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Composition of equity and mixed pension funds in Slovakia

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Abstract

Research background: Since January 2013, pension fund management companies have had to establish at least two pension funds, one guaranteed bond fund, and at least one unguaranteed equity fund. This division has brought many changes in portfolios of pension funds in Slovakia. Currently, six pension funds management companies manage six bonds, six equity, five indexed and three mixed funds.

Purpose of the article: The aim of this article is to monitor the composition of assets during 2009 and 2014 and describe relation between equity and mixed pension funds' profit and components of assets they own. The results of this research contribute to a better understanding of the importance of certain types of financial assets owned by equity and mixed funds and their impact on pension funds' profit. Last, but not least, this article helps to improve the legislative management of pension funds and their impact on macroeconomic situation in Slovakia, because pension funds are still concentrating higher and higher amount of financial assets from government bonds to companies' stocks.

Methods: This relation will be described by linear mixed-effects model with random effects of years and pension funds management companies. Random effects also help to identify the impact of changes during the period studied, and in case that profit is significantly different across the pension funds management companies

Findings & Value added: The underlying model data will be chosen from annual balance sheets, income statements and notes of Slovakia-based equity and mixed funds during the period studied.

Introduction

Pension funds are getting more and more attractive nowadays. The demographic ratio unfavourable to productive population, as opposed to retired population, is the cause of struggles with paying the pension from the state budget (Chovancová *et al*, 2005, p. 117).

In the majority of OECD member countries, significant amounts of assets have been accumulated by pension funds over the years. In 2014, the value of assets in pension funds in four countries (Netherlands 159.3, Iceland 146.8, Switzerland 120.3 and Australia 110) was higher than their GDP (OECD, 2015). The continuous increase of ageing population and less confidence in PAYG public pensions in developed countries might cause the increase of complementary social securities (Thomas *et al*, 2014).

The Slovak pension fund market is relatively young. The second pillar (old-age pension saving), including pension management companies along with pension funds, was established 1 January 2005 based on Act No 43/2004 Coll. on old-age pension savings. This reform resulted in transformation of one-pillar pension system with set pay as you go (PAYG) contributions into a system of three individual pillars (Orenstein, 2011, p. 74). Since its establishment, it has undergone many changes such as change of contribution limit or name of individual pension funds. Charges for money evaluation have been implemented as well as the possibility of measurement of assets at amortized cost. The limitations of financial assets have been adjusted too. The impact of legislative changes and constant reopening of the second pillar have significantly influenced its development and development of assets in pension funds.

Quarter-on-quarter, the volume of financial instruments in pension funds has grown from EUR 3,588 million in fourth quarter of 2012 to EUR 7,909 million in fourth quarter of 2014. At the end of this period, the volume of pension funds' assets represented 8% of total amount of financial assets owned by all financial institutions in Slovakia (Papík, 2015, pp. 551–552). Similar situation is in Poland, where Poland pension funds owned 12.45% of total amount of financial assets owned by all financial institutions in 2011 (Ostrowska, 2014, p. 159).

The current value of assets in the second pillar is EUR 7,664 million which is 10.6% of GDP. A significant majority of contributions (83.8%) was saved in guaranteed bond funds. At the same time, approximately 10.4% of contributions were saved in the equity funds, 4.6% in index funds and 1.3% in mixed funds.

Assets in Slovak guaranteed bond pension funds can only be composed of financial market instruments and debt securities. This appears to be their

biggest disadvantage at the time of decreasing interest rates, since the traditional financial instruments with regular interest income do not generate enough revenues. During the first years of pension saving, there is a potential for the savers to place their financials into equity funds or mixed funds which can be composed of equity securities. Return on shares has been proved more stable as far as a long-term horizon is concerned (Siegel, 2011, p. 290).

Equity and mixed funds can own a wide range of financial assets. These have a various impact on the revenues of each pension fund types. Finding the most important portfolio components can help to regulate this sector meaningfully and in perspective, especially in countries like Slovakia, where one of the pension fund sector reforms started with selling out equity securities from equity and mixed funds, and contributed to stagnation of those funds' returns from 2009 to 2012. Equity and mixed funds in this era couldn't make a profit from growing of capital market that occurred after the global financial crisis.

During the post financial crisis era of 2009 and 2014, equity and mixed pension funds' assets in Slovakia were transformed dramatically. The aim of this article is to monitor the composition of assets during this period and describe the influence of equity and mixed pension funds' assets on their profit. The results of this analysis identify those key components of assets, which mainly generate the profit of these funds. This knowledge helps to understand how to regulate this part of financial sector correctly, because an incorrect legislation e.g. incorrectly defined limits on financial assets, can slow down the assessing of funds' capital and decrease the value of savers' pension in the future.

Pension funds' asset allocation and their profit

The issue of the optimal pension funds' asset allocation is being discussed very frequently. High percentage of assets invested into equity securities such as shares or units, causes increased values of pension units (the share of assets in a pension fund) that are more dependent on the stock market instabilities. The risk premium for owning shares was the driving force for fulfilling pension companies' plans abroad. That is the main reason why foreign pension funds own equity securities in such amount.

On 1 July 2009 amendment no. 137/2009 guarantees in all types of pension funds came into force. Since then, pension management companies have been obliged to secure the clients by at least such value of savings which they contributed. The risk of paying up for possible losses arising

from investing into volatile securities significantly increased for pension management companies and led to securities sale (Papík, 2016a, pp. 548–549). Until 2012, Slovak pension funds did not own any significant amount of shares which protected them from instabilities on the market caused by the financial crisis outbreak in 2009 and debt crisis in 2011. The obligation to guarantee a nominal depreciation of assets was abolished for mixed and equity pension fund in 2012 (Amendment no. 252/2012).

Many authors have dealt with the issue of composition of pension funds' assets and their revenues. Certain relation between percentages of equity to expected rate on pension assets was discovered by Amir and Benartzi (1998). Their research has also shown that pension funds' returns can be better predicted by equity percentage than by expected rate of returns. Regression model identified that assets allocation is the only significant predictor and that returns do not depend on funds' size. These observations have been reflected by many authors. Li and Klumpes (2007) proved that expected rate of return does not depend on the United Kingdom pension funds' size and rejected the hypothesis about its dependency on assets allocation too.

Nowadays, the topic of allocation assets in pension funds is being researched for instance by a team of authors led by Louton (2015) or Naczyk and Domonkos (2016). One part of Louton's (2015) research was focused on composition of US pension funds. He found a correlation between US equity and real estate ($\rho = 0.56$), US equity and other assets ($\rho = 0.77$), non-US equity and real estate ($\rho = 0.46$) and non-US equity and other assets ($\rho = 0.65$). This correlation shows a certain level of interactivity which is necessary to be observed or reflected in the models. The influence of legislative changes on pension funds' asset allocation was analysed by Naczyk and Domonkos (2016, pp. 167–183).

Another research did not take into consideration international accounting standards, but a regional accounting standard. This article identified eight key components of pension fund portfolios. However, it has the following shortcomings: the result of used model was non-normally distributed and equity and mixed funds were analysed along with bond pension funds resulting in inaccurate results since the assets of these two groups of pension funds have been totally different since 2012 (Papík, 2016a, pp. 547–555).

The overview of literature has shown that that all current bodies of research have one deficiency in common. Owned assets are studied only at the level of basic classification (equity, debt securities, real estate and other assets) ignoring specific characteristics of portfolio components such as expected maturity, currency or accounting classification. Pension funds in

Slovakia are based on Slovak accounting regulations (SAR) respecting International Accounting Standards. Similar to IFRS, there are several security categories which have an impact on financial instrument's value. Securities can be evaluated by amortized value when they are held to maturity or by real value (RV) when they aren't. Since 2013, both valuation methods can be used as far as pension funds are concerned.

Actively regulated equity and mixed pension funds influenced by legislative changes and falling interest rates started getting rid of debt securities which are being replaced mostly by European and American units and European stocks. Table 1 shows that the amount of equity securities increased by more than 50%. The maturity of debt securities has been extended significantly from up to one year to over five years which again, resulted from low interest rates. Influenced by low interest rates, the volume of financial deposits in banks has decreased of more than 23% over last six years.

“The Act on Accounting 431/2002 in Slovakia defines revenues as increases in economic benefits during an entity's financial year, which can be measured reliably.” (Kajanová, 2014, pp. 131). The trend in the changing level of Slovak pension funds' revenues is the same across pension management companies and types of pension funds. Since the beginning of the period studied until 2012, pension funds had reached almost no profit at all, but in 2013 their profit jumped to approximately 5 to 10%. During this period, pension funds started increasing the volume of equity securities which resulted in increased profit. Significant impact of increasing stocks and shares has been proven in analysis (Kajanová, 2016). Equity and mixed pension funds started changing their portfolio composition in 2012.

Then the income volatility got higher, and the profit of some pension funds decreased the following year. Because of almost no volume of equity investments, the actively regulated equity and mixed funds were able to manage the adverse situation on financial markets caused by financial crisis in 2009 and debt crisis in 2011 quite well. There was only one pension fund that generated loss during the period studied, more particularly it was equity fund called AXA with the loss of 0.1% of its overall amount of assets.

Based on CoPlot in Fig.1 two following hypotheses can be formulated: The pension funds' profit is influenced by situation on financial markets which appears to be a random effect typical for each pension fund changing depending on particular year. The second hypothesis indicates that profits of individual pension funds do not differ significantly across companies, which suggests that there is no compelling random effect related to pension management company. Based on this assumption, in the part Research Methodology, two linear mixed effects model have been suggested.

Research methodology

For the purpose of the article's aim, information about pension funds' assets was collected from balance sheets, income statements and notes of six equity and six mixed funds from 2009 to 2014. In 2013 mixed pension funds of Allianz and AXA and in 2014 mixed pension fund of AEGON ceased to exist. All these pension funds are managed by six pension funds management companies:

- AEGON, d.s.s., a.s.,
- Allianz – Slovenská dôchodková správcovská spoločnosť, a.s.,
- AXA d.s.s., a.s.,
- Dôchodková správcovská spoločnosť Poštovej banky, d.s.s., a.s.,
- NN dôchodková správcovská spoločnosť, a.s. and
- VÚB Generali dôchodková správcovská spoločnosť, a.s.).

Independent variables of model are represented by pension funds' assets (e.g. bonds, stocks, shares), expressed as the ratio of total assets volume of the pension fund. These variables take values from zero to one.

The data have become input values of linear mixed-effects models which monitor the relationship between the amount of various assets and pension funds' profits. The model consists of random slopes which represent specific years, and fixed scopes representing each component of assets.

Studied linear mixed-effects model (1) has following vector form:

$$Y_{it} = \beta_1 X_{1,it} + \dots + \beta_{k-1} X_{k-1,it} + \beta_k X_{k,it} + \delta_1 T_1 + \dots + \delta_t T_t + \varepsilon_{it} \quad (1)$$

where Y_{it} is an dependent variable representing comprehensive income including income from investments, costs and fees in particular year for pension fund i and in time t . The variable $X_{k,it}$ is a dependent variable which represents the volume of owned assets like securities, cash or receivables to total assets. The β_k is the coefficient for the independent variables, and k is the number of tested independent variables (in our case it is 10). Variable T_t represents the time period from 2009 to 2014 expressed as dummy binary variable. δ_t represents the coefficient for the binary time variables and the last one ε_{it} stands for the residuals of linear mixed-effects model for pension fund i and in time t . Since previous research reject the hypothesis about the influence of pension funds' the size on their returns, this variable wasn't implemented into the model. The model does not have any interactions, since previous observations have identified only a relation between equity and real estates and other assets not owned by Slovak pension funds.

Statistical software R was used to estimate the parameters of model, namely its build-in function for Linear Mixed-Effects Models (lmer()) which is contained in package lme4. The absence of collinearity was tested among independent variables. The selections of final models were conducted through a stepwise regression function using Chi-square goodness of fit test, log-likelihood ratio function, Akaike Information Criterion and Bayesian Information Criterion. The selected final models were then compared to the real observation by Shapiro test, which indicated that the model is well-fitted. The fitted model was also described by Residuals vs. Fitted and Normal Q-Q plots.

During the analysis, the second mixed-effects model (2) was created in the following form:

$$Y_{it} = \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + \delta_1 T_1 + \dots + \delta_t T_t + Y_1 E_1 + \dots + Y_n E_n + \varepsilon_{it} \quad (2)$$

where all variables are the same as in model (1) and variable E_n represents entities, in our case six pension funds management companies expressed as dummy binary variable and Y_n represents the coefficient for the binary entities' variables.

Models (1) and (2) were tested by analysis of variance about existence of significant difference between both models. The results of this analysis answer the question whether pension funds' profit depends on management company or not. Analysis of variance was also computed by statistical software R with built-in function for Computation of analysis of variance (anova).

Results of analysis

The results of linear mixed effects model with random effects of years are represented in Table 2. The results of fixed effects from Table 2 show that bonds at RV over 5 years in EUR, stocks at RV in EUR, stocks at RV in USD, stocks at RV in CZK, shares at RV in EUR and shares at RV in USD have a significant effect on equity and mixed pension funds' profit and bonds at RV up to 1 year in EUR, bonds at RV up to 5 years in EUR, receivables, and deposits and cash do not. If the coefficient is positive, the likelihood of increasing of pension funds' profit is higher. Confidence interval of all significance variables was above the zero, so there is a positive influence of tested variables on profit with 95% probability

Random effects from Table 2 show that there is a negative relation among the years 2009, 2010, 2011 and 2014 and pension funds' profit.

Pension funds' profit was lower during these years than grand mean of pension funds' profit during whole observation period. The higher profit in 2012 and 2013 was caused by growing on financial markets after the financial crisis in 2009 and the debt crisis in 2011 as well as by the legislative change in Slovakia.

The analysis of residuals reveals to what extent the model is fitting. Plot Fitted vs. Residuals suggests homoscedasticity, because fitted values are distributed relatively normally. The small group on the left side does not look like a big issue. We did not reject the hypothesis that residuals come from a population which has a normal distribution by Shapiro-Wilk normality test ($W = 0.97647$, $p\text{-value} = 0.233$). These results, indicating that residuals originate from normal distribution, are also confirmed by Figure 2 Normal Q-Q plot, which compares normal theoretical quantiles with residuals' quantiles. Normal Q-Q plot of our residuals contains of short tails which does not make data non-normal.

Computed analysis of variance showed (not in any table) that there is insignificant difference ($SD = -375.3$, $\chi^2(1) = 0$, $p\text{-value} = 1$) between linear mixed model with only time random intercepts (1) and model with time and pension funds management companies intercepts (2). Tested hypothesis saying that pension funds management companies have an impact on pension funds' profits in our model has been rejected. This is the reason why only years are considered as random effects in our linear mixed-effect model.

Conclusions

The results of previous research clearly show that the countries in which pension funds invested in stocks, are more likely to witness lower volatility than the average (Thomas *et al.*, 2014).

Other research by Papík (2016b, p. 131) has shown that there are 3 significant financial portfolio components in the Slovak insurance companies. These are: shares at fair value through profit or loss, bonds available for sale and bonds held to maturity. Research of the Slovak pension funds has brought similar results showing that not only equity securities were owned by pension funds, but a wide range of debt securities and money market transaction too. This research has identified 8 significant variables. These are: bonds at fair value through profit or loss with maturity up to 1 year, up to 5 years and more than 5 years, shares and stock, both denominated in euros cash in USD and CZK and deposits in banks in EUR (Papík, 2016a, pp. 552–553).

Both of these analyses were based on a linear regression model ignoring aspects such as time or company that was managing the fund. The results of our complex mixed effects linear regression model show that the influence of equity securities such as shares and stocks is higher than that of debt securities. Only bonds with maturity over 5 years have a significant impact on profits of pension funds. These results are interesting, since bond securities in equity and mixed funds represented about 60% of total assets, while nowadays it is only over 30%. The analysis shows that even though the legislation restricted owning of riskier assets to 3 years, equity securities play an important role in portfolios of pension funds and the Slovak pension fund sector has relatively developed after last reforms comparing to neighbouring countries.

This result has been confirmed by random effects from our model. The years when the legislation allowed for owning riskier financial assets have higher grand mean of revenues than years, when it was not possible. In 2012 and 2013, pension funds made a higher profit than in other years as a consequence of owning stocks and shares. Slovak pension funds partly gained on growth thanks to growth on global financial markets during these years.

The analysis of random effects also shows that there is no difference between the same types of pension funds owned by different pension fund management companies. The profit differences are caused by differences in assets components. The pension funds with higher level of profit have higher amount of stocks denominated in EUR or USD. These assets are a clue to the growth of pension fund's value. A saver does not need to know by which company the pension fund is managed, or where he has his savings, but he needs to know asset allocation of the fund, because this is the main reason why some funds are more successful than others.

This research has introduced an approach how to analyse asset allocation in pension funds. This analysis was made in relation to the Slovak pension fund sector, and can be used for predicting returns of the Slovak pension funds, in case the asset allocation is known. It is necessary for the next research to continue in established research methods, analyse pension funds in other countries and compare them with obtained results.

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Annex

Table 1. Asset composition of equity and mixed funds during period from 2009 to 2014

	2009	2010	2011	2012	2013	2014
Number of funds	12	12	12	12	10	9
Bonds at RV	68.90	68.93	71.59	69.72	37.52	38.60
In Euro	68.90	68.93	71.53	69.39	36.37	37.36
Up to one month	0.71	1.91	0.02	0.02	0.01	0.01
Up to three months	3.43	1.34	0.04	0.04	0.04	0.03
Up to six months	0.00	0.01	1.57	0.01	0.01	0.01
Up to one year	39.15	27.67	15.64	8.07	0.00	0.00
Up to two years	2.13	4.94	6.66	1.32	1.92	1.24
Up to five years	19.48	23.85	35.69	35.91	10.07	11.07
Over the five years	4.01	7.84	13.03	24.02	24.32	24.99
In other currencies	0,00	0.07	0.33	1.14	1.23	0,00
Up to five years	0,00	0.07	0.19	0.82	0.18	0,00
Over the five years	0,00	0,00	0.13	0.32	1.05	0,00
Shares at RV	0.00	0.00	0.00	2.79	23.89	27.05
In Euro	0.00	0.00	0.00	2.03	14.22	15.77
In US dollars	0.00	0.00	0.00	0.76	9.68	11.28
Derivatives at RV	0.01	0.00	0.00	0.00	0.05	0.00
Currency	0.01	0.00	0.00	0.00	0.05	0.00
Stocks at RV	0.63	0.06	0.00	3.68	25.79	28.35
In Euro	0.33	0.06	0.00	2.72	12.12	13.28
In US dollars	0.18	0.00	0.00	0.23	4.87	6.15
In Czech crowns	0,00	0,00	0,00	0.73	4.78	4.39
In other currencies	0.13	0,00	0,00	0,00	4.01	4.49
Gold	0.00	0.00	0.00	0.26	0.65	0.88
Cash and cash equivalents	5.78	3.04	2.81	1.63	3.35	3.08
Rec. and deposits	25.21	28.00	24.83	21.96	8.75	2.11

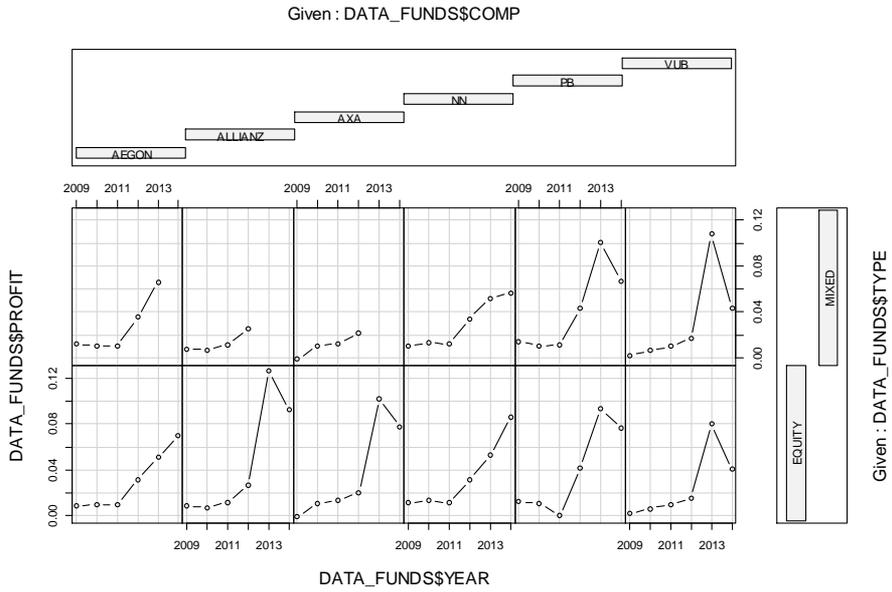
Note: calculations based on balance sheets from 2009 to 2014.

Table 2. Results of linear mixed-effects model

Fixed effects	Estimate	Std. Error	df	t value	Pr(> t)
Bonds at RV up to 1 year in EUR	0.00248	0.01025	32.6	0.242	0.81027
Bonds at RV up to 5 years in EUR	0.00946	0.01131	59.5	0.837	0.40619
Bonds at RV over 5 years in EUR	0.06094	0.01280	57.3	4.760	1.35e-05
Stocks at RV in EUR	0.30113	0.07256	61.0	4.150	0.00010
Stocks at RV in USD	0.21540	0.05674	66.6	3.796	0.00032
Stocks at RV in CZK	0.08726	0.01662	54.3	5.250	2.59e-06
Shares at RV in EUR	0.10725	0.01851	46.1	5.792	5.87e-07
Shares at RV in USD	0.08782	0.04235	66.5	2.074	0.04199
Rec. and deposits	0.01328	0.01013	55.6	1.311	0.19519
Cash & cash equivalents	-0.01530	0.02675	66.5	-0.572	0.56929
Random effects	Estimate	Std. Error			
2009	-0.00084	0.00299			
2010	-0.00035	0.00299			
2011	-0.00444	0.00299			
2012	0.00083	0.00299			
2013	0.01458	0.00322			
2014	-0.00556	0.00336			
R-squared	0.88046				
Residual deviance	-399.6				
Degrees of freedom residuals	55				
Akaike Inf. Criterion	-375.598				
Bayesian Inf. Criterion	-349.142				
Log-likelihood ratio test	199.8				
p-value (Shapiro-Wilk norm. test)	0.2338				

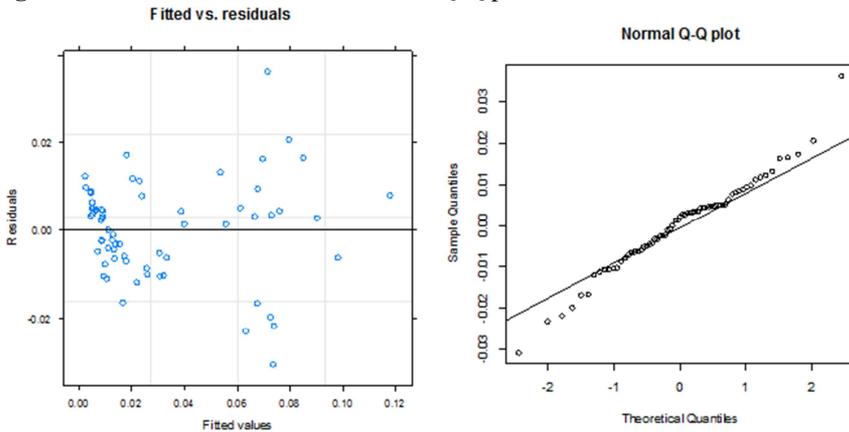
Note: calculations in R based on data from balance sheets and income statements.

Figure 1. Cplot of pension funds' profit in the years 2008–2014



Note: calculation in R based on income statements from 2009 to 2014.

Figure 2. Fitted vs. residuals and normal Q-Q plot



Note: calculations in R based on data from balance sheets and income statements.