

Return-risk profile of Slovak pension funds

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Abstract: *The pension fund management companies in the Slovak republic create and manage four types of pension funds. For deeper analyze is necessary to examine individually all type of pension funds. The most important indicator for pension fund participants is the revenue of the investment. Revenues of the fund's assets portfolio may be determined by dividends, interest rate, premium or net capital profit (loss) based on the situation of the price of securities. On the other hand, the risk and active measures taken for its elimination are essential for a pension fund manager. The result of this paper is comparison return-risk profile among Slovak pension funds.*

Keywords: *return, risk, Slovak pension funds, standard deviation.*

JEL: *G10, G11, G23, J32.*

Introduction

Pension funds in Slovakia differ from each other especially by their risk profile and investment orientation. Pension funds according to the risk rate use several investment tools with the aim of ensuring valuation of the entrusted funds. They reflect different preferences of the pension savers. In terms of the fund underlying security, the index pension fund is the most risky type of fund and the bond pension fund is the less risky one.

Bond pension fund is the most conservative type of pension fund in the pension management companies' administration. The assets portfolio of the pension fund is mainly formed by bond investments, as well as by investments to the financial market tools and transactions with the purpose of limiting the exchange risk. A pension fund administrator should orient, according to the fund specialisation, on investments reducing other risks related to investments on the capital markets.

Pension management companies guarantee in the second pillar additional payment of the negative difference related to investment of the bond pension fund. The obligation to settle the difference arises in the case when nominal investment devaluation occurs over five years. Pension management companies guarantee this way that the pension unit will not drop to a lower level than it was five years ago.

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Mixed pension fund is formed by investments to several tools of the financial market. Pension fund managers may invest into a share not more than 50 % of the net value of the fund assets and not less than 50 % of the net value of the fund assets into bonds and financial investments. The share of investments secured against the above risk must be created at least by a half of the total amount of investments of the mixed pension fund. The legislation enables the pension administrators to invest also into securities whose underlying securities are formed by precious metals in the maximum amount of 20 % of the fund investment value. The mixed pension fund enables to distribute the risk among shares, bonds and commodity investments.

The equity pension fund enables the fund managers to invest as much as 80 % of the net fund assets value into shares. The portion of bonds and financial market tools must be not less than 20 % of the net fund assets value. The share pension fund, similarly like the mixed pension fund, enables investing into precious metals securities. The portion of investment reducing the exchange risk must be formed at least by 20 % of the securities portfolio of the share pension fund. Participation in the fund is suitable especially for savers with low aversion to risk and better understanding of the financial market relations.

The index pension fund is passively managed pension fund whose profitability depends on the increase of the value of the entrusted share index or several indexes. The biggest possible deviation from the pension unit is 10%. Failure to meet this condition causes decrease of remuneration for the index pension fund administration by 50%. Portfolio of the index fund is not formed by bonds; it is entirely dependent on the development of the stock market (Andrei & all, 2016).

1. Literature review

In order to reduce differences between individual generations, it is possible to apply standpoints of several theories. To maintain the system, Aron (1966) considers it important to maintain the balance between the level of paid pension benefits as compared with total income of citizens (Arltová, 2016). This indicates that increased income from continuous system will be provided by rising salaries of citizens or overall increase of population. In order to maintain welfare in the continuous system, constant rise of salaries and population, exceeding current market interest rates, must be ensured.

Auerbach and Kotlikoff (1987) consider the continuous system a deficit funding scheme transferred from generation to generation. Based on the life cycle concept, transfer of funds between generations lowers the saving ratio and does not reflect the difference in the consumption tendency. According to the authors, the continuous funding system leads for this reason to increasing deficit of the state budget.

Based on analysis of the OLG models, Feldstein (1998) highlights the positive effect of the fund system on the economic activity and the level of new investments in economics. Growth of the number of pensioners in the continuous system is associated with the decrease of investment activity. Decreased investment is caused by lowering ratio of private savings of citizens (Androniceanu, Dragulanescu, 2014). The fund system is, on the other side, able to stimulate the level of investment activity in economics through accumulation of private savings.

However, Orszag and Stiglitz (1999) explain that rising saving ratio does not have to necessarily lead to increased economic activity. Establishment of the fund systems requires transfer of funds from the state budget to private funds. Decreased income means for the state increased deficit for the need of funding pension entitlements of current pensioners. The need to cover the deficit means minor costs of the state budget on funding investment and development activities. Stabilisation of the system and its complete transformation is followed by the need of covering pensioners' entitlements. According to opponents of the fund system, establishing the fund system does not lead to increased investment and economic growth.

In order to maintain the continuous system, stable rise of salaries or contributions to the system, i. e. increase of contributions or stabile growth of population, is therefore essential. Negative demographic development is very challenging in case of deficit funding. Barr (2000) considers analysis of the fund system's assets very important in pension economics. The fundamental aspect for pension systems is also the willingness to prefer future consumption to the current one. Preference in consumption is expressed by the amount of contribution for pension security to the fund or continuous system. The existence of the fund system is, according to Barr, irrelevant, whereas stability of the continuous system is essential.

Rising saving ratio in economics practically occurs only in own creation of the system by cumulating sources at the part of consumers. Lowering savings of current pensioners will be compensated in economics by creation of savings of the currently working pensioners. According to Barr (2000), effect of the transformation of the continuous system to the fund system on the level of currently paid pension benefits is therefore essential. Decrease of pensioners' income is associated with the decrease of overall consumption of households and, at the same time, with increased saving ratio. Growth of payments from the continuous system is closely connected with the increase of taxes or public debt. Connection of these two elements will cause decrease of savings and partial increase of the need of private capital.

The transfer from the continuous system to the fund system is also associated with entitlements for additional sources. Profit of the t generation is equal to the value of the difference between the fund system profit and valorisation of pension benefits from the continuous system. In order to maintain the fund

system benefits, it is therefore necessary to decrease pension benefits paid to current pensioners or to take measures leading to increase of the state budget contributions.

According to Brunner (2003), the risk of system transformation is making one generation poor in favour of another generation. Additional sources are necessary to avoid similar negative effects.

In case of the pension system management, Holzmann and Guven (2009) calculate differences between assets and liabilities of the system' financial balance. Deficit of the pension account means additional need of saving measures or increased requirements for the rise of contributions to the system. To estimate the future deficit of the pension scheme, the essential factor is the difference between current and future contributions and current and future entitlements for payments from the system. Discrepancy between the items means occurrence of so-called fiscal gap in management of the state budget. According to Beetsman and Oksanen (2007), the rule of equal contribution and equal payment from the system on the basis of intergeneration solidarity should apply for the same generations of the population.

Chovancová and Árendáš (2015) researched the market efficiency through the adaptive markets hypothesis. The paper investigates the evolution of weak-form market efficiency. The results shows although the share markets are weak-form inefficient in the long-term, there are some shorter time periods of weak-form effectiveness that modulate with interval of weak-form efficiency. Chovancová and Árendáš (2015) investigate capitalisation pension pillars in the three develop countries. The result showed that long term investing (through cost averaging strategy) reduces the impacts of market turbulences on the asset portfolio. The results also confirmed that indexing is more convenient compared to conservative investment in the long term.

2. Research objective, methodology and data

The main aim of our paper is to quantify the Return-risk profile of Slovak pension funds. The most important indicator for pension fund participants is the revenue of the investment. Revenues of the fund's assets portfolio may be determined by dividends, interest rate, premium or net capital profit (loss) based on the situation of the price of securities.

Efficiency of the fund manager's investment may be expressed by the revenue of the portfolio, i. e. weighted average of revenues of the individual securities included in the portfolio, where shares of individual assets of the portfolio represent the scale. Mathematical expression of the relationship is as follows:

$$r_p = \sum_{i=1}^N w_i r_i$$

N – number of securities in the portfolio;

r_p – standard portfolio revenue;

w_i – weight of individual securities;

r_i – revenues from security i ;

provided that:

$$\sum_{i=1}^N w_i = 1$$

Estimated revenue is also influenced by the probabilities of states of the economy. For this reason, the estimate revenue of the portfolio is expressed by weighted average of individual estimated revenues of the portfolio securities. The scale is represented by ratios of standard value of these securities at the standard value of the entire portfolio.

$$E(r_p) = \sum_{i=1}^N w_i E(r_i)$$

w_i – weight of individual investments in the portfolio;

$E(r_p)$ – estimated portfolio revenue;

$E(r_i)$ – estimated revenues of individual securities.

On the other hand, the risk and active measures taken for its elimination are essential for a pension fund manager. The primary goal of risk management is to transfer potential loss arising out of investments to a third subject. The most important strategy minimalising the risk is hedging. The core of hedging is making transactions leading to decrease or complete elimination of risks associated with securities. For a fund manager, decrease of the portfolio assets risk is very important as it also decreases the risk of the portfolio as a unit. However, the ratio of participation from the growth of secured assets decreases as well. Use of the hedging strategy on the market means opening the opposite position on the futures market with regard to the set position on the spot market. In an attempt to protect its portfolio against price fluctuations, the pension fund management must in a long position on the underlying securities market open a short position based on a derivative contract (mostly using the finance futures and options). This process may be mathematically expressed through the following relations:

$$P_h = P_s - hP_f$$

P_h – value of the hedge portfolio;
 P_s – value of the underlying security;
 H – number of futures contracts within the long position;
 P_f – value of the futures contract.

The optimum value of the coefficient should provide for risk-free hedge portfolio. It means the same value of the portfolio in both - increase and decrease of the underlying security. This requires:

$$\Delta P_h = \Delta P_s - h \Delta P_f$$

If $\Delta P_h = 0$, the following applies:

$$h = \frac{\Delta P_s}{\Delta P_f}$$

The formula expresses equation of the ratio of rate volatility of securities that are protected against the value movement and volatility of futures contract that should protect the portfolio from the value movement.

For pension funds managers and pension funds participators are also important return measures and reporting techniques. Professional community has recognized several return methods. The most used method is dollar-weighted rate of return. The dollar-weighted rate of return can be mathematically expressed through the following relations:

$$RR_{DW} = \frac{(MV_1 - MV_0)}{MV_0}$$

Where:

RR_{DW} = the dollar-weighted rate of return
 MV_1 = the market value of the fund at the end of period
 MV_0 = the market of the fund at the beginning of period

But the dollar-weighted rate of return has significant shortcomings. The big problems for this method are inflows and outflows resources during the measured period. The result of distortion is systematically overvaluation and undervaluation depending on cash flow. The most useful method for measure of investment performance is time-weighted rate of return. The essence of this method is based on systematically calculated pension funds asset cash flow.

Each contribution or withdraw is deducted from gross underwriting result. The result is the adjusted for the changes in cash flow. Mathematical expression of the relationship is as follows:

$$RR_{TW} = \left(\frac{MV_1}{MV_0} \times \frac{MV_2}{MV_1 + C_1} \right) - 1$$

Where:

- RR_{TW} = the time-weighted rate of return
- MV_0 = market value of the fund in period 0
- MV_1 = market value of the fund in period 1
- MV_2 = market value of the fund in period 2
- C_1 = net contribution in period 1

An important criterion for pension fund managers is volatility, respectively variability of returns. This relationship is expressed through standard deviation indicator. The standard deviation allows accurate expression of the volatility of actual quarterly returns relative to the average quarterly return. When using annualized returns, it is usually to specify standard deviation on an annualized basis. Standard deviation on an annualized basis can be mathematically expressed through the following relations:

$$\sigma = \left(\frac{\sum (x_i - \mu)^2}{n} \right)^{0.5}$$

Where:

- σ – annualized standard deviation
- x_i - quarterly returns
- μ – average quarterly returns
- n – numbers of quarters

Following hypothesis are tested:

Hypothesis 1: Higher risk profile (the higher standard deviation value) generates higher return.

Hypothesis 2: Lower risk profile (the lower standard deviation value) generates lower return.

3. Result and discussion

We applied time-weighted rate of return method for Slovak pension fund. As we can see in *Table 1* higher performance was recorded in this period index pension funds. Index pension funds profited from the good situation on the stock market. Index funds as passively types of pension funds benefit on the increase of the value of the entrusted share index or several indexes. Other types of pension funds recorded lower but more stable returns.

Return-Risk Profile of Slovak Pension Funds

Table 1. Returns of the Slovak pension funds according to time-weighted rate of return method, 2005-2015

Year	Equity funds	Bond funds	Mixed funds	Index funds
2005	3,55	2,81	3,30	X
2006	4,56	3,46	4,02	X
2007	3,51	3,99	3,26	X
2008	-8,03	2,98	-6,04	X
2009	1,12	1,91	1,6	X
2010	1,30	1,27	1,55	X
2011	1,42	1,47	1,60	X
2012	3,39	2,67	3,92	7,13
2013	3,77	1,09	2,87	16,86
2014	9,27	3,35	7,91	11,72
2015	1,44	0,86	1,65	4,16

Source: own calculations based on ADSS data

For deeper analyse of Slovak pension funds is necessary quantify risk profile each pension funds according to different investment orientation. We want to know for analyse each pension funds actual (quarter) return, average return, difference between actual and average return and squared difference. From the data aggregates the resulting standard deviation for each pension fund.

Table 2. Index of Standard Deviation for Equity pension funds, 2012-2015

Year	Quarter	Actual Return	Average Return	Difference	Squared Difference
2012	1Q	1,230	2,618	-1,388	1,925
	2Q	1,950	2,618	-0,668	0,446
	3Q	2,490	2,618	-0,128	0,016
	4Q	1,150	2,618	-1,468	2,154
2013	1Q	1,980	2,618	-0,638	0,406
	2Q	2,430	2,618	-0,188	0,035
	3Q	3,120	2,618	0,503	0,253
	4Q	1,680	2,618	-0,938	0,879
2014	1Q	4,920	2,618	2,303	5,302
	2Q	4,980	2,618	2,363	5,581
	3Q	5,450	2,618	2,833	8,023
	4Q	4,550	2,618	1,933	3,735
2015	1Q	1,140	2,618	-1,478	2,183
	2Q	0,650	2,618	-1,968	3,871
	3Q	0,210	2,618	-2,408	5,796
	4Q	0,950	2,618	-1,668	2,781

Source: own calculations based on ADSS data

Return-Risk Profile of Slovak Pension Funds

Average quarter return was in this period 2,618%. Total squared difference from 2012 to 2015 is 43,385. Standard deviation for equity pension funds is defined follow formula:

$$\sigma = (((((43,385)^2)/16)4)^{0,5}) = 21,692$$

Table 3. Index Standard Deviation for Bond pension funds, 2012-2015

Year	Quarter	Actual Return	Average Return	Difference	Squared Difference
2012	1Q	1,650	0,966	0,684	0,468
	2Q	1,360	0,966	0,394	0,155
	3Q	1,450	0,966	0,484	0,234
	4Q	1,910	0,966	0,944	0,891
2013	1Q	0,510	0,966	-0,456	0,208
	2Q	0,260	0,966	-0,706	0,499
	3Q	0,310	0,966	-0,656	0,431
	4Q	0,150	0,966	-0,816	0,666
2014	1Q	1,650	0,966	0,684	0,468
	2Q	1,970	0,966	1,004	1,008
	3Q	2,230	0,966	1,354	1,833
	4Q	1,120	0,966	0,154	0,024
2015	1Q	0,510	0,966	-0,456	0,208
	2Q	0,320	0,966	-0,646	0,418
	3Q	0,090	0,966	-0,876	0,768
	4Q	-0,120	0,966	-1,086	1,180

Source: own calculations based on ADSS data

Bond pension fund recorded average return 0,966 %. Total squared difference from 2012 to 2015 in this type of pension fund is 9,456. Formula for quantify standard deviation is in the form:

$$\sigma = (((((9,456)^2)/16)4)^{0,5}) = 4,728$$

Table 4. Index Standard Deviation for Mixed pension funds, 2012-2015

Year	Quarter	Actual Return	Average Return	Difference	Squared Difference
2012	1Q	1,120	1,541	-0,421	0,177
	2Q	1,650	1,541	0,109	0,012
	3Q	2,150	1,541	0,609	0,371
	4Q	1,980	1,541	0,439	0,193
2013	1Q	0,960	1,541	-0,581	0,338
	2Q	1,960	1,541	0,419	0,175
	3Q	1,020	1,541	-0,521	0,272
	4Q	1,010	1,541	-0,531	0,282

Return-Risk Profile of Slovak Pension Funds

Year	Quarter	Actual Return	Average Return	Difference	Squared Difference
2014	1Q	1,950	1,541	0,409	0,167
	2Q	2,980	1,541	1,439	2,070
	3Q	3,250	1,541	1,709	2,920
	4Q	2,150	1,541	0,609	0,371
2015	1Q	0,950	1,541	-0,591	0,350
	2Q	-0,120	1,541	-1,661	2,760
	3Q	1,910	1,541	0,369	0,136
	4Q	-0,260	1,541	-1,801	3,245

Source: own calculations based on ADSS data

Average type of pension fund was in this period 1,541%. The sum of squared differences is 13,837. Annualized standard deviation has form:

$$\sigma = (((((13,837)^2)/16)4)^{0,5}) = 6,916$$

Table 5. Index Standard Deviation for Index pension funds, 2012-2015

Year	Quarter	Actual Return	Average Return	Difference	Squared Difference
2012	2Q	3,120	3,688	-0,568	0,323
	3Q	4,540	3,688	0,852	0,726
	4Q	3,950	3,688	0,262	0,069
2013	1Q	5,590	3,688	1,902	3,618
	2Q	6,120	3,688	2,432	5,915
	3Q	4,620	3,688	0,932	0,869
	4Q	4,590	3,688	0,902	0,814
2014	1Q	3,580	3,688	-0,108	0,012
	2Q	4,820	3,688	1,132	1,281
	3Q	5,010	3,688	1,322	1,748
	4Q	3,650	3,688	-0,038	0,001
2015	1Q	1,950	3,688	-1,738	3,021
	2Q	0,920	3,688	-2,768	7,662
	3Q	1,150	3,688	-2,538	6,441
	4Q	1,710	3,688	-1,978	3,912

Source: own calculations based on ADSS data

Index pension fund recorded higher average return 3,688 %. Total squared difference is 36,410. This number indicates formula for standard deviation calculation:

$$\sigma = (((((36,410)^2)/15)4)^{0,5}) = 18,802$$

Table 6. Return-Risk profile of Slovak pension funds

	Equity funds	Bond funds	Mixed funds	Index funds
Four-year annualized return	19,26%	9,94%	15,41%	39,75%
Standard deviation	21,692	4,728	6,916	18,802

Source: own calculations

Conclusions

A comparison of the annualized standard deviations reveals that the least risk is accompanied with unsurprisingly bond pension funds. On the contrary the most risky pension funds in the Slovak republic are equity pension funds. *Table 6* compare four-year annualized return and standard deviation.

Hypothesis 1: The highest standard deviation recorded equity pension funds. But the highest four-year annualized return reached index pension funds. The main reason for this result is in the nature of the funds. The index pension fund is passively managed pension fund whose profitability depends on the increase of the value of the entrusted share index or several indexes.

On the contrary equity pension funds are actively managed pension funds and equity creates only part of asset portfolio. This means that the index pension fund was able to benefit more with the bull trend on the stock market.

Hypothesis 2: The lowest value of standard deviation and also four-year annualized return recorded bond pension fund. Bond pension fund is the most conservative type of pension fund in the pension management companies' administration. The assets portfolio of the pension fund is mainly formed by bond investments, as well as by investments to the financial market tools and transactions with the purpose of limiting the exchange risk. The fund investment profile provides stable return associated with lower risk.

Investment performance must be evaluated on the basis of not only the returns, but also on the level of risk taken to achieve these returns. Along these lines, there are several tools available to properly gauge performance on a return-risk basis. A History of Slovak pension funds is too short so that we can develop all the methods of analysis. Despite this we were able to apply some analytical methods. Results recorded, that higher risk does not mean higher return in the case equity pension funds. On the other side more conservative type of pension funds generated less, but more stable return in less risk environment. Pension system of the Slovak Republic is significantly dependent on effective operation of pension funds managed by administrative companies. With regard to system problems of the pension security scheme, it is necessary to approach parameter changes in management and regulation of the pension funds leading to sustainable stability of the funding system.

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