile, it is the only company still present in WIG20 between 2011 and 2018, whose number of shares in the WIG20 portfolio decreased (from 310 to 289 million). The reason was the limitation of the share of a single company in the WIG20 capitalization to 15%. The number of shares in the remaining 12 “old” companies either increased (including PZU not only because of the split) or did not change. This means that the investor imitating faithfully the changing WIG20 portfolio (using rebalancing) reduced the number of shares in one of the two companies generating the highest rates of profit, and increased or maintained the number of shares in companies generating lower profits or losses.

## Summary

Stock market indices are used as benchmarks or bases for comparisons and assessments. Because of that, they are very popular both among investors and among scientists interested in finances. Investing by copying the stock market index portfolio, which is rapidly gaining importance, is referred to as passive investment (*Investopedia*, 2019). However, this term is not accurate, as index portfolios are subject to periodic and extraordinary adjustments. Consequently, the indices do not illustrate the implementation of the passive buy and hold investment strategy, but the rebalancing strategy of adjusting the structure of the share portfolio to the changing portfolio of the underlying index. Portfolio changes must be made after any adjustment to the composition or structure of the index. This affects investment performance. The article attempts to provide a partial answer to the question of the scale of this impact. It presents the results of the study on the extent to

which viability of investments in the equity portfolio modified according to the WIG20 portfolio adjustments differed from the viability of investments according to the buy and hold strategy in the years 2011-2018.

In line with the buy and hold strategy, having a stable portfolio of shares with a structure such as the initial WIG20 portfolio would be more profitable in 2011-2018 than the investment strategy consisting of adjusting the portfolio to maintain its structure identical to the changing structure of the WIG20 portfolio. Such a result, especially given the significant scale of the difference in the investment performance (more than a percentage point per year on average in favour of the buy and hold strategy), is surprising at the first sight. However, the analysis leads to the conclusion that this result has specific reasons. Although the shares in some of the companies that became very cheap were removed from the index portfolio, those were companies with a small share in the initial capitalisation of the index. In turn, the prices of shares in the companies that replaced them mostly increased before being included in the WIG20 portfolio, but not afterwards. A significant part of the “new” companies painfully confronted with the barriers to further growth and the problem of overinvestment, financed to a large extent by debt. Finally, the WIG20 portfolio adjustment rules adopted by the Warsaw Stock Exchange had a negative impact on the performance of the investment compliant with the variable WIG20 structure. In particular, they lead to such reduction in the number of shares in the company’s index portfolio,

which became so much more expensive, that their share in the WIG20 capitalisation exceeded 15%. As a consequence, the investor mapping the WIG20 portfolio was forced to quickly sell the shares in a very large company that become more expensive and acquire shares in other companies in the index portfolio. It is a denial of the principle of investment, considered by practitioners as fundamental: let profits grow, cut losses while they are still low. According to the study presented, the theory and practice of passive investments in the variable portfolio of the WIG20 index contradict this principle.

The study described above was to compare the performance of the investment in line with buy and hold strategies with the rebalancing of the portfolio of shares in the selected period and scope. Its results cannot be generalised. Successive studies, concerning different markets and indices, may produce different results at different times. They will not be easy studies. When analysing the buy and hold strategy, all events such as splits, reverse splits, rights issues, mergers, dividends in the form of shares, as well as atypical index adjustments associated with some of these events, should be properly taken into account. Particular care is therefore needed with regard to published results if the research is not described in detail.

To sum up, there is one more aspect to be noted. The described study leads to the conclusion that the dissemination of the passive stock investment strategy, consisting of mapping the variable portfolio of an index, carries greater risks than those indicated so far in the literature (Fierla, Grygiel-Tomaszewska, 2017).

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