

EVALUATION OF SECOND PILLAR PENSION FUNDS' SUPPLY AND INVESTMENT STRATEGIES IN BALTICS

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Abstract. Pension accumulation companies in Baltics are allowed to offer any number of second pillar pension funds with different investment strategies. Funds are traditionally categorized by maximum limit of investments in equities. It shall help participants to choose the fund according to their risk aversion and age. However, no scientific research has been conducted to assess correctness of such a breakdown and to estimate the differences (if they exist) of pension funds assigned to distinct groups. The results show that there are limitations to the supply side of second pillar pension funds and to participants' possibilities to select appropriate investment strategies over life-cycle. The findings from statistical analysis suggest that used classification of pension funds is not necessarily meaningful. Even if two funds belong to different categories, this does not mean that their investment strategies and results will differ significantly. It raises the need for stricter rules for setting pension funds' investment strategies and linkage to age of participants in order to increase compatibility between supply of funds and participants' needs over life-cycle.

Keywords: second pillar pension fund, pension funds' supply, pension funds grouping, pension accumulation company, investment risk, investment strategy, investment performance.

JEL Classification: D92, G11, H55, J26, J32.

Introduction

Baltic funded pension systems are similar to those introduced in the last decade of the 20th century and the first decade of the 21st century in other Central and Eastern European countries (Mitchell, Oreinstein 2005; Holzmann 2007; Ebbinghaus 2011; Égert 2012; Bielawska *et al.* 2015). One of the most important features of this system is an essential role of “second pillar” pension funds, i.e. funds that are designed as a partial replacement of traditional pay-as-you-go pension system. Establishment of second pillar pension funds allowed participants to diversify their obligatory old-age pension insurance contribution between non-funded and funded systems. The main aim of this reform was to use financial markets and investment instruments in order to diversify and improve old-age protection in the future.

A second pillar pension system was established in Latvia in 2001, in Estonia in 2002, and in Lithuania in 2004. Systems were established fairly recently, and still more participants are joining the system compared with the number of participants who are reaching payout phase (Volskis 2012).

Details of second pillar pension systems in Lithuania and in other Baltic States were presented and analyzed by scientists (Lazutka 2008 *et al.* 2013; Gudaitis 2009, 2012, 2013; Volskis 2012; Medaiskis, Gudaitis 2013; Bitinas, Maccioni 2014; Maccioni, Gudaitis 2014) and public institutions (Lietuvos bankas 2013; European Commission 2015). However, in these papers the attention paid to comparative analysis of investment strategies, risk and returns of the funds is not sufficient. On the other hand, this issue is important for participants who choose pension funds and wish to compare them from point of view of risk aversion, performance and investment strategies. Present paper intends to fill this gap.

Each pension accumulation company (service provider) in all Baltic States offers several second pillar pension funds with different investment strategies (and risks). The number of companies and the number of pension funds have changed since introduction of second pillar pension system. Despite positive development in the beginning of the reform, supply of second pillar pension funds has decreased from 2012. Main reasons of this decrease are analyzed later in this paper.

It is important for a pension fund participant to have sufficient options of selecting appropriate investment strategy during entire accumulation period in same pension accumulation company. In paper, authors assess offered investment strategies and risks from perspective of entire market and of each individual market participant. One of main aspects considered in this paper relates to supply side of second pillar pension funds. Although initially number of pension funds in all three Baltic States seems quite high (respectively 20 funds in Estonia, 20 funds in Latvia and 24 funds in Lithuania), fundamental question is whether these funds are sufficiently different in terms of their underlying risk and return characteristics. These aspects are important because frequently mentioned optimal choice for long-term pension accumulation is so-called life-cycle investment strategy, under which investment risk is decreased over time when participant ages. In Lithuania, Latvia, and Estonia pension funds are traditionally divided into different categories (according to their risk). Pension system participants could possibly realize aforementioned life-cycle strategy (Bodie *et al.* 1992, 2004; Kaupelytė, Dačioliene 2011; Gudaitis 2012; Fagereng *et al.* 2017) by jumping from one fund belonging to a riskier group to another fund with lower risk. This could work if these two funds are actually different in their risk and return characteristics. However, it is possible for pension funds belonging to different categories to show no significant differences in their average investment return and its variability. This could negatively affect size of final accumulated pension wealth when a participant's behavior in changing pension funds over time is based on assumption that pension funds differ in terms of their risk and returns. Therefore, one part of this paper contains statistical testing of differences of pension fund results.

1. Supply and investment risk trends of Second pillar pension funds in Baltics in 2002–2015

In this section, authors analyse supply and investment risk choices of second pillar pension funds for period from start of pension reforms until end of 2015 in Lithuania, Latvia, and Estonia. Additionally, authors provide results and discuss reasons behind these choices. Assessment is based on a comparative statistical analysis of data.

change in number of pension accumulation service providers and pension funds in Lithuania, Latvia and Estonia from beginning of reform until end of 2015 is summarized in Figure 1 and Figure 2. It shows that number of market participants had more or less stabilized from 2007 in Lithuania and Latvia, but has been gradually decreasing since 2012, except in Estonia, where number of pension accumulation service providers has been stable since beginning of reform. The most probable reason for decreasing number of funds is political uncertainty of funding of private second pillar. In context of global financial crisis, contributions to second pillar pension funds have decreased in many Central and Eastern European countries, including Lithuania and other Baltic States (Volskis 2012). Later political decisions to fully (Hungary) (Simonovits 2012; Jeko, Nenovsky 2012) or partially (Poland) (Fultz 2012), nationalize private second pillar pension funds raised concerns about long-term continuity and sustainability of private second pillar pension funding. In this situation, some second pillar pension service providers decided to leave market.

Currently there are 5 pension accumulation companies and 20 second pillar pension funds in Estonia, 7 companies and 20 second pillar pension funds in Latvia and 6 companies and 24 second pillar pension funds in Lithuania. Pension accumulation companies are asset management companies or life insurance companies, which despite other financial services can establish and manage pension funds.

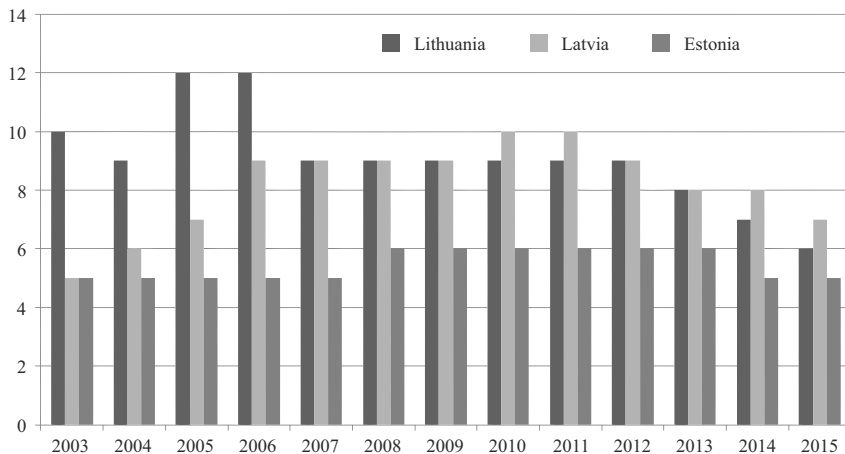


Fig. 1. Number of second pillar pension accumulation companies in Lithuania, Latvia, and Estonia, from establishment until 2015

Source: authors' calculations according to data of Estonian Pension Portal (Pensionikeskus 2016); Latvian Pension Portal (Manapensija 2016); Bank of Lithuania (2016).

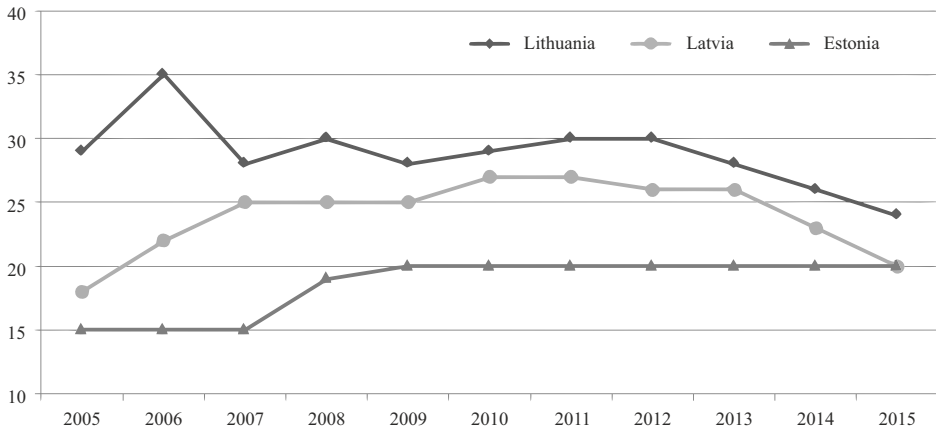


Fig. 2. Number of second pillar pension funds in Lithuania, Latvia and Estonia from inception until 2015

Source: authors' calculations according to data of Estonian Pension Portal (Pensionikeskus 2016); Latvian Pension Portal (Manapensija 2016); Bank of Lithuania (2016).

Reduction of contributions into second pillar has not entirely discouraged activity of second pillar, especially when taking into account that after crisis scale of financing of second pillar was at least partially restored. In Lithuania, in 2014 diversification of second pillar financing was increased because, since 2014, contribution of all new participants consists of three sources: social insurance, state budget and a part of a participant's salary.

From perspective of Baltic States, similar possibilities to offer different pension funds with various investment strategies are available in all three Baltic States: Lithuania, Latvia, and Estonia. Nevertheless, some differences in offered second pillar pension fund investment strategies and options available for pension fund participants can be identified. Firstly, in Lithuania, pension accumulation companies provide widest scope of pension plans (investment strategies) compared with Latvia and Estonia. Lithuanian pension accumulation companies can offer a pension plan with up to 100 per cent of assets invested in equities. In Estonia and Latvia, limits of invest into equities asset class are lower. An Estonian pension fund can invest up to 75 per cent of total assets of fund in equities. In Latvia, limit is even lower: no more than 50 per cent of total assets can be invested in equities. Secondly, process of changing pension service provider is most limited (complicated) in Lithuania. If a pension fund participant wants to change pension accumulation company in Lithuania, he/she needs not only to conclude a contract (open a pension account) with new service provider, but also to terminate contract (close a pension account) with current provider. In Latvia and Estonia, in order to change service provider, persons need just to conclude a contract (open a pension account) with a new service provider.

Second pillar pension funds in Lithuania are divided into four groups according to their investment strategy. This division should allow the monitoring, evaluation, and compari-

son of the investment results of second pillar pension funds with a similar investment risk. Most of the second pillar pension funds are “mixed”: assets of second pillar pension funds are invested into high investment risk asset classes (e.g., equities) and into less risky asset classes (e.g., government bonds). The differentiation of investments into high investment risk asset classes (equities) is the simplest way for classifying pension funds into different groups. According to the data of the Bank of Lithuania (2016), second pillar pension funds are divided into following four groups depending on share of investments into equities:

- conservative pension funds (assets under management (hereinafter, AUM) are not invested into equities);
- pension funds investing a small part into equities (up to 30 per cent of AUM are invested into equities);
- pension funds investing a medium part into equities (up to 70 per cent of AUM are invested into equities);
- pure equity pension funds (up to 100 per cent of AUM are invested into equities).

In Latvia, second pillar pension funds, depending on the share of investments into equities, are divided into following 3 groups (Manapensija 2016):

- conservative pension funds (AUM are not invested into equities);
- balanced pension funds (up to 25 per cent of AUM are invested into equities);
- active pension funds (up to 50 per cent of AUM are invested into equities).

In Estonia, second pillar pension funds, depending on the share of investments into equities, are divided into the following 4 groups (Pensionikeskus 2016):

- conservative pension funds (AUM are not invested into equities);
- balanced pension funds (up to 25 per cent of AUM are invested into equities);
- progressive pension funds (up to 50 per cent of AUM are invested into equities);
- aggressive pension funds (up to 75 per cent of AUM are invested into equities).

Differentiation of second pillar pension funds according to investment risk level is presented in Tables 1–3.

Despite the fact that classification of second pillar pension funds into categories (names, number of categories) is similar in all countries, the investment risk of the categories differs in each country.

Table 1. Breakdown of second pillar pension funds according to investment risk in Lithuania

Pension fund group	Investment risk	No of pension funds	No of companies, offering at least 1 pension fund in a group
Conservative	Very low	7	6
Small part into equities	Low	4	4
Medium part into equities	Medium / High	8	6
Pure equity	High / Very high	5	4
Total:		24	–

Source: authors' calculation according to data of Bank of Lithuania (2016).

Table 2. Breakdown of second pillar pension funds according to investment risk in Latvia

Pension fund group	Investment risk	No of pension funds	No of companies, offering at least 1 pension fund in a group
Conservative	Very low	8	7
Balanced	Low	4	4
Active	Medium	8	7
Total:		20	–

Source: authors' calculation according to the data of Latvian Pension Portal Manapensija (2016).

Table 3. Breakdown of second pillar pension funds according to investment risk in Estonia

Pension fund group	Investment risk	No of pension funds	No of companies, offering at least 1 pension fund in a group
Conservative	Very low	6	5
Balanced	Low	5	5
Progressive	Medium	5	5
Aggressive	Medium / High	4	4
Total:		20	–

Source: authors' calculation according to the data of Estonian Pension Portal (Pensionikeskus 2016).

Table 4. Breakdown of supply of second pillar accumulation companies in Lithuania

No of pension funds offered by pension accumulation company	No of pension accumulation companies
1–3	4
4–5	1
More than 5	1

Source: authors' calculation according to the data of Bank of Lithuania (2016).

Table 5. Breakdown of supply of second pillar accumulation companies in Latvia

No of pension funds offered by pension accumulation company	No of pension accumulation companies
1–3	6
4–5	1
More than 5	–

Source: authors' calculation according to the data of Latvian Pension Portal (Manapensija 2016).

Table 6. Breakdown of supply of second pillar accumulation companies in Estonia

No of pension funds offered by pension accumulation company	No of pension accumulation companies
1–3	1
4–5	3
More than 5	1

Source: authors' calculation according to the data of Estonian Pension Portal (2016).

Although in each Baltic country participants have possibility to choose from more than 20 pension funds, from the perspective of investment structure and risk in the same accumulation company, it might be limited and complicated for a participant to select an appropriate investment strategy (and investment risk) during the entire accumulation period. As can be seen from Tables 4–6 respectively, in Lithuania, 4 out of 6 pension accumulation companies offer only up to three pension funds each with different investment strategies (investment risk). In Latvia, almost all market players (6 out of 7) offer up to three pension funds with different investment strategies (investment risk). More diversified offering is observed in Estonia, where only 1 of 6 pension accumulation companies offers only up to three pension funds with different investment strategies (investment risk). Considering the fact that every market player must offer one conservative pension fund in all Baltic countries, it is evident that these pension accumulation companies are offering only two pension funds that are invested into financial asset classes with a higher investment risk (e.g., equities). Therefore, it can be concluded, that most of pension accumulation companies are offering a low choice of investment strategies for participants. Due to small number of offered second pillar pension funds, it might be difficult for participants to choose pension funds (investment risk) according to their investment risk tolerance level in same service provider during entire accumulation period, which might be as long as 40–45 years.

In recent years few research about pension funds' participants' choices were conducted. Lippi (2016) has analysed behaviour of occupational pension funds' participants in Italy. Results show, that hat majority of enrolled workers opt for median investment line. On the other hand, Van Binsbergen *et al.* (2014) argue, that complexity and choice-overload might therefore render participants unable and perhaps even unwilling to actively choose. Authors distinguished three types of decisions: savings decision, investment decision, and risk-sharing decision.

Moreover, possibilities gradually to reduce investment risk as retirement age approaches are very limited in all three countries. Moreover, it might be observed that due to legal requirements possibilities to choose a pension fund with higher investment risks are more limited in Estonia than in Lithuania, and are limited most in Latvia. However, only observation that number of funds with different risk profiles managed by each provider seems to be quite low is not sufficient to make conclusion that supply of second pillar pension funds is actually too low in Baltics. Therefore, it is important to analyze historical results of different funds achieved during the last 10–12 years and to compare them across different fund categories in an effort to estimate whether the aforementioned classes of funds are indeed different in terms of risk and reward taken by pension system participants.

2. Testing hypothesis concerning returns of pension funds

There are some papers (Jurevičienė, Samoškaitė 2012) that estimate and compare traditional risk-adjusted performance measures (e.g. Sharpe ratio) for pension funds in Lithuania. However, based on our knowledge, this paper is first attempt in research literature to test statistical significance of differences of mean returns of pension funds in Baltics.

Recent years different aspects of mutual funds' performance, diversification and asset management style were analysed by scientists. Results of Bams *et al.* (2017) research show, that about 14% of analysed US equity funds individual funds are significantly misclassified. Blake *et al.* (2017) find, that pension funds rebalance their portfolios in a way that is consistent with meeting their mandate restrictions on asset weights in short term, and with maintaining a long-term strategic asset allocation that matches maturity of their liabilities. It also refers, that pension funds herd strongly both in asset classes and in clearly defined subgroups. Bekaert *et al.* (2017) analysed diversification from local and international investments perspective in 401(k) plans in US. One of the findings, that improving the quality of the international investment options offered by 401(k) plans, in terms of number of funds available and their fees, generates more investment in international equity. Brown and Davies (2017) study showed, that passively managed products become more attractive to investors, active managers' revenues from portfolio-management services fall, reducing their effort incentives. More-severe decreasing-returns-to-scale are also associated with reduced incentives and increased moral hazard. Performance-based fees and holdings-based data are all unlikely to mitigate moral hazard.

Hypothesis testing, which is performed below, can help to answer an important and popular question about returns of second pillar pension funds in Lithuania: are the average annual returns, achieved by different pension fund categories during the last 10 years, statistically different, taking into account their variability during different periods?

Methodology

We employ *t*-test for hypothesis about difference between two means. We use this technique to examine whether an observed difference of means between two funds (or groups of funds) is due to a chance or different underlying values for mean. This test was used in a similar way to compare mean investment returns of pension plans with a different share of investments in alternatives (Robertson, Wielezynski 2008). Hypothesis (1) we formulate is as follows:

$$\begin{aligned} H_0 : \mu_1 &= \mu_2; \\ H_a : \mu_1 &\neq \mu_2, \end{aligned} \tag{1}$$

where μ_1 stands for "true" underlying mean annual return of a particular pension fund or a group of funds, while μ_2 stands for same for second pension fund or a group of funds. In null we state that underlying mean returns of two funds are equal, taking into account their variability. *T*-test procedure depends on assumption about population variance – it must be assumed that "true" population variances are 1) equal or 2) unequal. In our case, it means that we would assume in advance that risk (volatility of returns) is identical (or unequal) for two funds or two groups of funds. Since we do not have a reason to believe that any two funds or categories have same "true" risk level, as a part of experimental planning, in our analysis we suppose that population variances are unequal. Moreover, this assumption is supported by results of a diagnostic check using *F*-statistic, testing equality of variances (see Tables 9, 12 and 15); only in the case of

the Estonian progressive and aggressive fund groups the assumption of equal variances is not rejected at 1 per cent significance level.

The t statistic (2) is calculated as follows:

$$t = \frac{(\bar{R}_1 - \bar{R}_2) - (\mu_1 - \mu_2)}{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_1}\right)^{\frac{1}{2}}}, \quad (2)$$

where $\bar{R}_i, i=1, 2$, is sample mean of annual returns for i -th fund (or i -th group of funds), n_i is number of elements in time series of sample returns for i -th fund, s_i is standard deviation of sample returns

Decision about stated hypothesis is based on value of statistic t . If $|t| > t_{\alpha/2}$, then H_0 is rejected with significance level α (we use $\alpha = 0.01$ and $\alpha = 0.05$). Here $t_{\alpha/2}$ is critical value taken from of t -distribution with df degrees of freedom (3), which is calculated using this formula:

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{(s_1^2/n_1)^2}{n_1} + \frac{(s_2^2/n_2)^2}{n_2}}. \quad (3)$$

Rolling 12-month returns are used in calculations.

As regards to limitations in data or sample analysis, few points could be mentioned. For pension fund returns we used rolling 12-month percentage change in net asset value of each fund; therefore, it doesn't reflect net return for fund participants, because, for example, in Lithuania, not only asset management fee but also contribution fee is applied (latter is deducted from contribution before it reaches pension fund assets; it will disappear in 2017 and was equal to 0.5% in 2016). However, we believe, that this does not significantly influence final results of testing procedure, as same calculation principle is used for all funds and across all periods. Furthermore, pension funds are long-term products and 10–12 years' period is relatively short compared with whole accumulation cycle of 30–45 years.

3. Results

3.1. Case of Lithuanian funds

We included in our analysis only those funds which were introduced in 2004–2007 period and were still managed in middle of 2015. Major part of return series consists of 121 observations from middle 2004 till middle 2015 period, as 17 funds have been managed since 2004.

Firstly, we tested hypothesis about differences in mean returns across 4 fund categories – 1) conservative funds, 2) those whose portfolio can be invested in equities up to 30 per cent, 3) up to 70 per cent and 4) up to 100 per cent. For this, we need to have a time series of rolling 12-month returns for each category. These were constructed as a

simple average of 12-month returns of all funds belonging to that category. Corresponding return series are given in Figure 3 and summary of mean returns and their standard deviations is presented in Table 7.

Results given in Table 8 below indicate that hypothesis about equality of mean returns is rejected at 1 per cent significance level only in cases where conservative category is compared with others, i.e. differences between mean returns achieved in conservative funds category and other riskier categories are statistically significant. Hypotheses about equality of mean returns between all riskier categories cannot be rejected at 1 per cent and 5 per cent significance levels. This conclusion suggests that, in terms of average results achieved during last 10–12 years, pension funds in Lithuania could be differentiated only into two groups – conservative and all other funds.

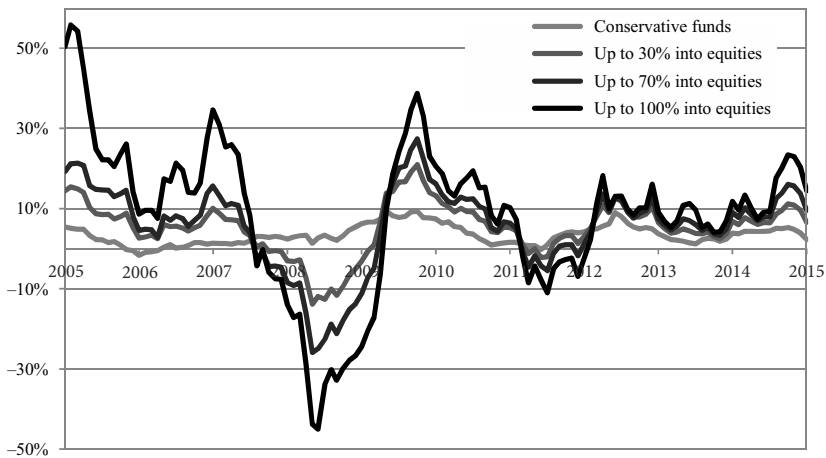


Fig. 3. 12-month rolling returns of pension funds categories

Table 7. Mean returns and standard deviations used in hypothesis testing

Fund category	Mean 12-month return, perc.	Standard deviation, perc.	Return achieved per one unit of risk, perc.	Number of funds in category
conservative	3.42	2.44	1.40	7
up to 30% equities	5.32	6.47	0.82	4
up to 70% equities	5.82	10.38	0.56	8
up to 100% equities	8.63	18.51	0.47	5

Table 8. Results of hypothesis testing across 4 fund categories

H_0 :	$\mu_{cons} = \mu_{30\%}$	$\mu_{30\%} = \mu_{70\%}$	$\mu_{70\%} = \mu_{100\%}$	$\mu_{30\%} = \mu_{100\%}$	$\mu_{cons} = \mu_{100\%}$	$\mu_{cons} = \mu_{70\%}$
<i>t</i> statistic	-3.01**	-0.45	-1.45	1.86	-3.07**	-2.47*
p-value	0.003	0.65	0.147	0.065	0.002	0.014

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

Table 9. Results of variance hypothesis testing across 4 fund categories

H_0 :	$\mu_{\text{cons}} = \mu_{30\%}$	$\mu_{30\%} = \mu_{70\%}$	$\mu_{70\%} = \mu_{100\%}$	$\mu_{30\%} = \mu_{100\%}$	$\mu_{\text{cons}} = \mu_{100\%}$	$\mu_{\text{cons}} = \mu_{70\%}$
F statistic	7.03**	2.58**	3.18**	8.20**	57.6**	18.12**
p-value	0.00	0.00	0.00	0.00	0.00	0.00

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

It is important to correctly interpret above-mentioned results in Table 8. It is usually thought that mean returns (together with their risk characteristics) of Lithuanian pension funds (such as those given in Table 7 above) are in line with core idea of financial markets theory, i.e. that higher returns are achieved with higher levels of risk. However, it is important to assess whether those apparently different mean returns achieved by different fund categories can be proved to be statistically different, taking into account variability of returns in different time periods. For example, mean 12-month return (5.82 per cent) achieved during last 10 years by a category of funds that invest up to 70 per cent in equities, is lower than corresponding return (8.63 per cent) achieved by those funds, who can be invested in equities up to 100 per cent. One possible interpretation why hypothesis that “true” mean returns of these two fund categories are equal was not rejected could be as follows: difference between historically achieved mean returns is too low compared with difference in volatility of returns of these two groups, as for the first category a return of 5.82 per cent was achieved with 10.82 per cent of risk (measured as the standard deviation of returns), while in the second category a return of 8.63 per cent is associated with 18.51 per cent of risk. It is expected that the increase in risk by almost 8 percentage points would be rewarded with a higher than 8.63 per cent return. It should be noted that in this case, for example, if the mean return of the riskiest fund category would be equal to 11 per cent (with risk remaining the same), the hypothesis about the equality of mean returns would be rejected. It is also worth noting, that the mean return achieved per one unit of risk is the lowest for the riskiest fund category.

We present results of hypothesis testing for all 24 funds in Lithuania in Annex. Each cell in matrix provides value of t-statistic for corresponding pair of funds. marked cells conform to situation where hypothesis about equality of mean returns is rejected. There are at least three interesting conclusions. Firstly, let us look at rectangular areas of diagonal in matrix. It can be seen that, except for conservative category, there are very few cells inside each group where hypothesis is rejected. This means that funds belonging to same category are very similar in terms of their achieved average return (taking into account variability of returns). In other words, there are no statistically significant leaders inside different risk groups. Secondly, inside the conservative category, in most cases hypothesis is rejected. It can thus be concluded that this category is quite diverse in terms of results of its members. Thirdly, let us compare funds across different categories. The most rejection cells are found when fund from conservative category is compared with fund from other categories. This conclusion is in line with one found previously in Table 8, when hypothesis was tested for mean returns of different categories.

3.2. Case of Latvian funds

As it was mentioned above, compared with Lithuanian system, where pension funds are traditionally differentiated into 4 groups, in Latvia pension funds are divided into three types: conservative (money is invested in bonds, bills, etc.), balanced (up to 25 per cent in equities) and active (up to 50 per cent in equities). Since these categories are not directly comparable with those in Lithuania (and in Estonia as well), we only test hypotheses about mean returns and variances for funds in a particular country and not across all Baltic states.

Table 10 below presents average 12-month returns and standard deviations of three aforementioned Latvian pension fund groups. We included 18 funds into our calculations: those introduced in 2003–2005 and still managed in 2016. It can be noted from Table that average returns are very similar in their size for all three types of funds. Standard deviations differ more, but all are, for example, lower than those of Lithuanian pension funds belonging to group with up to 30 per cent in equities.

Testing procedure is the same as described above for Lithuanian pension funds. Results in Table 11 show that hypothesis about equality of mean returns is not rejected for all three cases, i.e. we conclude that there are no statistically significant differences between average returns even in case of conservative and active pension funds.

On the other hand, Table 12 indicates that variances are statistically different across all three groups. Again, we conclude that even if in terms of risk (standard deviation) pension funds seem to be reasonably divided in different groups; however, their achieved returns are not significantly different.

Table 10. Mean returns and standard deviations used in hypothesis testing

Fund category	Mean 12-month return, perc.	Standard deviation, perc.	Return achieved per one unit of risk, perc.	Number of funds in category
Conservative	3.90	2.66	1.46	7
Balanced	3.62	3.43	1.06	4
Active	3.91	4.49	0.87	7

Table 11. Results of hypothesis testing across 3 fund categories (Latvian case)

H_0 :	$\mu_{\text{cons}} = \mu_{\text{balanced}}$	$\mu_{\text{balanced}} = \mu_{\text{active}}$	$\mu_{\text{active}} = \mu_{\text{conservative}}$
<i>t</i> statistic	0.76	-0.60	0.01
p-value	0.44	0.55	0.99

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

Table 12. Results of variance hypothesis testing across 3 fund categories

H_0 :	$\mu_{\text{cons}} = \mu_{\text{balanced}}$	$\mu_{\text{balanced}} = \mu_{\text{active}}$	$\mu_{\text{active}} = \mu_{\text{conservative}}$
<i>F</i> statistic	1.65**	1.72**	2.84**
p-value	0.00	0.00	0.00

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

Testing corresponding hypotheses for individual funds (as in Annex for Lithuanian case) showed that hypothesis about equality of mean returns was rejected only in about 13 per cent of all combinations of pairs of individual funds, with a relatively higher share in case when conservative and active funds are compared.

3.3. Case of Estonian funds

As mentioned, second pillar pension funds are divided into 4 categories in Estonia: conservative (0 per cent equities), balanced (up to 25 per cent equities), progressive (up to 50 per cent equities) and aggressive (up to 75 per cent equities). As can be seen from Table 13, the diversity of fund groups in terms of risk (standard deviation) in Estonia is higher than in Latvia, and is more similar to the Lithuanian case. In Estonia, as well as in Latvia and Lithuania, the average return achieved per one unit of risk decreases with higher risk.

In our calculations we included 13 funds. Testing procedure is the same as for Latvia and Lithuania. Results in Table 14 below indicate that hypothesis about equal mean returns is rejected at 1% significance level only when comparing conservative and aggressive funds – the situation is similar to what we get for Lithuanian funds.

Hypothesis about equal variances is not rejected only when comparing progressive and aggressive groups.

Table 13. Mean returns and standard deviations used in hypothesis testing

Fund category	Mean 12-month return, perc.	Standard deviation, perc.	Return achieved per one unit of risk, perc.	Number of funds in category
Conservative	3.64	3.43	1.06	5
Balanced	4.29	5.95	0.72	3
Progressive	5.63	9.94	0.57	4
Aggressive	6.89	11.16	0.62	1

Table 14. Results of hypothesis testing across 4 fund categories

H_0 :	$\mu_{cons} = \mu_{bal}$	$\mu_{bal} = \mu_{prog}$	$\mu_{prog} = \mu_{aggr}$	$\mu_{aggr} = \mu_{bal}$	$\mu_{aggr} = \mu_{cons}$	$\mu_{prog} = \mu_{cons}$
t statistic	-1.08	-1.34	-0.97	2.37*	3.2**	2.18*
p-value	0.28	0.18	0.33	0.02	0.02	0.03

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

Table 15. Results of variance hypothesis testing across 4 fund categories (Estonian case)

H_0 :	$\mu_{cons} = \mu_{bal}$	$\mu_{bal} = \mu_{prog}$	$\mu_{prog} = \mu_{aggr}$	$\mu_{aggr} = \mu_{bal}$	$\mu_{aggr} = \mu_{cons}$	$\mu_{prog} = \mu_{cons}$
t statistic	3.02**	2.79**	1.26	3.51**	10.59**	8.41**
p-value	0.00	0.00	0.09	0.00	0.00	0.00

Note: ** hypothesis is rejected at 1% significance level, * hypothesis is rejected at 5% significance level.

It also should be noted that, for Estonian funds, share of individual pairs for which hypothesis about equal mean returns is rejected is the highest among all three countries (more than 25 per cent). It means that diversity of funds in terms of their mean returns in Estonia is relatively higher than in Latvia and Lithuania.

To summarize results for all three countries, testing procedure indicated that null hypothesis about equality of mean returns cannot be rejected at all in Latvia, and is rejected only when comparing conservative category with riskier funds in Lithuania and in Estonia, i.e. there tend to be no statistically significant differences between returns achieved by riskier pension fund groups. We think that one of main reasons behind this could be fact that in all three Baltic States pension funds are categorized only by maximum limit of investments into equities. This could lead to an overlap (in terms of actual investment portfolio compositions) between funds belonging to different categories. For example, even if one fund declares the maximum limit in equities of 50 per cent, another – 70 per cent (and funds belong to different groups), actual investments (and results) of these two funds can be very similar.

Conclusions

Although comparative analysis of second pillar pension funds offered in Baltics showed that quite a large number of second pillar pension funds is offered in each market, possibilities to select various investment strategies (investment risk levels) are limited, due to legislation and number of pension funds offered in specific risk categories, e.g. it is possible to select only 4 funds in category “Small part into equities” (Lithuania), “Balanced” (Latvia) and “Aggressive” (Estonia). It is important that some market players are offering a very limited scope of pension funds with different investment strategies, e.g. majority of pension accumulation companies are offering only up to 3 pension funds with different investment strategies in Lithuania and Latvia. Due to this, possibilities are quite low to select pension funds during long-term accumulation period (that lasts up to 45 years) based on principle of so-called life-cycle strategy in same pension accumulation company. This study provided evidence that, second pillar pension market has been concentrating during last decade in all Baltic countries. Global financial crisis and unstable political decisions and changes of second pillar pension parameters like contribution levels have stimulated concentration in market. Present study demonstrates that it is caused pension fund participants to lower possibility for selecting pension funds with different investment strategy and risk due whole accumulation period (30 years and longer).

In order to verify possible conclusion about low supply side of second pillar pension funds in Baltics, statistical analysis was performed in this paper to test hypothesis about equality of average returns achieved by different pension fund groups in three Baltic countries during last 10–12 years. Although in many cases variances of returns of separate pension fund categories are statistically different, situation is not same regarding their returns. Testing results indicate that null hypothesis about equality of mean returns cannot be rejected at all (Latvia) or is rejected only when comparing conservative category with riskier funds (Lithuania and Estonia), i.e. there tend to be no statistically sig-

nificant differences between returns achieved by riskier pension fund groups. A similar conclusion is drawn from comparison of returns among individual funds – depending on which country is analysed, share of individual pairs of funds, for which hypothesis about equal mean returns is rejected, varies between around 13 and 25 percent. Diversity of funds in terms of their mean returns in Estonia seems to be relatively higher than in Latvia and Lithuania. These findings from statistical analysis provided evidence that that traditional classification of pension funds is not necessarily meaningful, i.e. even if two funds belong to different categories by their risk, this does not necessarily mean that their investment strategies and actual returns will differ significantly. This raises a natural question about possible need for stricter rules in terms of pension fund investment strategies and their linkage to fund a participant's age in order to increase compatibility between supply side of pension funds and needs of pension system participants over their entire life-cycle.

Additionally, research results provide important insights for public policy, with possibility of including these preferences in regulations, with aim of benefiting pension fund participants in a long term perspective. Overall, the findings have important implications for pension accumulation companies, responsible for selecting and implanting investment strategies in pension funds, and participants, who selecting pension funds available in market. It also creates background for further researches on pension funds' investment strategies and risk management by offering a deeper understanding of pension funds' offering, investment strategies and risk management in Baltics.

However, there are several limitations in the research. Firstly, second pension pillar market is highly concentrated in the Baltics. Thus changes in offering in one of service provider might significantly influence results of research. Secondly, the principles of pension fund grouping are different due to legal requirements in the countries. Thus the comparison of the countries might not fully reflect all the differences appearing due grouping. Thirdly, pension funds are long-term products, thus 10–12 years' period is relatively short compared with whole accumulation cycle of 30–45 years.

The future research second pillar pension market in Baltic countries should be compared with the same markets in larger Central European countries in order to make more comprehensive comparison of factors, which are influencing second pillar pension market offering and concentration. Additionally, similar research should be repeated after several years, when pension funds' performance will continue for 20 years or longer.

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