PREMISES OF BEHAVIORAL FINANCE IN RATIONAL DECISION-MAKING

Laurențiu Droj
Finance-Accounting Department, Faculty of Economic Sciences,
University from Oradea, Romania
ldroj@yahoo.com
Elena – Ana Iancu (Nechita)
Alexandru Ioan Cuza" Police Academy of Bucharest
Faculty of Juridical and Administrative Sciences,
University of Agora from Oradea, Romania
anaelena2009@yahoo.com
Ioana Florina Popovici – Coita
Finance-Accounting Department, Faculty of Economic Sciences,
University from Oradea, Romania
popovici.florina@yahoo.com

Abstract
One cannot separate decision from psychology of human being. People see world by perception and this leads to various ways of understanding even the most concrete or certain things. Financial literature reflects the subjective nature of human being in making decisions by classifying decision-making process into being “rationally” oriented or the opposite, “irrational”, according to individual’s attitude towards risk – “appetite” or “aversion”. Process of understanding risk associated with future financial returns implies attaching mental probabilities to it. This activity is always affected by human nature of agents that take financial decisions, therefore bearing risk. Psychological factors such as perception, framing effect, information asymmetry, irrationality, emotions are accompanying every financial decision. Paper intends to study the direct relationship between psychological traits of a human being playing the role of a decisional agent in financial context. Financial decisions are always accompanied by the notion of probability in defining what we call as "expected" returns that translate into risk associated with financial investments. Empirical analysis done on the financial market reflects that agents use their perception on risk of gaining or losing from a certain financial transaction to decide whether to invest or not. The notion of “expected utility” has been complementary used with the one of “prospect value” as financial literature evolved over time and researchers brought new insights into the mechanism of financial decision. This paper studies direct relationship between psychological traits of a human being according to classical and rational decision-making process in the light of the prospect theory and risk attitude regarding financial outcome of decisions. In this sense, an econometric model is tested on the international financial market in order to find out what kind of subjective factors lie hidden in an investor`s mind and test the degree of irrationality lies beneath a rational financial decision. The result is incorporated in a decisional model describing how agents use their perception on risk of gaining or losing from a certain financial transaction.

Keywords: irrationality, financial risk, decision, psychological factors
JEL Classification: G02, G11, G32

Introduction

Financial decisions are always accompanied by notion of probability in defining what we call as "expected" returns that translate into risk associated with investments on the capital market. This mathematical probability is seen as being objectively estimated (Markowitz, 1959; Sharpe, 1964; Kolmogorov & Fomin, 1970, Baele et al. 2014) or purely psychological (Allais, 1988). The notion of "expected utility" (Markowitz, 1959) has been complementary used with the one of "prospect value" (Kahneman & Tversky, 1974, 1979, 1991, 1992) as financial literature evolved over time and researchers brought new insights into the mechanism of financial decision. Probability is used as an objective mathematical formula (Markowitz, 1959; Sharpe, 1964) or as a psychological intuition depending on the context and nature of the decision (Allais, 1988). Authors like Kahneman & Tversky (1979, 1991) found that people place "weights" more than "percentages" to future events and founded "prospect theory" to describe the mechanism of decision – making involving monetary benefits. They also defined what we call as "marginal value" (Kahneman & Tversky, 1974, 1979; Kahneman et. al, 1991). In this sense, decision-making is seen differently from what we know from classical theory in terms of final values or „expected". Prospect theory sees that people compare various states of alternatives for finding the motivational „difference" that acts as a stimulus to act.

One cannot separate decision from the psychology of human being. People see world by perception and this leads to various ways of understanding even the most concrete or certain things. Also, financial literature reflects even the subjective nature of the human being in making decisions as being "irrational" by assuming risks in situations that would require acting more safe (Aumann 2004, Aumann & Serrano, 2008). Some authors explain this behavior as "gambling risk" (Markowitz, 1952, 1991; Stancu & Mitroi, 2007; Kahneman & Tversky, 1992; Bătrâncea 2009).

This paper intends to study the direct relationship between psychological traits of a human being playing the role of a decisional agent in financial field. The decision mechanism that lies under financial investments forces the agent to choose between gains and losses with an uncertain probability (Kahneman & Tversky, 1974; 1981, 2002). In this sense, we are considering an econometric model tested on the capital market in order to find out what kind of subjective factors lie hidden in an investor`s mind. The result is incorporated in a decisional model describing how agents use their perception on risk of gaining or losing from a certain financial transaction.

1. Premises of the econometric model

Risk measurement in this context makes use of data sources available on the capital market, namely the time series of the shares` prices traded. These in turn are modeled using an econometric methodology and the results show an objective picture of the risk associated with different decision alternatives in the financial market. The empirical results of the econometric model used for this purpose provides information about the factors that drive agents in their financial decisions.

The emergence of numerous models measuring risk and its associated cost of capital for companies listed on the stock market was driven by the motivation to find an optimal model to capture the fair value of it. This attempt isn`t over yet and

it represents the subject of numerous research papers. History mentions the founders of the cost of capital model - Sharpe and Lintner (1964) founding in 1965 the standard model that is still used to measure the cost of capital on the capital market (CAPM). But they are not the only ones who were concerned about this issue in such period Harry Markowitz (1952), Jensen (1978, 1981), Ross (1976), Merton (1982), Fama and French (2003), Estrada (2000) and others were concerned with finding the most suitable model to estimate the expected returns on the capital market. Sharpe (1964) launches the hypothesis of its model, similar to that held by Harry Markowitz (1952) on the evolution of capital yields as exclusively related to the value of the slope of the regression line passing closest to yield values analyzed (beta coefficient). Later, in 1991, Sharpe introduces the risk-free asset rate as compared to the level of returns on risky assets resulting from the difference between what they called "risk premium".

Markowitz H. (1952) regards financial decision as being divided in two stages, the first refers to the analysis of alternatives and second is the acting itself. First step is done based on experience and knowledge of each individual and second step is done based on expectations for future benefits. Main theories on financial decision are based on „perceived" expectations of future returns. Markowitz (1952) speaks about positive nature of „expected return" and about its variance as „undesirable". In this sense, investor will want to maximize expected return and minimize its variance, but not to the same extent. Risk is defined as the standard variation of "expected" returns. According to utility theory (Markowitz, 1952) people reject risk of all kind whereas in prospect theory (Kahneman & Tversky, 1974, 1979, 1991) risk has a positive nature in case of losses. Agents are seeking risk when they want to diminish their chances to lose money in transactions but when it comes to certain benefits people tend to avoid risk. In prospect theory, risk has a dual nature depending on the context. In this sense, Estrada (2000) defines „downside risk" as the negative side of the probability that price of securities in the portfolio might fall. Sharpe (1964, 1991) follows the agents' premises of utility preferences used by von Neumann & Morgernstern (1944) for the definition of expected utility. In Sharpe's (1991) opinion agents have various degrees of "risk tolerance" in facing financial decisions. In the same manner as Markowitz (1952), Sharpe (1964, 1991) views risk as having a „penalty effect" on the future financial results.

Several human factors like subjectivity, perception, heuristics, framing effect, irrational acting, emotions, social representations, accompany every financial decision (Kahneman & Tversky 1974, 1981, 2002, Kahnemann et al. 1991, Kirchler 2002; Kirchler 2007; Popovici 2010). These factors relate to formation of expectations regarding future return or „cost of capital" which in turn is affected by agents' appetite or aversion of risk, information asymmetry, greed or fear of losing a certain monetary benefit. Some others (Mayfield, 2004; Hearn, 2009; Donadelli & Prosperi, 2012; Lischewski & Voronkova, 2011) view instead of the cost of capital as the primary motivational mobile to financial transactions the „expected premium". This in turn comes to sustain the prospect theory (Kahneman & Tversky, 1974, 1979, 1991) stating the premise of „marginal utility" referring to the fact that people look for the „marginal value" in comparing various alternatives when it comes to decision.

2. Methodology and database

Type of data used in the testing econometric model refers to time-series with a weekly frequency. The analyzed period ranges from 03.01.2000 to 28.12.2015 in a sample spread over 52 time series. Data series were built on the closing price of shares included in the sample. The values used are weekly averages of daily closing prices. Statistical population was that of 50 companies listed on the US international market (listed on the stock exchange NYSE Equity and NASDAQ Equity) and whose data were provided by finance.yahoo.com database. The companies were selected on the criteria of having at least 174 observations per series, to provide sufficient data for a more precise analysis and to obtain statistically meaningful results.
There were included in the sample the weekly average values of closing prices of the S&P500 as a representative index for the overall market analyzed. The weekly rates of US Treasury Bills T-13 week were included in the sample as representative for the risk-free asset in the model. Both time series include observations for the period 03.01.2000 to 28.12.2015.

2.1. Objective of the empirical study

Financial time series analysis involves unpredictable aspects of capital market share price. These include notion of "noise" that makes it difficult to reveal some trends or patterns of evolutionary time series analysis. Aim of present econometric analysis is related to understanding the functioning of capital markets, price formation related to the investors' expectations. The stock market is one of the most volatile markets compared to the real estate or human resources.
Volatility of the financial market is given by the trading of intangible assets (rights) unlike material goods traded on other markets. On the financial market, period between two successive transactions is very short compared to other markets. It can sometimes be a few seconds, minutes or hours. Also, pricing in this market is influenced by purely subjective factors, such as investor expectations regarding future profit made and financial growth prospects of companies.

Objective of the empirical analysis consists in studying the decisional mechanism performed by agents in selecting various financial alternatives based on perceptions regarding „expected return" affected by risk for gains or losses.

To get the per share rate, the following formula (1) was used:

$$\mathrm{Ri} = \log\left(\frac{\mathrm{P_t}}{\mathrm{P_{t-1}}}\right)$$

where:

P_t , P_{t-1} - stock prices in the current period (t) and previous (t-1);
R_i – expected return on a company's share

The same formula described above was used for the calculation of yields for the S&P 500, in accordance with the following:

$$\mathrm{Rm} = \log\left(\frac{\mathrm{P_t}}{\mathrm{P_{t-1}}}\right)$$

where:

P_t , P_{t-1} - traded index values in the current period (t) and previous (t-1);
R_m – expected market return of the S & P 500

Based on the above transformations, time series were generated covering a period from 03.01.2000 to 28.12.2015. Treasury bills yields were used from the website finance.yahoo.com. Market risk premium is defined by the formula (2) below (Mayfield, 2004; Hearn, 2009; Donadelli & Prosperi, 2012; Lischewski & Voronkova, 2011):

$$\text{Expected market risk premium} = \text{Rm} - \text{Rf}$$

where:
R_{ft} - risk-free asset is the rate (in this case - T-Bills Treasury rate 13 week)
The term "expected" refers to the future potential gain that could be obtained from various transactions on the capital market. The term "expected" is used to express the degree of probability that may occur in future transactions. The unpredictability of capital markets can also lead to the occurrence of losses for investors. The concept used as "risk-free" means that the likelihood of getting a clear gain is 100%. This cancels risk. When the probability p% is less than 100% to get a sure win, it means that (100% -p%) there is a risk of losing. Future returns on the capital market are called “stochastic” or "random". This can take positive or negative value with a certain probability.

2.2. Estimation of the econometric model tested

The construction of the econometric model is based on the understanding of the concept of regression. Econometric regression models are used to establish a relation between two or more variables. This can be linear or non-linear. Most real phenomena evolution is nonlinear but financial literature uses deterministic models that can be predicted, studied and compared with each other to identify any correlation between them. The correlation between the two phenomena, that they evolve synchronously or asynchronously, and does not necessarily imply a causal link (Donadelli & Prosperi, 2012; Lischewski & Voronkova, 2011).
Empirical study reflects cost of capital estimated using the Sharpe (1964, 1991) model according to the formula (3):

$$C_{ki} = R_{fT} + (R_{mT} - R_{fT})\beta_{iT}$$

where:
C_{ki} - is the cost of capital estimated by the Sharpe model (1991)
i - is the company that owns the action
T –number of periods analyzed in the sample, t belogs to the discrete interval {2000-02, 2003-05, 2006-08, 2009-11, 2012-15}.
R_{mT} = expected market return calculated as the arithmetic mean of the values taken by the variable linear vector $R_{mt} = [R_{m1}, Y_{m2}, \ldots, Y_{mt}]$, t = 1, 2, …,n; that is related to the selected period T.
R_{fT} = risk-free asset yield calculated as the arithmetic mean of the values taken by the variable linear vector $R_{ft} = [R_{f1}, Y_{f2}, \ldots, Y_{ft}]$, t = 1, 2, …,n for the selected period T.
β_{iT} - beta value or risk measure

The concept of cost of capital is estimated ex - post on the basis of historical data, using linear regression method. The concept is seen in the financial literature as "expected" return to any investor who buys shares of companies listed on the stock exchange.
Empirical analysis captured various stages of the US economy and its impact on the global market. Period 2000 - 2002 captures a step of decrease in US capital market (see graph below) followed by one of growth for the years 2003 - 2005. These two periods preceding the economic crisis started in 2006 and continued until the end 2008. Market growth is slowed in 2006 and market returns followed a downward trend until 2008. The period 2006-08 is known in US history as the US financial crisis. Since 2009 the market followed an upward trend that continues to 2015. Periods 2009-11 and 2012-15 are in post-crisis and capture the recovery of the American capital market.

2.3. Estimation technique

In order to estimate the coefficients of regression equation, least squares method was used because it is applicable to a linear equation but not necessarily linear parameters and variables (Gujarati, 2004; Brooks, 2008). Assumptions of linearity in parameters refer to the fact that they are not altered by multiplication, division or lifting power. In case of violation of one of assumptions required for OLS coefficients to be BLUE, several specific tests may be applied to correct problems in data collected.
Firstly, heteroskedasticity disables OLS method to produce consistent estimators. Secondly, presence of autocorrelation of coefficients errors causes that results estimated by OLS to be no longer consistent. In order to eliminate these two problems of time series, the Newey-West procedure was used to estimate the regression parameters that actually produce standard errors 'HAC' already corrected for autocorrelation and heteroskedasticity.

3. Empirical results of the model

Following the equation regressions performed there were obtained empirical results referring to values taken by beta and alfa coefficient. Standard valuation model (Sharpe, 1964, 1991) reflects companies' own capital returns and their volatility compared with evolution of global capital market yields. The value of coefficient β reflects the risk and reflects degree of volatility of company's shares in relation to the global market. Results of t-statistic indicator show that values of beta coefficient indicate that it is statistically significant. Instead alpha coefficient is statistically insignificant in most cases[42].
Empirical results show that sectors such as ***financial*** and ***services*** show higher volatility than the overall market. Several reasons for this refer to the fact that businesses affected by financial crisis cut budgets for services offered by third parties. Companies in the financial sectors bear higher risk than other sectors because financial crisis was generated from the financial instruments used by this sector.

[42] results of the tests applied were not included in the paper but can be presented upon request;

Technology sector was more volatile than the market before the crisis started and became less volatile afterwards. ***Industrial goods sector and basic production*** have experienced on average higher volatility in the pre-crisis period and lower than the overall market in post-crisis. One reason for this phenomenon could be the fact that production sector suffered the most from the financial crisis due the slowing down on the real estate market.
Consumer goods, healthcare, utilities sectors showed on average lower volatility than the overall market with beta coefficient values generally below one. This result is supported by the fact that businesses may cut investment spending or services to third parties but cannot apply the same measure to food, clothing, healthcare, consumer goods or utilities which are needed for daily living.

3.1. Stock performance versus risk estimated according to the cost of capital model (Sharpe 1964, 1991)

Empirical results reveal that among the 50 US companies included in the sample, cost of capital shows negative values for several shares indicating a pessimistic perspective of the investors. On the other side, positive values indicate optimistic outlook on the expected returns of the shares. The mathematical explanation of the negative values showed by the cost of capital relies on the fact that the risk-free rate being larger than the market rate, investors believe their portfolios will be negatively affected, they would rather pay to get rid of the shares showing negative cost of capital.
A pattern of behavior encountered in 80% of the companies showing high cost of capital refers to the fact that the maximum values of the indicator were recorded in the pre-crisis and crisis periods showing that the investor sentiment on the growth prospects of their respective companies were optimistic until the summer of 2006 when the market began to fall dramatically unleashing the crisis.
In other cases, a pattern of behavior encountered in over 80% of the companies showing minimum values of cost of capital refers to the fact that the minimum values of the indicator were recorded during the crisis which shows that investor sentiment on the growth prospects of these companies have become pessimistic in 2006, during the crisis on the US stock market.
Alpha coefficient indicates how much a share expected return "exceeds" market yields, if its values are positive. The indicator shows how much the share returns are far lower from market yields if its values are negative. Alpha coefficient values[43] for shares with minimum cost of capital values were found showing negative values for more than 90% of cases, reflecting lower yields than the overall market
Although gross production fell between 2008-09 and started to rise towards 2010, industrial production sector showed increased volatility while other sectors showed decreasing volatility during economic recovery this in turn showing that investors started to gain trust in the capital market.
Sectors like **financial** and **basic materials** have shown negative values during the whole period analyzed due to the fact that these sectors were expected to bring losses to investors so they were eager to get rid of these shares reflecting a negative value of the “expected return indicator” (cost of capital). Other sectors showed positive values of the indicator “cost of capital” but decreasing towards one

[43] results are not presented in the paper but offered upon request

as the period approaches 2014 because investors expected lesser profit for lower risk as economy got out of recession and started recovering.

3.2. Building model financial decision under risk and gains / losses uncertain

The decision model is built from elements such as a subject and an object. In this case, the subject is an individual decision or agent who pursues a certain gain but can hold only according to the risk attached to it. Object of the decision refers to the monetary value of that gain or loss. Any decision bears risk. Subjects makers are primarily humans. There are categories of agents who are attracted to risk and others who reject risk.

Table 1. Categories of risk depending on the sector in beta coefficient

Sectors	Low risk/ Low volatility	Medium risk/ Medium volatility	High risk/ High volatility
Financial			x
Services			x
Industrial Goods		x	
Primary production		x	
Technology		x	
Consumer goods	x		
Health Care	x		
Utilities	x		

Source: author's econometric modeling

Decision model includes factor related to performance of companies listed on the stock exchange. Any agent or investor will have an “eye” on beta and alpha coefficients related to the stock returns of the companies they invested in or intend to invest. In the eyes of investors, a company’s stock market performance comes in the form of "expectations" regarding future profits they can get by investing in its shares. In the empirical study this is reflected in the form of cost of capital showing an optimistic view if the values are high or pessimistic if the values are low.

This paper sets out three categories of agents according to their attitude towards risk, "homo ludens" (Kirchler et al., 2007; Bătrâncea, 2009), "homo oeconomicus", "homo-switch social" (Popovici et al. 2010). Based on the empirical results, financial - decision model is described as followed:

"Homo Ludens" will be attracted to risk and will prefer to own shares in its portfolio in the category of high-risk or high volatility sectors such as financial, and services. High performance companies (high cost of capital) will be very attractive to this type of investor.

"Homo Oeconomicus" will present risk aversion and it will try to avoid it as much as possible by focusing on low-risk sectors such as consumer goods, utilities, healthcare. Lower risk companies will be attractive to “homo oeconomicus” because of its prudential nature.

"Homo Switch - social" will show a dual attitude to risk. It will ignore risk or avoid it in financial transactions following other type of objectives than financial. This type of agent will be attracted to the shares of companies in sectors that have a medium degree of volatility medium or medium risk, such as those in the technology sector, industrial goods and primary production.

Conclusions

Classical economic theory is centered on the rational agent oriented towards maximizing its utility from every financial transaction. Modern theories like game theory, behavioral finance, economic psychology, agent-based modeling speak about agent's behavior that is guided by emotions reflected into strategies followed in order to maximize benefits from transactions whether it is about monetary return, psychological satisfaction or social benefits (Popovici et al. 2010, Popovici, 2010).
A company listed on the stock exchange has an increased visibility to investors and they can "charge" or rather "encourage" any action or new project undertaken by a company. In this respect, any company manager will be attentive to the evolution of beta and alpha coefficients related stock returns because they are a "barometer" of investors' perspective on the companies' financial value and it can directly influence its stock' performance.
Each category of agents described in the decisional model presents a specific attitude towards risk. The first category "homo economicus" presents risk aversion when it comes to certain gains. This type of investor will put his "eggs" in sectors showing lower risk but lower gains. Investors like this will invest their savings into shares from the utilities, consumer or healthcare because these offer lower risk. The second category of subjects "Homo Ludens" will present appetite for risk when it comes to sure losses for two reasons, namely: the risk of losing consists as a motivation to fight risk thus being attracted to it. An incentive for this category of agents represents the "playing for fun" that drives them into taking additional risk. This type of investors will chose financial sector or services because of the high degree of risk born which could also translate into high gains which is also shown by the increasing optimism shown from expecting higher profits as time approaches 2014 for the shares held by this type of agent. Third class of agents, "homo-switch social" has a dual attitude towards risk assuming additional risk without financial motivation. However, this category of subjects may present risk aversion in financial situations without apparent reason but rather stimulated by other purposes, such as social, environmental or psychological. This type of agent will invest in technology, primary or basic goods sector because it offers a safer option and also brings advantages like innovation or seed capital companies.
The reality of everyday human decisions on capital market financing involves a degree of risk. Some investors are attracted to risk, others avoid risk and a third category has a dual attitude towards risk, meaning that in specific situations may be attracted to risk or reject it. Financial decision-making on the capital market depends on agents' risk attitude which will also influence companies' stock performance.

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