

Folia Oeconomica Stetinensia DOI: 10.2478/v10031-010-0008-4



METHODOLOGICAL ASPECTS OF BEHAVIOURAL PORTFOLIO WITH MULTITASKING

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Received 27 October 2010, Accepted 22 May 2011

Abstract

The main goal of this article is to show how much complicated is the process of building portfolio in behavioural approach. This approach is strongly connected with multitasking because of fact of conflicting goals in the making decision process. The graphic interpretation of the influence of the changes in investor's preferences on the utility curve will be analysed in this paper. The perspectives theory by Kahneman and Tversky is the base of methodological considerations included in this work.

Keywords: behavioural portfolio, multitasking, utility curve.

JEL classification: G11, C91.

Introduction

Since the beginning of the 1990s dynamic changes have been observed in the science of finance. Financial markets have created virtual tools which nowadays play definitely the most important role in financial transactions. Unfortunately these deep changes are also the cause of some turbulences in the markets.

When the internet did not dominate the systems of information transfer in the world, there was no threat of the absorption of redundant information by investors making investment decisions. The development of civilization and the growing needs of investors and the limitations of resources have led to devaluation of the theory of financial crisis. The crisis has occurred in the intellectual sphere, which has raised doubts about the usefulness of classical methods and financial models, and in the financial sphere, which was reflected in the financial markets in 2008.

All these events have made researchers to start searching for a coherent theory that would help explain the causes of deviations from the assumptions found in classical models of finance. Theories grown on the basis of Kahneman and Tversky's findings led to the formation of dynamic case studies that would confirm the validity of the theory of perspective.

The decision support tool in the analysis of investment portfolio will be presented in this article. Another aspect to be underlined is the perspective of multitasking in decision-making. The paper will present graphical interpretation of the impact of changes in the sensitivity curve of investor utility.

1. Behavioural portfolio theory

Behavioural Portfolio Theory (BPT) has its beginning in the work of H. Shefrin and M. Statman, published in 2000 in the Journal of Financial Quantitative Analysis¹. The basis for this theory were the SP/A (security, desire for wealth/aspiration) of L. Lopes² and the theory of perspective of Kahneman and Tversky³. It assumes that investors in the process of making investment decisions on the market do not behave rationally in the sense of *homo oeconomicus*. This means that according to themselves they are rational and their decisions are based on the conditions unknown to others.

These theories are in the centre of the behavioural finance. They are trying to explain events through the prism of the market behaviour of market participants. The reason is that in practice of the last few years it became clear that the capital market is difficult to predict, and predictions often greatly miss the reality. Financial market anomalies can be explained in the behavioural approach, using models in which market participants are fully rational⁴. Psychologists prove that irrationality is caused by investors' confidence in the stability of the environment and their preferences. These two factors determine that the structure of the portfolio may not correspond to the optimal portfolio from the perspective of traditional finance (for example: mean-variance portfolio of Markowitz). A number of factors such as mental accounting affects the growing importance of emotional factors⁵.

Investment funds' portfolios offer the investor, by name, a simple choice options (aggressive, balanced, safe funds). The construction of such portfolios, however, is not based on traditional models, but on the anticipation of possibilities to ensure the expectations of potential customers of the fund. This way of building a portfolio looks like a pyramid of independent assets, where each level of the pyramid is determined by two emotions: fear and hope. At the lowest level of the pyramid there are the assets with very low risk and low return and on top there are these which are the potentially most profitable⁶. The figure 1 shows the pyramidal structure of portfolios.



SHARE IN PORTOLIO

Fig 1. Risk pyramid

Source: own work based on A. Lavine (1996), p. 33.

The risk pyramid presented in Figure 1 shows one of the phenomena in the process of building a portfolio. The structure of equity funds portfolios is similar to the pyramid, while excluding the risk-free securities, the largest share of its shares are large and medium-sized companies (nearly 70% according to the research of the Polish market⁷. This is not the only

criterion used by fund managers. Another one, more dangerous, is the criterion of managerial experience and their ability to navigate the complicated matter of market. Often, you can also meet the imitation of big market players, an imitation which is a sign of confidence that on the market there are also investors who know more than the others.

2. Multitasking in economy

Multitasking is known to man since the beginning of their activities, not only the economic ones. In practice, people who, like Napoleon, can simultaneously conduct a number of operations, without prejudice to any, are considered very valuable. Often a man, and recently also a busy man, trying to solve their problems by integrating the automation activities. The need for the automation of human activities is the result of the development of knowledge and skills and a natural need to facilitate the operation. Several models of automation described in the literature can attest to that⁸. Attempts to tackle a complex problem of decision-making in multitasking sometimes focused on the problem of attention. Attention may be defined as concentration of consciousness and, formally, as the application of means by which the resources available to the person in the decision process are allocated to perform multitasking.

In psychology we can distinguish three types of attention (concentration): a selective, focused and divisible. The selective attention is limited because a man by nature can simultaneously respond to a limited number of stimuli (scarcity of resources from nature). The result of this is the fact that we perform some tasks at the expense of others. The focused attention indicates that the person selects stimuli: reject those deemed to be insignificant, focuses on the ones that, in their opinion, are the most important. The last type is divisible attention. It is defined as an attempt to distribute the scarce capacity between the tasks to be performed. This is the best place for the automation to appear.

In technical sciences multitasking can be understood as an extension of the theory and the models of attention. The best example of this application is the theory of queues from the operations research. It concerns the systems for which access sequence is to be solved in order to optimize the use of resources. Multicriterial programming is also found in the control theory, where the theory of optimal control have their roots. The application of the optimal control theory to human behaviour is based on the assumption that in the continuous system, as a result of man's experience, the human work systems are getting closer to the automated ones.

Psychological models and theories are different from engineering, mainly because they are primarily focused on explaining the processes and mechanisms that underlie behaviour.

Theories and models show that a man has limited resources in the form of visual or audio channels. These resources must be allocated among competing stimuli coming from different sources.

3. Behavioural model with multitasking

Underlying deliberations about the structure of behavioural portfolio are two concepts that will help construct adequate tools. At this point the term "mental accounting" must be emphasised. It lies in the subconscious of every investor who examines each component of the portfolio separately. Each investor deciding to choose certain assets to the portfolio determines the goal of investment, ignoring such an important factor as the correlation between rates of return on portfolio components. So investors need to use tools with more than one goal function.

If, however, the research makes reference to the prospect theory, it is natural to use, for example, the framing effect to construct a model in the portfolio analysis. This coefficient (FC) was described at work⁹ and it uses the conclusions drawn from the general curve of Kahneman and Tversky¹⁰. The finding to which it refers says that investors feel that the loss can be balanced only by generating a profit of about 2.5 times higher than the loss (the asymmetry of the curve point C). This factor could be expressed by the formula:

$$FC = \frac{RR}{S_p}$$

where:

RR – rate of return (logarithm),

 S_p – standard deviation of *RR*.

The human needs described above build a need to process several tasks at once. The complex situation cannot be excluded in which several goal functions for various groups of risk may appear contradictory. We could generalize that the basic parameters of the portfolio securities are the complex of various goal functions as an equation shows:

$$R_{sj} = \sum_{i=1}^{n} x_{ij} \cdot R_{ij} \rightarrow \max i S_{pj} = \sqrt{X^T \cdot D \cdot X} \rightarrow \min,$$

with:

 $x_{ij} \ge 0,$ $\sum_{i=1}^{n} x_{ij} = 1.$

And for the first goal function:

$$S_{pj} = \sqrt{X^T \cdot D \cdot X} = \alpha_j$$

where α_i is a constant value.

The most important parameter for the global portfolio is the rate of return RR, while the risk parameter (S_p) will be of secondary importance due to its optimization within individual portfolios related to the specific investment objective, and not at the level of the global portfolio. So, the presence of optimal portfolios in sense of the effective border will be a rather rare case.

A very important element should be noted – the relationship of the parameters of the portfolio with the utility curve. An element binding these two elements is the FC (frame coefficient) factor whose size – the relationship of profit and loss – is generally a decisive factor in the usefulness of the portfolio. It can propose FC as the goal function in such a process. Then an image of variability of psychological sensitivity of investor to specific situations can be obtained. In this case the objective function is:

$$FC \rightarrow \kappa$$
,

where:

 κ – is an arbitrary number to specify the profit risk (norm 2.5).

Assumptions:

 there are any number of portfolios in which the sum of all individual shares do not exceed 100% and the sum of the shares of individual portfolios in a global portfolio is also 100%.

2) as in classical cases, individual shares are greater than or equal to 0.

The results of global portfolios consisting of two autonomous portfolios are presented in Figure 2. In addition, due to the fact that losses should be considered as more meaningful for individual investor, changes were made only in this part of Figure 2.

It may be noted that equating the levels of risk and rate of return in terms of utility (the sensitivity of the investor) – decreasing the degree of differentiation in the sense relation of investor's feelings after gaining and losing money – leads to flattening of curves on the side of losses. Additionally, the structure and basic characteristics of the simulated portfolios of securities could be presented (Figure 3). The results of sample analysis for companies from the Stock Exchange in Warsaw are presented in Table 1.



Fig. 2. Utility curves for selected levels of sensitivity to losses Source: own researches.



Fig. 3. Share of groups of assets in the global portfolio depending on the ratio FC Source: own researches.

The investor, who establishes for himself a high level of frame coefficient (FC) in goal function, invests most of their assets in increased risk securities (e.g. in NewConnect market), in accordance with previous observations regarding the sensitivity of the investor. With lower investor's sensitivity it could result in the rise of importance of securities of the lowest floors of the pyramid of risk (WIG20). It will be reflected in the results of the individual portfolios, which are contained in Table 1.

FC	RR	Sp	Share of P1	Share of P2	Vs
	%				
1.00	15.0	15.0	77.7	22.3	100.0
2.00	38.8	19.4	42.5	57.5	50.0
2.30	49.7	21.6	27.8	72.2	43.5
2.35	52.0	22.1	25.1	74.9	42.6
2.40	54.5	22.7	22.3	77.7	41.7
2.45	56.9	23.2	19.3	80.7	40.8
2.50	60.9	24.4	16.2	83.8	40.0
2.55	59.9	23.5	12.6	87.4	39.2
2.60	62.8	24.1	9.3	90.7	38.5
2.65	65.5	24.7	5.8	94.2	37.7
2.70	68.1	25.2	2.1	97.9	37.0
2.73	68.6	25.1	0.0	100.0	36.7
2.50 (behav)	72.5	29.0	12.3	87.7	40.0
2.72 (class)	78.9	29.0	0.3	99.7	36.8

Table 1. The main characteristics of portfolios

Source: own researches.

The table provides information about basic characteristics of the simulated portfolios. Extensive simulation studies in this area were made for the purpose of verifying the thesis of the practice of creating portfolios and the usefulness of behavioural models presented above. In the table we can find: the rates of return and risk for different models – the best result was obtained for the classical model of Markowitz. This portfolio contains almost entirely the shares of companies with higher risk and it assumes higher sensitivity to losses than almost all other models. The behavioural model, which was estimated according to the principle described previously, using the optimization formula for each goal separately and then additionally optimized shares of the different risk groups in order to achieve a level of 2.5. In this case companies from the safe group accounted for 12.3% in the global portfolio.

Conclusions

Optimization of FC leads to the determination of such structure, which would aim to ensure a sense of comfort for individual investor (it will help to ensure such a level of return, which counterbalances feelings of grief after the loss with the pleasure of the earning). The results of such optimization should be only slightly worse than the gradual optimization in the behavioural portfolio or classical optimization in the Markowitz model.

So it is possible to make a choice between a behavioural and classical model. The advantages of the latter are well known, but it does not make this portfolio type popular. The reasons for this complication can be divided into two parts: scientific and practical. In the scientific part it can be related to irrationality of the assumptions in the model. In the practical part it could be caused by the investors' educational deficiencies, by mental accounting and by the influence other non-economic factors. By this way we can conclude that, because of practical obstacles in using the classical model, the presented model can be expected to be applied more frequently.

Notes

- ¹ Shefrin, Statman (2000), p. 127.
- ² Lopes (1987).
- ³ Kahneman, Tversky (1979).
- ⁴ Barberis, Thaler (2002), p. 2.
- ⁵ Zaleśkiewicz (2003); Thaler (1999).
- ⁶ Zaleśkiewicz (2003), p. 147; Shefrin, Statman (2000).
- 7 Majewski (2005).
- ⁸ Pew, Mavor (1995), pp. 112–128.
- ⁹ Majewska, Majewski (2009); Majewski (2010).
- ¹⁰ Kahneman, Tversky (1979).

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