VERSITA

Folia Oeconomica Stetinensia
DOI: 10.2478/v10031-010-0014-6

Wydział Nauk Ekonomicznych i Zarządzania
Uniwersytetu Szczecińskiego

POLISH PENSION FUNDS INVESTMENT – IS THERE A PLACE FOR REAL PROPERTY IN A PORTFOLIO?

Magdalena Zaleczna, Ph.D.

Department of Investment and Real Estate
Faculty of Economics and Sociology
University of Lodz
Rewolucji 1905r., 90-214 Lodz, Poland
email: mzaleczna@uni.lodz.pl

Rafał Wolski, Ph.D.

Department of Industry Economics and Capital Market
Faculty of Economics and Sociology
University of Lodz
Rewolucji 1905r., 90-214 Lodz, Poland
email: rwolski@uni.lodz.pl

Received 27 September 2010, Accepted 30 June 2011

Abstract

The pension fund investments should be characterised by a long term, low risk and profitability, which implicates the necessity of portfolio diversification. In general, pension funds having regular long-term contributions should develop the long-term policy and its effects would be responsible for the economic position of their future beneficiaries. The ways of capital allocation are also critical in terms of the entire economy, as a constant flow of financial resources provided by pension funds stimulates the activity of its recipients. The typical assets in a pension fund's portfolio in the developed economy are stocks, bonds and real property owing to low (negative) correlation between these assets and their diversified potential. The legal investment limits imposed on the Polish pension funds exclude direct investment in real property, which is responsible – in the authors' opinion – for the lower level of diversification and hinders the risk reduction. The authors analyze the Polish pension fund portfolios focusing on risk and return levels. The aim of the study is to find the answer to the important question about the results of hypothetically added real property to the portfolios of pension funds.

Keywords: investment, legal regulation, pension funds.

JEL classification: E22, G11, G23.

Introduction

The number of people in the post-working age in proportion to the working age people will increase. According to estimations conducted by the European Central Bank, by 2050 the ratio[1] of the 65+ to people of 20–64 years of age will have amounted to 55%, which means a significant rise from the current level of 26% in the Euro zone[2]. This ratio will obviously be different in individual countries. In Poland the currently observed tendencies, in the scope of vital statistics, are similar to the countries of Western Europe and Scandinavian countries, however the Polish population is still relatively young. The trends in the mortality level manifested by longer life expectancy of population, are accompanied by irreversible changes in the fertility model (higher mean age of childbearing, smaller number of children). In the next decades the demographic structure of the Polish population will reflect the present tendencies – the aging of the population will be rapid. The statistical projections forecast that in 2035 the age group of 65+ will increase by more than 10%.

Thus, the investment activity of pension funds is of crucial importance for many millions of people who anticipate social protection at the post-working age. The amount of money being collected and invested by pension funds has been growing steadily and the financial resources invested by the funds may significantly influence the economy. The value of assets collected by pension funds in a number of countries is larger than their GDP – see Table 1.

Table 1. Pension funds' assets in relation to GDP (%)

Country	2001	2007	2008
Australia	75.29	110.36	91.78
Czech	2.27	4.70	5.17
Nederlands	102.62	138.05	113.66
Germany	3.44	4.65	4.75
Poland	2.43	12.16	10.98
US	71.54	78.46	58.41
Hungary	3.89	10.89	9.64

Source: own work based on OECD Statistics (Pensions Indicators).

Having in mind the variety of pension systems and their popularity in different countries it can be noticed that there are enormous dissimilarities between the assets' worth in relation to the GDP. However, there are some common points in the picture – rapid increase of pension funds

assets in post-socialist countries like Poland, Czech, Hungary and generally negative influence of the financial crisis[3].

1. Investment rules and regulations at the international level

The investments of pension funds are required to be distinguished by their long-term character and low level of risk, which involves the necessity to diversify the investment portfolios of these entities. The predictability of contribution payments favours the long-term investment policy while the results of business operations determine the economic position of future old-age pensioners. Such investment decisions also have a significant impact on providing a source of financing for different types of activities, including those which stimulate economic development.

In July 2004, the OECD Council adopted a special regulatory recommendation for pension funds – the "Recommendation of the Council on Core Principles of Occupational Pension Regulation". According to this document, to accomplish the goal of the funds, which was to provide future old-age pensioners with financial resources, required effective legal regulations and appropriate supervision. The document indicated that within investment activity it was necessary to comply with the rules of safety, profitability and liquidity with the use of available opportunities to reduce investment risk through investment portfolio diversification. In response to the financial crisis, also experienced by pension funds and their beneficiaries, the OECD Council adopted in June 2009 a new "Recommendation of the Council Core Principles of Occupational Pension Regulation". The OECD aimed at stronger regulation and better governance to improve the regulation and supervision of private pension systems, covering the various aspects of the operation of these systems, such as licensing, governance, funding, investment and the rights of pension plan members.

The pension funds' investment was a subject of the OECD guidelines, called the 'Guidelines on Pension Fund Asset Management', adopted in 2006. The guidelines were elaborated upon and substantial attention was paid to the recommended investment policy. It was indicated that the limits on the share of particular kinds of assets should not be of the floor character; it is necessary to ensure diversification of investment portfolios and risk management. The investment limitations which interfere with adequate diversification should not be applied.

2. Assets in the investment portfolios of pension funds

Typical assets in the investment portfolios of pension funds include stocks, bonds and real property due to their low correlation and diversification potential[4]. A review of studies on the portfolio structures and financial performance of pension fund investments reveals the importance of such factors as timing, tax regulations and investment type.

In those countries where pension funds are not forbidden by legal regulations to invest in the real property market, real property is a component of investment portfolios, although its share varies. First of all it is the pension funds possessing substantial financial resources who are interested in such investments, which results from a large capital intensity of the real property and its low liquidity. It is also indicated that the share of real property generally represents a lower level than that suggested by theoretical research[5]. The selection of investment for the pension fund portfolios in the real property market is not limited to office and retail real property only, as in some cases profitable housing properties are also within the range of investors' interest.

Table 2. The average allocation of pension funds assets in 2008 (%)

Country	Cash/bank deposits	Bonds	Stocks	Real property	Mutual funds	Other
Australia	10.70	n/a	23.26	4.49	54.84	6.71
Czech	8.06	78.89	2.99	0.88	3.21	5.97
Nederlands	4.74	37.46	37.28	2.66	n/a	17.86
Germany	2.92	26.01	0.04	2.44	36.12	32.47
US	1.18	22.91	37.10	1.73	17.01	20.07
Hungary	3.00	62.01	12.2	0.31	22.23	0.25

Source: own work based on OECD Statistics (Pensions Indicators).

A key research issue is the difference between theory and practice as regards the share of real property in investment portfolios. Theoretical research points to the need to include real property in the portfolio to a larger extent than it happens in practice. It is suggested that the share should amount to 15–20% (this concerns both commercial and housing real property)[6]. However, specific features of the real property contribute to reduction in the share of such assets in investment portfolios, see Table 2.

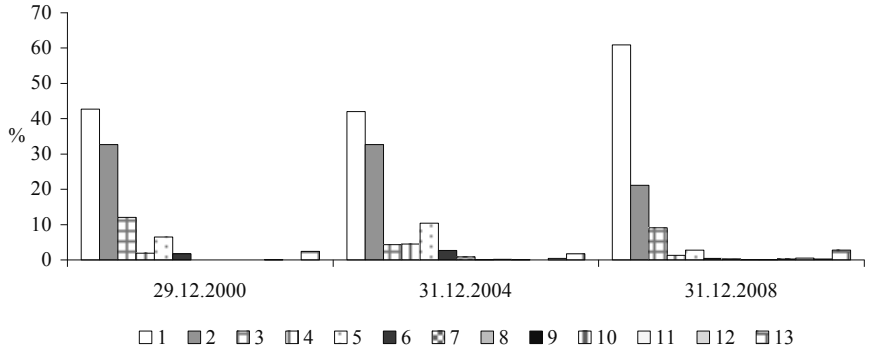
3. Pension funds in the light of the Polish regulations

The operations of pension funds in Poland are regulated by the Act on the Organization and Operation of Pension Funds[7]. Pursuant to art. 139 of the Act cited, a pension fund should allocate its assets in accordance with the above Act while aiming to provide maximum security and profitability of its investments. In order to ensure portfolio diversification, the legislator specified a list of possible categories of investments where fund assets may be allocated (art. 141) as well as investment limits in particular categories of investments (art. 142).

The Polish legislators have excluded real property as direct investment. However, pension funds may invest in real property indirectly: in investment certificates issued by real property closed-end investment funds or mortgage bonds. In spite of the OECD recommendations and foreign analyses and studies, the Polish regulations make full diversification of investment portfolios impossible. Polish investment limits are exceptional in the light of studies on national regulations in the OECD (OECD Survey of Investment Regulation of Pension Fund 2008). Out of 29 countries surveyed (and 34 pension systems) only 6 exclude the possibility to invest in real property and they include Iceland, Italy, Japan, Poland, Slovakia and Turkey. The approach that specifies some investment limits prevails, although in the case of legal regulations 12 pension systems do not provide any restrictions on investments in the real property market[8].

The solution adopted in Poland, which is the exclusion of direct investment in the real property market from the range of possibilities of allocation of financial resources by pension funds, leads to a low level of diversification of investment portfolios and thus the principal investment directions include State Treasury bonds and the stocks of Polish companies quoted on the Stock Exchange in Warsaw – see Figure 1. Therefore, the changes of trends in the stock market influence the performance of pension fund investments and risk is not reduced through adding of a low-correlated class of assets, that is, real property.

The deep falls of stock market influenced the results of pension funds investment in Poland, for the first time since their establishment the pension funds experienced the negative rate of return (from June 2006 to June 2009), with the average of –2.93%, and in specific cases: from –0.045% to –5.544%[9]. In that time the significant changes in portfolio structure took place, the level of Polish stocks in portfolio decreased from 38.2% (June 2007) to 20.6% (March 2009), and the level of Polish bonds increased from 60.6% to 78.8%. Due to these results the Polish Ministry of Labour has been preparing the new regulations for the Polish pension funds activities.



1 Treasury bonds with fixed interest
2 Stocks quoted on the official market of the Stock Exchange
3 Treasury bonds with floating interest
4 Deposits in domestic banks
5 Zero-coupon treasury bonds
6 Treasury bills
7 Stocks quoted at foreign stock exchanges
8 Investment certificates issued by closed-end investment funds
9 Investment certificates issued by specialist closed-end investment funds
10 Mortgage bonds
11 Bank securities issued by domestic banks
12 Bank securities issued by foreign banks
13 Others

Fig. 1. Structure of aggregated assets of pensions funds in Poland

Source: own work based on statistics from the Polish Financial Supervision Authority.

The previous amendment of the Act on the Organization and Operation of Pension Funds, which came into force on 1 January 2004, made it possible for the pension funds to invest their capital in the investment certificates of closed-end investment funds which, in turn, may invest directly in real property. Pursuant to the act, pension funds may allocate not more than 2% of their assets in investment certificates issued by one closed-end investment fund or one specialized closed-end fund. The total value of a fund's investment in investment certificates issued by a closed-end investment fund may not exceed 10% of the value of its assets. As regards a fund's investment in investment certificates, a restriction also exists to the effect that the maximum allocation limit within one issue is 35%[10]. Pension funds may also invest in the real property market in an indirect manner through the acquisition of shares or stocks issued by entities investing in the real property market or the acquisition of mortgage bonds. However, the share of such indirect investments in the real property market is quite insignificant in the investment portfolios of pension funds.

The absence of pension funds as a direct institutional investor in the investment market significantly weakens the investor structure on the Polish real property market. The development of pension funds, in compliance with legal regulations, contributes only in an indirect manner to the development of this market[11].

4. The study of impact of adding real property to the investment portfolios of pension funds

The study is aimed to reveal the impact of the diversification of the pension fund portfolio through the inclusion housing or commercial real property into its structure and was conducted in the years 2003–2009 (the first half). The data on the value of shares in Open-end Pension Funds OFE was obtained from the Quarterly Bulletins published by OFE supervisory authorities (currently it is the Polish Financial Supervision Authority[12]). Apart from 14 funds, a hypothetical fund was taken into account in the study and its share value was estimated as the average for the shares of the funds quoted. The return level for the market portfolio was determined on the basis of quotations of the largest Warsaw Stock Exchange Index WIG and the yield of fifty-two week Polish T-bills was assumed as a return level on risk-free assets. The WIG index value was obtained from the Stock Exchange in Warsaw and the yield of bills from the Ministry of Finance. All the rates of return were calculated on a semi-annual basis. In total, this provided 13 observations for each asset. All the data concerning average prices of apartments were obtained from the bank PKO BP. Prices from the five largest Polish cities were selected for the study, as well as average prices. Thus, this data set included apartment prices from Lodz, Wroclaw, Poznan, Cracow and Warsaw. Moreover, average prices from all over Poland were used in the calculations. As regards commercial real property, data concerning office, industry and retail real property were used. Quotations were obtained from reports of the Colliers Company.

Methodology

In order to examine how real property will influence the efficiency of pension fund portfolios, an efficiency study of OFEs was conducted, and then the portfolios consisting of investments in a real property market and shares in pension funds were optimized. In the course of the research work, a hypothesis was formulated that pension funds which diversify their portfolios by means of real property investment may achieve larger efficiency. In order to verify this hypothesis, an efficiency analysis of the OFE portfolios without real property was carried out and, in the case of selected funds, with real property investments at a various level.

The pension fund efficiency analysis was carried out through the calculation of three portfolio efficiency ratios[13]: of Sharpe[14], Treynor[15] and Jensen[16]. Then, with the use of Markowitz[17] and Sharpe[18] techniques, portfolios which included 5% of real property and 95% of shares in selected pension funds were optimized. Next, a real property share was increased to 10% and 20%. It was assumed that the largest real property share in a pension fund portfolio would amount to 20%.

While analyzing subsequent investments, the average return levels, total and systematic risk levels and the volatility indicator were calculated.

Six pension funds were selected to build portfolios that included real property. They included one hypothetical fund whose shares were valued on the basis of the average value of 14 operating funds, two funds representing the highest, two the lowest and one fund representing the Sharpe ratio from the middle of the ranking.

The study results

Table 3 presents the results obtained for OFEs, housing investments and market investments. All pension funds demonstrate a low risk-level, similarly to investments in the commercial real property market and 52-week treasury bills. A volatility indicator at a level lower than one has been observed only in commercial real property and government securities. In the case of 12 pension funds, the Sharpe ratios are lower than the market ratio. The Treynor ratios are lower than the same ratios determined for the market index in 6 cases. The Jansen ratio assumes negative values in each case. Regarding to the Jensen ratios and almost all the Sharpe ratios analysis reveals that in the period studied, funds were not in the possession of investment portfolios of efficiency larger than the market index. However, it is necessary to bear in mind that the pension fund strategy is of a long-term character and the presented study period covers extremely turbulent events, which undoubtedly had an impact on the analysis results.

On the basis of the adopted research strategy, and the ranking of the Sharpe ratio value, the portfolios used for the subsequent studies included the hypothetical pension portfolio and five actual pension fund portfolios; two with the highest Sharpe ratio (AIG OFE – OFE 1 and Generali OFE – OFE 14), two with the lowest ratio (Aviva OFE Aviva BZ WBK – OFE 4 and Bankowy OFE – OFE 3) and one with a medium ratio (the seventh out of fourteen) (OFE PZU „Zlota Jesien" – OFE 11).

Table 3. Risk analysis results

Open-end Pension Funds	Average R	Standard deviation	Beta	Volatility indicator
AIG OFE	0.042	0.065	0.255	1.553
Allianz Polska OFE	0.036	0.059	0.220	1.634
Bankowy OFE	0.036	0.063	0.245	1.753
Aviva OFE Aviva BZ WBK	0.036	0.065	0.253	1.814
OFE WARTA	0.039	0.066	0.259	1.676
ING OFE	0.038	0.065	0.246	1.704
AEGON OFE	0.037	0.062	0.231	1.664
Pekao OFE	0.042	0.075	0.283	1.795
OFE Pocztylion	0.039	0.062	0.242	1.579
OFE Polsat	0.045	0.087	0.352	1.913
OFE PZU "Złota Jesień"	0.039	0.066	0.243	1.694
Nordea OFE	0.036	0.062	0.238	1.702
AXA OFE	0.040	0.062	0.237	1.565
Generali OFE	0.043	0.062	0.244	1.450
funds – weighted average	0.038	0.064	0.248	1.673
resale housing market				
Poland	0.076	0.164	0.348	2.165
Wroclaw	0.082	0.121	0.264	1.486
Lodz	0.104	0.190	0.210	1.815
Cracow	0.085	0.105	0.293	1.235
Warsaw	0.081	0.104	0.312	1.277
Poznan	0.086	0.136	0.354	1.583
new housing market				
Poland	0.095	0.120	–0.003	1.257
Wroclaw	0.095	0.161	0.324	1.684
Lodz	0.069	0.181	0.336	2.609
Warsaw	0.084	0.135	0.369	1.606
Warsaw	0.064	0.090	0.209	1.408
Poznan	0.085	0.264	0.439	3.119
commercial real property				
office	0.067	0.010	0.011	0.146
industry	0.082	0.014	0.013	0.164
retail	0.076	0.015	0.017	0.192
capital assets				
WIG	0.081	0.217	1.000	2.670
52-week treasury bills	0.027	0.005	–0.011	0.199

Table 3 cont.

Open-end Pension Funds	Sharpe ratio	Treynor ratio	Jensen ratio	WIG correlation ratio
AIG OFE	0.268*	0.068**	–0.054	0.852
Allianz Polska OFE	0.196	0.052	–0.058	0.816
Bankowy OFE	0.185	0.048	–0.059	0.841
Aviva OFE Aviva BZ WBK	0.177	0.046	–0.060	0.841
OFE WARTA	0.225	0.057**	–0.057	0.857
ING OFE	0.214	0.057	–0.057	0.819
AEGON OFE	0.207	0.055	–0.057	0.811
Pekao OFE	0.233	0.062**	–0.055	0.817
OFE Pocztylion	0.238	0.060**	–0.056	0.854
OFE Polsat	0.242	0.060**	–0.056	0.881
OFE PZU “Złota Jesień”	0.220	0.059**	–0.056	0.803
Nordea OFE	0.192	0.050	–0.059	0.837
AXA OFE	0.249	0.066**	–0.055	0.823
Generali OFE	0.297*	0.075**	–0.052	0.855
funds – weighted average	0.219	0.057**	–0.057	0.834
resale housing market				
Poland	n/a	n/a	n/a	0.461
Wroclaw	n/a	n/a	n/a	0.471
Lodz	n/a	n/a	n/a	0.240
Cracow	n/a	n/a	n/a	0.605
Warsaw	n/a	n/a	n/a	0.652
Poznan	n/a	n/a	n/a	0.566
new housing market				
Poland	n/a	n/a	n/a	–0.006
Wroclaw	n/a	n/a	n/a	0.438
Lodz	n/a	n/a	n/a	0.402
Warsaw	n/a	n/a	n/a	0.593
Warsaw	n/a	n/a	n/a	0.504
Poznan	n/a	n/a	n/a	0.362
commercial real property				
office	n/a	n/a	n/a	0.251
industry	n/a	n/a	n/a	0.214
retail	n/a	n/a	n/a	0.257
capital assets				
WIG	0.262	0.057	n/a	1.000
52-week treasury bills	n/a	n/a	n/a	–0.447

* Sharpe ratio higher than market ratio.
** Treynor ratio higher than market ratio.

Source: own research.

The conducted portfolio optimization led to results which were not surprising. While analyzing them it is necessary to take into account a number of restrictions connected with this research. The first and the most serious is the length of the research period adopted. This length is determined by data availability. The very short period in conjunction with an extremely turbulent situation (initial unprecedented rises followed by dramatic falls suggesting investors' panic) may be the reason for such results of the optimization – easy to predict and homogenous. This homogeneity was manifested in the maximum real property share in investment portfolios. Each time, no matter which OFE was diversified, and irrespectively of the manner of optimization, similar results were obtained, which proved that a portfolio should be diversified with real property to the greatest possible extent; thus the real property share should amount to 5, 10 and 20%. Table 4 presents results for Markowitz optimization.

Table 4. The structure of OFE portfolio diversified by real property, Markowitz methodology

Investment	Share (%)	Return level	Standard deviation	Beta	Sharpe ratio	Treynor ratio	Jensen ratio
1	2	3	4	5	6	7	8
OFE AV	95	0.042	0.066	0.246	0.148	0.040	–0.052
real property	5						
OFE AV	90	0.044	0.062	0.222	0.195	0.055	–0.048
real property	10						
OFE AV	80	0.048	0.054	0.200	0.295*	0.080**	–0.043
real property	20						
OFE4	95	0.039	0.067	0.251	0.111	0.029	–0.054
real property	5						
OFE4	90	0.042	0.064	0.233	0.157	0.043	–0.051
real property	10						
OFE4	80	0.046	0.057	0.203	0.256	0.071**	–0.045
real property	20						
OFE3	95	0.039	0.065	0.244	0.116	0.031	–0.054
real property	5						
OFE3	90	0.043	0.064	0.233	0.164	0.045	–0.050
real property	10						
OFE3	80	0.046	0.055	0.198	0.263*	0.073**	–0.045
real property	20						
OFE11	95	0.042	0.067	0.239	0.149	0.042	–0.051
real property	5						
OFE11	90	0.044	0.064	0.219	0.194	0.057**	–0.048
real property	10						

1	2	3	4	5	6	7	8
OFE11	80	0.048	0.055	0.197	0.293*	0.082**	–0.043
real property	20						
OFE1	95	0.044	0.063	0.242	0.196	0.051	–0.049
real property	5						
OFE1	90	0.047	0.063	0.229	0.242	0.066**	–0.045
real property	10						
OFE1	80	0.050	0.054	0.206	0.342*	0.090**	–0.041
real property	20						
OFE14	95	0.045	0.061	0.232	0.220	0.058**	–0.047
real property	5						
OFE14	90	0.048	0.059	0.220	0.267*	0.072**	–0.044
real property	10						
OFE14	80	0.051	0.051	0.198	0.372*	0.097**	–0.040
real property	20						

* Sharpe ratio higher than market ratio.
** Treynor ratio higher than market ratio.

Source: own research.

Table 5 presents results obtained while optimizing portfolios with the application of Sharpe Single Index Model. Some small differences in index values were revealed. However, taking into account the fact that each time real property represents the maximum permissible value in investment portfolios, such results should not be surprising.

Table 5. Structure of OFE portfolios diversified with real property, Sharpe methodology (Single Index Model)

Investment	Share (%)	Return level	Standard deviation	Portfolios beta	Sharpe ratio	Treynor ratio	Jensen ratio
1	2	3	4	5	6	7	8
OFE AV	95	0.042	0.066	0.246	0.148	0.040	–0.052
real property	5						
OFE AV	90	0.044	0.062	0.222	0.195	0.055	–0.048
real property	10						
OFE AV	80	0.050	0.063	0.197	0.285*	0.090**	–0.041
real property	20						
OFE4	95	0.039	0.067	0.251	0.111	0.029	–0.054
real property	5						
OFE4	90	0.042	0.063	0.227	0.157	0.043	–0.051
real property	10						

1	2	3	4	5	6	7	8
OFE4	80	0.048	0.063	0.202	0.252	0.078**	–0.043
real property	20						
OFE3	95	0.039	0.065	0.244	0.116	0.031	–0.054
real property	5						
OFE3	90	0.042	0.062	0.220	0.163	0.045	–0.050
real property	10						
OFE3	80	0.048	0.062	0.196	0.257	0.081**	–0.043
real property	20						
OFE11	95	0.042	0.068	0.242	0.149	0.042	–0.051
real property	5						
OFE11	90	0.044	0.064	0.219	0.194	0.057**	–0.048
real property	10						
OFE11	80	0.050	0.065	0.194	0.280*	0.093**	–0.041
real property	20						
OFE1	95	0.044	0.063	0.242	0.196	0.051	–0.049
real property	5						
OFE1	90	0.047	0.063	0.229	0.242	0.066**	–0.045
real property	10						
OFE1	80	0.052	0.063	0.203	0.327*	0.101**	–0.039
real property	20						
OFE14	95	0.045	0.061	0.232	0.220	0.058**	–0.047
real property	5						
OFE14	90	0.048	0.060	0.220	0.267*	0.073**	–0.044
real property	10						
OFE14	80	0.053	0.061	0.195	0.351*	0.109**	–0.038
real property	20						

* Sharpe ratio higher than market ratio.
** Treynor ratio higher than market ratio.

Source: own research.

Conclusions

The increase in efficiency of each portfolio is not surprising against a background of stable real property prices in the Polish market. However, it seems that the studies should be repeated in the future in order to cover the whole business cycle including not only the stock exchange cycle but the cycle in the real property market as well. The Sharpe, Treynor and Jensen ratios in the constructed portfolios with real property revealed some improvement with respect to the pension fund ratios. The chosen methods of optimisation are based on the risk level optimisation

in relation to the rate of return. The results of the analysis seem to be logical and coherent with the application of this approach. The real property fills in the gap between bonds and stocks. The undertaken analysis provide a positive verification of the research hypothesis and thus one could tentatively argue that the diversification of pension fund portfolios through investment in the real property market is favourable for the beneficiaries.

Notes

[1] The ratio is defined as the 'old age dependency ratio'.

[2] Find more in: a speech by Gertrude Tumpel-Gugerell, a member of the European Central Bank Management Board, the Euro Finance Week, Frankfurt am Main, 18 November 2008, http://www.ecb.int/press/key/date/2008/html/sp081118.en.html.

[3] The OECD estimates that the current financial crisis has resulted in the reduction of pension fund assets by 3.3 billion USD, that is, by about 20% in nominal value and 22% in real value (Pension Markets in Focus 5/2008, OECD). This loss mostly concerns the USA (2.2 billion USD) and those countries where pension funds invested mostly in stocks (Great Britain, Ireland, Australia).

[4] Hoesli, Lekander, Witkiewicz (2004), Quan, Titman (1999), Seiler, Webb, Myer (1999).

[5] Hoesli, Lekander, Witkiewicz (2003), Hoesli, Lekander (2005), Worzala, Sirmans, Lizieri, Schulte, Ooi, Hordijk, Newell (2006).

[6] Hoesli, Hamelink (1997), Ziobrowski, Ziobrowski (1997).

[7] Act of 28 August 1997 on the Organization and Operation of Pension Funds, Journal of Laws No. 139, Item 934, as amended.

[8] OECD (2008).

[9] Komisja Nadzoru Finansowego (2009).

[10] Ordinance of the Council of Ministers of 3 February 2004 on the determination of maximum share of open-end pension fund assets which may be allocated in particular classes of investments and additional restrictions with respect to running investment operations by pension funds, Journal of Laws, No. 276, Item 32 as amended.

[11] Henzel, Ramian, Śmietana, Zagórska (2007).

[12] The Act of 21 July 2006 on Financial Market Supervision, Journal of Laws of 2006, No. 157, Item 1119.

[13] Flaherty, Li (2004).

[14] Sharpe (1966, 1994), Israelsen (2005).

[15] Treynor (1966).

[16] Jensen (1968).

[17] Markowitz (1952).

[18] Sharpe (1963).

References

Flaherty, S., Li, J. (2004). Composite Performance Measures. *Chinese Economy*, 37/3, 39–66.

Henzel, H., Ramian, T., Śmietana, K., Zagórska, E. (2007). Znaczenie inwestorów instytucjonalnych na polskim rynku nieruchomości, *Nieruchomość*, 1.

Hoesli, M., Hamelink, F. (1997). An examination of the role of Geneva and Zurich housing in Swiss institutional portfolios. *Journal of Property Valuation and Investment*, 15(4), 354–371.

Hoesli, M., Lekander, J., Witkiewicz, W. (2003). Real estate in the institutional portfolio: a comparison of suggested and actual weights, *Journal of Alternative Investments*, 7(3), 53–59.

Hoesli, M., Lekander, J., Witkiewicz, W. (2004). International evidence on real estate as a portfolio diversifier, *Journal of Real Estate Research*, 26(2), 161–206.

Hoesli, M., Lekander, J. (2005). Suggested vs. actual institutional allocations to real estate in Europe: A matter of size?, *Journal of Alternative Investments*, 8(2), 62–70.

Israelsen, C.L. (2005). A refinement to the Sharpe ratio and information ratio. *Journal of Asset Management*, 5/6, 423–427.

Jensen, M.C. (1968). The Performance of Mutual Founds in the Period 1945-1964. *Journal of Finance*, 23, 389–417.

Jobson, J.D., Korkie, B.M. (1981). Performance Hypothesis Testing with the Sharpe and Treynor Measures. *Journal of Finance*, 36, 889–908.

Komisja Nadzoru Finansowego Report (2009).

Markowitz, H.M. (1952). Portfolio Selection. *Journal of Finance*, 7/1, 77–91.

OECD, Survey of Investment Regulation of Pension Fund (2008).

Worzala, E., Sirmans, C.F., Lizieri, C., Schulte, K.-W., Ooi, J., Hordijk, A., Newell, G. (2006). An International Comparative Study of the Pension Plan Community and Real Estate Investments, Hartford (CT): Pensions Real Estate Association.

Pilotte, E.A., Sterbenz, F.P. (2006). Sharpe and Treynor Ratios on Treasury Bonds. *Journal of Business*, 79, 149–180.

Quan, D.C., Titman, S. (1999). Do real estate prices and stock prices move together? An international analysis, *Real Estate Economics*, 27(2), 183–207.

Seiler, M.J., Webb, J.R., Myer, F.C.N. (1999). Diversification issues in real estate investment, *Journal of Real Estate Literature*, 7(2), 163–179.

Sharpe, W. (1963). A Simplified Model for Portfolio Analysis, *Management Science*, 9, 277–293.

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Condition of Risk, *Journal of Finance*, 19, 425–442.

Sharpe, W. (1966). Mutual Fund Performance. *Journal of Business*, 39, 110–138.

Sharpe, W. (1994). The Sharpe Ratio. *Journal of Portfolio Management*, 21, 49–58.

Special Feature: Private Pensions and the 2008 Turmoil in Financial Markets (2008). Pension Markets in Focus 5, OECD.

Treynor, J. (1961). Market Value, Time and Risk. non-published paper.

Treynor, J. (1966). How to Rate Management Investment Funds, *Harvard Business Review*, 43, 63–75.

Ziobrowski, B.J. Ziobrowski, A.J. (1997). Higher real estate risk and mixed-asset portfolio performance. *Journal of Real Estate Portfolio Management*, 3(2), 107–115.