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POLISH OPEN-END PENSION FUNDS PERFORMANCE AND ITS PERSISTANCE

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Abstract. This paper deals with the assessment of the investment results achieved by 14 pension funds functioning on the Polish market in 2000–2013. Calmar, Omega, upside potential ratio (UPR) and Sortino ratios were used to estimate the fund performance in different time frames (two, three, four, five, six and seven years). The performance persistence was investigated by evaluating the Spearman's rank correlation for the above given sub-periods. The obtained results show randomness of ranking positions occupied by pension funds in successive periods. Almost all Spearman's correlation coefficients occurred statistically insignificant.

Key words: effectiveness, performance measures, pension funds ranking, correlations

INTRODUCTION

The investment results achieved by pension funds are of fundamental importance for future retirees. The current legislative framework has suggested measures to evaluate the effectiveness of pension funds. This study applies to methodology used to assess the collective investment institutions, which is not compatible with the methodology introduced by act on pension funds. The authors believe that pension funds should be treated as capital market participants on equal terms with open-end mutual funds, given the fact that the latter are often chosen by those who wish to save for their retirement within third pillar of the pension system. With regard to the legal changes that came into force in 2014, pension funds, from the point of view of the limitations imposed on investment portfolios were a sort of stable growth open-end mutual funds. Both types of funds might be compared as

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shown by Karpio and Żebrowska-Suchodolska [2012, 2013]. Today they should be compared with equity or balanced open-end mutual funds. However, the period of functioning of pension funds is too short to be able to make a reliable assessment of effectiveness after legislative amendments. Therefore, the study covers the years 2000–2013, and the rankings were used to create non-classical indicators of the investments efficiency, rather than relying on the classical measures of rates of returns or the Sharpe ratio. Volatility, as measured by standard deviation, is seen as less relevant as a risk measure than the potential losses on investments. The following indicators have been applied in this study: Omega [Shadwick and Keating 2002], upside potential ratio (UPR) [Sortino et al. 1999], Sortino [Sortino and Price 1994] and Calmar [Pedersen and Rudholm-Alfvin 2003] ratio considered to be the indicators of profits and losses. The above given factors are mostly used to assess the hedging funds, that is the reason they were constructed. According to the authors, there are no obstacles in using them to assess the investment effectiveness of the less risky subjects, in particular of the open-end mutual funds or open-end pension funds. The paper was devoted to this last funds existing on the Polish market. Among all the factors of gains and losses, the given four seem to be the most widespread in literature, and that is why it was decided to stick only to them. What is more, they do not demand the construction of the market factor, as for example it is with the Information ratio and Sharpe-Israelsen's indicators. They appeal to the commonly understood (by the clients of funds) notion of risk as the measure of loss. However, these losses are understood differently in every effectiveness measure. That is why it was decided to find out if different risk approaches in the factors of investment effectiveness lead to different rankings of funds. It is worth adding that the use of the Information ratio and Sharpe-Israelsen's indicators to construct rankings and to examine the persistence still remain in the area of interest of the authors. These coefficients are the subject of the studies and the results of which are being prepared to issue.

METHODOLOGICAL ASSUMPTIONS

Since 1999, the pension fund market in Poland has changed. It has experienced a consolidation through mergers and acquisitions reducing the number of pension funds from original 21 to 14. As a result of this, the studies will focus on their current number while the name of the acquiring entity is retained. They are: AEGON, Allianz, Amplico, Aviva, AXA, Bankowy, Generali, ING, Nordea, Pekao, Pocztylion, Polsat, PZU and Warta. Pension fund market in Poland was created by act on pension fund in 1997. Throughout the time it witnessed a consolidation since they started their operation in April 1999. The initial year of study is 2000. The whole period 2000–2013 was divided into: two-, three-, four-, five-, six- and seven-year sub-period. Later we create rankings of funds and check which funds were the leaders and which were the losers. That allows to draw conclusions about the effectiveness of operation both in short (two-, three-year) and long sub-periods

(six-, seven-year). In order to get information about the stability of the ranking positions, as well as the efficiency of the entire pension fund market, Spearman's rank correlation coefficients have been calculated for the sub-periods of equal length. The following formulas of the ratios have been used:

- Calmar ratio [Pedersen and Rudholm-Alfvin 2003]:

$$\text{Calmar} = \frac{R}{\left|MDD_T\right|}$$

where R – annual rate of return.
The maximum decrease in the rate of return is defined by the following formula:

$$MDD_T = \min_u \left\{ \frac{S_u - \max_t S_t}{\max_t S_t} \right\}$$

- Omega ratio [Shadwick and Keating 2002]:

$$O = \frac{\frac{1}{T-1}\sum_{t=1}^{T} \max\left\{R_t - m, 0\right\}}{\frac{1}{T-1}\sum_{t=1}^{T} \max\left\{m - R_t, 0\right\}}$$

- The ratio of the excess rate of UPR return [Sortino et al. 1999]:

$$UPR = \frac{\frac{1}{T-1}\sum_{t:R_t>m}\left(R_t - m\right)}{\sqrt{\frac{1}{T-1}\sum_{t:R_t<m}\left(R_t - m\right)^2}}$$

where m is the minimum acceptable rate of return, in the study, it is assumed that it is equal to zero. Such an assumption is dictated by the fact that the period of studies includes good and bad stock exchange situation. In order to have one and the same minimum acceptable rate of return in the entire period, its prudential value equal to zero is assumed.

- Sortino ratio [Sortino and Price 1994]:

$$S = \frac{\bar{R} - m}{\theta(m)}$$

- Risk measure is defined as follows:

$$\overline{\theta(m)} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left[\left(R_t - m\right)^-\right]^2}$$

In the brackets, the following formula appears:

$$(x)^{-} = \begin{cases} x, \text{ when } x \leq 0 \\ 0, \text{ when } x > 0 \end{cases}$$

Owing to this, the risk only takes into account the rate of return lower than the minimum acceptable rate of return. Therefore, it clearly refers to the loss because, $m = 0$ is assumed, as was mentioned in the studies.

THE ANALYSIS OF RANKING POSITION BASED ON PERFORMANCE COEFFICIENTS

Detailed studies of the investment efficiency measured with profits and losses ratios were performed on the basis of all the measurements mentioned in the introduction. The basis of the assessment were the monthly percentage changes of the funds share units, the commission and the managing fees were not included. The following tables include the ranking positions of the pension funds in selected sub-periods for all used measures. The funds are put in the alphabetical order. Due to limited space, we use abbreviations for names of pension funds as follows: Aegon – Ae, Alianz – Al, Amplico – Am, Aviva – Av, AXA – AX, Bankowy – Ba, Generali – Ge, ING – IN, Nordea – No, Pekao – Pe, Pocztylion – Po, Polasat – Pol, PZU – PZ, Warta – Wa. Performance coefficients are abbreviated as well, namely: Omega – O, Calmar – C, UPR – U, Sortino – S. The detailed results are given in folloming tables (Tables 1, 2, 3, 4).

As we can see in Tables 1, 2, 3 and 4 that Bankowy Fund relatively often appears in the 14th position in the rankings, especially in the longer sub-periods. As it is well known, that fund subsided with assets as a result of very poor investment results. Quantitative evaluation allows to express a very unflattering opinion about this fund. Pocztylion is in a little better condition. At the beginning of its operation, it most frequently occupied the penultimate, the 13th or 12th place. In the following periods those funds began to occupy a better position, but their positions were still quite low on the market. We can also see rather chaotic distribution of funds on the first position. Table 1 provides exceptions for two-year sub-periods. In 2000–2001 and 2002–2003 Polsat Fund was on the first position in the rankings. The some happened for the Generali Fund in 2006–2007 and 2008–2009. However such situation has not occurred for longer sub-periods. We may conclude that the funds are not able to maintain their high marketing ranking position for too long. They lose their leadership positions and quickly experience fall in the rankings. For example in 2000–2006 (six- and seven-year sub-periods) Polsat Fund held the first position in the rankings while in the remaining years, until 2013, it dropped to the last position. Our conclusions apply also to other funds, but the ranking position change is not as extreme as in the case of Polsat Fund. It should be remembered that saving in second pillar of the retire system by definition and character, should be long-term – dozens or tens of decades. The results indicate that in 2000–2013 there were no pension funds, which would be able to ensure the stability of the ranking position in the periods longer than two years.

Table 1. Coefficients of pension fund performance for two year sub-periods (desciptions of all symbols are in the text)

Item	2000–2001				2002–2003				2004–2005				2006–2007			
	O	C	U	S	O	C	U	S	O	C	U	S	O	C	U	S
Ae	9	9	10	9	9	11	10	9	9	10	9	9	8	7	10	8
Al	6	4	9	7	2	1	3	2	13	12	11	12	3	5	2	2
Am	13	13	14	13	7	9	6	6	4	1	2	2	4	4	5	3
Av	3	5	5	3	14	12	12	12	5	2	3	5	6	2	6	6
AX	4	2	6	6	12	14	13	13	1	5	6	4	7	6	7	7
Ba	14	14	13	14	4	4	5	4	12	11	10	10	13	13	14	13
Ge	5	6	4	5	10	8	9	11	6	7	4	6	1	1	1	1
IN	8	8	7	8	8	7	11	10	10	3	8	8	12	8	12	12
No	2	7	1	2	3	5	4	3	11	8	13	13	11	10	11	10
Pe	10	10	12	10	5	6	1	5	7	14	12	11	2	11	8	5
Po	12	11	11	12	13	13	14	14	8	9	7	7	10	9	9	9
Pol	1	1	2	1	1	2	2	1	3	4	1	1	9	14	13	11
PZ	7	3	3	4	6	3	8	7	14	13	14	14	5	3	3	4
Wa	11	12	8	11	11	10	7	8	2	6	5	3	14	12	4	14

Item	2008–2009				2010–2011				2012–2013			
	O	C	U	S	O	C	U	S	O	C	U	S
Ae	4	4	4	4	12	11	10	11	13	12	11	11
Al	2	1	2	2	8	6	4	7	5	5	7	7
Am	8	8	10	8	5	8	5	5	1	2	2	2
Av	14	14	14	14	7	7	7	8	10	13	13	13
AX	3	3	5	3	1	1	1	1	7	10	10	10
Ba	5	5	3	5	6	4	6	6	8	8	5	5
Ge	1	2	1	1	9	9	9	9	12	11	12	12
IN	13	12	12	13	4	3	8	4	3	4	8	8
No	7	7	11	7	2	2	2	2	2	1	1	1
Pe	11	10	8	10	11	12	12	12	11	6	9	9
Po	6	6	7	6	13	13	13	13	6	3	3	3
Pol	10	13	13	12	14	14	14	14	14	14	14	14
PZ	9	9	9	9	10	10	11	10	9	9	6	6
Wa	12	11	6	11	3	5	3	3	4	7	4	4

Table 2. Coefficients of pension fund performance for three year sub-periods (desciptions of all symbols are in the text)

Item	2000–2002				2003–2005				2006–2008				2009–2011			
	O	C	U	S	O	C	U	S	O	C	U	S	O	C	U	S
Ae	6	8	8	8	13	14	11	12	9	9	8	9	11	10	8	11
Al	3	3	7	4	8	3	8	8	1	1	1	1	10	9	9	10
Am	11	9	13	13	6	9	6	5	6	6	9	6	3	4	7	5
Av	8	8	5	6	7	8	5	6	10	10	12	10	9	7	10	8
AX	9	7	9	9	4	7	7	7	4	4	5	4	1	1	1	1
Ba	14	12	14	14	12	12	10	10	13	13	13	13	2	3	3	2
Ge	7	6	6	7	5	6	4	4	2	2	2	2	4	2	4	4

Table 2, cont.

Item	2000–2002				2003–2005				2006–2008				2009–2011			
	O	C	U	S	O	C	U	S	O	C	U	S	O	C	U	S
IN	5	13	4	5	14	13	14	14	11	11	11	11	8	6	11	9
No	1	10	1	1	11	10	13	13	8	8	7	8	7	5	5	6
Pe	10	1	12	11	3	1	3	3	3	3	3	3	12	12	12	12
Po	13	11	11	12	9	11	9	9	7	7	6	7	14	14	13	14
Pol	2	2	3	2	1	2	1	1	14	14	14	14	5	13	2	3
PZ	4	5	2	3	10	5	12	11	5	5	4	5	13	11	14	13
Wa	12	4	10	10	2	4	2	2	12	12	10	12	6	8	6	7

Table 3. Coefficients of pension fund performance for year sub-periods (desciptions of all symbols are in the text)

Item	2000–2003				2004–2007				2008–2011			
	O	C	U	S	O	C	U	S	O	C	U	S
Ae	7	8	9	8	9	7	8	9	9	6	6	8
Al	3	3	5	3	7	8	5	5	2	1	1	2
Am	11	12	13	13	2	3	2	2	6	8	11	7
Av	9	5	6	6	5	2	3	4	12	13	13	13
AX	8	4	10	9	3	5	4	3	1	2	4	1
Ba	14	14	14	14	14	12	14	14	5	5	3	5
Ge	5	6	4	5	1	1	1	1	4	4	2	3
IN	6	9	7	7	12	6	10	11	8	7	12	9
No	2	7	1	2	13	10	12	13	3	3	5	4
Pe	10	10	11	11	4	13	9	6	13	12	9	12
Po	13	11	12	12	11	9	6	7	11	10	8	11
Pol	1	1	2	1	6	14	11	10	14	14	14	14
PZ	4	2	3	4	8	4	7	8	10	11	10	10
Wa	12	13	8	10	10	11	13	12	7	9	7	6

Table 4. Coefficients of pension fund performance for five-, six-, seven-year sub-periods (desciptions of all symbols are in the text)

Item	Five-year sub-period								Six-year sub-period							
	2000–2004				2005–2009				2000–2005				2006–2011			
	O	C	U	S	O	C	U	S	O	C	U	S	O	C	U	S
Ae	7	7	7	6	8	6	7	7	7	7	6	8	8	6	7	7
Al	3	3	6	5	3	3	2	2	3	4	8	6	2	1	1	2
Am	12	12	13	13	2	4	4	3	11	12	13	12	4	4	5	4
Av	9	5	5	8	12	11	14	14	8	5	5	5	12	12	13	12
AX	5	4	9	7	4	2	6	5	4	3	9	7	3	3	3	3
Ba	14	14	14	14	14	13	11	13	14	14	14	14	10	11	10	10
Ge	6	6	4	4	1	1	1	1	5	6	3	3	1	2	2	1
IN	10	9	10	10	11	8	13	12	10	9	10	9	11	10	12	11
No	2	8	1	2	10	10	10	10	2	8	2	2	6	5	6	6
Pe	8	10	11	9	7	9	5	6	9	10	11	11	5	9	4	5
Po	13	11	12	12	6	5	3	4	13	11	12	13	9	7	8	9

Table 4, cont.

Item	2000–2004				2005–2009				2000–2005				2006–2011			
	O	C	U	S	O	C	U	S	O	C	U	S	O	C	U	S
Pol	1	1	2	1	5	14	12	8	1	1	1	1	14	14	14	14
PZ	4	2	3	3	9	7	9	9	6	2	4	4	7	8	9	8
Wa	11	13	8	11	13	12	8	11	12	13	7	10	13	13	11	13

Item	Seven-year sub-period							
	2000–2006				2007–2013			
	O	C	U	S	O	C	U	S
Ae	9	7	8	9	8	6	7	7
Al	3	4	6	4	2	1	1	1
Am	12	12	13	13	1	3	4	2
Av	10	5	5	6	12	11	13	13
AX	7	3	10	8	4	4	6	5
Ba	14	14	14	14	6	8	5	6
Ge	4	6	3	3	5	5	2	4
IN	5	9	11	11	7	7	12	8
No	2	8	2	2	3	2	3	3
Pe	6	10	9	7	9	12	8	9
Po	13	11	12	12	11	9	9	10
Pol	1	1	1	1	14	14	14	14
PZ	8	2	4	5	10	10	10	11
Wa	11	13	7	10	13	13	11	12

THE PERSISTENCE OF PENSION FUNDS

The precise support of applications at the quantitative level, according to the study of persistence, i.e. stability of the ranking position of funds, is measured with Spearman's rank correlation coefficient:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i}{n\left(n^2 - 1\right)}$$

where: d_i – difference between the ranks assigned to both characteristics for i and $i + 1$ observation unit;
n – sample size.

In order to get an answer to the question about the stability of ranking positions of the fund, the following hypotheses were tested:

- H_0: $r_s = 0$ – rank correlation coefficient is statistically insignificant (not significantly different from 0);
- H_1: $r_s \neq 0$ – rank correlation coefficient is statistically significant (significantly different from 0).

The test statistic $t = \frac{r_s}{\sqrt{1-r_s^2}}\sqrt{n-2}$ has the t-Student distribution with $v = n - 2$ degrees of freedom. The null hypothesis rejection area is determined by the value of read from the tables with critical values of t-Student distribution. In all cases, a significance level was equal to 0.05. It should be noticed that the Spearman's correlation ratio is used with the small amount of data, as it is in the above case (14th ranking positions). That is the reason why more complex methods of evaluating the persistence for example based on regression were not used.

The following tables (Tables 5, 6, 7) contain the results obtained for all the performance ratios (Omega, Calmar, UPR and Sortino measures).

Table 5. Spearman's rank correlation coefficients between performance measures for two-year sub-periods

Coefficient	2000–2001 / / 2002–2003	2002–2003 / / 2004–2005	2004–2005 / / 2006–2007	2006–2007 / / 2008–2009	2008–2009 / / 2010–2011	2010–2011 / / 2012–2013
Calmar	0.2176	–0.4110	0.1604	0.2703	0.1780	0.3011
Omega	0.1429	–0.4462	–0.0066	0.3143	–0.0549	0.7011[a]
UPR	–0.0066	–0.2112	0.0704	0.3608	0.1956	0.3802
Sortino	0.1385	–0.2527	–0.1692	0.4198	0.0857	0.5429[a]

[a] Statistically significant results.

Table 6. Spearman's rank correlation coefficients between performance measures for three- and four-year sub-periods

Coefficient	Three-year sub-period			Four-year sub-period	
	2000–2002 / / 2003–2005	2003–2005 / / 2006–2008	2006–2008 / / 2009–2011	2000–2003 / / 2004–2007	2004–2007 / / 2008–2011
Calmar	0.4022	0.3319	0.1121	0.2220	0.1912
Omega	–0.1341	0.1209	–0.2088	0.1209	–0.0066
UPR	–0.2747	–0.0637	–0.2879	–0.0286	0.0462
Sortino	–0.2132	0.0330	–0.2571	–0.0330	0.1253

Table 7. Spearman's rank correlation coefficients between performance measures for five-, six- and seven-year sub-periods

Coefficient	Five-year sub-period	Six-year sub-period	Seven-year sub-period
	2000–2004 /2005–2009	2000–2005 /2006–2011	2000–2006 /2007–2013
Calmar	0.1912	0.1648	0.0198
Omega	0.3495	0.2967	0.1254
UPR	–0.2044	–0.1560	–0.1033
Sortino	0.1516	0.0505	–0.0637

Grey shaded areas in Table 5 show statistically significant results. As it is seen, it concerns only two of the four ratios and only the last two-year sub-periods. It confirms the results conducted in the previous section. Apart from that there is no correlation between the ranking positions occupied by pension funds in various sub-periods both short (two-, three-year sub-periods) and long (six- to seven-year sub-period). We therefore may conclude that on the Polish pension fund market there are no strong leaders who, through their investment policy, become especially attractive entities for its customers. It is definitely the situation that shows the managers of investment portfolios in a bad light. High ranking position is motivating for managers, who want to improve their results. This is not the case here. According to the authors, the reasons could be found in the two aspects of the pension fund market. Firstly, the principles of assessment of fund performance, established by the legislative body, were (up to the end of 2013) based on the benchmark constructed by funds themselves, and not on the parameters independent of them and related to the capital market. From the enigmatic interviews incidentally appearing in the press, we may get the impression that the managers were trying to achieve the results only slightly higher than the projected benchmark so as not subsidize the assets. On the other hand, good results, different from the results achieved by other pension funds, would increase the "bar", which could hardly translate into the profits of the fund itself. The level of the fee, which, in the meantime, had changed and was made dependent on fund performance, had to motivate the managers to manage portfolios better. However, they proved to be inefficient. Another explanation for the results obtained, related to some extent to the first one, is the fact that the vast majority of new fund participants have not had chosen a pension fund in a conscious and well-thought manner, but rather submitted to the result of the lottery-drawing. The choice of open-end pension fund by new participants appears random, and not based on previous performance. If so, the managers have not had to lobby for their company, because new participants of the funds were not interested in their performance.

CONCLUSIONS

The profits of fund owners depend on the number of fund participants, but they do not have a significant impact on how many people decide to choose a particular fund. The reason is probably low investment awareness of young people, at least in the context of pensions, i.e. payments that occur in 30 or 40 years. Hence, their decision leave the choice of pension funds to blind fate. However, the situation seems to be improving, which can be seen by a choice of pension funds instead of ZUS, which was made by the end of July 2014 by more than 2.7 million people. It showed a conscious belief that the capital market will "take care" of their pensions rather than politicians, on whom the first pillar of pension system in Poland is based.

The authors are aware of the fact that the presented analysis is far from being complete, in particular, the impact of the financial crisis on the results of pension funds was not taken into account. This is a separate issue, which was partially analyzed in the previous works and mainly concerned equity, balanced and stable growth open-end mutual funds. Therefore, taking into account the impact of the financial crisis on the pension fund

market constitutes the next step in the market analysis of these entities. The second aspect, currently researched, is the persistence based on the Information ratio and Sharpe--Israelsen's ratios. Both of these measures include the market factor independent of the pension funds themselves but refer to the capital market. Thus, the assessment of the effectiveness of the investment is then deprived of deficiency, as mentioned above. Here, the case is the evaluation based on the benchmark constructed on the basis of the results achieved by the funds themselves, and not the market indicator independent of them.

In conclusion, it should be mentioned that, in the previous work [Karpio and Żebrowska-Suchodolska 2012] it was shown that the markets of pension funds and open--end stable growth mutual funds are very similar. However, the studies related only to the period 2005–2010 and were carried out on the basis of different methods. The basis of earlier deliberations of the authors was the alpha coefficient in the characteristic line, where the market factor was the WIG index. The application of the three methods used for assessing the investment policy yielded similar values in the case of pension and stable growth mutual funds, and two of the three methods showed a variable activity prevailing in the stable growth and pension fund markets. It should be noted, however, that the methods used presented only joint-stock part of the portfolio of funds. Therefore, the results for the years 2000–2013 obtained in the present study little differ from those formulated for the years 2005–2010.

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WYNIKI INWESTYCYJNE POLSKICH OTWARTYCH FUNDUSZY EMERYTALNYCH I ICH PERSYSTENCJA

Streszczenie. Praca dotyczy oceny wyników inwestycyjnych osiąganych przez 14 funduszy emerytalnych funkcjonujących na polskim rynku w latach 2000–2013. Do oceny wykorzystano współczynniki: Calmara, Omega, potencjał nadwyżkowej stopy zwrotu (UPR) oraz Sortino, biorąc pod uwagę różne okresy czasu (dwa, trzy, cztery, pięć, sześć i siedem lat). Persystencję osiąganych wyników zbadano, obliczając współczynnik korelacji rangowej Spearmana dla wspomnianych podokresów. Uzyskane wyniki wskazują na przypadkowość pozycji rankingowych zajmowanych przez fundusze emerytalne w kolejnych okresach. Prawie wszystkie współczynniki korelacji Spearmana okazały się statystycznie nieistotne.

Słowa kluczowe: efektywność, miary wyników inwestycyjnych, rankingi funduszy emerytalnych, korelacja

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