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Behavioural Finance Efficiency under the Influence of Country's Economic Cycle

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Today's practice and society habits declare the importance of personal finance management. The latest research confirms the necessity of investment timing strategies based on generated returns which keeps savings work more efficient. Earlier studies involved country's economical cycle and well timed investment decisions according to cycle period. But the main constraint was defined - the decision to purchase a security can be difficult since there are many attributes to consider and can include the necessary examination of these attributes, it also can be thought of as a multi-criteria decision-making problem. The purpose of this article is to demonstrate a created personal investment decisions model, which allows private investor to make effective investment decisions during different countries economical cycle periods. Research methods used are based on systematic literature analysis, mathematical statistics methods, logical comparative and generalization analysis.

After the systemized literature studies, a model of evaluating efficiency of private investor's decisions was created and it consists of five stages: (1) investor behaviour analysis (survey), (2) the determination of the economic cycle stages (Hodrick-Prescott filter method), (3) private investor's behavioural performance assessment, (4) investment instruments selection (Data Envelopment Analysis Method - multi-criteria decision-making technique) and allocation of savings analysis, (5) the investor's behaviour in performance assessment. This model allows evaluating of efficiency of private investor's investment decisions during different country's economic cycle phases.

Created model application is performed during different stages of Lithuania's economic cycle. Also there is a summary of adaptive model results, where financial return of investment was compared to effectiveness of average statistical Lithuanian's residents financial decisions (18 investment portfolios are summarized). It was found that created model could be relatively simply adapted to practice and also could empower private investor to make effective personal finance decisions on the influence of country's economic cycle. It should be noted, that studies show the amount of average Lithuanian's revenue loss on the impact of inefficient personal finance management decisions.

Keywords: *Countries economical cycle, Hodrick-Prescott filter, investment strategies, investment timing, data envelopment analysis.*

Introduction

According to Adamauskas and Krusinskas (2012), economic cycle research is one of the most popular topics of scientific literature discussions over the last years encompassing global economy long-term grow and recession starting from 2007. Such cycles can also be observed in personal finance management – unsustainable and inefficient savings management can be noticed in the conservative countries. However, the interaction between private investors behaviour and countries economical cycle is not fully revealed and explored. This interdisciplinary approach combines several studies like macroeconomics, investment timing, investment strategies, asset allocation, statistical investor attitude to risk, profits, etc. Moreover, it is difficult to understand and measure how much statistical resident could earn taking into account effective and efficient investment solutions.

Statistics and social surveys results showed that a lot of people have accumulated savings and this phenomenon approves the fact of importance of personal finance management. The mentality of Lithuanians and mistrust of banking system and/or individual its' participants influenced keeping and saving money in cash. Recent studies showed that the amount of savers prefers bank deposits for saving, but sometimes it is not enough, because of inflation rate. The main problem of this article defined – how could private investor choose investment instruments during different countries economical cycle.

The research aims to define how much average Lithuanian resident lost additional income during effective periods of countries economical cycle defined due to inadequate personal finance decisions. The article presents decisions' efficiency measurement model, which evaluates behaviour of private investor during different countries economical stages. The model consist of 5 stages: (1) investor behaviour analysis (survey), (2) the determination of the economic cycle stages (Hodrick-Prescott filter

method), (3) private investor's behavioural performance assessment, (4) investment instruments selection (Data Envelopment Analysis Method - multi-criteria decision-making technique) and allocation of savings analysis, (5) the investor's behaviour in performance assessment. It was noticed, that this model could be simply adapted into practice and empower private investor to take efficient personal finance management solutions.

1. Investors approach and the relevance of personal finance management

It is obvious, that the aim of personal finance management is to ensure necessary financial resources at all times – now and in the short and long terms. Although there are a lot of educational literature of personal finance management solutions and lessons, not everybody wants or try to get acquainted. The statistics showed that the propensity to save exists and quite a lot of people keeps their money in the "socks", when question arises – why do people consciously understanding that they don't have enough knowledge to make efficient decisions do not consult with specialists and keep their money in "jar". Maybe the main reason is that people in the conservative countries, such as Lithuania, do not trust banking system or a part of it. On the other hand, if private investor takes into account some investment decisions, do he really understand the quality of it or which multi criteria decision manage him to do it.

Considering facts mentioned before, investors are facing several problems: the fact of investment, the goals, structure and diversification of portfolio, the time to purchase, it's duration, investment subject selection, costs, asset allocation and etc. According to the objective of this paper, the novelty of the research is private investor behaviour analysis under the influence of country's economical cycle using Data Envelopment Analysis (hereinafter, DEA) methodology to form hypothetic portfolios.

2. Country's economical cycle and investment timing strategies

According to problematic of this article and model structure mentioned before, theoretical issues must be analysed. After the analysis of main investment management solutions and its efficiency under the influence of country's economical cycle, Adamauskas and Krusinskas (2012) argues, that many mathematical tools can be used to identify country's economical cycle periods, however, after the overlook of science literature Hodrick-Prescott filter was selected, which helps to get "gentle" non-linear graphical sequence in the analysis of sensibility of periodical fluctuations in short and long terms. French (2001) argues that the sensibility of trend is obtained under the modification of multiplayer λ (the frequency of period) in short term. Hodrick and Prescott recommend to use λ=1600 value in analysis of quarterly steps of fluctuations.

According to Koopman (2003) and French (2001), the main idea of methodology of Hodrick-Prescott is the decomposition of time series. Let say y_t (when t=1,2,..., T) shows logarithms of time series. When the series y_t are made from trend components which are denoted by τ and components of cycle denoted by c, this way $y_t = \tau_t + c_t$. Considering relevant and positive values of λ, there is a component of trend which minimizes:

$$\min \sum_{t=1}^{T} (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \qquad (1)$$

The first term of the equation is the sum of the squared deviations $d_t = y_t - \tau_t$ which penalizes the cyclical component. According to Ahumada and Garegnani (1999), the second term is a multiple λ of the sum of the squares of the trend component's second differences. This second term penalizes variations in the growth rate of the trend component. The larger the value of λ, the higher is the penalty.

After Adamauskas and Krusinskas (2012) research of financial investment timing strategies analysis, equity shares and funds were assigned for expansion period; meanwhile commodities, bonds and deposits in the banks were assigned for contraction period. It must be mentioned, that risks of each instrument are estimated for those strategies. Also the authors argue, that these investment instruments must be most efficient according to country's economical cycle and asset allocation must be done to keep portfolio sustainable and profitable. Combining these theoretical issues the determination of the country's economical cycle could be done and effective performance could be adapted. These steps are the parts of final private investors' behaviour evaluation model (parts 2 and 3 of the final model). However the authors described some constrains: the decision to purchase security can be difficult since there are many attributes to consider and can include the necessary examination of several attributes, it can be thought of as a multi-criteria decision-making problem. To solve this problem Data Envelopment Analysis was selected as a multi-criteria decision-making technique for investment instruments selection and allocation of savings analysis (part 4 of the final model).

3. The main issues of Data Envelopment Analysis

According to Singh and Bharadwaj (2010), a portfolio is an appropriate mix or collection of investments held by institution or private individuals. The portfolio optimization problem is a well-known difficult problem occurring in financial real world. The problem consists of choosing an optimal set of assets in order to minimize the risk and maximize the profit of the investment. The investor's objective is to get the maximum possible return on an investment with the minimum possible risk. This objective is achieved through asset diversification, i.e. creating a portfolio by investing funds in a wide range of stocks. However, since there is a large number of stocks to invest in, this objective leads to two investment problems:

(1) selecting stocks to be included in the portfolio (asset selection);

(2) appropriately proportioning the total money to be invested in the selected stocks for best return from the portfolio (asset allocation).

Singh and Bharadwaj (2010) argue that the well-known theory of portfolio selection by Harry Markowitz provides a conceptual framework for the optimal portfolio

selection. Markowitz selected a quantitative framework for the selection of a portfolio. This framework assumes that the assets follow a multivariate normal distribution. This means that the return on a portfolio can be completely described based on return and risk. For a particular universe of assets, the set of portfolios of assets that offer the minimum risk for a given level of return forms the efficient frontier. The portfolios on the efficient frontier can be found by quadratic programming (QP). Also authors noticed two weakness of such approach:

- The underlying assumption of multivariate normality is not sustainable (statistically this is known as leptokurtosis);
- Integer constraints that limit a portfolio to a specified number of assets, or to impose limits on the proportion of the portfolio held in a given asset, cannot easily be applied.

As Singh and Bharadwaj (2010) noticed, Markowitz' theory suggests that for an investor to assess the worth of a stock, he can look into the risk-return profile of the stock and select accordingly. However, due to the combinatorial explosive nature of portfolio optimization problem, it is not practical to evaluate all combination of asset selection and allocation.

In this article we used Data Envelopment Analysis mathematical tool to create optimal and effective portfolios. According to Powers and McMullen (2000), Lin and Chen (2006), DEA is a multi-criteria decision-making technique that can select the "most favourable," or desirable alternatives from a large set when it is necessary to consider several attributes, given, of course, the utility function of the decision-maker. According to science literature, there are a lot of investment instrument selection methods, however, DEA was selected for some kind of reasons:

- There is a possibility to evaluate a huge amount of instruments (unlimited Decision Making Units (DMU's) amount);
- There is a possibility to evaluate different types of actives (stocks, investment funds, etc.) and event different types of funds;
- The Return of investment instruments, which were selected by DEA, has better performance compeering with Benchmark indexes of Markets;
- Methodology empowers to evaluate *n* variables and systemize them into one effectiveness index (DMU);
- Methodology involves traditional risk indexes/ratios;
- Relatively simple applicability and this means that this model could be simply adapted to practical usage.

DEA also helps to minimize the complexity of analysis by simultaneously evaluating the attributes of interest and presenting a single, composite score, referred to as efficiency. Efficiency, as used in this paper, describes the alternative(s) with a set of attributes that collectively dominate the others based on the simultaneous analysis of all alternatives and their attributes as described above. The efficiency value of an alternative is the objective function value of mathematical programming model. An alternative is deemed DEA-efficient if its costs (inputs) are offset by its benefits (outputs). Otherwise, an alternative is classified as DEA-inefficient.

The typical DEA model

According to Chen and Lin (2006), suppose we have a set of n decision making units, j = 1, ⋯, n. For each unit, there are *t* outputs, r = 1, …, t and *m* inputs, i = 1, …, m. Let y_{rj} (x_{rj}) be the r_{th} (i_{th}) known output (input) of unit j. Define

$$h = \frac{\sum_{r=1}^{t} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{2}$$

where $u_r \geq 0$, $v_i \geq 0$ are unknown variables. The DEA relative efficiency measure h_{j0} for a target decision-making unit j_0 can be determined by solving the following famous CCR model (Charnes et al. 1978)

$$\begin{aligned} &\max\ h_{j_0} = \frac{\sum_{r=1}^{t} u_r y_{rj_0}}{\sum_{i=1}^{m} v_i x_{ij_0}} \\ &s.t. = \frac{\sum_{r=1}^{t} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, j = 1,\ldots,n, \\ &\frac{u_r}{\sum_{i=1}^{m} v_i x_{ij_0}} \geq \varepsilon, r = 1,\ldots,t, \\ &\frac{v_i}{\sum_{i=1}^{m} v_i x_{ij_o}} \geq \varepsilon, i = 1,\ldots,m. \end{aligned} \tag{3}$$

where ε is a positive non-Archimedean infinitesimal, smaller than any positive real number, and is used to prevent the weights from being zero.

The above fractional programming problem can be transformed into equivalent linear program. Lin and Chen (2006) noticed that there are three main fund performance evolution ratios: Treynor, Sharpe and Jensen ratios. During the last two decades a lot of researches were done evaluating investment funds performance in two ways – risk and profitability using CAPM model (Capital Asset Pricing Model). The results mainly were depended on Bechmark portfolio, risk measurement methods and main CAPM issues. The variety of authors, like Stephens and Proffitt (1991), Sortino and Price (1994), Ferson and Schadt (1996), Schneeweis and Spurgin (1998), Chen (2006), made an upgrade to this model, however, these models can not evaluate risk correctly and ensure positive return. This is because almost all methods are based on regression models and interdependent relations expose all portfolios. Funari (2002) argues that DEA, unlike other methods, empower investor to include a lot of multiplayers, which effect fund performance. This author introduced Murthi (1997) created DEA methodology and after the upgrades of Basso and Funari (2001) named it DPEI. The main advantage of this technique is that no benchmark is required; DEA compares each fund together and, according to Lin (2006), methodology shows reasons of inefficiency, in other words, that we need to make this fund work better. According to Kogon (2008) and other authors mentioned before, DPEI methodology includes all the most know and standard ratios like Sharpe ratio, the reward-to-half-variance index, Treynor index, and Jensen index.

Specifically, the DPEI of the target fund j_0 is defined as the optimal value of the following DEA model

$$\begin{aligned} &\max DPEI_{j_o} = \frac{R_{j_0}}{\sum_{i=1}^{I} w_i c_{ij_0} + v\sigma_{j_0}} \\ &s.t. \frac{R_j}{\sum_{i=1}^{I} w_i c_{ij} + v\sigma_{j_0}} \le 1, j = 1,...,J, \\ &w_i \ge \varepsilon, v \ge \varepsilon. \end{aligned} \quad (4)$$

where J is the number of funds in the category, I is the number of different transaction costs, R_j is the return rate of the j_{th} fund, σ_j is the standard deviation of the return for the j_{th} fund, c_{ij} is the value of the i_{th} transaction cost for the j_{th} fund, ε is the same as that in problem (3), and weights w_i and ν are variables of the problem.

A second DEA indicator for the mutual fund performance is IDEA−1 index proposed by Basso and Funari (2001). This indicator differs from the DPEI in two aspects: included in it are only the investment costs which directly weigh on the investors, i.e., subscription and redemption fees; except for σ_j, other usual risk measures such as HV_j , β_j of the j_{th} fund are also taken into account in this index. According to the authors, this factor can be added to the outputs in the IDEA−1 index as well as fund return, which results in a two outputs DEA portfolio performance measure IDEA−2. IDEA−2 is defined as the optimal value of the following problem:

$$\begin{aligned} &\max I_{j_o}, DEA-2 = \frac{u_1 R_{j_0} + u_2 d_{j_0}}{\sum_{i=1}^{h} v_{j_0} q_{ij_0} + \sum_{i=1}^{I} w_i c_{ij_0}} \\ &s.t. \frac{u_1 R_j + u_2 d_j}{\sum_{i=1}^{h} v_i q_{ij} + \sum_{i=1}^{I} w_i c_{ij}} \le 1, j = 1,...,J, \\ &u_r \ge \varepsilon, v_i \ge \varepsilon, \\ &w_i \ge \varepsilon, \\ &r = 1,2, \\ &i = 1,...,h, \\ &i = 1,...,I. \end{aligned} \quad (5)$$

where $q_{1j},\cdots,q_{hj}$ are h different risk measures considered for the j_{th} fund, d_j is the stochastic dominance indicator for the j_{th} fund, which can be determined by using approaches in Basso and Funari (2001, 2002).

Other parameters and variables have the similar meanings as those in the model (4). Furthermore, by augmenting the outputs in the model (5), it is needed to include a few traditional performance indexes. After the analysis of science literature, the main DPEI multiplayers were selected to evaluate investment funds (see Table 1). Talking about stocks, it was defined, that DEA empower to create perfect opportunities to form profitable portfolio. Moreover, Wilcoson symbolic tag test and T-test analysis approved those portfolios, which are created using DEA are more efficient than average market statistics in other words – benchmarks. As was mentioned before, Sharpe ratio is involved into analysis. Authors Charnes, Cooper, Lewin and Seiford (1994) were working with banking sectors' analysis and purpose to use those variables (see Table 1).

Table 1

Variables and their classification for DEA method

DEA for stocks evaluation		**DEA for funds evaluation**	
Variable	*Classification*	*Variable*	*Classification*
1 Year Return	Output	Expected Return or the Expected Excess Return	Output
3 Year Return	Output	Standard deviation	Input
5 Year Return	Output	Beta Ratio	Input
10 Year return	Output	Subscription and redemption fees	Input
EPS	Output		
P/E Ratio	Input		
Beta	Input		
Sigma	Input		

In this context output variables are beneficiaries of each stock position; meanwhile input variables are "price", which has to be paid (including risk). However, all these variables are different and expressed in several extensions. According to Herrero (2002), Kalvelagen (2002), Glawisching (2010) it is very important to standardize all variables, in other words, each position variable must be expressed using same technique. Strong (1998) and McMullen (2008) noticed, that some of variables e.g. returns, can correlate with each others, however, DEA methodology doesn't have multicolinearity problem, because model simply searches for best combination of return with maximum efficiency measure.

4. Practical model application in Lithuania

Investor's behaviour analysis

According to the first part of the model mentioned in this article there was a survey performed. The amount of four hundred respondents ensure 95 % probability of correct sample size, in other words, this amount of respondents empower to make conclusions to all residents of Lithuania with 5 % of error. Survey had 4 different classes of questions: savings, investment, risk and demographical data of respondents. The aim of survey was to clarify how many savings do average resident has, what are habits of saving and keeping money, what is the experience of investment, asset allocation, how residents realize the risk and what would they do if they get unplanned additional money, etc. There were totally 439 respondents fixed in which 405 of them filled the survey correctly.

Conclusively, the results of survey show average resident approach of personal finance management, habits of saving money, goals of saving and decisions of simulated situations. There was defined, that more than 70,65 % of respondents keep money for saving (45 % of respondents saves 100-300 LTL, 26 % - 300-700 LTL every month, etc.) after deduction of all monthly expenses and approve the fact of importance of efficient personal finance management necessity. The main purpose of saving is keeping the money for a "black day" (41,30 % of savers); meanwhile others are saving for a new car (16,30 % of savers), for senility (13,04% of savers), etc.. The results show that 44,48 % of savers usually keep their money in banks, 21,74 % used to invest their money, however, up to 15,22 % keep their money in cash. Other survey's (RAIT, 2011) results show that only 6 % of residents invest their savings and up to 14 % of respondents do not want to answer this question. Surveys approve the fact that the amount of residents who keep their money in bank accounts is growing: in 2008– 52 % of residents, in 2011 – 69 % of residents. However, up to 76,14 % of respondents does not have any investment experience or just invested into second and/or third stage pension funds. Meanwhile up to 47,62 % of experienced respondents usually invest into stocks, bonds and/or investment funds. It was defined, that the acceptable amount of average part of savings for investment is up to 38,57 % of all amount of savings. The structures of average portfolios were defined: 28,57 % of investors choose stocks, investment funds, the same amount of investors form heir portfolio with 40 % of stocks and 60 % of bonds and/or investment funds. Survey results are necessary to evaluate average investor's behaviour efficiency.

Determination of countries economical cycle

Adamauskas and Krusinskas (2012) argue, that after the Hodrick-Prescott filter adjustment for Lithuania economical cycle analysis, the results showed that assigned Lithuania economical cycle began in the third quarter of 2004. The expansion period continued till the third quarter of 2008, when the peak was defined. The contraction period was much shorter and ended in the first quarter of 2010. To sum up, the analyzed Lithuanian economical cycle was defined and it continued from 2004 Q2 till 2010 Q1. These periods were admitted as effective investment periods. After the investment timing strategies analysis, equity shares and funds were assigned for expansion period; meanwhile commodities, bonds and deposits in the banks were assigned for contraction period. Besides, Exchange-Trade funds (ETF) of commodities were used instead of real commodities for some reasons: it trades like a stock; by owning an ETF, investor gets the diversification of index fund as well as the ability to sell short, buy on margin and purchase as little as one share; another advantage is that the expense ratios for most ETFs are lower than those of the average mutual fund or commodity position.

Private investor's behavioural performance assessment

According to the results of Adamauskas and Krusinskas (2012) analysis, although the average annual population was declining, the average annual amount of deposits increased, which shows that during this period statistical Lithuanian kept enough revenue for savings. The part of deposits for one statistical resident increased from 1.144,28 LTL in 2004 to 3.534,48 LTL in 2010. The peak of deposits was defined in 2007 and reached the highest point in 2008 when recession began. The results showed that during expansion stage average deposit for one statistical citizen was 2.054,93 LTL, meanwhile during contraction period - 3.538,16 LTL and this means, that average annual profitability of deposits during expansion period reached 4,94 % and during recession – 6,87 %. According to Central bank of Lithuania during the period of 2005-2008 it was observed that average inflation rate exceeded interest rates of deposits and this means, that savings in the bank deposits just only decreased the influence of price changes and did not create additional return of "working money". This fact again approves that the personal finance management issues are relevant.

Investment instruments selection and allocation of savings

Nasdaq OMX Baltic markets were selected for analysis. According to investment timing strategies there were 85 issuers and 140 investment funds selected from the markets of Vilnius, Tallinn and Riga. The aim of this part of model is to exclude most efficient positions using DEA method. Analysis requires including 10-year Return variable, this way maximum term of data was taken (from 2000). The main problem is that Nasdaq OMX Baltic markets are conditionally young and there are some data missing. To solve these constraints, there were 3, 5 and 8 years returns analyzed. Also both positions with negative return and less than 5-year performance history were removed from the research (the constraint of DEA model: no negative variables). EPS and P/E variables were calculated for defined expansion period. These markets do not calculate Beta variable, which shows the relations with markets, this way Beta was manually involved:

$$Beta = \beta_i = \frac{r_{im}\sigma_i\sigma_m}{\sigma_m^2} \quad (6)$$

where:

β_i – the system risk of investment instrument *i*;

σ_m – standard deviation of market portfolio;

σ_i – standard deviation of investment instrument *i*;

r_{im} – the profitability of market portfolio.

Standard deviation (*Sigma*) was calculated using daily data of 3 years period. Besides, 1 year return was removed because of negative variable's values. All calculated variables are shown in Annex 1.

Meanwhile, just only 34 from 85 issuers were involved into the research after data conformity and DEA methodology requirements. DEA results showed that most efficient issuers are *LOK1R, LTT1R* and *RAR1R* (LOK1R-Daugavpils Lokomotīvju remonta rūpnīca (Ryga), LTT1R-

Latvijas tilt (Ryga), RAR1R - Rīgas autoelektroaparātu rūpnīca (Ryga)), which DMU (decision making units) reached 100%. See Annex 2.

Alternatively like stocks, investment funds evaluation requires different variables for DPEI methodology (see Annex 4). Besides, all funds that started their performance from 2005 were removed from the research. To sum up, only 26 funds were appropriated for analysis. The most efficient funds were defined: Growth Fund, SEB Eastern Europe Fund ex. Russian, GE Money Europe Bond fund and SEB Eastern Europe Bond Fund (see Annex 3).

Investor's behaviour in performance assessment

As was mentioned before, Lithuanian economical cycle was defined using Hodrick-Prescott filter (expansion period was started in 2004 Q2 and continued till the third quarter of 2008, when the peak was defined; the contraction period was much shorter and ended in the first quarter of 2010). These periods were admitted as effective investment terms. The researchers argue that it is very important to manage assets according to country's economical cycle period this way investment timing was analysed. After the investment timing strategies analysis, equity shares and funds were assigned for expansion period, meanwhile commodities (or ETFS), bonds and deposits in the banks were assigned for contraction period. In order to evaluate private investor's behaviour efficiency, the sum of investment was admitted as average deposit for one resident during different Lithuanian economical cycle periods. In this case, the amount of 2.054,93 LTL was assigned for expansion period (when average resident got about 101,53 LTL annual return from deposit in banks); meanwhile the amount of 3.538,16 LTL was assigned for contraction period (when average resident got about 243,04 LTL annual return from deposit in banks). At this point of view, the main problem for investor is investment objects selection. As an opportunity to solve this problem we have DEA methodology results: 3 issuers (stocks) and 4 investment funds from Nasdaq OMX Baltic markets.

According to the survey and DEA results, 18 investment portfolios were created in order to compare real and hypothetic returns and decision efficiency. Portfolios named BM1 and BM2 are OMX Baltic Benchmark GI indices, which help us to compare portfolios performance. As it is seen in Table 2 the structure of portfolios was created according to the science literature authors and the results of the survey as the best structure (or favourite selected) of hypothetic portfolio, if average resident ever try to invest. The results of the portfolios showed that during Lithuanian economical cycle expansion period and using DEA methodology investor earned from 193,98 LTL to 9.980,55 LTL from stocks and from 223,81 to 2.870,85 LTL from investment funds. The return of the portfolios with structure of stocks reached up to 4.514,95 LTL and with funds – 1.453,52 LTL. According to the most favourable structure called "60:40", the return reached up to 3.874,50 LTL. Moreover, according to average resided habits of keeping their savings, the return of the portfolio was up to 829,59 LTL.

Table 2

The assessment of portfolios

Portfolio	*Structure*	*Receivable amount, Lt*	*Return, Lt*	*Profitability*
		Expansion period 2004 Q2- 2008 Q3		
BM1	OMX Baltic Benchmark GI	-	-	53,44%
PT #1	LOK1R (100%)	2.248,90	193,98	9,44%
PT #2	LTT1R (100%)	12.035,47	9.980,55	485,69%
PT #3	RAR1R (100%)	5.438,82	3.383,89	164,67%
PT #4	SEB Growth Fund (100%)	4.925,78	2.870,85	139,71%
PT #5	SEB Eastern Europe Fund ex. Russian (100%)	4.464,04	2.409,11	117,24%
PT #6	GE Money European Bond Fund (100%)	2.278,73	223,81	10,89%
PT #7	SEB Eastern Europe Bond Fund (100%)	2.365,22	310,29	15,10%
PT #8	LOK1R (33%), LTT1R (33%), RAR1R (33%)	6.567,82	4.514,95	219,71%
PT #9	SEB Growth Fund (25%), SEB Eastern Europe Fund ex. Russian (25%), GE Money European Bond Fund (25%), SEB Eastern Europe Bond Fund (25%)	3.508,44	1.453,52	70,73%
PT #10	LOK1R (20%), LTT1R (20%), RAR1R (20%), SEB Growth Fund (10%), SEB Eastern Europe Fund ex. Russian (10%), GE Money European Bond Fund (10%), SEB Eastern Europe Bond Fund (10%).	6.751,39	3.874,50	188,55%
PT #11	Deposit in Bank (45%), bank account (17%), cash (16%), stocks/funds (22%)	2.884,52	829,59	40,37%
		Contraction period 2008 Q4 – 2010 Q1		
BM2	OMX Baltic Benchmark GI	-	-	-21,95%
PT #12	Deposit in Bank	3.902,71	364,56	10,30%
PT #13	Lithuanian bonds	4.039,49	501,34	14,17%
PT #14	SPDR Gold Trust (GLD) ETFS (100%)	4.773,16	1.235,00	34,91%
PT #15	iShares Silver Trust (SLV) ETFS (100%)	3.358,27	-179,89	-5,08%
PT #16	United States Oil Fund LP (USO) ETFS (100%)	1.521,19	-2.016,96	-57,01%
PT #17	United States Natural Gas Fund LP (UNG) ETFS (100%)	819,96	-2.718,20	-76,83%
PT #18	United States Gasoline Fund LP (UGA) ETFS (100%)	2.452,69	-1.085,46	-30,68%

During contraction period, despite investments info Gold Trust ETFS, other portfolios were unprofitable (the range of loss was from 179,89 LTL to 2.718,20 LTL). However, the return of portfolio named PT#14, which all consist of SPDR Gold Trust (GLD) ETFS, was up to 1.235,00 LTL. Besides, Lithuanian bonds generated

sustainable return in amount of 501,34 LTL. Please notice that investment amounts in contraction period do not involved return of investment during expansion period.

To sum up, the maximum return during Lithuanian economical cycle could be reached up to 11.215,55 LTL (including return of expansion period) with the most risky investment strategy. The return of the portfolios with structure of "60:40" of investment instruments during expansion period and bonds during contraction period generated up to 4.375,84 LTL (with reinvestment of return of expansion period - 4.423,52 LTL). Please notice, that the return of portfolio, which has structure as the best way to safe money according to average Lithuanian resident, earned 1.194,15 LTL (with reinvestment of return of expansion period - 1.279,60 LTL) and this amount is 42,85 % better than average interests from bank deposits. The survey results showed that there are many residents who keep their money in cash, so as an example, considering inflation rates during country's economical cycle, the amount of 1.000 LTL decreased up to 733,32 LTL and this means slump of 26,68 %.

All the facts mentioned above approve and confirm the necessity of personal finance management. This paper and the research show how much do average Lithuanian resident may additionally perform during terms analyzed. Also, the results approve the appropriateness of DEA for investment instruments selection (considering the fact, that the return of portfolios, which were generated using DEA methodology, are better than main Nasdaq OMX Baltic Benchmark index).

Despite the fact, that situation with personal finance management is getting better every year in Lithuania, the mentality and incorrect understanding of financial solutions of Lithuanian's resident in the level of society-wide do not improve so fast, so it is obvious that the same mistakes will be done during a few economical cycles in the future.

Conclusions

1. According to science literature and last surveys, it was defined, that the main aim of personal finance management is to ensure financial sources both, now and in the short and long terms. This way it is very important to manage effective personal finance management solutions, save rationally and allocate asset correctly. Private investor is facing several problems: time to invest, investment objects selection, asset allocation, investment strategy and etc..

2. The main issue of the practical applicability of this paper results is to show, how much average resident of conservative country, such as Lithuania, loses managing with inefficient investment decisions.

3. There are many methods of investment objects and/or instruments selection, however, after the scientific literature overview, Data Envelopment Analysis was selected to evaluate big amount of instruments and different types of them. Besides it was defined, that traditional and/or basic investment evaluation methods/ techniques usually have their main special purposes and the result of them let private investor know the level of profitability and risk, sometimes compare investment object with each other with a lot of contractions. In the private investor's behaviour evolution context it is noticed, that these techniques require additional economical and/or financial knowledge and this becomes additional constraint; meanwhile DEA empower to express efficiency ratio and become available for average knowledge resident.

4. Thus, after the overlook of scientific literature, the model was created and it consists of five stages: (1) investor behaviour analysis (survey), (2) the determination of the economic cycle stages (Hodrick-Prescott filter method), (3) private investor's behavioural performance assessment, (4) investment instruments selection (Data Envelopment Analysis Method - multi-criteria decision-making technique) and allocation of savings analysis, (5) the investor's behaviour in performance assessment.

5. The Hodrick-Prescott filter results showed that Lithuania's economical cycle began in the third quarter of 2004. The expansion period continued till the third quarter of 2008, when the peak was defined. The contraction period was much shorter and ended in the first quarter of 2010. According to the model, private investors' behaviour was analysed using the survey, which shows that for more than 70% of respondents left the money for saving after deduction of all monthly expenses and more than 40% of savers keep their money for the "black day". This phenomenon is inherited for conservative countries (such as Lithuania).

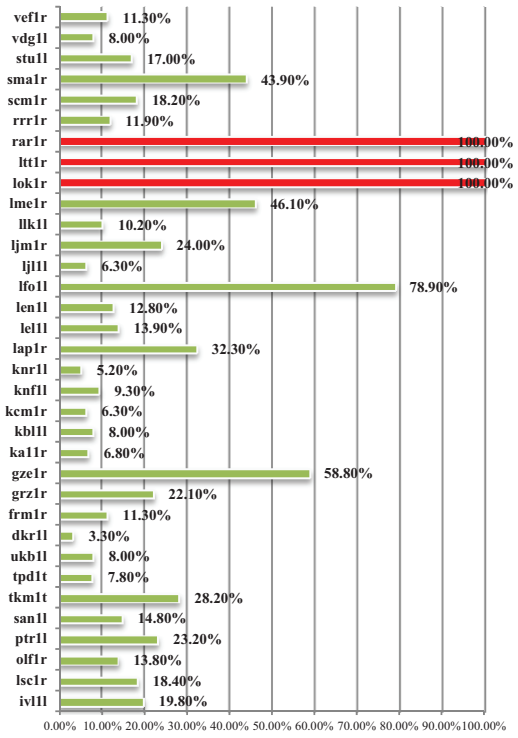
6. The results showed that maximum return during Lithuanian economical cycle could be reached up to 11.215,55 LTL and this amount is 200,53 % better than average interests from bank deposits (including return of expansion period) with most risky investment strategy. The return of the portfolios with structure of "60:40" of investment instruments during expansion period and bonds during contraction period generated up to 4.375,84 LTL (with reinvestment of return of expansion period - 4.423,52 LTL). Moreover, the return of the portfolio, with structure as the best way to safe money according to average Lithuanian resident, earned 1.194,15 LTL (with reinvestment of return of expansion period - 1.279,60 LTL) and this amount is 42,85 % better than average interests from bank deposits. Thus, this situation approves the fact of necessity of personal finance management. The main constraint of this model is that the results of the past do not guarantee the future prospects.

7. It is very important to create more confidential banking system, secondly, promote society to allocate their savings from cash to e-money and make them work and the last but not the least thought – to increase dissemination of financial-economical knowledge skills for conservative countries like Lithuania (e.g. by appealing to potential material benefits). As a result, these changes will decrease the amount of circulating cash, increase deposits in banks and more investment solutions will be used. Also, these changes can help to avoid or even minimize the impact of inflation. Furthermore, the model created is the proof of existing techniques, which can empower investor to increase efficiency of investment decisions.

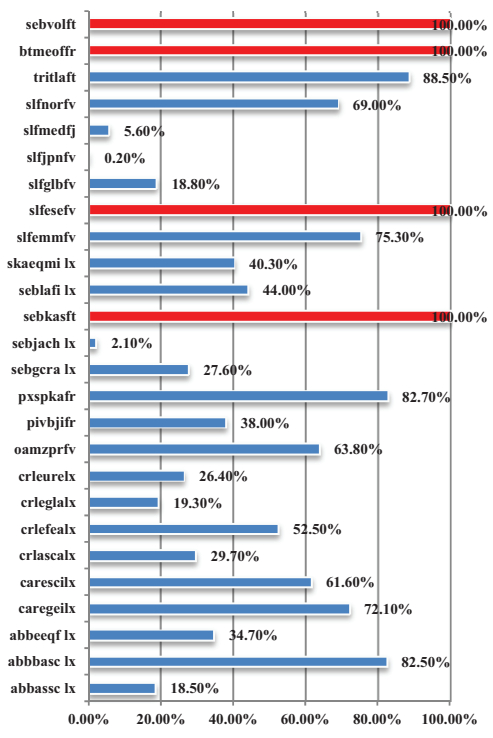
Annex 1. Values of DEA variables evaluating stocks

DMU	*1y return*	*3y return*	*5y retur.*	*8y return*	*EPS*	*P/E*	*Sigma*	*β*
Classification	*Removed*	*Output*	*Output*	*Output*	*Output*	*Input*	*Input*	*Input*
IVL1L	-0,15	0,04	0,28	0,19	0,387	16,779	0,032	0,21
LSC1R	-0,06	0,07	0,11	0,08	0,684	5,586	0,019	0,1575
OLF1R	-0,24	0,02	0,19	0,15	0,119	39,091	0,022	0,18
PTR1L	-0,24	0,13	0,18	0,14	1,071	5,234	0,026	0,195
SAN1L	0,13	0,01	0,19	0,12	0,536	33,377	0,033	0,2325
TKM1T	-0,12	0,08	0,11	0,21	1,671	13,481	0,037	0,2325
TPD1T	-0,13	0,05	0,03	0,15	0,1283	49,271	0,042	0,2775
UKB1L	-0,18	0,03	0,1	0,04	0,467	12,536	0,041	0,2775
DKR1L	0,17	0,02	0,05	0,04	-0,44	2,911	0,031	0,2325
FRM1R	0,07	0,39	0,38	0,29	0,726	8,145	0,076	0,54
GRZ1R	-0,16	0,1	0,43	0,26	1,19	4,108	0,042	0,435
GZE1R	-0,1	0,01	0,02	0,08	2,944	10,905	0,021	0,135
KA11R	0,02	0,14	0,16	0,18	0,086	22,486	0,046	0,36
KBL1L	-0,15	0,014	0	0,06	0,42	11,462	0,031	0,2175
KCM1R	0,02	0,15	0,14	0	0,0975	77,372	0,04	0,2925
KNF1L	-0,01	0,1	0,11	0,03	0,045	184,133	0,016	0,1575
KNR1L	0,01	0,02	0,09	0,02	0,09	41,056	0,034	0,24
LAP1R	0,03	0,08	0,45	0,48	1,697	2,692	0,055	0,7275
LEL1L	0,06	0,07	0,14	0,2	0,095	35,242	0,025	0,195
LEN1L	-0,03	0,05	0,12	0,17	0,0425	55,506	0,025	0,1725
LFO1L	0,23	0,23	0,29	0,09	6,865	3,352	0,033	0,24
LJL1L	-0,11	0,03	0,09	0,03	0,0367	10,009	0,022	0,18
LJM1R	0,13	0,13	0,16	0,19	1,2891	4,746	0,03	0,225
LLK1L	0,02	0,08	0,14	0,07	0,118	8,758	0,027	0,1875
LME1R	-0,01	0,02	0,18	0,15	3,239	2,058	0,027	0,21
LOK1R	-0,08	0,11	0,24	0,3	10,117	0,1488	0,05	0,39
LTT1R	-0,01	0,36	0,36	0,2	18,347	2,208	0,062	0,4575
RAR1R	-0,08	5,16	3,61	3,39	0,249	6,968	0,045	0,4275
RRR1R	0,05	0,14	0,34	0,29	0,099	23,312	0,047	0,3525
SCM1R	0	0,19	0,24	0,14	1,204	3,58	0,037	0,3225
SMA1R	0,04	0,21	0,29	0,21	5,309	3,476	0,046	0,3525
STU1L	-0,01	0,04	0,06	0,13	0,61	10,346	0,027	0,18
VDG1L	-0,19	0,05	0,13	0,1	0,094	23,156	0,031	0,2175
VEF1R	0,14	0,13	0,67	0	0,048	70,947	0,09	0,705

Annex 2. DEA efficiency ratios evaluating stocks



Annex 3. DEA efficiency ratios evaluating funds



Annex 4. Values of DEA variables evaluating funds

Name of fund	***Average Return,%***	***Standard deviation***	***β***	***Subscription fees,%***	***Redemption fees,%***
Classification	*Output*	*Input*	*Input*	*Input*	*Input*
SEB Choice Asia Small Caps ex. Japan Fund	1,06	1,183	59,15	2	1,5
SEB Eastern Europe Small Cap Fund	4,68	1,105	55,25	2	1,75
SEB Europe Chance/Risk Fund	1,84	1,052	52,6	2	1,4
Carlson Fund - Global Emerging Markets	5,02	1,289	64,45	5	1,75
Carlson Fund - Scandinavia	3,68	1,108	55,4	5	1,5
Carlson Fund - Asian Small Cap	2,1	1,356	67,8	5	1,75
Carlson Fund - Far East	2,85	1,198	59,9	5	1,25
Carlson Fund – Global SRI	0,96	0,922	46,1	5	1,25
Carlson Fund - Europe	1,33	0,963	48,15	5	1,25
ZPR small caps.	3,82	1,272	63,6	2	1,5
Citadele Baltic Sea Equity Fund	1,79	0,832	41,6	2	2
Citadele Russian Equity Fund	5,51	1,455	72,75	2	2
SEB Global Chance/Risk Fund	1,39	0,935	46,75	2	1,5
SEB Choice Japan Chance/Risk Fund	0,13	1,334	66,7	2	1,5
SEB Growth Fund	5,39	1,005	50,25	2	1,75
SEB Choice Asia ex. Japan Fund	2,76	1,317	65,85	2	1,75
SEB Ethical Europe Fund	2,09	0,989	49,45	2	1,5
SEB Choice Emerging Markets Fund	4,72	1,316	65,8	2	1,75
SEB Eastern Europe Fund ex Russia	8,01	1,93	96,5	2	1,75
SEB Global Fund	0,98	0,999	49,95	2	1,5
SEB Choice Japan Fund	0,01	1,274	63,7	2	1,5
SEB Medical Fund	0,25	0,763	38,15	2	1,5
SEB Nordic Fund	3,75	1,121	56,05	2	1,3
Trigon Balkan Fund A	3,88	0,749	37,45	2	1,5
GE Money European Bond fund	1,17	0,111	5,55	2	1,4
SEB Eastern Europe Bond Fund	0,93	0,145	7,25	0,5	0,25

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Saulius Adamauskas, Rytis Krušinskas

Asmeninių finansų valdymo efektyvumas skirtingais šalies ekonominio ciklo laikotarpiais

Santrauka

Dabartiniu metu atliekamuose tyrimuose bei mokslinėse studijose vis dažniau iškeliama kokybiškų ir efektyvių asmeninių finansų valdymo sprendimų svarba. Kyla mokslinė problema – privataus investuotojo investicinių priemonių pasirinkimas skirtingais šalies ekonominio ciklo laikotarpiais. Buvo pastebėta, kad privatus investuotojas susiduria su keletu problemų: paties investavimo faktu, investicinių tikslų nustatymo, portfelio struktūros ir diversifikavimo klausimais, taip pat tinkamo investavimo periodo parinkimo, jo trukmės ir, be abejo, investicinių priemonių atrankos bei turto alokacijos klausimais. Šio straipsnio tikslas yra pateikti sukurtą privataus investuotojo sprendimų modelį, kuris leidžia priimti efektyvius investicinius sprendimus skirtingais šalies ekonominio ciklo laikotarpiais. Tyrimų metodai yra pagrįsti sisteminga literatūros analize, matematiniais statistikos metodais ir loginėmis lyginamosiomis bei apibendrinančiomis analizėmis.

Statistikos ir socialinių tyrimų rezultatai rodo, kad daugybė šalies gyventojų turi santaupų, o tai pagrindžia asmeninių finansų valdymo svarbą. Lietuvių mentalitetas ir nepasitikėjimas bankine sistema ir/ar atskirais jos dalyviais sąlygoja taupymą grynais pinigais. Paskutiniai tyrimai rodo, jog kiekvienais metais vis daugiau taupančiųjų pasirenka bankinius indėlius, tačiau kartais to nepakanka, nes gaunamos palūkanos tik sumažina infliacijos daromą įtaką. Susisteminus mokslinės literatūros autorių siūlomų studijų rezultatus, buvo suformuotas kompleksinis privataus investuotojų investicinių sprendimų efektyvumo vertinimo modelis.

Atlikus mokslinių šaltinių analizę , buvo nustatyta, jog Hodrick-Prescott filtras (*toliau HP*) yra viena iš populiariausių priemonių nagrinėjant cikliškumus. Sukurtos vaizdavimo ir analizės galimybės, bei aiškus reikalingų analizei kriterijų sąrašas paaiškina metodo paplitimą ir dažną naudojimą. Harvey (2003) teigimu, Hodrick-Prescott filtras yra matematinis įrankis, naudojamas makroekonomikoje tiriant realių ekonominių ciklų atskirų komponenčių cikliškumams nustatyti tam tikroje laiko eilutėje. Naudojant šį metodą buvo identifikuoti Lietuvos ekonominio ciklo periodai, kurie laikomi efektyviais investavimo laikotarpiais. Rezultatai parodė, kad Lietuvos ekonominis ciklas prasidėjo 2004 m. III ketvirtį ir nuosaikiai augo iki 2008 m. III ketvirčio, kada buvo fiksuojama ciklo viršūnė. Nuosmukio periodas buvo kur kas trumpesnis ir baigėsi 2010 m. I ketvirtį. Reziumuojant, Lietuvos ekonominio ciklo augimo nustatytas augimo periodas – 2004 Q2-2008 Q3, o nuosmukio periodas – 2008 Q4-2010 Q1. Šie laikotarpiai naudojami tolimesniuose skaičiavimuose kaip efektyvios investavimo trukmės. Atsižvelgiant į Adamausko ir Krušinsko (2012) investavimo strategijų analizės rezultatus, buvo nustatyta, kad skirtingomis ekonominio ciklo fazės laikotarpiais keičiasi ne tik investuotojų aktyvumas, pačios investicijos pelningumas, rizika, bet ir patys aktyvai. Kilimo laikotarpiu buvo išlaikyti rizikingesni ir kartu didesnį portfelio prieaugį galintys užtikrinti investiciniai būdai, tokie kaip akcijos ir investiciniai fondai, o antruoju laikotarpiu, bangai žemėjant – žaliavos, vyriausybės vertybiniai popieriai ir/arba indėliai.

Remiantis minėtu modeliu buvo atlikta privataus investuotojo elgsenos analizė nustatytais laiko intervalais. Pastebėta, kad nors visu šalies ekonominio ciklo laikotarpiu kasmet Lietuvos gyventojų skaičius mažėjo, vidutiniai metiniai indėliai augo, o tai įrodo, kad vidutiniam „statistiniam" lietuviui pakako pajamų santaupoms. Gyventojui tenkanti indėlių dalis išaugo nuo 1.144,28 LTL 2004 metais iki 3.534,48 LTL 2010 m. Intensyvus indėlių augimas pasireiškė dar 2007 m, o labiausiai išaugo 2008 m., tada, kada prasidėjo ekonominis nuosmukis. Tyrimo rezultatai atskleidė, kad augimo metu vidutinis gyventojui tenkantis indėlis yra 2.054,93 LTL, o nuosmukio periodu – 3.538,16 LTL. Vidutinė metinė palūkanų norma už indėlius šalies ekonominio ciklo augimo laikotarpiu siekė 4,94 %, o nuosmukio periodu – 6,87 %.

Investuotojo elgsena buvo vertinama atliekant apklausą. Klausimai buvo suskirstyti į keturias grupes: santaupų, investicijų, rizikos sampratos bei respondentų demografinių duomenų. Pagrindiniai apklausos tikslai buvo išsiaiškinti vidutinio statistinio lietuvio požiūrį į taupymą, taupymo tikslus, įpročius, investavimą, lėšų valdymą, rizikos suvokimą bei investicinės veiklos patirtį. Apklausoje dalyvavo 439 respondentai, o apklausos rezultatai parodė vidutinio statistinio lietuvio nuomonę apie asmeninių finansų valdymą, jo taupymo įpročius ir tikslus, požiūrį į riziką, investavimo patirtį ir atliekamus investicinius sprendimus. Pagal tyrimo rezultatus 70,65 proc. apklaustųjų lieka pinigų santaupoms (atskaičius visas mėnesines išlaidas). Tai pagrindžia faktą, kad yra svarbu kokybiškai valdyti santaupas. Pagrindinis taupymo tikslas yra santaupos „juodai dienai" (41,30 proc. taupančiųjų). Apklausų rezultatai taip pat parodė didėjantį,banko indėliuose santaupas laikančiųjų, skaičių 2008 – 52%, 2011 – 69 %. Atlikto tyrimo rezultatai taip pat atskleidė, kad net 76,14 proc. atsakiusiųjų neturi investavimo patirties arba yra investavę tik į antros ir/ar trečios pakopos pensijų fondus. O turintys patirtį investuoti (47,62 proc. investuojančių) dažniausiai renkasi akcijas/obligacijas ir investicinius fondus. Buvo nustatyta, kad vidutiniškai investicijoms skiriama 38,57 proc. santaupų, o vertinant investicijų struktūrą, po 28,57 proc. investuotojų renkasi tiek akcijas, tiek investicinius fondus, tiek portfelį formuoja 40:60 santykiu (40 proc. akcijų ir 60 proc. obligacijų ir/arba VVP ir/arba investiciniai fondai). Šis tyrimas parodė investuotojo elgsenos filosofiją, suformavo modelyje sudaromų portfelių struktūrą, atskleidė elgsenos ypatumus.

Investicinių būdų atrankos ir santaupų alokacijos klausimai buvo išnagrinėti naudojant duomenų glaudinimo analizės matematinį įrankį (*ang. Data*

Envelopment Analysis, toliau DEA). Atliktus mokslinės literatūros ir studijų analizę buvo nustatyta, kad yra daugybė investicinių instrumentų atrankos metodų, tačiau DEA buvo pasirinktas dėl šių priežasčių:

- Metodas leido įvertinti didelį kiekį aktyvų vienu metu;
- DEA metodas gali vertinti skirtingas aktyvų klases (tiek akcijų, tiek investicinių fondų) be,i pvz. skirtingų tipų, veikimo vietovės, valdytojų fondus (akcijų, obligacijų, fondų fondus, kt.);
- Metodo atrinktų efektyviausių aktyvų kombinacijų pelningumas yra didesnis už rinkos indeksą;
- DEA leidžia *n* kintamųjų susintetinti į vieną skaitmeninę reikšmę ir nurodyti efektyvumo indeksą, kuriame būtų įvertinti ne tik pelningumo, bet ir rizikos matai;
- DEA metodika parinkus atitinkamus kintamųjų derinius atitinka vertinimo, koreguoto pagal riziką, analizę, kitaip tariant, gautas rezultatas yra adekvatus skirtingiems rizikos, pelningumo ar diferencinio pelningumo išraiškoms;
- Iš dalies nesudėtingas pritaikomumas.

Efektyvumo sąvoka, šiame tyrime, apibūdinama kaip alternatyvus kriterijų rinkinys, kuris labiausiai dominuoja lyginant su kitais sprendimų variantais atliekant modeliavimo rezultatų analizę, visų galimų alternatyvų, su visais galimais sprendimo variantais. Kitaip tariant, efektyvumo dydis yra gaunamas remiantis tiesinio matematinio programavimo modeliu. Atsižvelgiant į mokslinėse studijose rekomenduojamus analizuoti kintamuosius, buvo sukurta investicinių instrumentų vertinimo duomenų bazė. Iš 85 publikuojamų emitentų buvo atrinkti 34, kurie atitiko DEA modeliui keliamus reikalavimus. DEA metodo rezultatai parodė, kad efektyviausi yra LOK1R, LTT1R and RAR1R (LOK1R - Daugavpils Lokomotīvju remonta rūpnīca (Ryga), LTT1R - Latvijas tilt (Ryga), RAR1R - Rīgas autoelektroaparātu rūpnīca (Ryga)), kurių efektyvumo matas siekė 100 proc.. Kitaip nei akcijoms, investiciniams fondams vertinti naudojami kiti kintamieji, kurių kombinacija vadinamas DPEI. Iš publikuojamų fondų tolimesnei analizei atrinkti 26, kurie atitiko keliamus kriterijus. Tyrimo rezultatai parodė, kad efektyviausi yra Growth Fund, SEB Eastern Europe Fund ex. Russian, GE Money Europe Bond fund ir SEB Eastern Europe Bond Fund.

Sukurtas modelis buvo pritaikytas skirtingais Lietuvos ekonominio ciklo laikotarpiais. Pateikta adaptuoto modelio rezultatų suvestinė, bei gautas rezultatas palygintas su vidutinio statistinio lietuvio investiciniais sprendimais (suformuota 18 investicinių portfelių). Buvo nustatyta, kad sukurtas modelis gali būti sąlyginai nesudėtingai pritaikomas praktikoje, o tai leidžia privačiam investuotuotojui priimti efektyvius investavimo sprendimus, skirtingaiss šalies ekonominio ciklo laikotarpiais. Pastebėta , kad jei visuomenės narys vadovautųsi statistinio lietuvio nuomone kaip geriausia taupyti, bendras ekonominio ciklo laikotarpio uždirbamas pelnas būtų vidutiniškai 42,85 proc. Didesnis, nei gaunamos palūkanos iš indėlių.

Raktažodžiai: *šalies ekonomikos ciklas, Hodrick-Prescott filtras, investavimo strategija, investavimo laiko pasirinkimas, duomenų gaubtumo analizės metodas.*

The article has been reviewed.

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