Prospecting for Sustainable Investment Possibilities in Financial Markets

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ABSTRACT

The main objective of the paper is to analyse the author's proposed model, which is adequate for stock prices and currency exchange rates markets stochasticity, as well as discuss its application to investor's possibilities research in those markets. The paper is grounded on the hypothesis of stratification of stock profitability ratios, traded on the market. In other words, the concept of stratification means concentration into certain groups in risk-profitability plane. If the hypothesis proved overall, then a constructive scheme for investor's possibilities research in exchange and capital markets would appear, as well as efficient investment strategies would develop.

Keywords: Strata's Cores Portfolio, Stratification, Stochastic Market Model, Market Efficiency.

1. INTRODUCTION

The main purpose of this paper, talking picturesquely, should be the answer how adequately with the help of investment analysis methods to change stock prices or exchange rates deriving in the market into constructive information about market opportunities for investors by investment efficiency fully describing indicators – profitability, reliability and riskiness, and how to develop investment strategies with the help of this information.

Considering implementation of the main objective, particular tasks of this paper were:

- to remind the fundamental results of scientific researches, which created an opportunity to develop the main consistent patterns of capital and exchange markets.
- to complement steady conception of stochastic market model by necessity to reflect possibilities of investment efficiency according its profitability, reliability of possibility and riskiness of profitability's set for any investment assets profitability possibilities probability distributions and variety of interactions among these assets.
- to use the stratification of efficiency indicators of separate investment assets in the risk-profitability plane for description of market possibilities or simply for investor's possibilities description according to the indications mentioned above.
- to form the efficiency zone of the analysed market like an explication of efficient line of modern investment portfolio with the help of the conception of adequate portfolio and the facts of efficiency values stratification formed in the market.
- to discuss the formation of the izoguarantees network as the main tool for investment strategy selection;
- to appeal to imitative technologies, which would enable the solution of complex stochastic programming tasks systems, which are adequate enough models for market behaviour description.

The paper aims to reveal that the stated hypothesis about stratification of stock profitabilities corresponds to statistical data in capital, as well as in exchange markets, and it does not contradict any economic consistent pattern. Along with that, it is showed how using such an assumption and possibilities of the adequate portfolio it is possible to forecast profitability possibilities of the analysed market with regard to the reliability (guarantee) and riskness of these possibilities. Performed experimental calculations allow making an assumption that the sets of stock profitabilities being formed are the realizations of the certain stochastic process on every observation step of the process.

2. CONTEMPORARY PROBLEMS AND METHODS OF INVESTMENT MARKETS' ANALYSIS

Efficiency of the capital and exchange markets is analyzed from market participants and especially investor's positions. The main tool analyzing investor possibilities is the Modern Portfolio Theory (MPT), which analyzes how rational investor diversifies investment capital into different investment instruments, at the same time showing how the risky investment assets are evaluated [1, 2]. MPT is based on the entirety of diversification principles, developed by Markowitz and other scientists, together with Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT), which is a particular kind of investment assets fundamental analysis [3, 4, 5].

The practice of mentioned theories and principles bristles with many problems. First, the rational investor never will have an opportunity to estimate all possible investment assets, while at the same time the logic of the mentioned theories is based on the assumption that infinite number of investment market assets is included into estimation. If investor doesn't want "to go" together with the market and takes just very small number of investment assets, then he must know how the logic of mentioned theories and principles has to change.

Thus, this is important, but not the main imperfection of investor interest's description, using MPT, CAPM and APT theories. Investors thought and decisions making logic can't be fully described using only two parameters – profitability and risk, which compose the background of the theories mentioned above [6, 7]. Even nonprofessional investor aside profitability and profitabilities set risk must know the reliability of every possibility (see Fig. 1).

Though, in the case of probability distributions of certain profitability possibilities (e.g. in the case of normal distribution), an average profitability possibility and standard deviation (parameter of risk) fully describe reliability or guarantee of all possibilities, i.e. the probability that obtained profitability won't be less than in the concretely chosen level of profitability. However, profitability possibilities, which would conform to the normal distribution, rarely occur in reality. In pursuance of MPT, CAPM and APT completeness for investor's interests' revelation and for implementation means search, it is required to choose adequately the parameter of risk and precisely identify probability distribution of profitability possibilities. There is one more, rather linguistic misunderstanding. The concept "expected value" becomes a synonym of "mean value" in the context of profitability-risk analysis. Though, the market expects or there is expected in the market not an average value, but most expected value. Thus, "most expected" concept must be used in the English literature for description of investment market behavior. This concept in mathematics and especially in statistics sounds good and has its pseudonym – mode, i.e. the value of possibilities, having the highest probability. All concepts and conclusions of MPT, CAPM and APT using not an average value – "mean value" or "average" but the most expected value (moda) must be reviewed.

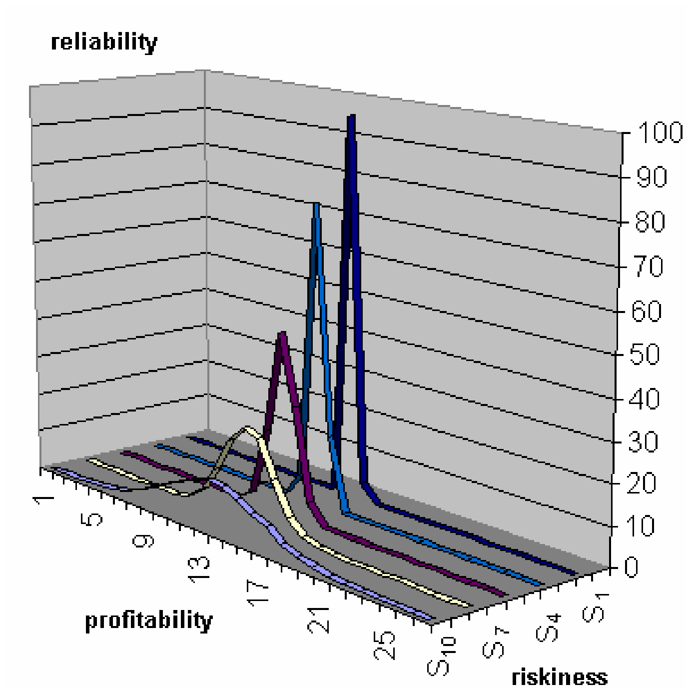

Fig. 1. The fragment of stochastic capital market view: riskiness (abscissa), profitability (ordinate), reliability (in applicate the density function is presented)

Thus, for further discussion an attitude, that every investor in order to realize and to estimate possibilities of investment should know at least three parameters of these possibilities – all possibilities of investment, including the most expected value, the reliability (guarantee) of each possibility, and exposure to risk, is taken. Thus, if we don't want to alienate from MPT logic in investment portfolio analysis, we must intercept risk of portfolio in the abscissa and probability distributions of the portfolio possibilities in the ordinate (see Fig. 1).

Performing further analysis of investor opportunities in the capital and exchange markets and searching for opportune strategies for the investor, the limitations of investor's opportunities, dictated by the market, must be considered. The easiest way of understanding those limitations is to analyze the Efficient Market Hypothesis (EMH), which states that stock prices set in the market are the best indicators of stock value, because of high efficiency prices evaluation mechanism, which is typical for capital market [8, 9]. Certainly, market efficiency by itself is a controversial concept, and it is supposed that there are three degrees of market efficiency. First – weak-form efficiency, when current changes of prices do not depend on historical changes of prices. Second – semi-strong form efficiency, when all public information reflects in stock prices.

Third – strong-form efficiency, when all existing information reflects in stock prices.

Having its own peculiarities, there exists the hypothesis of exchange rates market efficiency, which states that rates of exchange rates futures are non-biased forecasts of exchange rates. Arised empirical discrepancies show not irrationality of market participants, but other existing reasons: risk effect, transactions costs and state policy.

It's not possible to understand the interaction of Efficient Market Hypothesis and investor possibilities. However, if market fully accumulates all possible information about stocks utility, and at the same time generates efficient frontier and market portfolio by specifying values of stocks and exchange rates – then practically there are no possibilities to overtake the market in order to get investment profitability. Market portfolio must be copied. Many market indexes, in turn, are composed like the analogue for the market portfolio. Thus, we almost always have indicators of the market maximum possibilities, which, practically, cannot be exceeded invoking individual investor portfolio in the long period.

Conclusions given above can appear as not fully adequate for reality, because MPT, CAPM and APM are based on the assumptions, which are not fully proved by empirical researches. Especially many comments are formulated for CAPM, and first of all because of assumptions stating that market portfolio should analyze all investment assets of the market and analogue of individual market portfolio – all investment assets available for an individual.

From the other side, we can see that in the most innovative sphere of human activities – investment - new works constantly appear, which signalize about existence of opportunities to beat the market, and the practice shows that it is pretty uncommon but real opportunities. Furthermore, market by itself is evolving intensively [8, 9, 10, 11].

3. STOCHASTIC MARKET MODEL APPLICATION TO INVESTOR'S POSSIBILITIES RESEARCH IN FINANCIAL MARKETS

In the previous part of the text the concept of the stochastic (probabilistic) financial market model was introduced. However, from the beginning of this text the position was taken that any future profitability possibilities of the investment mean must be analysed as a probability distribution of certain possibilities.

Capital market is usually perceived as a medium-term or long-term market, where funds are lent to traders and industrials, government, local authorities and other institutions. The funds are provided by the private investors, insurance companies, pension funds, etc. Stock exchanges are component parts of the capital markets, and their development level often fully characterizes the improvement or the state of maturity of capital market of the country. Stock exchanges were trading with the help of their brokers for a long time; though now they are open for a direct investor. This could be a precedent for new investment strategies emerging and general investment culture increase.

From the viewpoint of capital lenders, capital market is a very risky capital employment area. Here the investment capital can be influenced by different varieties of risk. For operative analysis and decisions the risk of lent capital-generated profitability is very important. Further in the text the investment capital profitability possibilities, as well as profitability risk will be described.

As it was already discussed in the beginning of the chapter, for lent (invested) capital profitability possibilities analysis the model of those possibilities probability distribution will be used [12]. Thus let us assume that such description of possibilities is, from one side, enough for our objectives implementation, and from another side, there are always possibilities for concretizing profitability possibilities probability distribution in the situations under analysis. Naturally, in such situation the stock exchange could be analysed as n-dimensional probability distribution (n – the number of stocks traded on stock exchange), but analytically it would be very difficult to examine or even formalize various practical situations. Moreover, in that case there is no possibility to present geometrical view of the situation.

For the reasons described above, in initial position it will be assumed that two-dimensional (plane) model is adequate enough for the stock exchange, where profitability possibilities probability distribution of every stock is represented by two indicators – standard deviation (abscissa) and full possibilities spectrum of profitabilities (ordinate) [13]. In Markowitz portfolio mean value is selected out of spectrum of all possibilities. This is a widely used pattern for simplifying the research of complex and even not-fully described by these two parameters probability distributions. The fact is that standard deviation of the profitability possibilities probability distribution in many cases can be used as a risk indicator for initial analysis. Also, taking into account that usually profitability possibilities probability distributions are not symmetrical, investor is most interested in profitability possibilities characteristic – mode of the distribution, which is the value of the possibility which has the highest probability. Thus invoking every stock's risk and profitability indicators for stock exchange research, certain geometrical view opens, and appears a possibility to analyse the possibility of the whole market, as well as possibilities of a separate investor in the market, if he selects certain stock portfolio.

It seems that there is a need to pay attention to the circumstance that with the help of such market view, in many markets, analysed by the author, more or less clear stratification of the spectrum of the points, presenting profit possibility and risk, can be observed, as it is seen from Fig. 2. It is no less important that analysis of the market geometrical view has shown that the formed stratas practically retained with small changes during a long period of time. If this could be accepted as objectively appearing consistent pattern, then there should be found out how consistent patterns of formation and change of stratas and their cores (certain resultant of all the stocks in the strata) can be used for market possibilities analysis.

In essence, for market behaviour and perspectives possibilities analysis usually various indices are used, as they combine and summarize all the stocks in the market. However, taking into account the fact that market behaviour is strongly influenced by various interdependency changes of the groups of stocks, it is required admitting that neither for index selection, nor for their change analysis and forecasting, information about separate stock groups interdependencies formation or change in not fully used [14].

Meanwhile, viewing the market behaviour as the behaviour of interdependent stratas, while developing market behaviour and possibilities investigation model, opens the real possibilities of thorough taking into account stocks and their groups interdependence formation and change mechanism. Thus appears the possibility of operative evaluation of the correlation dependencies, constantly changing in the market and having a strong influence on its behaviour, as well as the possibility to transfer to s-dimensional (s – the number of the stratas, formed in particular market) probability distributions analysis, if s appears relatively small: $s<...<n$.

The influence of separate stock groups interdependencies change on the market and on investor's possibilities will be evaluated in further part of the text. Meanwhile, Fig. 2 also fixes our attention on the situation how the selection of stock profitability possibilities probability distribution parameters, intended to characterize risk and standard profitability, can change the market geometrical view. Fig. 2 presents a case when stock riskiness is evaluated by average standard deviation, and profitability – by real value of profitability.

However, there is a need to pay attention once more to the persistence of stratification consistent patterns. The formed logics of stock stratification remains similar in all the sections.

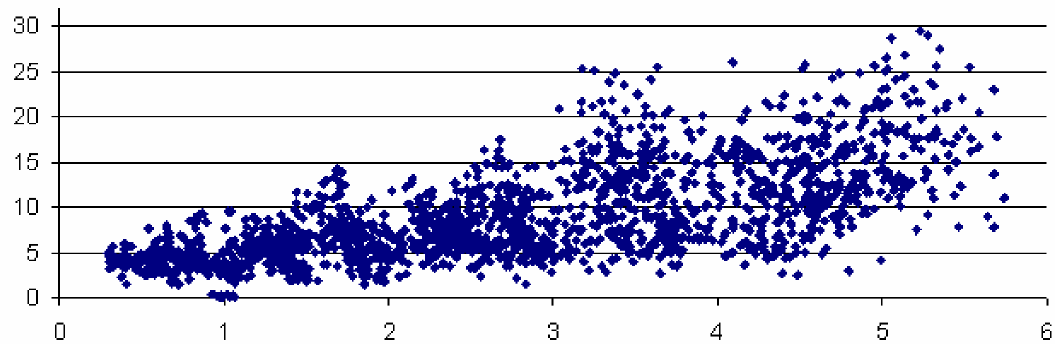

Fig. 2. Two-dimensional view of the stock market stocks profitability possibilities, when profitability possibilities risk is measured in standard deviation, and profitability – in particular realization.

The views of the profitability possibilities stratas, presented on Fig. 2, provoke an assumption that according integrated behaviour of the cores of stratas, the whole market behaviour can be described. For this reason the cores (resultants) of the stratas are determined, which are assumed as profitability mean values and standard deviations of all the stocks, composing the strata. Table 1 presents the statistical evaluations of the 8 stratas' cores, which are formed by the stocks profitabilities, selectively sampled from the real market.

Using features of the stratas, the market portfolio could be represented by all the stratas' cores portfolio. The stratas' portfolios would be closer to market behaviour than index portfolios, because in indexes calculation stock prices interdependencies are not taken into account. Thus, in indexes calculations only stock prices and market capitalization are used, while using stratas cores portfolio it is possible to take into account not only stock prices, but also of other quantitatively evaluated parameters, which could be significant in description of stock market behaviour

Table 1. Parameters of the stocks cores profitabilities

Stratas	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mean values of profitabilities	3,49	4,59	5,83	7,51	9,09	12,99	11,00	15,24
Standard deviations of profitabilities	1,31	2,11	2,64	3,19	3,49	3,81	4,32	4,46

Also, quasi-stratas could be selected not only by naturally observing their formation, but also with the help of clasterization methods forming the artificial stratas.

Thus the material presented in this chapter could be accepted as an attempt to systematize decision management researches in financial markets according certain attitudes, through using certain circumstances unfolding in those markets, and primarily using a very preliminary assumption about stratificative nature of profit possibilities in capital and exchange market.

Further in the paper an attempt of demonstrating how cores of the stratas, with the help of portfolio technique, could be structurized into the information required for the investor.

4. APPLICATION OF MARKET PORTFOLIO BASED ON STRATAS' CORES TO QUANTITATIVE DESCRIPTION OF THE INVESTMENT SPACE

First of all it is advisable to discuss the hypothesis about stratificial nature of market profitability possibilities, raised in the third chapter of the paper. It is clear that such attitude is not yet based on wide and resumptive empirical observations. However, if the assumption proves out, even in its weakest form, then the possibilities of more constructive market analysis appear. First of all, the attention is paid to the so-called cores of the stratas, which were obtained on the basis of direct historical market data, accepting them as profitability possibilities (the sum of random numbers) of the stocks plumped into their environment (strata). Direct historical market data was complemented by adequate "widening" of the number of observations to the amount, which would allow using imitative technologies for technical analysis of the situations occurred [15]. Thus the centers of the generated stratas were used for traditional "standard deviation – different profitability possibilities" portfolio set formation, as well as for dimensional Markowitz portfolio set analogue formation (see Fig. 6). Fig. 3 shows empirical (discrete) profitability possibilities probability distribution (histogram) function. The histogram has a clearly defined log-normal distribution form. It is also clear that the modes of the distributions – the values of possibilities having the highest probability – substantially vary from the mean value of possibilities. There is no doubt that probability distributions of the portfolios of such assets' profitability possibilities will not be symmetric. Thus the efficiency line of "standard deviation – mean" portfolio set will not have unambiguous confidence level in all the points.

However, gradually explaining the description of reliability of market-provided possibilities for the investor, the so-called "standard deviation – quartiles" set of portfolios may also be analysed. Fig. 6 shows the bunch of such sets. The quintile of 0,005 level (having the minimum value) is selected as the zero quartile, and 0,995 level quintile (having the maximum value) – as the fourth quartile.

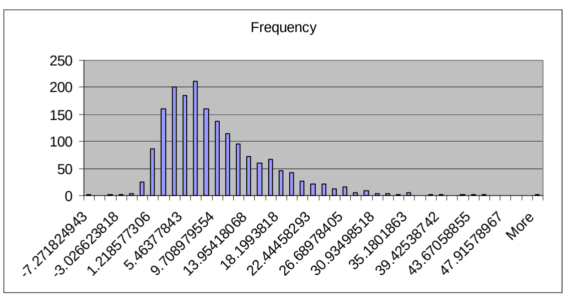

Fig. 3. Probability distributions (histograms) of profitability possibilities of the selected stocks

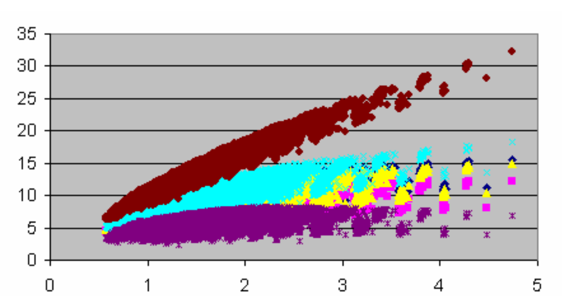

Fig. 4 "Standard deviation – profitability possibilities quartiles" set of portfolios

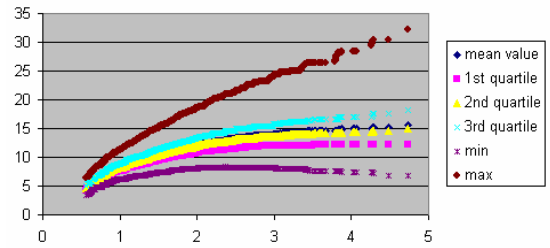

Fig. 5. Efficiency lines of "standard deviation - profitability possibilities quartiles" set of portfolios, or simply market possibilities izoguarantees

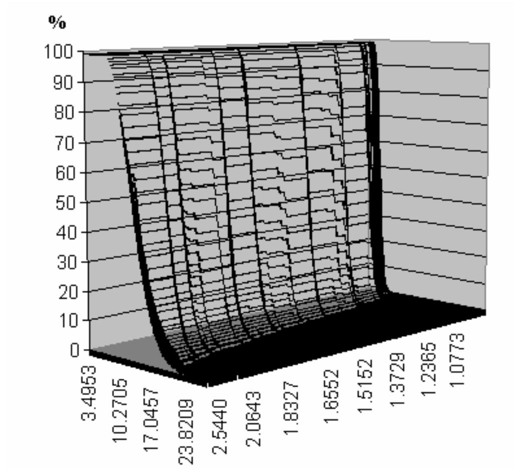

Fig. 6. Dimensional view of the market-provided possibilities for the investor, or modern investment portfolio efficiency line extend, or, simply, Markowitz portfolio dimensional view, or investment market possibilities view

The possibilities of pursued reliability assessment are disclosed analyzing Fig. 5, which shows the efficiency lines of the sets of portfolios, presented on Fig. 6, which are the izoguarantees of the reliability levels *a* = 0,05; 0,25; 0,50; 0,75; 0,995 for the respective portfolios. In other words, these are the points subject to the following provision:

$$P\left\{\xi \geq I_r^a\right\} = a \qquad (1)$$

for every value of the standard deviation (risk).

here: *a* – selected confidence level

I_r^a – the value of the izoguarantee of the confidence level under the value of standard deviation equal to *r*.

Finally let us take the continuous confidence flow and raise all the formed izoguarantees to the height *a* on applicate axis. Then the modern portfolio view in the space will be formed. This is illustrated on Fig. 6. Here every value of the portfolio is described by its profitability, reliability (guarantee) and risk.

5. CONCLUSIONS AND RECOMMENDATIONS

1. Expectations of the investor's utility abundantly react to the profitability, guarantee (reliability) of profitability and risk. Thus the possibilities offered for the investor should be evaluated at least according three parameters: profitability, reliability (guarantee) and riskiness.
2. Adequate investment portfolio allows to explicate the concept of efficient frontier, applying the conception of efficiency zone, used in modern portfolio, when investment efficiency is characterized by profitability, guarantee and riskiness.
3. Using observable facts of market assets efficiency values stratification in risk-profitability plane and using the cores of these stratas as resultants of the certain stratas, there is a possibility of formation of portfolio sets of different reliability with efficiency lines, fully reflecting the whole market provided possibilities for the investor.
4. In order to use the network of izoguarantees, i.e. the lines of the efficiency zone, having the same reliability (guarantee) level, it is required to form the adequate market behaviour forecasting system, which would enable to select efficient decision strategies in exchange and capital markets.
5. Development and application of the model, adequate for exchange and capital market stochasticity, and intended to market possibilities and individual investor's possibilities research, requires invoking possibilities of imitative technologies, which allow to solve the systems of stochastical programming tasks at the desired precision.

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