

THE ASSESSMENT OF THE EFFICIENCY OF INVESTMENT IN THE SHARES OF THE POLISH IT SECTOR

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Abstract: The present article is to assess the effectiveness of investment in the shares of the Polish IT sector with the help of rates of return, and risk-sensitive profitability measures based on the Capital Asset Pricing Model - CAMP. The analysis consisted in a statistical verification of the assets management in relation to the results of the selected global sector stock market indexes. The results of the study show that regardless of the changing market conditions, the effectiveness of investing in the shares of the Polish IT sector in the analyzed period differed from the market portfolio results determining global markets of modern technologies.

Key words: Polish IT sector, Polish Stock Exchange, world stock market indexes, risk measurement

Introduction

The years 2014-2015 saw an increase in the geopolitical risk which resulted in the real world perils of local conflicts and turnovers, increased frequency of terrorist attacks and the events in Ukraine in the first place. The complicated political circumstances influenced the decisions of investors on global markets. The year 2014 in Poland was the time of economic recovery. Yet the growing geopolitical tension outside the eastern border, and the concern about the influence of the Russian sanctions on Polish GDP acted as a hindrance for domestic and foreign investors. The worsening economic situation on the Russian market resulted in the withdrawal of capital from the East Central Europe markets, including the Polish one. The economic growth did not motivate investors to place capital in Polish shares, which was visible in the results of the Warsaw stock exchange indexes. The broad shares market measured through WIG index gained only 0.3%, while at the same time the index of treasury bonds with maturity periods between 7 and 10 years ended 2014 with a profit of almost 18%, but the price to profit rate did not imply the overvaluation of Polish shares. The WIG index of companies reporting profit reached 11.3% which is about 7% below the median from the last 10 years. Comparing Poland to other countries from our region such as the Czech Republic or Hungary, pricing on our market was relatively attractive for investors looking for opportunities in the so called CE3 region (Central European Three). The IT sector has always excited investors a lot. In times of crisis companies often reduce the outlays on IT solutions and the decreased demand for these products is reflected in the instability on the information technology sector. But it is actually the time of market turbulence when the abilities and accessibility of good IT

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systems allowing processing data into market knowledge fast is crucial. It impacts on the decision making efficiency and the market success can depend on its accuracy (Zuzik et al., 2014; Liu et al., 2014). Unstable geopolitical situation and the battle for customers should be a sufficient incentive to use the IT solutions which yield competitive advantages on the market. Thanks to the observed instability of market situation, company take-over's, mergers and demise of companies operating in the Polish area of IT and telecommunication, the companies still operating on the market know how to withstand crisis periods. The goal of the analysis is the assessment of investments in IT companies in 2014. The above analysis fits with the mainstream results in the subject literature. And although obtained results vary slightly according to the measures used, the rates of return and the values of measures adjusted for risk were repeatable.

Our conclusion that the effectiveness of investments in the shares of the Polish IT sector is interrelated with market trends does not deny the fact that there are companies managed in a better or worse way. Successes and failures across consecutive downturn periods are important signals for investors. They also make an interesting source for the analysis of the managerial skills of the Polish IT sector companies' staff. Because of the volume of the publication, the analysis is narrowed down to the selected companies included in WIG-INFO quoted on the Warsaw Stock Exchange and to the sole WIG-INFO subindex.

The analysis not only use the rates of return but it also took into account the profitability measures risk based on the Capital Asset Pricing Model – CAMP. The analysis consisted in a statistical verification of the quality of assets management in relation to the results of the global stock market indexes of the modern technologies sector. The analysis used data accessible on the StockWatch.pl website.

The results of the study show that in the face of changing market conditions, the effectiveness of investing in the shares of the Polish IT sector in the analyzed period differed significantly from the market portfolio results determining global markets of modern technologies.

Methods of Investment Efficiency Assessment

The subject literature sees the evaluation of the investment efficiency of financial instruments as a comparison of achieved results with the results calculated for a specific benchmark which can be an economy success index such as a stock index or a specially designed investment portfolio (Hagigi and Sivakumar, 2009). Investors optimize their investment portfolios according to the benchmark (Dawidowicz, 2008; Soltes and Pinka, 2015). Basic methods of investment analysis are the commonly known statistical methods: the historical rate of return, the standard deviation, the coefficient of variation and the beta coefficient (Kiselakova et al., 2015). From the investor's standpoint, measuring the risk is not the only significant issue (Ennouri, 2013). Calculating the measures of its diversification is another. The measures we can highlight are the DR measure,

which is the relationship between the market and total risk and the determination coefficient. Other methods are: the Tracking Error rate and the Information Ratio. The Tracking Error rate is a standard deviation between the rate of return achieved by a given financial instrument and the rate of return obtained on the benchmark. It is calculated through the following formula:

$$TE = \sqrt{\frac{\sum_{i=1}^n (R_p - R_m)^2}{n}} \quad (1)$$

where: TE - Tracking Error, R_p - financial instrument rate of return, R_m - market portfolio (benchmark) rate of return, n - the number of return periods.

The Information Ratio (IR) determines the volume of the additional rate of return per a relative risk unit. It also tells us if the risk caused by the deviation from the accurate index representation is compensated by an increased rate of return. It is calculated on the basis of the following formula:

$$IR = \frac{R_p - R_m}{TE} \quad (2)$$

where: IR- the Information Ratio

Both the Tracking Error index and the Information Ratio are used to assess the investment efficiency of different financial instruments.

The effectiveness analysis is usually based on the Capital Assets Pricing Model (CAMP) or its developments (Sharpe, 1964; Lintner, 1965, Jorion, 2006). The CAMP results can be complemented by the commonly used indexes of investment efficiency which present the results of a financial instrument in the light of the risk involved in achieving them. We can specify the following measures: the Sharpe ratio, the Treynor ratio, the Jensen's Alpha, the Sharpe Alpha and the Modigliani and Modigliani index (Ostrowska, 2003; Skrodzka, 2014).

The Sharpe ratio determines the relationship between the risk premium and the standard deviation from the financial instrument rates of return. It is calculated through the following formula:

$$S_p = \frac{R_p - R_f}{s_p} \quad (3)$$

where: S_p - Sharpe ratio, R_p - rate of return of a financial instrument in a given time, R_f - average rate of return of risk-free instruments in the same time, s_p - standard deviation of the financial instrument rate of return in a given time

The index values of the examined financial instrument higher than the benchmark's indicate an efficient investment.

The structure of the Treynor ratio is similar to the Sharpe ratio. It is calculated on the basis of the following formula:

$$T_p = \frac{R_p - R_f}{\beta_p} \quad (4)$$

where: T_p - Treynor ratio, β - beta factor - the systematic risk of a financial instrument rate of return in a given time.

The Treynor ratio determines the size of the premium, and the size of the difference between the instrument rate of return and the risk-free instrument rate of return per a unit of the taken systematic risk. A comparison of the Treynor ratio for a given asset with the benchmark index allows for a complete assessment of the analyzed financial instrument (Reilly and Brown, 2001).

The bigger the positive difference between these indexes the higher the efficiency. Another measure used in the efficiency assessment is the Jensen's Alpha. It is calculated through the following formula:

$$J = (R_p - R_f) - (R_m - R_f)\beta_p \quad (5)$$

where: J - Jensen's Alpha, β_p - beta coefficient of the financial instrument.

Positive index values express how much the asset's results exceeded the expectations. Negative index values mean that the results of the financial instrument are worse than expected, and that it figures below the SML line. Sharpe ratio is yet another measure. Its structure resembles the Jensen's Alpha. In order to calculate the following formula is used:

$$AS = \frac{(R_p - R_f) - (R_m - R_f)S_p}{S_m} \quad (6)$$

where: AS - Sharpe Alpha, s_m - standard deviation of the rate of return on the market portfolio, s_p - standard deviation of the financial instrument rate of return

Sharpe Alpha determines the difference between the financial instrument rate of return and the model portfolio rate of return whose investment risk is measured through the total risk of the financial instrument.

A positive index value suggests an efficient investment, whereas a negative one means the asset is inefficient. The M^2 measure, i.e. the Modigliani and Modigliani index measures the rate of return achieved by a given asset on the basis of the total risk of the benchmark. In order to calculate it we use the formula:

$$M^2 = \frac{S_m}{S_p} (R_p - R_f) + R_f \quad (7)$$

where: M^2 - Modigliani & Modigliani measure

The calculation of M^2 assumes that the portfolio built-up from a given financial instrument will be increased or decreased by risk-free assets with the help of a "leverage" which is a quotient of the standard deviation of the asset and the

standard deviation of the benchmark. In this way a new portfolio is created - RAP. Its rate of return resembles the benchmark's rate of return (Czekaj et al., 2001). The analyzed financial instrument can be described as efficient if the RAP rate of return is higher than the benchmark's rate of return or inefficient if the rate of return on this portfolio is lower than the benchmark's rate of return.

The Analysis of Investment into the Selected IT Companies Quoted on the Warsaw Stock Exchange

The IT sector is the most intellectual and innovative sector of the economy. Property is not its biggest asset. It is the people, experience and solutions whose value is hard to be expressed on the balance sheet. Currently, the IT sector gives employment to about 400 thousand people. The IT sector is in a way a kind of the economy's bloodstream which, along with the energy and transport systems, conditions the efficient functioning of the economy. Modern infrastructure and an effective IT sector is a matter of prime importance for every country. They foster economic growth and competitiveness. For this reason, it is desirable to analyze the IT sector for the investment attractiveness.

The analysis concentrates on the biggest companies of the WIG index which belonged to the information technology sector: Asseco Poland SA (ASSECOPOL), CD Projekt SA (CDPROJEKT), Comarch SA (COMARCH), Medicalgorithmics SA (MEDICALG), Comp SA (COMP), Asseco Business Solutions SA (ASSECOBS), ATM SA (ATM), Asseco South Eastern Europe SA (ASSECOSEE), Sygnity SA (SYGNITY). The listed companies have the biggest shares in the portfolio of the WIG-INFO subindex. Table 1 presents the analyzed companies.

Table 1. The analyzed IT sector companies (*Own study based on information published on the www.gpw.pl*)

Name of the company. Description of activity	Financial results in 2014
Asseco Poland SA (ASSECOPOL) It is a consulting firm in the area of computer software and hardware. It also produces and supplies computer software and hardware.	The company's profits: 6231.9 million zł, operating profit: 636.7 million zł, net profit: 358.4 million zł. In 2014 EBIDTA was 905.1 million zł.
CD Projekt SA (CDPROJEKT) The company distributes computer games and films (CD Projekt Sp. z.o.o.), produces computer games connected with the brand Wiedźmin, and distributes games digitally to customers from all over the world (GOG Ltd.).	Consolidated income in 2014: 96.1 million zł, operating profit: 6.1 million, and net profit: 5.2 million In 2014 EBIDTA was 9.3 million zł.
Comarch SA (COMARCH) The company designs, produces and supplies IT systems which include computer software, computer and network hardware, implementation, training and operation services.	The company's profit: 1038.3 million zł, operating profit: 98.5 million zł, net profit: 67.9 million zł. In 2014 EBIDTA was 152.9 million zł.

Medicalgorithmics SA (MEDICALG) The group is the producer and supplier of an innovative technology in the field of remote cardiological diagnosis.	Consolidated income in 2014: 27 million zł, operating profit: 13.9 million, and net profit: 14.5 million zł. In 2014 EBIDTA was 14.5 million zł.
Comp SA (COMP) Offers services connected with the development and increasing efficiency of business, building dedicated information systems in terms of infrastructure and software, and managing information safety.	The company's profit: 581.8 million zł, operating profit: 48.9 million zł, net profit: 21.8 million zł. In 2014 EBIDTA was 65.6 million zł.
Asseco Business Solutions SA (ASSECOBS) The company supplies, adapts and configures their original business applications for enterprises.	The company's profit: 145 million zł, operating profit: 34.2 million zł, net profit: 28.5 million zł. In 2014 EBIDTA was 46 million zł.
ATM SA (ATM)The company offers telecommunication services: access to the Internet, broadband data transfer, co-location and hosting for entrepreneurs and institutions on the basis of their own optical networks and data centres.	The company's profit: 127.8 million zł, operating profit: 21.5 million zł, net profit: 8 million zł. In 2014 EBIDTA was 43.4 million
Asseco South Eastern Europe SA (ASSECOSEE)The company offers services for the banking sector.	The company's profit: 500.9 million zł, operating profit: 46.2 million zł, net profit: 39 million zł. In 2014 EBIDTA was 69.2 million zł.
Sygnity SA (SYGNITY)The activity of the company is concentrated on six sectors of the economy: the banking and financial sector, the industry sector, the telecommunication sector, the public utility segment, the health care sector, and the public administration sector	The company's profit: 500.9 million zł, operating profit: 21.6 million zł, net profit: 12.9 million zł. In 2014 EBIDTA was 38.7 million zł.

The measures presented in the previous sub-chapter were used to assess the efficiency of investment in the selected group of IT sector companies listed on the Warsaw Stock Exchange in 2014 and in the WIG-INFO based portfolio.

The WIG-INFO is a sector index which includes 26 companies listed on the Warsaw Stock Exchange, participating in the WIG index and classified in the information technology sector.

The analysis used the monthly rates of return of the discussed qualities. The efficiency assessment was carried out on the basis of three different benchmarks – indexes of the new technologies sector DJ Technology (DJUSTC), DAX Technology (CXPHX), CNX PSE (CNXPSE):

- DJUSTC is a sector index for 136 companies from the modern technologies sector listed on the New York stock exchange,
- CXPHX is a sector index for 17 companies from the modern technologies sector listed on the German stock exchange in Frankfurt,
- CNXPSE is a sector index for 20 companies from the modern technologies sector listed on the Indian NSE stock exchange.

Thus defined benchmarks and the chosen group of shares listed in 2014 had the following measures calculated: R_p - the simple annual rate of return, s_p - the standard deviation of the monthly rates of return, RP - premium for risk, DR - the relation of

the market risk to total risk index, J - Jensen's Alpha, S_p - Sharpe ratio, beta- the beta coefficient, AS - Sharpe Alpha, T_p - Treynor ratio, M^2 - Modigliani and Modigliani index, TE - Tracking Error, IR - Information Ratio.

The results for individual benchmarks are shown in Tables 2-7. Column one contains the abbreviated names of the listed companies according to the Warsaw Stock Exchange classification. Presented in bold are the results of the shares of companies which according to the calculated measures achieved better results than the benchmark which means the investments in the given quality were efficient.

Table 2. Basic indexes of the DJ Technology (DJUSTC) benchmark

Financial instrument	R_p	s_p	RP	DR	TE	IR
ASSECOPOL	5.8091286	5.273539	1.34	0.114552	5.554783	0.77523
CDPROJEKT	-4.0229885	5.004946	-8.49	-0.03292	5.801747	-0.95244
COMARCH	19.441571	10.39326	14.97	0.247836	10.08802	1.77821
MEDICALG	-0.5263157	18.19387	-5.00	-0.19843	18.76164	-0.10816
COMP	-17.431192	5.960772	-21.90	0.312325	6.375856	-2.96965
ASSECOBS	3.9634146	6.120995	-0.51	-0.22704	7.039026	0.34956
ATM	-8.24	4.326453	-12.71	0.114246	5.096449	-1.91169
ASSECOSEE	-15.306122	8.105073	-19.78	-0.16991	9.119887	-1.84311
SYGNITY	-29.274611	13.29637	-33.74	-0.09514	13.87402	-2.21835
WIG-INFO	-0.9215996	3.793588	-5.39	0.299378	4.068847	-0.59586
Benchmark	19.259554	2.220115	14.79			

Table 3. Basic indexes of the DAX Technology (CXPHX) benchmark

Financial instrument	R_p	s_p	RP	DR	TE	IR
ASSECOPOL	5.809128631	5.2735390	1.34	-0.4659	9.048574326	0.49477
CDPROJEKT	-4.02298851	5.0049460	-8.49	-0.29439	8.404477306	-0.63717
COMARCH	19.44157187	10.393267	14.97	0.105959	11.16139081	1.62251
MEDICALG	-0.52631579	18.193873	-5.00	-0.02392	19.06000943	-0.0975
COMP	-17.4311927	5.9607729	-21.90	0.034028	8.281162441	-2.26578
ASSECOBS	3.963414634	6.1209952	-0.51	-0.05254	8.319311531	0.31629
ATM	-8.24	4.3264538	-12.71	0.174552	6.502494207	-1.47206
ASSECOSEE	-15.3061224	8.1050734	-19.78	0.056384	9.704085857	-1.71456
SYGNITY	-29.2746114	13.296376	-33.74	0.291558	12.96485477	-2.36074
WIG-INFO	-0.92159963	3.7935881	-5.39	-0.24975	7.337642235	-0.30714
Benchmark	15.30790327	5.2618731	10.84			

The rates of return of the analyzed shares were changeable which was reflected in the values of the standard deviation of the monthly rates of return. It was mainly due to the exchange value variability on the Warsaw Stock Exchange.

Table 4. Basic indexes of the CNX PSE (CNXPSE) benchmark

Financial instrument	R _p	S _p	RP	DR	TE	IR
ASSECOPOL	5.809128631	5.2735390	1.34	-0.26153	11.37683586	0.26385
CDPROJEKT	-4.02298851	5.0049460	-8.49	0.011357	10.31511733	-0.66216
COMARCH	19.44157187	10.393267	14.97	0.128868	12.6067981	1.31946
MEDICALG	-0.52631579	18.193873	-5.00	-0.19869	21.6375376	-0.15407
COMP	-17.4311927	5.9607729	-21.90	0.009655	11.20201452	-1.80669
ASSECOBS	3.963414634	6.1209952	-0.51	-0.07428	11.12233351	0.10394
ATM	-8.24	4.3264538	-12.71	0.240487	9.267026005	-1.19211
ASSECOSEE	-15.3061224	8.1050734	-19.78	-0.1479	13.19666638	-1.37258
SYGNITY	-29.2746114	13.296376	-33.74	-0.17846	17.41716857	-1.84197
WIG-INFO	-0.92159963	3.7935881	-5.39	0.01437	9.724595707	-0.38345
Benchmark	33.97745268	8.5552125	29.51			

The analysis of the estimated measures of the expected income shows that the investments in shares of SYGNITY, COMP and ASSECOSEE companies brought the biggest loss. The purchase of the shares of the COMARCH group was the most attractive in terms of the expected rate of return. The annual rate of return of this company hovered around 19.4% and was higher than the rate of return of the benchmarks: DJUSTC and CXPHX. The values of the premium for market risk index of the analyzed companies, except for COMARCH, were negative for all benchmarks. The shares of COMARCH had a better RP result than DJUSTC and CXPHX benchmarks. Their results were worse, though, in the case of the CNXPSE benchmark.

Table 5. Risk-adjusted efficiency measures of the DJ Technology (DJUSTC) benchmark

Financial instrument	J	S _p	Beta	AS	T _p	M ²
ASSECOPOL	-0.0.7097	0.044863	0.272100	-2.448390	0.8694953	0.4721025
CDPROJEKT	-0,50339	-0.11734	-0.07421	-3.135513	7.9132778	0.1119900
COMARCH	0.325437	0.157496	1.160222	-3.654750	1.4108503	0.7221596
MEDICALG	2.816913	0.053797	-1.62615	-8.284481	-0.601903	0.4919367
COMP	-2.72580	-0.29827	0.83855	-4.812821	-2.120234	-0.289701
ASSECOBS	0.847113	0.022797	-0.62596	-2.976910	-0.222928	0.423114
ATM	-1.24766	-0.23021	0.22263	-3.198786	-4.473660	-0.138599
ASSECOSEE	-0.70546	-0.17355	-0.62030	-5.533271	2.2676379	-0.012801
SYGNITY	-0.49484	-0.08565	-0.56977	-7.908630	1.998844	0.1823388
WIG-INFO	-0.95723	-0.09990	0.511557	-2.310472	-0.740868	0.1507003
Benchmark		0.509142	1		1.1303542	

And high values of the Tracking Error index suggest that all discussed companies conducted a proactive management strategy in 2014. Only in the cases of ASSECOPOL, COMARCH and ASSECOBS, the obtained values of the Information Ratio lead to the conclusion that the application of a proactive management strategy in 2014 brought the expected results in the form of an additional rate of return.

Table 6. Risk-adjusted efficiency measures of the DAX Technology (CXPBX) benchmark

Financial instrument	J	S _p	Beta	AS	T _p	M ²
ASSECOPOL	0.684659	0.044863	-0.46693	-0.725129	-0.506686	0.6085670
CDPROJEKT	-0.31858	-0.11734	-0.28001	-1.500021	2.0973447	-0.244932
COMARCH	1.436065	0.157496	0.209291	-0.258489	7.8211626	1.2012249
MEDICALG	1.058140	0.053797	-0.08269	-2.339176	-11.83594	0.6555759
COMP	-1.81493	-0.29827	0.038547	-2.864989	-46.12327	-1.196977
ASSECOBS	0.198198	0.022797	-0.06112	-0.976721	-2.283098	0.4924600
ATM	-1.13372	-0.23021	0.143521	-1.785009	-6.939774	-0.838852
ASSECOSEE	-1.48997	-0.17355	0.086849	-2.884734	-16.19618	-0.540699
SYGNITY	-1.84586	-0.08565	0.736747	-3.563704	-1.545827	-0.078199
WIG-INFO	-0.20621	-0.09990	-0.18005	-1.070822	2.1048778	-0.153185
Benchmark		0.182367	1		0.9595920	

The assessment of the results of the basic indexes shows that out of all discussed investments in terms of DJUSTC and CXPBX benchmarks, the one in the shares of COMARCH was the most efficient. The mere comparison of the rates of return does not allow us to fully assess the results of investments. What is needed is the measurement of the investment risk connected with the rate of return achieved by a given investment.

The values of the systematic risk measured through the beta coefficient in relation to DJUSTC show that in 2014 only COMARCH reacted significantly to the market changes, and in relation to CXPBX and CNXPSE none of the companies acted aggressively. The negative values of indexes mean that some of the companies' shares reacted reversely to the changes of the rate of return of the discussed portfolios.

Considering the following measures: Sharpe ratio, Sharpe Alpha, Modigliani & Modigliani index, investments in the shares of all analyzed companies and in the WIG-INFO based portfolio should be described as insufficient.

Table 7. Risk-adjusted efficiency measures of the CNX PSE (CNXPSE) benchmark

Financial instrument	J	S _p	Beta	AS	T _p	M ²
ASSECOPOL	0.629105	0.044863	-0.1612089	-1.26426	-1.4676	0.7563184
CDPROJEKT	-0.60346	-0.11734	0.0066442	-2.01169	-88.3895	-0.631374
COMARCH	1.255717	0.157496	0.1565546	-1.32103	10.45577	1.7199133
MEDICALG	2.007619	0.053797	-0.4225503	-4.19920	-2.31637	0.8327495
COMP	-1.79431	-0.29827	0.0067268	-3.47438	-264.3059	-2.179293
ASSECOBS	0.268948	0.022797	-0.0531466	-1.60249	-2.625685	0.5675415
ATM	-1.29212	-0.23021	0.1216167	-2.22731	-8.189717	-1.597022
ASSECOSEE	-1.06546	-0.17355	-0.1401207	-3.71334	10.03874	-1.112258
SYGNITY	-0.46355	-0.08565	-0.2773615	-4.92304	4.106136	-0.360285
WIG-INFO	-0.39451	-0.0999	0.0063721	-1.45865	-59.4773	-0.482204
Benchmark		0.284600	1		2.434819	

In relation to all benchmarks, Jensen's Alpha determined the shares of COMARCH, MEDICALG and ASSECOBS as definitely efficient. In terms of the DJUSTC benchmark, Treynor ratio marked the following shares efficient: COMARCH, CDPROJECT, and in terms of CXPHX: COMARCH, CDPROJECT and the WIG-INFO based portfolio, in terms of CNXPSE: COMARCH, ASSECOSEE, SYGNITY.

The analysis of the investment efficiency based on the benchmark does not allow us to determine if the discussed company achieves the best or the worst economic results, but enables us to state if the investment in their shares was efficient in terms of the assumed benchmarks. The IT sector is the most innovative sector of the economy.

The analysis of the efficiency of investment in the discussed group of IT sector companies in relation to the global sub-indexes of modern technologies showed that because of the geopolitical risk and the bad economic situation the majority of risk-adjusted indexes deemed the investments in the discussed shares and in the portfolio based on the WIG-INFO ineffective. Only the shares of the COMARCH group turned out to be attractive for investors. In such geopolitical circumstances, global investors perceive Poland as a risky market. On the other hand, looking at the European market valuations, the Polish stock market is an attractive place to invest.

Summary

The present article is to assess the effectiveness of investment in the shares of the Polish IT sector by means of the rates of return, and risk-sensitive profitability measures based on the Capital Asset Pricing Model - CAMP. The analysis consisted in a statistical verification of the assets management in relation to the results of the selected global sector stock market indexes. The results of the study

show that regardless of the changing market conditions, the effectiveness of investing in the shares of the Polish IT sector in the analyzed period differed from the market portfolio results determining global markets of modern technologies.

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OCENA EFEKTYWNOŚCI LOKOWANIA KAPITAŁU W AKCJE POLSKIEGO SEKTORA IT

Streszczenie: Niniejszy artykuł ma na celu ocenę efektywności lokowania kapitału w akcje spółek polskiego sektora IT z wykorzystaniem stóp zwrotu oraz uwzględniających ryzyko miar rentowności opartych na modelu wyceny aktywów kapitałowych (z ang. *Capital Asset Pricing Model* – CAPM). Przeprowadzona analiza polegała na statystycznej weryfikacji jakości zarządzania aktywami w odniesieniu do wyników wybranych, światowych, sektorowych indeksów giełdowych. Wyniki analizy pokazują, iż w obliczu zmiennych warunków rynkowych w badanym okresie efektywność inwestowania w akcje spółek polskiego sektora IT różniła się istotnie od wyników portfeli obrazujących światowe rynki nowoczesnych technologii.

Słowa kluczowe: Polski sektor IT, polska giełda, światowe indeksy giełdowe, miary ryzyka

投資效率在波蘭IT部門的股份的評估

摘要：本文章以評估投資的成效在波蘭的IT部門提供的回報率的幫助，並根據資本資產定價模型風險敏感的盈利措施的股票 – 坎普。所述分析包括，在資產管理的相對於選定的全球扇區股市指數的結果的統計驗證。研究結果顯示，無論在不斷變的市場條件下，投資於在分析期內波蘭IT行業的股票的有效性來自不同市場的投資合結果確定現代技術的全球市場的結果。

關鍵詞：波蘭的IT界，波蘭證券交易所，世界股市指數，風險計量