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THE EVALUATION OF THE II PILLAR PENSION'S FUNDS: AN INTEGRATED APPROACH USING MULTI-CRITERIA DECISION METHODS

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Abstract. Lithuania has had a significant reform path in the last twenty-five years like other communist bloc countries during the intense changes in the world. Changes and transformations took place in various areas including social security system. Since 2004 have been significant developments legalizing the three-pillar old age pension system supported by the World Bank. Currently, the pension funds operating more than ten years and their assessment still have not stopped being the centre of numerous discussions. There are ongoing discussions about the fund performances' benefit, efficiency and its evaluation. Therefore, this paper investigates the funds' valuation problem by testing II pillar pension's funds in Lithuania. We use the multi-criteria methods with two scenarios: first we estimate II pillar pension's funds by applying a return (as well as the added value) and the risk indicators; second we include only the most popular derivative indicators: Sharpe, Treynor and Jensen's alpha ratios. Our results indicate that based on the second scenario methodology is more precise evaluated II pillar pensions funds' performance, but funds evaluation model based on multi-criteria assessment is more appropriate for larger funds groups. However, in order to assess the performance of the funds and compare them with each other it is important not only use the mathematical methods but also to maintain a holistic approach which allows to integrate micro and macro environmental factors into the funds' assessment.

Keywords: pension fund, private pension, multi-criteria decision making, multi-criteria analysis.

JEL Classification: G230, C390.

Introduction

During the last decades have risen the wave of retirement pension systems' reforms based on demographic changes in the world. Some countries carried out the parametric reforms of pension systems, i.e. they made only partial changes of the system; meanwhile others has had fundamental changes of the structure of the system. Lithuania belongs to the second group of the changes: a three-pillar old-age pension system (which was suggested by World Bank in 1994) has been implemented since 2004. Nevertheless, when the global crisis happened, such changes caused only more debates about the efficiency of the system, its eligibility and benefits to participants. It should be noted that unlike many countries, the participation in the II pillar pension funds is not mandatory for Lithuania; however, if an individual choses to participate, the opportunity stopping the participation is not eligible anymore. Moreover, the majority of the workers chosen to participate in these funds and thus it imply the need to analyse and evaluate these funds, and the comparison of each other.

The analysis of literature shown that scientists analyse the indicators which assess pension funds (such as a change of the value of the unit, standard deviation, Sharpe ratio, Jensnen's alpha etc.), but they do not seek to unite them into a single whole (Bartkus 2007, Jasienė and Kočiūnaitė 2007, Lieksnis 2010, Gudaitis 2010, Bohl et al. 2011, Huang and Mahieu 2012, Jurevičienė and Samoškaitė 2012, Kumar Gandhi and Perumal 2016 etc.). Multi-criteria decision methods (Pendaraki and Zopounidis 2003, Pendaraki et al. 2005, Lin et al. 2007, Alptekin 2009, Chang et al. 2010, Sielska

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2010, Babalos et al. 2011, Stankevičienė and Gavrilova 2012, Stankevičienė and Bernatavičienė 2012, Jurevičienė and Bapkauskaitė 2014, Alibakhshi and Moghadam 2016, Afful-Dadzie E. and Afful-Dadzie A. 2016, Duarte Junior and Barbosa Medeiros 2016 etc.) can help to systematize indicators.

Therefore the aim of this article is to analyse and assess II pillar pension funds in Lithuania using multi-criteria methods and to propose proper and advanced assessment model for pension funds. This article allows to evaluate and compare the II pillar pension funds, and also to adapt multi-criteria methods where various pension funds ratios are combined into a single one indicator. Different multi-criteria decision methods' results are combined into one indicator, and used to test funds' performance.

The paper is structured as follows: the first section analyses the problem of II pillar pension funds valuation, discusses the methods used for the funds assessment, also there are presented multi-criteria methods. The second section presents a comprehensive methodology of research, describe the process and structure of the empirical research. The third section represents the results of the research: estimate the performances of pension funds, present the consolidation of the results based on 6 different multi-criteria methods (SAW, SR, GA, TOPSIS, VIKOR, COPRAS) in two scenarios. Moreover, this paper proposes a framework that supports the proper valuation of pension funds. Finally, the fourth section discusses the conclusions and future work.

1. Literature review

Social security system reforms are an ongoing process around the world. After Lithuania has regained its independence the social insurance system was created based on fundamental principles: universality, solidarity, etc. Lithuanian social insurance system is based on PAYG basis for a long time. However, according to the offerings of the World Bank and good practices of Latin America's countries (e.g. Chilean case), the old-age pension of state social insurance contributions has been validated in Lithuania since 2004. This gives the basis for accumulative pension insurance. Since 2004 a new pension scheme started to run in Lithuania where every person (who has not reached the retirement age, and is insured for the basic and supplementary parts of the pension) may have an option to sign a contract with pension's funds management company (that how the part of the contributions of state social pension insurance started to accumulate in II pillar pension funds). In regards to this an old-age pension of the Sodra has been launched to cut for the accumulation periods. This system has been improved in 2013: the greatest accumulation was legalized. It means that the participant, who is willing to accumulate more funds for his old-age pension obtains more contributions from state's budget. These reforms determined that have been formed 3 groups of the insured residents: 1) participants who accumulate only a part of state's social insurance contribution; 2) participants who accumulate maximally (the part of state's social insurance contribution + own funds and contributions from state's budget), and 3) participants who do not accumulate in II pillar pension funds.

Rabikauskaitė and Novickytė (2015) results showed that fund participants (both prospective and existing) often chooses the fund not to follow to save more money (funds which earn the highest return), but driven by other motives. However, it noted that participation in the II pillar pension funds is not mandatory in Lithuania thus partly fair participant's motive to assess whether it is worth to start participation in these funds at all. However, surprising this situation and allow a certain irrationality of investors when the fund is not changed even it demonstrating minimal growth or even negative results. Chybalski (2011) agreed that people are not focused on the fund's investment performance, but are exposed to management companies advertising campaigns influence. Also Skučienė (2011) stated that "irrational, suboptimal private pension participants' behaviour can lead to low pensions for the future, which is incompatible with the pension policy objectives of increasing the welfare of the population or mentioned promises of higher future pensions from private pension schemes rhetoric". Lithuanian and other countries experience shows that many pension funds participants do not have enough knowledge about the financial markets and the economic cycle fluctuations, therefore often selected inadequate risk fund or funds are replaced at the wrong time, in addition to the greater part of the participants behave passively and does not increase the risks of the fund, although it is recommended at the proper time. In this way, participants will lose share of funds and the investment does not reach the largest return. Appropriate management pension funds risk based on the customer's age, reduced impact of the financial crisis and at the same time to ensure maximum profitability. Thus a significant impact on the fund's choice must not only its performance, but other variables – the participant's competence in managing their income, their financial behaviour rationality, and age and risk tolerance level.

There are a lot of methods applied to assess the pension (or investment) funds: Sharpe ratio, Jensen's alpha, beta or Treynor indicators (Redman et al. 2000, Artikis 2003, Noulas et al. 2005, Aamir Shah and Hijazi 2005, Jagric et al. 2007, Bohl et al. 2011, HemaDivya 2012), also Sortino index (Hribernik and Vek 2011, Kolbadi and Ahmadinia 2011, Parlak 2014), Fama index (Prajapati and Patel 2012, Parlak 2014), Sterling indicator (Kolbadi and Ahmadinia 2011). Also regression models are applied: such as CAMP (Capital Asset Pricing Model) (Bohl et al. 2011, Adami et al. 2014),

Table 1. Multi-criteria methods and their properties

Methods	Method features
SAW	– *It is one of the oldest and the most widely used multi-criteria method.* – *These results of this method may not always reflect the reality because of contradictory indicators.* – *It can only combine maximizing or minimizing indicators.*
SR	– *The simplest and the most basic multi-criteria method.* – *It can show the approximate results.* – *The weights of indicators are not included.* – *This method does not depend on the normalization or transformation of data.*
GA	– *The weights of indicators are not included.* – *Only maximizing indicators can be included.*
TOPSIS	– *The method is based on principle of the proximity of the ideal point.* – *The results can be influenced by the measurement units of indicators.* – *It is easily affected by the instability of initial data.*
VIKOR	– *The method is based on principle of the proximity of the ideal point.* – *The results cannot be influenced by the measurement units of indicators.* – *The results of this method are often different from other multi-criteria methods' results.*
COPRAS	– *It is similar to SAW method, but it allows adding both types of indicators: minimizing and maximizing ones.* – *The result is identical to the SAW method if only the maximizing indicators are included.*

Source: made by the authors, based on Opricovic and Tzeng 2002, Ginevičius and Podvezko 2008a, Podvezko 2008, 2011, Podvezko and Podviezko 2009, Podvezko et al. 2010, Simanavičienė and Ustinovičius 2011.

Treynor – Mazuy (Lieksnis 2010), Fama – French (Adami et al. 2014) models and etc. Nevertheless, many authors (Pendaraki et al. 2005, Lin et al. 2007, Chang et al. 2010) state the main indicators that assess the investment (and pension) funds are: Sharpe ratio, Jensen's alpha and Treynor indicators.

The II pillar pension funds' valuation is analysed in Lithuanian only by Bartkus 2007, Jasienė and Kočiūnaitė 2007, Gudaitis 2009, 2010, Jurevičienė and Samoškaitė 2012. The statistical data from the Supervisory Authority (The Bank of Lithuania) included Sharpe ratio, alpha and beta indicators[1] (Novickytė et al. 2016). The mutual funds evaluation has more comprehensive analysis in Lithuanian scientific literature (Gavrilova 2011, Stankevičienė and Gavrilova 2012, Stankevičienė and Bernatavičienė 2012, Jurevičienė and Bapkauskaitė 2014), because they used different types of Treynor-Mazuy regression model, multi-criteria SAW method and mix of traditional evaluation ratios.

A variety of assessment methods imply the problem how to select the best method for evaluation. Some authors compare the funds rows calculated using different methods and close them despite the results are similar even though the fund's places are distributed unevenly (Artikis 2003, Noulas et al. 2005). Multi-criteria decision methods (MCDM) can be suitable for this task (Opricovic and Tzeng 2002, Pendaraki et al. 2003, Ginevičius and Podvezko 2008a, 2008b, Simanavičienė 2011, Jokšienė and Žvirblis 2011, Žvirblis and Rimkevičiūtė 2012, Prascevic Z. and Prascevic N. 2013, Sarkar 2013).

MCDM are a various methodologies; e. g. SAW, GA, SR, VIKOR, COPRAS, TOPSIS, PROMETHEE and others. Each of them has some disadvantages as well as advantages (see Table 1). Although their usage and characteristics are analysed quite extensively in the scientific literature (Ginevičius and Krivka 2009, Podvezko 2009, 2011, Podvezko and Podviezko 2009, Podvezko et al. 2010, Simanavičienė 2011, Antuchevičienė et al. 2011, Zavadskas et al. 2009, Chen 2012, Kareivaitė 2012, Bogdanovic, Miletic 2014, Drejeris 2014), it is still not decided what methods are the most for each task. Taking into account is suggested to analyse the object using different methods and to find the average of these results (Ginevičius and Podvezko 2008a). Principally to use some different techniques and combine them they must be compatible with each other. Some authors (mentioned before) have observed that it could be determined by using the correlation analysis.

To select the indicators is important when they are included in the complex index. According to Podvezko (2008) the assessment will be adequate, if it includes the ratios showing all the essential values. This shows that these methods depend on the researcher's point of view and his opinion which indicators are necessary to involve (see Table 2).

The universality and wide adaptation of MCDM used to test the II pillar pension funds in Lithuania. These integrated assessments help evaluate and choose appropriate the pension fund based on financial results.

[1] For more information regarding differences between author's opinions, their arguments about choices of one or other/or combinations of related indicators, as well as criteria why they had made such choices are presented in Novickytė, L., Rabikauskaitė, V., Pedroja, G. 2016. Social security issues: II pillar pension funds' performance in Lithuania, *Journal of Security and Sustainability Issues* 5(3): 329–354.

2. Research methodology

The pension funds assessment is conducted in 2 scenarios (see Fig. 1). The first one includes a return (as well as the added value) and the risk indicators: the average annual change in unit value, standard deviation, beta, and Jensen's alpha ratios showing the fund returns, risks, and to actively conduct the added value. The second scenario includes only the most popular derivative indicators (as discussed in the theoretical part of the article; they are also used to assess the investment funds performance): Sharpe, Treynor and Jensen's alpha ratios (Pendaraki et al. 2005, Lin et al. 2007, Chang et al. 2010). These indicators choose because it is important to test and compare the return and the risk of the funds, and also to find out what are the added values created by the funds' managers. The main ratio characteristics presented in Table 3, despite the fact that both Treynor and Sharpe ratios combine the reward and risk, Treynor ratio evaluates fund's reward related with the risk and contrary

Table 2. The indicators included by the authors when the pension and investment funds are assessed by using multi-criteria decision methods

Author	Indicators																						
	The percentage change of the annual value of the net asset	The average change of the value of unit/ Change in value of investment unit	Beta coefficient	VAR (value at risk) indicator	Annual return / the geometric mean of return / average net return / net return on investment	The difference of investment and risk-free return	The coefficient of variation	Treynor rate	Sharpe ratio	Jensen's alpha	The standard deviation of return / the standard deviation of change of unit's value	Henriksson and Metron alpha	Henriksson and Metron gama	Treynor – Mazuy gama	Treynor and Black ratio	Sortino ratio	Information ratio	The correlation coefficient	The number of Investment fund units in circulation	The average net asset value	The asset of investment funds/ the fund size	Management fees
Pendaraki and Zopounidis (2003)	+		+	+	+			+	+	+													
Pendaraki et al. (2005) (two scenarios)	+		+			+				+	+	+	+										
			+			+			+	+	+		+		+								
Lin et al. (2007)								+	+	+							+						
Alptekin (2009)								+	+	+						+							
Chang et al. (2010)								+	+	+							+						
Stankevičienė and Bernatavičienė (2012)		+	+		+		+		+	+	+				+				+	+	+		
Stankevičienė and Gavrilova (2012)		+	+		+				+	+	+			+				+	+		+	+	
Jurevičienė and Bapkauskaitė (2014)		+	+		+				+	+	+				+			+	+		+	+	

Source: made by the authors.

to the Sharpe ratio, this indicator evaluates systemic and not the general portfolio risk. Jensen's alpha measure added value created by the actions of funds' managers and it does not consider market development and the risk.

In order to avoid incompatibility of expert opinions only equal weights gave to the selected indicators. Each group of funds has been calculated applying 6 different MCDM, and the correlation coefficient used to check the compatibility of them. Finally all the results of these methods have been combined together into one composite ratio. Taking into account the composite ratio is formed a funds queue which shows the funds place.

To calculate the indicators used the data from The Bank of Lithuania and the pension funds management companies, the data from Bloomberg terminal and the MSCI database which provides the unit values of selected indices, and Euribor rates (this rate chosen because the Lithuanian Government securities do not meet the risk-free rate and has of a high risk premium during the research period).

As the starting point of Lithuania II pillar pension funds activity are not uniform (some of them started in 2004 like others only in 2011) in this research funds valued on each of them starting point and the analysis period covers 2004–2014 and data converted in annual average.

In Lithuania every II pillar pension fund must have a benchmark reflecting the best investment strategy of the fund. All the II pillar pension funds have the same investment restrictions thus; it is more adequate to apply a single index for each group of pension funds when beta coefficient is calculated. Two defining benchmarks chosen to represent all the possible sets of investment of II pillar pension funds; based on them formed the indicators for each pension fund group. The Ethical Euro Government Bond chosen for conservative pension funds' group, while The MSCI All Country World Index used for the equity funds' group. The synthetic indices created for mixed pension funds group (Invalda INVL 2014a, 2014b, Swedbank 2014a, 2014b, Danske Capital 2013, Aviva 2013, DNB 2015, ERGO 2013, SEB 2015): 30 per cent of the stock index and 70 per cent of the bond index complete the index for funds of a small stock share and the index for the average equity share group created by 50 per cent for each benchmark.

This research uses 6 MCDM (see Table 4), which are combined into a one single composite indicator (note that COPRAS method is used only when both maximizing and minimizing indicators are included, because if it only includes maximizing indicators, the results correspond to SAW results). In addition, to combine these methods and to calculate the average of the results, they must be consistent with each other. The compatibility is examined using the correlation coefficient: the bigger this coefficient is, the more the methods are in line with each other.

3. Results and discussion

The first step was to calculate the correlation coefficients between SAW and other MCDM to assess each of 4 groups of the pension funds (conservative, small equity share,

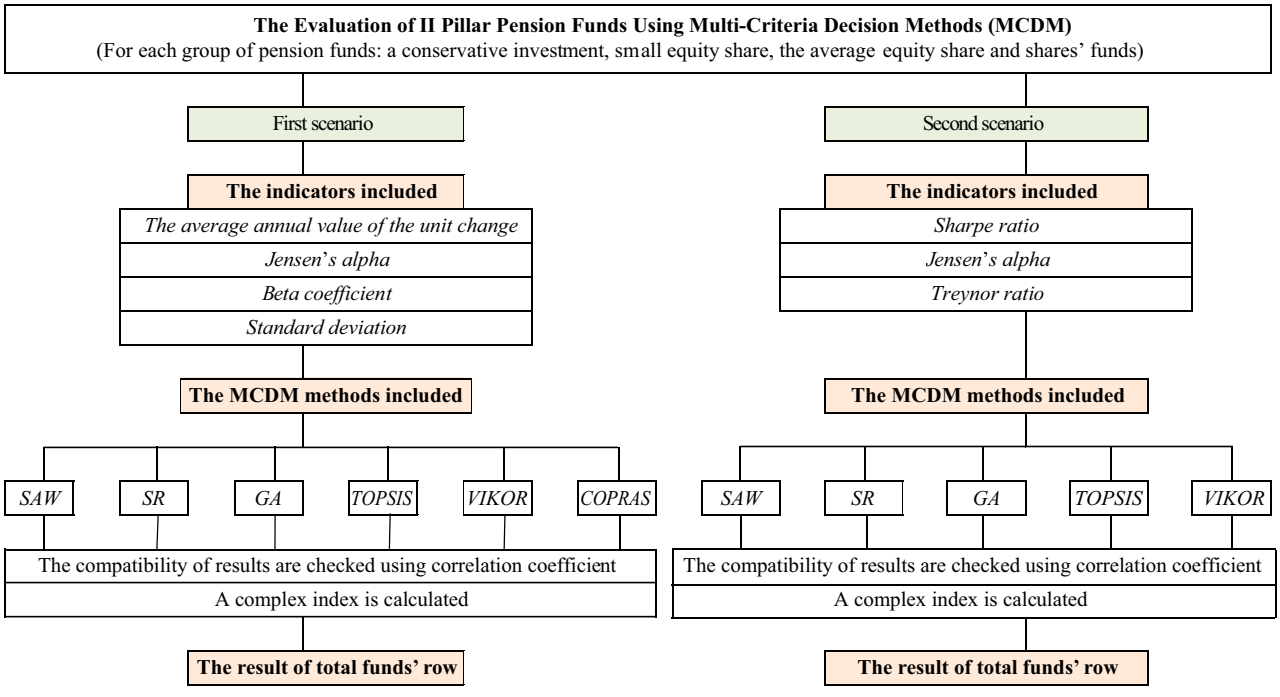

Fig. 1. The phases of the research (*source:* made by the authors)

Table 3. The indicators of assessment used to evaluate II Pillar Pension Funds' performance

Ratio	Formula	Description
Standard deviation	$\sigma_p = \sqrt{\frac{\sum(x_i - \bar{x})^2}{(n-1)}} \cdot \sqrt{n}$	It reflects the risk of the fund. The higher is the ratio, the higher is the risk.
Sharpe ratio	$SR = \frac{r_p - r_f}{\sigma_p}$	It is used to show how much investment return is given by each taken unit of risk.
Beta ratio	$\beta_p = \rho \frac{\sigma_p}{\sigma_m}$	The risk ratio is designed in order to show the connection between the fund and the market, i.e. how much influence of the systemic risk is done on the portfolio. A negative value of this ratio means that the fund is moving in the opposite direction from the market, zero means that fund and the market do not correlate with each other. When beta is in the interval from zero and one, fund takes a lower risk than the market does. Meanwhile, when beta is more than one, the fund gets a bigger risk than market. Finally, when beta is equal to one – fund has the same risk as the market.
Jensen's alpha	$\alpha_p = r_p - \left[r_f + \beta_p \left(r_m - r_f \right) \right]$	This ratio measures the added value created by the managers of the fund. The positive value means that the manager adds value, it means that he chooses investment positions, which help to outperform the market. Meanwhile, the negative ration means that the manager was not able to outperform the market.
Treynor ratio	$T = \frac{r_p - r_f}{\beta_p}$	It shows the return of the fund for each unit systemic risk unit. A higher value of this indicator shows a higher return on the risk, so in order to reduce the risk to a minimum, the maximization of this ratio should be achieved.
Markings used: σ_p – the standard deviation of the fund; x_i – the actual return of fund over the period; $\bar{x}$ – the average return of fund; n – the number of periods in a year; r_p – the fund's return; r_f – risk-free return of investment; σ_m – the standard deviation of market; ρ – correlation ratio between the market and the fund's returns; β_p – the fund's beta coefficient; r_m – market returns (the returns of the benchmark index).		

Source: made by the authors, according to Redman et al. 2000, Artikis 2003, Financial planning body... 2014, Infolex 2012, Parlak 2014.

Table 4. Multi-criteria decision methods used in evaluation of the performance of II Pillar Pension Funds

Method	Formula	Description
SAW	$S_j = \sum_{i=1}^{m} w_i \tilde{r}_{ij}$	SAW (Simple Additive Weighting) combines the indicators of the same direction (maximizing or minimizing) and their weights. In the research the minimizing indicators are rearranged to maximizing ones according to the formula (1) and then the normalization is done according to formula (2). After the normalization of the indicators the summarizing rate of the SAW method is found. The fund with the highest rate gets the first place, the rest of the funds are arranged in descending order. $\frac{\min_j r_{ij}}{r_{ij}}$; (1) $\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{i=1}^{m} r_{ij}}$; (2)
SR	$V_j = \sum_{i=1}^{m} m_{ij}$	SR (sum of ranks) method is based on the process when serial numbers are given for each fund according to different indicators. Then the summarizing indicator is calculated. The first place is given to the fund with minimum amount; all the funds are arranged in ascending order.
GA	$\prod j = \sqrt[m]{\prod_{i=1}^{m} \tilde{r}_{ij}}$	GA (geometric mean) is calculated using the method of simple geometric formula. The weights are not included in this case. The first place is given for the fund with maximum value and so all the funds are arranged in descending order.
TOPSIS	$C_j^* = \frac{D_j^b}{D_j^g - D_j^b}$	The summarizing rate of TOPSIS (Technique for Order Preference by similarity to an Ideal Solution) method is calculated according to the formula, following a three-step calculation. The Fund with the highest rate is in the first place and the funds are arranged in descending order.

End of Table 4

Method		Formula	Description
	1	$\widetilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^{n} r_{ij}^2}}$	The normalization of each rate is performed.
	2	$V^g = \left\{V_1^g, V_2^g, \ldots, V_m^g\right\} = \left\{\left(\max_j w_i r_{ij} / i \in I_1\right), \left(\min_j w_i \widetilde{r}_{ij} / i \in I_2\right)\right\}$ $V^b = \left\{V_1^b, V_2^b, \ldots, V_m^b\right\} = \left\{\left(\min_j w_i r_{ij} / i \in I_1\right), \left(\max_j w_i \widetilde{r}_{ij} / i \in I_2\right)\right\}$	The best V^g and the worst V^b solutions are counted.
	3	$D_j^g = \sqrt{\sum_{i=1}^{m} (w_i \widetilde{r}_{ij} - V_i^g)^2}$; $D_j^b = \sqrt{\sum_{i=1}^{m} (w_i \widetilde{r}_{ij} - V_i^b)^2}$	The distances of indicator values to the worst D^b and the best D^g solutions are searched in each fund.
VIKOR		$Q = \frac{v\left(S_j - S^b\right)}{\left(S^g - S^b\right)} + \frac{\left(1-v\right)\left(R_j - R^b\right)}{\left(R^g - R^b\right)}$	VIKOR (Serb. Vlse Kriterijumska Optimizacija I Kompromisno Resenje) method is only applied for maximizing indicators (the process of maximizing of indicators are calculated the same as in SAW method). The summarizing rate of this method is found by the formula given, when the required data is calculated in two stages. According to the results, they are lined up in ascending order: fund with the lowest value is in the first place.
	1	$\widetilde{r}_{ij} = \frac{\max_j r_{ij} - r_{ij}}{\max_j r_{ij} - \min_j r_{ij}}$	The normalization of each rate is performed.
	2	$S_j = \sum_{i=1}^{m} w_i \widetilde{r}_{ij}$; $R_j = \max_i \left(w_i \widetilde{r}_{ij}\right)$	Two auxiliary indicators, S_j and R_j are counted.
COPRAS		$K_j = S_{+j} + \frac{S_{-\min} \sum_{j=1}^{n} S_{-j}}{S_{-j} \sum_{j=1}^{n} \frac{S_{-\min}}{S_{-j}}}$	COPRAS (Complex Proportional Assessment) method is derived by the formula, and the normalization is carried out in accordance with the formula (3). $\widetilde{r}_{ij} = \frac{r_{ij} w_i}{\sum_{j=1}^{n} r_{ij}}$; (3) The summarizing indicators are lined up in descending order. It is worth noting that in the absence of minimizing indicators, this method is calculated in the same way as SAW.

Marking used: w_i – weight of a corresponding indicator; $\widetilde{r}_{ij}$ – normalized *i*-th value of the index *j* diately fund; m_{ij} – place of *i*-th indicator to *j*-th fund; $\min_j r_{ij}$ – minimum value of *i*-th indicator to *j*-th fund; r_{ij} – value of *i*-th indicator to *j*-th fund; $S_{+j} = \sum_{i=1}^{m} \widetilde{r}_{ij}$ – the sum of all *i*-th maximizing indicators for allalternatives; $S_{-j} = \sum_{i=1}^{m} \tilde{r}_{ij}$ – the sum of all *i*-th minimizing indicators for allalternatives; $S_{-\min} = \min_j S_{-j}$; $S^b = \min_j S_j$; $S^g = \max_j S_j$; $R^b = \min_j R_j$; $R^g = \max_j R_j$ – strategic weight (in case of the research – 0.5), I_1 – index set of maximizing indicators, I_2 – index set of minimizing indicators.

Source: made by authors based on Ginevičius and Podvezko 2008a, 2008b, 2008c, Podvezko 2008, Ginevičius and Podvezko 2009, Nisel 2014.

average share and shares pension funds) summarizing indicators estimated by the MCDM (see Table 9). The results showed that the coefficient values (modules) have a strong or medium connection; this allows combining the results into a one single indicator. The results calculated with VIKOR method has a weak correlation (–0.36) with SAW when the first case scenario chosen in a small share of the Fund's group (see Table 9). Therefore, the results of this method have not been included in the calculations of summarizing indicator.

Assessing the methods similarity showed that funds sequence calculated by VIKOR and SR MCDM the most often are different; on the other hand, values calculated using SAW and COPRAS usually coincided identically, because the methodologies for calculations are similar. However, it is more important to assess whether the MCDM is useful for estimating the II pillar pension funds, and compare them with the results from other funds to take into account indicators.

Assessment of Conservative II Pillar Pension Funds. In the first scenario (see Table 9) SAW and GA methods summarizing indicators showed that "Finasta konservatyvus" and "MP Stabilo II" funds only differ in hundredth parts. Similarly small differences observed calculated using GA method: "Danske konservatyvus" and "Swedbank Pensija1" rounded values equal to 0.09. In conclusion, although rated funds' locations may vary, but a small gap between the generalizing indicators may show that funds are running very similar. Thus, when evaluating funds using MCDM, it is worth paying attention not only to the Fund place, but also to its summarizing indicator values gap to others.

Table 5 showed that using MCDM and including different indicators, a different distribution of the funds row is obtained. However, in both scenarios "Finasta konservatyvus" fund is the leader: this fund generates the highest return (4.69 per cent) and assumes one of the lowest risks (standard deviation of 1.32 per cent).

"MP Stabilo II" fund counted in both scenarios entering into the second place: it has the lowest standard deviation (0.67 per cent), but also one of the lowest annual returns (2.5 per cent). It is important to emphasize that the "MP Stabilo II" has only been operating since 2011 and set apart from the others which makes the evaluation not fully adequate. The further row is different using both scenarios in funds' evaluation by MCDM. The last place holds "Swedbank Pensija 1" in the second scenario, while in the first "SEB Pensija 1". Although "SEB Pensija 1" has a higher return (average annual change of the unit value 2.61 per cent), it takes the highest risk (standard deviation equals to 2.38 per cent). Nevertheless, Sharpe ratio indicates that the fund's risk pays off (it is positive) – unlike "Swedbank Pensija 1" (its Sharpe ratio is negative and equal to –0.26). Finally, although "SEB Pensija 1" has a higher Treynor ratio (0.01, while "Swedbank

Table 5. The top row of conservative investment II Pillar Pension Fund

Conservative investment pension funds		Finasta Konservatyvaus investavimo	Aviva Europensija	DnB Pensija 1	ERGO konservatyvus	Danske Konservatyvus	SEB Pensija 1	MP Stabilo II	Swedbank Pensija 1
The Fund's row by the unit value changes, standard deviation, beta, and Jensen's alpha indicators using MCDM	Value	1.33	3.83	3.33	7.00	5.67	8.00	1.67	5.17
	Place	1	4	3	7	6	8	2	5
The Fund's row by Sharpe ratio	Value	1.88	1.00	0.93	0.38	0.28	0.17	2.21	–0.26
	Place	2	3	4	5	6	7	1	8
The Fund's row by Sharpe, Treynor and Jensen's alpha indicators using MCDM	Value	1.00	3.00	4.00	5.80	5.20	7.20	2.00	7.80
	Place	1	3	4	6	5	7	2	8
The Fund's row by the average annual value of the unit change	Value	4.69	4.46	3.54	3.07	2.63	2.61	2.50	1.88
	Place	1	2	3	4	5	6	7	8
The Fund's row by the average standard deviation	Value	1.32	2.26	1.43	2.27	1.52	2.38	0.67	1.26
	Place	3	6	4	7	5	8	1	2

Source: based on authors' calculations.

Pensija 1", this ratio equals to –0.03), it has a worse Jensen's alpha index (coefficient is –0.98 compared with "Swedbank Pensija 1", for which the index is equal to –0.03).

The second scenario is more targeted because it combines derivative indicators (ex. Sharpe ratio); if we use single indicators (standard deviation and etc.) instead derivate ratios, the results will not be correct. For example, the results based on the unit returns and standard deviation could be formed not entirely correct.

Assessment of Small Equity Share II Pillar Pension Funds. Table 6 showed all the cases then funds row position coincided. An analysis confirms that the indicators included in MCDM calculations are not contradictory and distinguished only by the standard deviation (risk) deployed to the funds row. However, this row only shows the risks taken regardless of the returns earned. As the fund participants focus on the return earned in the long-term, rather than the fund's volatility, this indicator does not have such a high importance that when choosing a fund and should be considered solely on its value.

Assessment of II Pillar Pension Funds' Medium-Equity Share. The first scenario (see Table 9) showed that using different MCDM the results have turned out to be quite different. Although the second place is given to "Danske Pensija 50" using all the MCDM, TOPSIS gives the second place to "Finasta aktyvaus investavimo" fund, because it has the highest average annual return (average annual change of the unit value 7.17 per cent). Meanwhile, using VIKOR method this fund is provided only in 8th place, because it has the highest risk indicators. In the 2nd case scenario (see Table 9) the results of SR and TOPSIS methods stood out. SR method gives the same places to "DnB Pensija 3" and "Danske Pensija 50" funds (the 3th and the 4th), as well as "SEB Pensija 2" and "Aviva Europensija extra" (the 7th and the 8th places). Although all the methods show that "SEB Pensija 1" has a better performance (given the 7th place), but using TOPSIS method "Aviva Europensija Extra" gets the 7th place. The main reason is that "SEB pensija 2" generates a higher return (average annual change of the unit value 4.44 per cent), but it also takes a higher risk (standard deviation is 6.68 per cent), and Sharpe ratio (0.33 per cent.) shows that the risks summed by the unit give a higher return than "Aviva Europensija Extra" (Sharpe ratio reaches 0.25 per cent). Although "SEB Pensija 2" has a worse Jensen's alpha, "Aviva Europensija Extra" has it negative too. It is better to consider "SEB Pensija 2" pension fund as the one performing better.

The summarizing indicators for some of the funds are quite alike. However, while forming the general row some of the funds get the lower positions. The funds' row calculated using the first case scenario GA method get almost the same summarizing indicators as "SEB Pensija 2", "Swedbank Pensija 3" and "Aviva Europensija extra" have. The same results showed applying SAW and COPRAS methods.

Both scenarios (see Table 7) which provides "MP MEDIA II" fund with the best place, however, the highest return generated "Finasta Aktyvaus Investavimo" fund (average change of the unit value during the year amounted to 7.17 per cent). This was influenced by higher risk (standard deviation of 8.71 per cent). However, it is important that "MP MEDIA II" has been only operating since 2007, thus avoiding poor results during the crisis' years. Meanwhile, "Swedbank Pensija 4" fund gets the 9th place while being calculated by all the MCDM. This indicates that the fund does not have a high rate of return (average change of the unit value equals to 2.23 per cent) or low risk (standard deviation was even 8.83 per cent), which would allow him to compete with the other funds.

Table 6. The top row of small equity share investment II Pillar Pension Fund

Small equity share pension funds (up 30 per cent)		Finasta Augančio pajamingumo	Aviva Europensija plius	DnB Pensija 2	Swedbank Pensija 2
The Fund's row by the unit value changes, standard deviation, beta, and Jensen's alpha indicators using MCDM	Value	1.40	2.00	3.00	4.00
	Place	1	2	3	4
The Fund's row by Sharpe ratio	Value	0.84	0.79	0.66	0.39
	Place	1	2	3	4
The Fund's row by Sharpe, Treynor and Jensen's alpha indicators using MCDM	Value	1.00	2.00	3.00	4.00
	Place	1	2	3	4
The Fund's row by the average annual value of the unit change	Value	7.22	5.13	4.46	3.69
	Place	1	2	3	4
The Fund's row by the average standard deviation	Value	5.94	3.71	3.40	3.76
	Place	4	2	1	3

Source: based on authors' calculations.

The difference between both case scenarios using MCDM for "Finasta Aktyvaus Investavimo" fund is also noteworthy. As the first scenario does not include Sharp ratio but standard deviation and return ratios separately, this has resulted in the fund confines exclusively into the yellow zone. Meanwhile, the second scenario involves derivative indicators and thus the funds get the second place. The same situation happens with "Danske pensija 50" which has one of the lowest standard deviations (4.84 per cent) and still gets to the second place, although in terms of average annual return (which amounts to 4.86 per cent) it is only in the fourth place which is also shown by using Sharpe Ratio (0.55). Given that one of the main goals of pension funds-returns is the added value in long-term it can be regarded as the results obtained in the second scenario.

Assessment of Shares II Pillar Pension Funds. In both scenarios MCDM row completely coincide, as well as in terms of average annual returns. This shows that it is worthwhile to follow these data despite the fact that Sharpe ratio shows that "Finasta Racionalios Rizikos" fund is better than "Swedbank Pensija 5". Such differences between these funds are noticeable, because the calculations based on the MCDM include Jensen's alpha index shows that "Finasta Racionalios Rizikos" fund managers create added value (alpha indicator is positive and reaches up to 1.10), and do not for "Swedbank Pensija 5" (Jensen's alpha indicator was negative at –3.59). Thus, the second scenario calculation using MCDM again shows an advantage, because it not only highlights the risk and return ratio, but also allows managers to take greater account of the added value created by their active actions. Finally, the results are similar to the results of a small equity share funds: the order of the row using the same methods is the same (see Table 8).

Summarizing the Lithuanian II pillar pension fund results showed that multi-criteria evaluation methods are a proper tool that allows a comprehensive assessment of the pension funds and make a well-considered decision about the pension fund. The second scenario presents more reasonable results and formed the best pension funds row is more precise than using the first scenario data which reflects the fund's performance. In the second scenario seeks minimally to take into account risk (the return) (e. g. 10 per cent) and first of all the fund highlighting in one aspect, then the results compared to the fund's average annual return (standard deviation). It was also noted that the funds evaluation model is more precisions for larger groups conservative and the average share funds. Small equity shares and share funds' results were not important to each one, where the specific performance valuation indicators (such as Sharpe, Jensen's alpha etc.) values during 2004–2014 is not contrary (top row of the funds were set out in much the same way using all the study indicators).

Finally, the analysis of scientific literature and early authors research (Rabikauskaitė and Novickytė 2015, Novickytė et al. 2016) and this study results allow creating a proper pension funds evaluation model (see Fig. 2). Figure 2 shows that when choosing the pension fund to fully assess its performance it is important to take attention to micro- and macro-environmental factors. Micro environmental factors relevant to participants (both prospective and existing) have his personal beliefs, risk tolerance level, and belong to a different social group, and so on. This is supported by DiCenzo (2007) study, where the author argues that the participants characterized the "automatic engagement" when account is taken of the surrounding advice and behaviour. Chybalski (2011) also agreed that

Table 7. The top row of medium-equity share II Pillar Pension Funds

Medium-equity share pension funds		Finasta Aktyvaus investavimo	MP Medio II	DnB Pensija 3	Danske pensija 50	ERGO balans	SEB Pensija 2	Swedbank Pensija 3	Aviva Euro-pensija ekstra	Swedbank Pensija 4
The Fund's row by the unit value changes, standard deviation, beta, and Jensen's alpha indicators using MCDM	Value	4.00	1.00	3.50	2.17	5.00	7.80	6.00	6.80	9.00
	Place	4	1	3	2	5	8	6	7	9
The Fund's row by Sharpe ratio	Value	0.57	0.95	0.58	0.55	0.43	0.33	0.38	0.25	0.00
	Place	3	1	2	4	5	7	6	8	9
The Fund's row by Sharpe, Treynor and Jensen's alpha indicators using MCDM	Value	2.00	1.00	3.90	3.10	5.00	7.30	6.00	7.75	9.00
	Place	2	1	4	3	5	7	6	8	9
The Fund's row by the average annual value of the unit change	Value	7.17	6.17	5.10	4.86	4.78	4.44	4.31	3.68	2.23
	Place	1	2	3	4	5	6	7	8	9
The Fund's row by the average standard deviation	Value	8.71	4.72	5.03	4.84	6.03	6.68	5.52	6.00	8.83
	Place	8	1	3	2	6	7	4	5	9

Source: based on authors' calculations.

people do not focus on the fund's investment performance, but are exposed to management companies advertising campaigns influence. Such conditions have an indirect impact on the pension funds results, when successfully operating Lithuanian pension funds are characterized by small number of participants and own small accumulated assets.

Natali (2011) points out that the most affected area by the crisis was the cumulative funds, which the return on investment dropped sharply. Bitinas (2011) agrees that it will take a long time to repair during the crisis the damage made to pensions and restore the impaired savings of population. The author notes that in addition to conventional measures, such as reducing benefits and increasing contributions, the reforms of social security and labour law were implemented. Thus a significant impact to take part in pension funds has macro-economic environment in the world and the country, the Government's response to global challenges (economic cycles). The Lithuanian government reduced the Sodra pensions and introduced further reductions for

Table 8. The Top Row of Shares II Pillar Pension Funds

Shares Pension Funds (up to 100 per cent)		Danske pensija 100	MP Extremo II	Finasta Racionalios rizikos	Swedbank Pensija 5	SEB Pensija 3
The Fund's row by the unit value changes, standard deviation, beta, and Jensen's alpha indicators using MCDM	Value	2.00	1.00	3.33	3.83	4.83
	Place	2	1	3	4	5
The Fund's row by Sharpe ratio	Value	0.54	0.76	0.23	0.49	–0.01
	Place	2	1	4	3	5
The Fund's row by Sharpe, Treynor and Jensen's alpha indicators using MCDM	Value	2.00	1.00	3.10	4.30	4.60
	Place	2	1	3	4	5
The Fund's row by the average annual value of the unit change	Value	6.54	6.43	5.66	5.65	2.02
	Place	1	2	3	4	5
The Fund's row by the average standard deviation	Value	7.98	6.21	14.87	9.46	12.03
	Place	2	1	5	3	4

Source: based on authors' calculations.

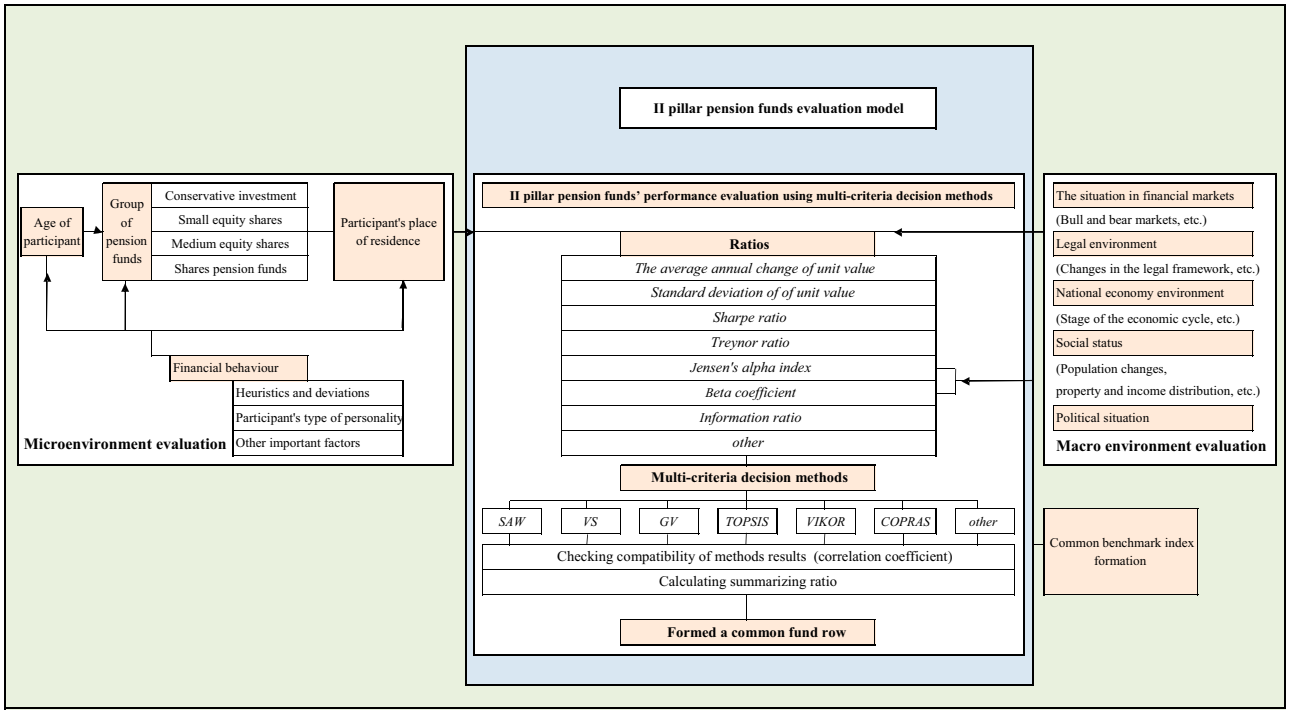

Fig. 2. Evaluation model of II Pillar Pension Funds (*source:* made by the authors)

working pensioners (Bitinas 2011). Gudaitis (2010) argues that such reductions can have a significant impact on the long-term factors. The European Commission's (EUROPOS KOMISIJA 2010) observes that demographic aging can also affect cumulative pension systems. This emphasizes that pension funds do not help to solve the demographic problems; moreover, this inevitable process can also affect them. The Green Paper (EUROPOS KOMISIJA 2010) suggests that potential of economic growth is reduced due to the aging population, thus reducing the rates of return, which makes the influence on financial asset prices. Liutvinavičius and Sakalauskas (2011) argue that the small financial literacy and emotions of participants find migration between the funds due to the wrong decisions. Lazutka (2008) agrees with this argument and identifies that the public campaign had a negative impact on the participation because the participants chose the fund without assessing their real possibilities. Finally, macro environment factors include changes in the legal framework, the economic cycles, social, political factors, and etc. have an important impact on the choice to take part in the pension system or not.

Thus, micro- and macro- environmental factors work together affects the number of participants in pension funds and the size of their managed asset. Distinguish factors enable to the fund manager to predict their managed fund performance prospects and potential. Both groups of factors, together with the selected fund's financial results analysis will allow a comprehensive assessment of the pension funds and propose to make a rational decision about the funds' performance. Funds complex evaluation would prevent not successful migration between funds or simply make an informed decision (not) to take part in the II pillar pension fund because withdrawing from participation of these funds now is not possible. In addition, it could be claimed that the composed model allows to continue further studies in fund valuation field and thus give a proper assessment model that is extremely important for financial, specialists, consultants etc.

Conclusions

Multi-criteria evaluation methods' analysis showed that they can used in the assessment the II pillar pension funds. It noted that their usefulness based on the fact that it can combine several different fund indicators into a single summarizing indicator. Noteworthy that MCDM are very different, however, it is suggested combining all the results calculated by using each method (SAW, SR, GA, TOPSIS, VIKOR and COPRAS) into a one indicator. This model combining different MCDM is important not only for further scientific studies in the field of evaluations of funds, but also practical for the financial specialists, consultants etc.

Lithuanian II pillar pension funds evaluation using multi-criteria methods were carried out in two scenarios.

- The results based on VIKOR method varied, while results based on SAW and COPRAS methods would usually coincide because of their similar techniques. The analysis allowed to determine that even though MCDM techniques create the best rows for funds, each fund summarizing ratio should be analysed separately too. It has been found that quite often fund summarizing ratios (calculated based on one of the MCDM) are very similar, even though funds were given different places. This suggests that when choosing a fund it is important to pay attention to individual funds place in the row as well as their exclusion summarizing indicator values compared with others.
- A comparison of both scenarios suggest that a more targeted scenario is the second one (combining Sharpe, Jensen's alpha and Treynor coefficients), as it does not have any serious effect on the funds row for exceptionally high (low) a particular fund return and risk, in other words, it shows the best equitable queue for funds.
- Pension fund valuation model based on multi-criteria methods is more appropriate to use for larger groups funds, as a wider choice of funds allows them to be systemized. These calculations are more suitable for countries which have a longer fund existence; because when the funds operate for a different period of time it is difficult to compare them with each other.

This article proposes a comprehensive II pillar pension fund valuation model that does not only incorporate exploitation of MCDM, but also covers macro- and micro-environmental factors. Further scientific studies suggest more detailed analysis of these factors and recommend connecting them creating a single decision-making model. This model would help to combine not only financial and economic factors but also to connect the psychological and environmental factors. In addition, it would also help combine the aspects of financial behaviour. Furthermore, these suggestions for proper evaluation model are very important not only for financial specialists, consultants etc. but it are equally important for further scientific researches in various fields of social sciences.

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APPENDIX

Table 9. Conservative, small equity share, average equity share, and shares (up to 100 per cent) pension funds summarizing indicator calculated based on MCDM with an equal weights in used parameters

The first scenario involving the unit value changes, standard deviation, beta and Jensen's alpha indicators										
Conservative Investment Pension Funds (I)		Finasta Konservatyvaus investavimo	Aviva Europensija	DnB Pensija 1	ERGO konservatyvus	Danske Konservatyvus	SEB Pensija 1	MP Stabilo II	Swedbank Pensija 1	**Correlation coefficient**
SAW	Value	0.20	0.14	0.13	0.07	0.09	0.06	0.20	0.11	**1.00**
	Position	**2**	**3**	**4**	**7**	**6**	**8**	**1**	**5**	
SR	Value	8	16	15	25	20	29	12	19	**–0.95**
	Position	**1**	**4**	**3**	**7**	**6**	**8**	**2**	**5**	
GA	Value	0.19	0.12	0.13	0.06	0.09	0.03	0.19	0.09	**0.99**
	Position	**1**	**4**	**3**	**7**	**6**	**8**	**2**	**5**	
TOPSIS	Value	1.18	0.83	0.86	0.63	0.73	0.60	0.98	0.74	**0.96**
	Position	**1**	**4**	**3**	**7**	**6**	**8**	**2**	**5**	
VIKOR	Value	0.00	0.70	0.35	0.95	0.65	1.00	0.16	0.85	**–0.93**
	Position	**1**	**5**	**3**	**7**	**4**	**8**	**2**	**6**	
COPRAS	Value	0.20	0.14	0.13	0.07	0.09	0.06	0.21	0.11	**1.00**
	Position	**2**	**3**	**4**	**7**	**6**	**8**	**1**	**5**	
Average of methods' positions		1.33	3.83	3.33	7.00	5.67	8.00	1.67	5.17	–
Colocation		**1**	**4**	**3**	**7**	**6**	**8**	**2**	**5**	
The second scenario involving Sharpe, Treynor and Jensen's alpha indicators										
Conservative Investment Pension Funds (II)		Finasta Konservatyvaus investavimo	Aviva Europensija	DnB Pensija 1	ERGO konservatyvus	Danske Konservatyvus	SEB Pensija 1	MP Stabilo II	Swedbank Pensija 1	**Correlation coefficient**
SAW	Value	0.22	0.16	0.14	0.08	0.09	0.07	0.18	0.06	**1.00**
	Position	**1**	**3**	**4**	**6**	**5**	**7**	**2**	**8**	
SR	Value	4	8	12	16	17	22	6	23	**–0.97**
	Position	**1**	**3**	**4**	**5**	**6**	**7**	**2**	**8**	
GA	Value	0.21	0.16	0.14	0.07	0.08	0.02	0.18	0.06	**0.98**
	Position	**1**	**3**	**4**	**6**	**5**	**8**	**2**	**7**	
TOPSIS	Value	1.97	0.53	0.37	0.10	0.10	0.06	1.03	0.03	**0.91**
	Position	**1**	**3**	**4**	**6**	**5**	**7**	**2**	**8**	
VIKOR	Value	0.00	0.48	0.54	0.86	0.82	0.95	0.22	1.00	**–0.99**
	Position	**1**	**3**	**4**	**6**	**5**	**7**	**2**	**8**	
Average of methods' positions		1.00	3.00	4.00	5.80	5.20	7.20	2.00	7.80	–
Colocation		**1**	**3**	**4**	**6**	**5**	**7**	**2**	**8**	

The first scenario involving the unit value changes, standard deviation, beta and Jensen's alpha indicators						
Small Equity Share Pension Funds (up 30 per cent) (I)		Finasta Augančio pajamingumo	Aviva Europensija plius	DnB Pensija 2	Swedbank Pensija 2	**Correlation coefficient**
SAW	Value	0.30	0.25	0.25	0.20	**1.00**
	Position	**1**	**2**	**3**	**4**	
SR	Value	10	8	8	14	**–0.59**
	Position	**3**	**1–2**	**1–2**	**4**	
GA	Value	0.28	0.25	0.24	0.18	**0.98**
	Position	**1**	**2**	**3**	**4**	
TOPSIS	Value	4.26	3.61	3.42	2.91	**0.99**
	Position	**1**	**2**	**3**	**4**	
VIKOR	Value	0.67	0.17	0.18	1.00	**–0.36**
	Position	**3**	**1**	**2**	**4**	
COPRAS	Value	0.30	0.26	0.25	0.20	**1.00**
	Position	**1**	**2**	**3**	**4**	
Average of methods' positions		1.40	2.00	3.00	4.00	–
Colocation		**1**	**2**	**3**	**4**	
The second scenario involving Sharpe, Treynor and Jensen's alpha indicators						
Small Equity Share Pension Funds (up 30 per cent) (II)		Finasta Augančio pajamingumo	Aviva Europensija plius	DnB Pensija 2	Swedbank Pensija 2	**Correlation coefficient**
SAW	Value	0.39	0.27	0.22	0.12	**1.00**
	Position	**1**	**2**	**3**	**4**	
SR	Value	3	6	9	12	**–0.98**
	Position	**1**	**2**	**3**	**4**	
GA	Value	0.39	0.26	0.22	0.12	**1.00**
	Position	**1**	**2**	**3**	**4**	
TOPSIS	Value	7.03	0.42	0.24	0.00	**0.87**
	Position	**1**	**2**	**3**	**4**	
VIKOR	Value	0.00	0.49	0.65	1.00	**–1.00**
	Position	**1**	**2**	**3**	**4**	
Average of methods' positions		1.00	2.00	3.00	4.00	–
Colocation		**1**	**2**	**3**	**4**	

The first scenario involving the unit value changes, standard deviation, beta and Jensen's alpha indicators											
Average Equity Share Funds (I)		Finasta Aktyvaus investavimo	MP Medio II	DnB Pensija 3	Danske pensija 50	ERGO balans	SEB Pensija 2	Swedbank Pensija 3	Aviva Europensija ekstra	Swedbank Pensija 4	**Correlation coefficient**
1	2	3	4	5	6	7	8	9	10	11	12
SAW	Value	0.12	0.17	0.12	0.13	0.11	0.10	0.10	0.10	0.05	**1.00**
	Position	**3**	**1**	**4**	**2**	**5**	**8**	**6**	**7**	**9**	
SR	Value	19	5	13	11	22	28	23	23	36	**–0.96**
	Position	**4**	**1**	**3**	**2**	**5**	**8**	**6–7**	**6–7**	**9**	
GA	Value	0.11	0.17	0.12	0.13	0.11	0.10	0.10	0.10	0.05	**1.00**
	Position	**4**	**1**	**3**	**2**	**5**	**8**	**6**	**7**	**9**	

1	2	3	4	5	6	7	8	9	10	11	12
TOPSIS	Value	–6.17	–5.28	–6.58	–6.44	–7.28	–7.96	–7.54	–7.95	–14.55	**0.87**
	Position	**2**	**1**	**4**	**3**	**5**	**8**	**6**	**7**	**9**	
VIKOR	Value	0.73	0.00	0.50	0.34	0.63	0.70	0.61	0.65	1.00	**–0.94**
	Position	**8**	**1**	**3**	**2**	**5**	**7**	**4**	**6**	**9**	
CO-PRAS	Value	0.12	0.17	0.12	0.13	0.11	0.10	0.10	0.10	0.05	**1.00**
	Position	**3**	**1**	**4**	**2**	**5**	**6**	**8**	**7**	**9**	
Average of methods' positions		4.00	1.00	3.50	2.17	5.00	7.80	6.00	6.80	9.00	–
Colocation		**4**	**1**	**3**	**2**	**5**	**8**	**6**	**7**	**9**	
The second scenario involving Sharpe, Treynor and Jensen's alpha indicators											
Average Equity Share Funds (II)		Finasta Aktyvaus investavimo	MP Medio II	DnB Pensija 3	Danske pensija 50	ERGO balans	SEB Pensija 2	Swed-bank Pensija 3	Aviva Euro-pensija ekstra	Swed-bank Pensija 4	**Correla-tion coeffi-cient**
SAW	Value	0.15	0.25	0.12	0.13	0.10	0.08	0.09	0.07	0.01	**1.00**
	Position	**2**	**1**	**4**	**3**	**5**	**7**	**6**	**8**	**9**	
SR	Value	7	3	10	10	15	22	19	22	27	**–0.93**
	Position	**2**	**1**	**3–4**	**3–4**	**5**	**7–8**	**6**	**7–8**	**9**	
GA	Value	0.15	0.24	0.12	0.13	0.10	0.08	0.09	0.07	0.00	**1.00**
	Position	**2**	**1**	**4**	**3**	**5**	**7**	**6**	**8**	**9**	
TOPSIS	Value	0.80	2.08	0.44	0.50	0.31	0.23	0.25	0.23	0.00	**0.94**
	Position	**2**	**1**	**4**	**3**	**5**	**8**	**6**	**7**	**9**	
VIKOR	Value	0.46	0.00	0.58	0.54	0.67	0.73	0.71	0.78	1.00	**–1.00**
	Position	**2**	**1**	**4**	**3**	**5**	**7**	**6**	**8**	**9**	
Average of methods' positions		2.00	1.00	3.90	3.10	5.00	7.30	6.00	7.75	9.00	–
Colocation		**2**	**1**	**4**	**3**	**5**	**7**	**6**	**8**	**9**	

The first scenario involving the unit value changes, standard deviation, beta, and Jensen's alpha indicators							
Shares Pension Funds (up to 100 per cent) (I)		Danske Pensija 100	MP Extremo II	Finasta Racionalios rizikos	Swedbank Pensija 5	SEB Pensija 3	**Correlation coefficient**
SAW	Value	0.22	0.29	0.16	0.18	0.14	**1.00**
	Position	**2**	**1**	**4**	**3**	**5**	
SR	Value	7	5	15	17	16	**–0.91**
	Position	**2**	**1**	**3**	**5**	**4**	
GA	Value	0.22	0.28	0.16	0.18	0.13	**1.00**
	Position	**2**	**1**	**4**	**3**	**5**	
TOPSIS	Value	–1.96	–1.92	–2.07	–2.16	–2.18	**0.89**
	Position	**2**	**1**	**3**	**4**	**5**	
VIKOR	Value	0.50	0.00	0.87	0.90	1.00	**–0.99**
	Position	**2**	**1**	**3**	**4**	**5**	
COPRAS	Value	0.25	0.32	0.17	0.14	0.13	**0.96**
	Position	**2**	**1**	**3**	**4**	**5**	
Average of methods' positions		2.00	1.00	3.33	3.83	4.83	–
Colocation		**2**	**1**	**3**	**4**	**5**	

The second scenario involving Sharpe, Treynor and Jensen's alpha indicators							
Shares Pension Funds (up to 100 per cent) (II)		Danske Pensija 100	MP Extremo II	Finasta Racionalios rizikos	Swedbank Pensija 5	SEB Pensija 3	**Correlation coefficient**
SAW	Value	0.24	0.27	0.19	0.15	0.15	**1.00**
	Position	**2**	**1**	**3**	**5**	**4**	
SR	Value	6	3	11	11	14	**–0.94**
	Position	**2**	**1**	**3–4**	**3–4**	**5**	
GA	Value	0.23	0.26	0.19	0.12	0.15	**0.98**
	Position	**2**	**1**	**3**	**5**	**4**	
TOPSIS	Value	0.46	0.81	0.23	0.12	0.10	**0.96**
	Position	**2**	**1**	**3**	**4**	**5**	
VIKOR	Value	0.44	0.00	0.74	0.89	1.00	**–0.97**
	Position	**2**	**1**	**3**	**4**	**5**	
Average of methods' positions		2.00	1.00	3.10	4.30	4.60	–
Colocation		**2**	**1**	**3**	**4**	**5**	

Source: based on authors' calculations.

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