THE MINISTRY OF HIGHER AND SPECIAL SECONDARY EDUCATION OF THE REPUBLIC OF UZBEKISTAN

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"THE EMPIRICAL CAPM:ESTIMATION AND IMPLICATIONS FOR THE REGULATORY COST OF CAPITAL"

5230600 – "Finance" educational specialty

GRADUATE WORK

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INTRODUCTION

Relevance of the theme of final qualifying work. In the condition of modernization of the Uzbekistan's economy, the government is not only paying attention to every sector of economy but also developing those sectors by studying foreign countries' experience. As other countries, Uzbekistan has several degrees about it. For instance, the degree of the Republic of Uzbekistan "About the securities market" and "About the activity of estimation". Besides, I.A. Karimov, the president of Uzbekistan also have some works "About the system of bank, money, credit, investment and financial resistance".

A set of systemic measures on radical change of ownership structure, decreasing the presence of the state in economy, altering the principles and approaches of corporate management has been realized. Modern management structures have been introduced in all joint stock companies.[1]

CAPM is considered to be the basic to calculate the costs of capital in the securities market. This model plays a main role in financial market, especially securities market. In order to develop the activity of corporate management CAPM is referred as the most-used model in the world economy.

The model is used for the determination of risk and expected return in portfolio. When this model is compared with the theory of Markowitz model, the mathematical theory of Markowitz to portfolio models of investor behavior, based on rational expectations in the framework of the overall concept of equilibrium. Sharpe's CAPM is considering the profitability of shares, depending on the behavior of the market as a whole. Early empirical tests of the CAPM such as those by Linter (1965), Black, Jenson, and Scholes (1972), and Fama and MacBeth (1973) collected on the directly of the association between rates of return and beta for cross part of securities. Later empirical tests of the model established by Fama and French (1992) focused on the analyze in the CAPM framework. These tests attempted to investigate whether other variables like size and book-to-market value

[1] **T**he speech of I.A,Karimov, the president of the Republic of Uzbekistan: The outcomes of socio-economic development in the country in 2015 and the crucial priorities of economic program for the year 2016. Site: press-service.uz

proportion, besides the beta, could clarify the variation of average rates of return for cross-part of securities.

There are several scientists who analyzed and gave their opinions. For instance, Breeden, Gibbons, and Litzenberger (1989) examined the empirical implications of the consumption-oriented capital asset pricing model (CCAPM), and compare its performance with a model based on the market portfolio.

The object of final qualifying work. Estimations and implications of capital costs is considered as the object of the work.

The subject of the final qualifying work. Tests or analysts of the capital asset pricing model is the subject of my graduation work.

The aim of the final qualifying work. Gaining more information about estimations and implications of capital asset pricing model

Tasks of final qualifying work are follows:

• to clarify the concept of the securities market and learn the conditions of its existence;

• to understand the CAPM and its current position;

• to learn identifying and analyzing the model of CAPM by several scientists ; • to study critiques of this model;

Project structure. Introduction**,** 3 chapters, 6 questions which covers the basic content of the final qualifying work, conclusions and suggestions, list of used literature.

CHAPTER 1 THEORETICAL FOUNDATIONS OF THE CAPITAL ASSET PRICING MODEL

1.1 Description and theoretical framework of the CAPM

Capital Asset Pricing Model (CAPM) - valuation model of return in financial assets serves as a theoretical basis for a number of different financial technologies for managing profitability and risk, applied in long and short-term investing in stocks.

The long-term assessment model or model to determine the cost of capital was designed by Harry Markowitz in 1950s. The Markowitz Efficient Frontier is the set of all portfolios that will give the highest expected return for each given level of risk. These concepts of efficiency were essential to the development of the capital asset pricing model[2].

Capital Assets Pricing Model (CAPM) was developed by William Sharpe in 1966, and brought the author the Nobel Prize. The model (as well as the APT) based on the economic model of equilibrium implies that prices of financial instruments reach their true values (values which allow the balancing of demand and supply of assets). In a theoretical sense, the CAPM can be seen as a further development of the theory of Markowitz with additional assumptions about the market participants and information available to them. As noted by Peters: "the CAPM combines the efficient market hypothesis (EMH) and mathematical theory of Markowitz to portfolio models of investor behavior, based on rational expectations in the framework of the overall concept of equilibrium[3]".

Since it is assumed that all information is equally available to all market participants, they are equally interpreted and have homogeneous forecasts as well as rationally react, whereby prices reach an equilibrium state.

[2] Markowitz, H.M. (1959). Portfolio Selection: Efficient Diversification of Investments. New York: John Wiley & Sons. (reprinted by Yale University Press, 1970, ISBN 978-0-300-01372-6; 2nd ed. Basil Blackwell, 1991, ISBN 978-1-55786-108-5)

[3] Edgar E. Peters. Fractal Market Analysis: Applying Chaos Theory to Investment and Economics. John Wiley and Sons, Inc., New York, NY., 1994

A market that satisfies all these assumptions is called a perfect market. In addition, the CAPM assumes a risk-free securities (e.g. government bonds or bank account), and unlimited divisibility of all assets.

CAPM is considering the profitability of shares, depending on the behavior of the market as a whole. Another initial assumption of the CAPM is that investors make decisions, taking into account only two factors: expected profitability and risk.

The point of this model is to show the close relationship between the rates of return to financial instrument risk.

It is known that the greater the risk, the greater the return. Therefore, if we know the potential risk of the security, we can predict the rate of return. Conversely, if we know the yield, we can calculate the risk. All calculations of this kind with respect to risk and return are carried out using a model of long-term asset valuation.

According to the model the risk associated with the investment in any risky financial instrument, can be divided into two types: systematic and unsystematic. Systematic risk is caused by general market and economic changes affecting all investment instruments and is not unique to a particular asset. Unsystematic risk associated with a particular issuing company.

Systematic risk cannot be reducing, but the impact of market returns on financial assets can be measured. As a measure of the systematic risk in CAPM, the indicator β (beta) is used as the sensitivity of a financial asset to changes in market yields. Knowing the index β of the asset, it is possible to quantify the value of the risk associated with price changes of the market as a whole. The larger the value of β stocks, the stronger grows its price with the overall market growth, but also vice versa - the stocks of companies with large positive β harder they fall when the market falls as a whole.

Unsystematic risk can be reduced by drawing up a diversified portfolio of a sufficiently large number of assets, or even a small number of interconnected anti-correlate assets[4].

Since any action has it's a level of risk, this risk must be covered by the returns, that the instrument remains attractive. According to the model estimates of long-term assets, rate of return of any financial instrument consists of two parts:

- The risk-free return;
- The premium return.

In other words, any profit from stock includes a risk-free profit (often based on the rates of government bonds) and risky profits, which (ideally) corresponds to the degree of risk this stock. If rates of return exceed the risk indicators, the tool generates more revenue than expected for its degree of risk. Conversely, if risk indicators were higher profitability, we need such a tool that is not needed.

CAPM is mainly adopted in researches on the relationship between the expected rate of return and risk of asset in the security market as well as the formation process of equilibrium price. Its main characteristic is creating the coefficient β to measure the market risk (systematic risk) of corporate securities. Formulas are as follows:

$$R_i = R_f + \beta_i\left(R_m + R_f\right) \quad (1)^5$$

Where β_i is equal,

$$\beta = \frac{Cov(R_i, R_m)}{\sigma^2 M} \quad (2)^6$$

R_i= expected return rate of security i

R_f = risk-free interest rate

R_m= expected return rate of market portfolio

β_i = coefficient β of the security i

[4] Sharpe, William F. (1964). "Capital Asset Prices – A Theory of Market Equilibrium under Conditions of Risk". Journal of Finance XIX (3): 425–42.
[5] Sharpe, William F. (1964). "Capital Asset Prices – A Theory of Market Equilibrium under Conditions of Risk". Journal of Finance XIX (3): 425–42.
[6] Sharpe, William F. (1964). "Capital Asset Prices – A Theory of Market Equilibrium under Conditions of Risk". Journal of Finance XIX (3): 425–42.

σ = standard deviation of return rate of market portfolio

Coefficient β represents the responsible sensitivity of risk from security i relative to the market risk. The expected return rate of an asset can be measured by β, the relative measurement of asset risk.

Risk-free return is the part of income, which is inherent in all investment instruments. Risk-free return is usually measured at rates of government bonds, because they are virtually risk-free. In the West, the risk-free return equal to about 4-5%.

Beta is a special coefficient, which measures the riskiness of the instrument. While the previous elements of the formula are simple, understandable, and locate them quite simple, then β is not easy to find; free financial services do not provide the β of companies.

Table 1

Interpretation of coefficient Beta (β)[7]

Beta	**Direction of changes in security's return in comparison to the changes in market return**	**Interpretation of β meaning**
$\beta_i>1$	The same as market	Volatility (risk) of stock is higher than market risk
$\beta_i=1$	The same as market	Stock's volatility (risk) is equal to market risk
$\beta_i<1$	The same as market	Stock's volatility (risk) lower than market risk
$\beta_i=0$	There is no relationship	Stock's risk is not influenced by market risk
$\beta_i<0$	The opposite from the market	Stock's volatility (risk) lower than market risk but in the opposite direction

The regression coefficient β serves as a quantitative measure of systematic risk that cannot be diversified. Securities having β-coefficient equal to 1, repeats market behavior as a whole (Table 1). If the value of the coefficient higher than 1, the reaction of securities ahead of the market will change both in one and in the

[7] The Table designed by author

other direction. The systematic risk of such a financial asset is above average. Less risky are the assets, the β-coefficients are below 1 (but above 0).

The concept of β-factors are the basis of capital asset pricing model. With the help of this indicator can be calculated as the value of the risk premium required by investors for investments with systematic risk above the average.

Beta — the angle of slope of the straight line from linear equations of the type $y = kx + b = R_i = R_f + \beta_i(R_m + R_f)$. This straight line is a straight line regression of the two data arrays: the profitability index and stocks. Graphical display of the relationship of these arrays will give a certain set, and the regression line will give us the formula and show us the dependency of correlation from the scatter of the points on the chart.

As a basis we take the formula y = kx + b. In this formula, k is replaced by the coefficient β, it is equivalent to a risk here.

We obtain y = βx + b. For the calculations we take the approximate figures for the risk-free rate of return of Corporation X and return the index of ABC stock exchange for the period from 15.04.2014-15.04.2015.

Calculations for simplifying operations were conducted in MS Excel program. Table data is presented in Appendix.

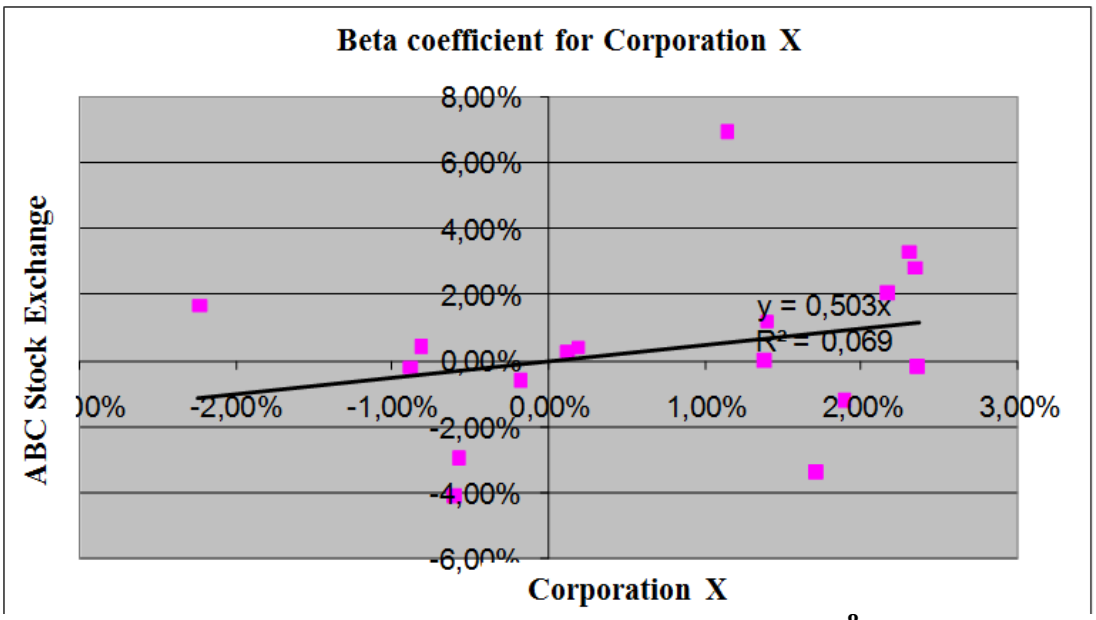

Figure 1 Beta coefficient for Corporation X[8]

[8] The Figure design by author

Thus, the Figure 1 shows that the beta coefficient is 0.503, therefore, earnings per share of the Corporation X grows more slowly than the return of market on which it is quoted.

Calculating the additional coefficient, R^2 correlation coefficient shows how the index change is driven by the stock price. In this example, the share of Corporation X is very weakly dependent on the ABC Stock exchange index since the correlation coefficient is equal to 0.069.

Consequently, the assessment of long-term assets Model (CAPM) can help determine the selection of shares in its investment portfolio. This model demonstrates a direct link between the risk of securities and their returns, allowing her to show a fair return on existing risk and vice versa.

In our case, the securities portfolio is composed of stocks with minimum risk. It is believed that investors are averse to excess in their view of risk, therefore, any security that is different from the risk-free government bonds or Treasury bills, can count on the recognition of investors only if the level of its expected return compensates for its inherent additional risk.

This allowance is called the risk premium; it depends on the value of β-coefficient of this asset, because it is intended to compensate only for systematic risk.

Unsystematic risk can be eliminated by the investor through diversification of its portfolio, so the market does not consider it necessary to establish remuneration for this type of risk.

1.2 Derivation and development of the CAPM

The Capital Asset Pricing Model (CAPM) with different degrees of rigor and details are described in detail in many textbooks on the theory of finance[9]. Therefore, without going into detail on the basic ideas that formed the basis of this model, we note that the CAPM originally was built as a one-period static general equilibrium model of the perfect market. Further development followed the path of

[9] Copeland, T., and Weston, J. 1992. Financial Theory and Corporate Policy // Addison–Wesley Publ. Co.

giving up some of the limitations inherent in an ideal perfect market. Currently, there are several versions of the model. The most famous version is the Sharpe-Lintner CAPM model[10].

The classical model of the CAPM, although it is usually written in the form of an econometric, general equilibrium model is (the idea goes back to James Tobin (1950's); rigorous derivation was carried out in [Jensen, 1969]). The model operates on the market portfolio of risky assets and risk-free asset in the framework of statics, which implies absolute liquidity in all market sectors and the same planning horizon for all investors.

In the early 1970s, Fischer Black proposed a new version of the CAPM, which now bears the model name or model Black with an asset with zero-beta. Externally, the bottom line is that the assumption of the existence of risk-free asset is excluded from the model. This leads to ambiguity in the choice of effective "model" portfolio (benchmark portfolio), is now playing the role of a substitute for the market portfolio in the classical CAPM, in relation to which the asset is built and zero-beta. Econometrics model is extremely complicated - instead of a simple single-index model, linear regression, we come to the two-factor model, which, in addition, a non-linear (since we do not know of an asset with zero beta, we cannot assume a beta regression coefficient). Note, however, that - in the past almost 30 years - econometrics, this was a very detailed and presented in the monograph[11].

More interesting, however, to turn to the economy model of the Black, this model - not just a response to the practice (and the Black was both luminary and in theory and in practice) the fact that there are markets where there is no risk-free asset. It is a response to the shortcomings of the outstanding theorist of classical CAPM. The fact that the market is always present assets with different liquidity and different ripening times (maturity). The main task of banks and many other financial institutions is to transform short-term liabilities (investments) in long-

[10] Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk // Journal of Finance, 19, 425–442. Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

[11] Campbell, J., Lo, A., and McKinlay, A. The Econometrics of Financial Markets. // Princeton University Press, Princeton, N.J., 1977.

term assets (investments in the real sector). Long-term assets in the banking system development and have the value and liquidity, but the "equalization" of speculative assets is incorrect. Thus, in the static model implicitly entered dynamic aspect. The specific implementation of liquidity can occur through the REPO market, the interbank loan market, currency and interest rate swaps. All these tools are not taken into account the CAPM, although their role is to support the liquidity of the visible speculative market is very high. From the point of view of classical CAPM the importance of these tools would imply an error in the model: the inefficiency of the market index. Model black allows you to include these tools as unobservable components of the financial market registered only after identifying the econometric model. This approach was developed in a series of works Kandel and Shanken, published in 1980-1990s. Part of these articles forms the basis of the following studies. Some of these articles form the basis for the following studies.

Assumptions model:

1) Investors shun risk and maximize the expected utility of their end of period wealth.

2) All prices are investors' beneficiaries and their actions can have an impact on asset prices.

3) Investors have homogeneous expectations about asset returns. The planning horizon is fixed and the same for all investors.

4) There is a risk-free asset. For any investor has unlimited borrowing and lending by some well-known risk-free rate.

5) All assets are infinitely divisible and traded on the market. The amount of any fixed asset.

6) The markets are perfect. Taxes, transaction costs, any market regulation, and restrictions on short sales do not exist.

7) Have full and free information for all market participants.

The main conclusions of this model are formulated as follows:

1) All investors hold risky assets in equal proportions. This proportion reflects the so-called market portfolio, i.e. a portfolio in which all risky assets are included

according to their specific weight in the aggregate value of all risky assets in the market.

2) The degree of risk aversion of the investor is reflected in the ratio between the share risk-free and risky assets in its portfolio. The more the investor avoids the risk, the greater the share of the risk-free asset, the smaller the share of risky assets.

3) The expected return of any i-asset E[Ri] is proportional to the degree of riskiness of the asset, and the measure of risk is the covariance Cov[Ri, Rm] returns the asset Ri and the market, the so-called tangent, portfolio (tangency portfolio) Rm.

The basic equation of the model:

$$E[R_i] = R_f + \beta_{im}\big(E[R_m] - R_f\big), \beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]} \quad (1)^{12}$$

where R_f - profitability risk-free asset (known to all the interest rate at which you can borrow and lend), R_m - yield of the market portfolio, β_{im} - asset beta coefficient reflecting the systematic risk of the asset, in fact the degree of "consistency" changes in asset yields with changes the yield of the market portfolio.

Model Sharpe–Lintner often is formulated in terms of excess return, having the meaning of market risk premium:

$$Z_m = R_m - R_f{}^{13}$$

Then:

$$E[Z_i] = \beta_{im}(E[Z_m]), \beta_{im} = \frac{Cov[Z_i, Z_m]}{Var[Z_m]} \quad (2)^{14}$$

The most important point in the model is the concept of the market portfolio, which refers to a portfolio consisting of all rice-forged assets, and in which the

[12] Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk // Journal of Finance, 19, 425–442. Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

[13] Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

[14] Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

proportion of each asset corresponds to its relative market value (equilibrium condition). It is obvious that the market portfolio should be one of many efficient portfolios by Markowitz. By effective portfolio means a series of long and short positions in assets, providing a minimum level of risk for a given level of return. The main practically important consequence of CAPM model of Sharpe-Lintner version is that the investment of all rational market participants is the same in structure and consists of a risk-free asset and the market portfolio.

The second, less well-known version of the CAPM is a version of the Black (Fisher Black)[15]. In contrast to the "classical" CAPM model of Sharpe-Lintner version, CAPM model in the Black version does not imply the existence of risk-free asset in the market. The main conclusion of the model, as in the "classic" version, is that the expected return on any asset $E[R_i]$ is proportional to the relative riskiness of the asset measure is the covariance $Cov[R_i, R_m]$ asset returns R_i and any of the minimum-variance portfolio R_m. The cardinal difference between the conclusions of the Black is that the expected return of any asset can be described by the expected return of any effective portfolio and profitability of a hypothetical portfolio R_z. This hypothetical unobservable portfolio, so-called asset with zero beta (zero-beta portfolio), is orthogonal to this efficient portfolio of R_m, and there is your only asset R_z for each efficient portfolio. Thus, an asset with a beta of zero, by definition, it is the combination of risky assets, the yield of which has a zero covariance with the portfolio of effective and lowest risk. The basic equation of the model:

$$E[R_i] = E[R_z] + \beta_{im}(E[R_m] - E[R_z]),\ \beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]} \quad (3)^{16}$$

We emphasize a few important differences between the Black's version from the "classic" CAPM:

[15] Black, F. 1972. Capital Market Equilibrium with Restricted Borrowing // Journal of Business, 45, 444–454.
[16] Black, F. 1972. Capital Market Equilibrium with Restricted Borrowing // Journal of Business, 45, 444–454.

- Since the version of Black cannot be formulated in terms of the excess return, under the income assets mean a real, rather than nominal rate of return (taking into account inflation leads to a more complex equation[17]

- Expected return on any asset is determined by a linear combination of the expected returns of the two portfolios unobservable (in fact, this is a two-factor model).

- Black's version does not require that all investors have formed the same investment portfolio structure. Other investors may form investment portfolios in accordance with their preferences, using different efficient portfolios and, consequently, different assets with zero beta.

- Since there is no known to all risk-free rates, the formation of individual investment portfolio requires either the possibility of short selling, or the existence of assets with a negative beta coefficient (negative covariance of return of at least one asset at a yield of efficient portfolio).

These differences make the Black's version more realistic and flexible than the Sharpe-Lintner version, but also much more difficult to verify and econometric applications.

Let's dwell briefly on the economic differences between the two versions. Sharpe-Lintner model operates only market portfolio of risky assets and risk-free asset in the framework of static and assumes absolute liquidity in all market sectors and the same planning horizon for all investors. Black's version radically different, in spite of the similarity of the equations. It allows you to include consideration not only the capital assets, but also the tools by which a developed banking system, the transformation of short-term speculative investment in long-term assets. The importance of these tools would mean in terms of the Sharpe-Lintner model inefficient market index as the approximation of the market portfolio. Black's version allows organically incorporating these tools as an unobservable component

[17] Cuthbertson, K. (1996). 'The Expectations Hypothesis of the Term Structure: The UK Interbank Market', The Economic Journal, Vol.106, No.436, pp.578-592.

of the financial market, registered only after the identification of an econometric model.

As noted in the first part of this work, the Black's version is essentially a two-factor. The factors in this case are unobservable traded portfolios: any of the efficient market portfolio and a portfolio that is orthogonal to it. This may provide another method of checking the model. The idea of the method is as follows. According to the available time series of returns of various assets methods of factor analysis, the two most important factors can be identified and form factor based on factors abstract portfolios. If the allocation factors to use the method of principal component, then by definition these factors and, therefore, formed the portfolios will be orthogonal. Then one of the portfolios can be viewed as efficient market portfolio, the other as an asset with a β of zero. Next, you need to test the hypothesis that the amount of regression coefficients of any of the assets in the portfolio formed is equal to one. This follows from the basic equation of the CAPM in the Black's version:

$$E[R_i] = E[R_z] + \beta_{im}(E[R_m] - E[R_z]),^{18}$$

$$E[R_i] = (1 - \beta_{im})(E[R_z] + \beta_{im}E[R_m]), (4)^{19}$$

where,

$$\beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]}\ ^{20}$$

the beta coefficient of an asset that reflects the systematic risk of an asset, in fact the degree of "consistency" changes of asset's return with changes in the market return portfolio.

In the construction of a standard capital asset pricing model, it is assumed that the distribution of returns is normal. The normal distribution is symmetric and is

[18] Cuthbertson, K. (1996). 'The Expectations Hypothesis of the Term Structure: The UK Interbank Market', The Economic Journal, Vol.106, No.436, pp.578-592.
[19] Cuthbertson, K. (1996). 'The Expectations Hypothesis of the Term Structure: The UK Interbank Market', The Economic Journal, Vol.106, No.436, pp.578-592.
[20] Cuthbertson, K. (1996). 'The Expectations Hypothesis of the Term Structure: The UK Interbank Market', The Economic Journal, Vol.106, No.436, pp.578-592.

determined by the expectation and variance. In the standard model of behavioral actions of investors affected by the expectation and variance of return (standard deviation of return).

Evidence shows that the returns distribution is not symmetrical. We can assume that in this case the actions of investors will affect not only the expected value and the variance of yield, but also the distribution coefficient of asymmetry. Intuitively, investors, ceteris paribus prefer a distribution with positive asymmetry coefficient. A good example is the lottery. As a rule, there is a big lottery prize with a low probability and a small loss is likely. Many people buy lottery tickets, despite the fact that the expected return on them is negative.

In accordance with Rao (1952), investors are primarily seeking to preserve the original value of their investments and avoid reducing the initial investment cost below a certain target level. This behavior corresponds to the preference of investors to positive asymmetry.

Consequently, the assets that reduce the asymmetry of the portfolio are undesirable. Therefore, the expected return of the asset must include a premium for the risk. Asymmetry can be included in the traditional pricing model[21].

In these models, it is assumed that all things being equal, investors prefer assets with higher returns, assets with a lower standard deviation and assets with greater asymmetry. Accordingly, it is possible to consider alternative behavioral model of investors based on three indicators of the distribution of asset returns. In Harvey and Siddique (2000) describes the set of efficient portfolios in the space mean, variance and asymmetry. For a given level of dispersion exists an inverse relationship between the yield and asymmetry. That is, to ensure that an investor holding assets with less asymmetry, they should have a higher yield. That is, the premium should be negative.

As for the variance, the yield on the asset does not affect the asymmetry of the asset itself, and the contribution of the asset portfolio in the asymmetry, that is, to

[21] Rubinstein, Mark, 1973. The fundamental theory of parameter preference security valuation, Journal of Financial and Quantitative Analysis 8, 61–69.

the asymmetry[22]. Coskewness should have a negative premium. Go with greater coskewness should have a lower yield than the asset at a lower coskewness.

Results Harvey and Siddique (2000) show that the skewness helps explain the variation in the yield of spatial data and significantly improve the value of the model. In the work Harvey (2000) has shown that if the markets are completely segmented, the effect on the profitability of the total dispersion and total skewness. The fully integrated markets is important only to the covariance and skewness.

One of the most common areas of modification of the standard pricing model is based on the use of sex as a measure of the variation in risk assets. Recall that in the classical theory, Markowitz following, for such a measure is taken of return variance, which is the same treats as deviations up and down from the expected value.

The root of the floor variation called downside risk - the risk of deflection down. It should be noted that this measure has its advantages and disadvantages. Among the shortcomings should be noted that the positive side of risk thrown associated with the excess of expectations. Moreover, such "risk" cannot be used as a volatility, and then for the pricing of financial derivatives.

On the other hand, the use of the floor variation within the portfolio theory allows to loosen some of the assumptions of traditional pricing models for financial assets (the assumption of normal distribution of returns and the assumption that the behaviour of investors is determined by the expected return and variance of return on assets).

In Estrada (2002a, 2002b) noted that, firstly, the standard deviation can be used only in the case of a symmetrical distribution of returns. Secondly, the standard deviation can be used directly as a measure of risk only when the normal distribution of yields. These conditions are not supported by empirical data. Furthermore, the use of beta coefficients are output in the traditional behavioral

[22] Harvey, C. R., and A. Siddique, 2000. Conditional Skewness in asset pricing tests // Journal of finance. Vol. LV, No. 3. June 2000.

model, as a measure of risk is challenged by many investigators in the emerging markets, the use of semi variation, in contrast, is supported on empirical data[23].

Using the floor variation is also supported and intuitive considerations. Typically, investors avoid the risk of increasing profitability is above average, they avoid the risk of reducing the yield below average or below a target value. Since investing in emerging markets is very risky for Western investors, the Western investor, first, avoids the risk of losing the value of their initial investment, or in accordance with the work Roy (1952), avoids reducing this value below a certain target level. Therefore, as a measure of risk in developing markets expedient to use dispersion and the floor, respectively, the standard deviation of the floor.

In studies Sintsov (2003) model tested in which the risk is measured using the lower second order partial moment, i.e. a variation of the floor. On the one hand, the use of the floor is the most popular variation CAPM model modification, on the other hand, the use of semi variations allows using statistical techniques available empirical testing pricing model.

Summary of Chapter 1

As a summary we can say that CAPM that was established by Harry Markowitz in 1950s and developed by William Sharpe in 1966 serves as a theoretical basis for a number of different financial technologies for managing profitability and risk, applied in long and short-term investing in stocks. This model refers to prices of financial instruments reach their true values. The Markowitz Efficient Frontier is the set of all portfolios that will give the highest expected return for each given level of risk. These concepts of efficiency were essential to the development of the capital asset pricing model.

William Sharpe's CAPM is based on the economic model of equilibrium implies that prices of financial instruments reach their true values. For the development of CAPM he got a Nobel Price. In a theoretical sense, the CAPM can

[23] Harvey, Campbell R., 2000. The drivers of expected returns in international markets // Emerging Markets Quarterly 4, 32–49. and Estrada J. 2000. The cost of capital in emerging markets: a downside risk approach // Emerging Markets Quarterly, 4 (3), 19–30.

be seen as a further development of the theory of Markowitz with additional assumptions about the market participants and data available to them. The point of this model is to show the close relationship between the rates of return to financial instrument risk.

A new version of the CAPM was proposed by Fischer Black in the early of 1970s that now bears the model name or model Black with an asset with zero-beta. Externally, the bottom line is that the assumption of the existence of risk-free asset is excluded from the model. This leads to ambiguity in the choice of effective "model" portfolio (benchmark portfolio), is now playing the role of a substitute for the market portfolio in the classical CAPM, in relation to which the asset is built and zero-beta.

The second, less popular version of the CAPM is a version of the Black (Fisher Black). In difference to the “classical” CAPM model of Sharpe-Lintner version, CAPM model in the Black version does not indicate the existence of risk-free asset in the market. The main conclusion of the model, as in the "classic" version, is that the expected return on any asset $E[R_i]$ is proportional to the relative riskiness of the asset measure is the covariance $Cov[R_i, R_m]$ asset returns R_i and any of the minimum-variance portfolio R_m. The cardinal variety between the conclusions of the Black is that the expected return of any asset can be described by the expected return of any effective portfolio and profitability of a hypothetical portfolio R_z.

In these models, it is assumed that all things being equal, investors prefer assets with higher returns, assets with a lower standard deviation and assets with greater asymmetry. Accordingly, it is possible to consider alternative behavioral model of investors based on three indicators of the allocation of asset returns. In Harvey and Siddique (2000) demonstrates the set of efficient portfolios in the space mean, variance and asymmetry. For a given level of dispersion exists an inverse relationship between the yield and asymmetry. That is, to ensure that an investor holding assets with less asymmetry, they should have a higher yield. That is, the premium should be negative.

CHAPTER 2 EMPIRICAL TESTING OF THE CAPM

2.1 The assumptions and analytical findings of the CAPM

Basically, CAPM is derived from and is a modified extension of Markowitz portfolio selection model with specific implications for equilibrium asset prices in the capital market. Therefore, like Markowitz model it assumes that participants in the capital market are rational risk-averse investors in the sense that they are mean-variance efficient portfolio optimizers. The assumptions of CAPM as specified by Sharpe (1964) and Litner (1966) can be summarized as the following:

1. Like the Markowitz model, CAPM assumes that investors are interested in only two characteristics of securities when deciding to invest in them; the expected rate of return and the risk of securities. The expected rate of return is defined as the forecast of future pay-off or cash flows from the investment, net of the initial investment, divided by the initial dollar value of the investment. Risk is defined as the probability of actual returns being different from expected return and is measured by standard deviation of returns. The CAPM, as well as the Markowitz model, assume that investors view risk with this perspective. In this sense investors are concerned only with the first two moments of the probability distribution function of returns; the first moment, which is the expected or average rate of return and the second moment, which is the variance of returns reflecting the amount of risk in the investment.

2. All investments are rational mean-variance portfolio optimizer and use Markowitz model to select an efficient portfolio from the efficient frontier.

3. All investors have similar economic view of the world and analyze securities in the same way. Therefore, all investors have identical estimates of probability distribution of securities' returns and of the expected rate of returns, expected variance and covariance of returns, and expected future cash flows of all securities. Furthermore, the rate of return of every security is normally distributed and therefore investors are only interested in the first two moments of securities' probability distributions. This assumption implies that all investors envision the same Markowitz efficient frontier portfolios and price securities according to the

same method and on the basis of the same inputs. This assumption is usually referred to as homogenous expectations or beliefs assumption.

4. Like any other perfectly competitive market, the capital market consists of many buyers and sellers of securities, called the investors. The wealth of each individual investor is small as compared to the total wealth of all investors and therefore each investor is a price-taker in the capital market. Although equilibrium prices are determined by the actions of all investors, the action of one individual investor by itself does not affect market prices.

5. All investors plan for one identical holding period. This single holding period could be one month, one year, or any other time period. But whatever it is, all investors are assumed to have homogenous holding period investment horizon.

6. Investments are limited to the universe of all publicly traded financial assets, like stocks, mutual funds, and bonds and to a risk free asset. Therefore, this assumption excludes investments in privately traded assets or investments in non-traded assets such as investments in education.

7. There is a risk-free asset, that is, an asset with zero variance of returns, that all investors can lend or borrow any amount of the risk-free asset at an identical risk-free rate.

8. Investment in the capital market does not involve any transaction cost or does not result in any tax liability for the investors. This assumption ensures that expected returns and variance of returns are the only factors that investors consider when selecting or rebalancing their portfolios.

9. As they stand, these assumptions are an oversimplification of reality. But this does not necessarily mean that the conclusions and implications that are logically deduced from there assumptions are not valid. In fact, as will be discussed below, other scholars have subsequently developed some modified versions of CAPM by dropping some of the assumptions that were made for the standard version of CAPM. The crucial thing about any theory or model, including the CAPM, is not to expect perfect validity of all the assumptions but rather it is to evaluate how well the model explains the reality and how well the predictions of

the model are consistent with what actually takes place in the real world. To establish this, one needs to regard the model as a set of hypotheses and test it against actual data. Major tests of the CAPM will be discussed in this paper, but before that it is essential to know what conclusions the CAPM derives from these assumptions and what sort of analysis is made to reach those conclusions.

CAPM faces many challenges when put into practice due to the strict assumptions.

1) Under the theoretical framework of CAPM, transactions will not occur. As it is known that, transactions in the capital market occur only when market participants have different estimate to specific assets. While the assumptions of the CAPM that "reasonable person" holds "complete information" and "homogeneous expectations" make people cannot see the transaction basis in capital market under CAPM framework. For all the investors will have the same attitude towards the same asset, no transaction will occur.

2) CAPM is contradictory to the portfolio theory. The main idea of Markowitz's portfolio theory is "risk diversification", which establishes the theoretical basis for "hedging" transaction. CAPM, based on the investment portfolio theory, actually cannot reflect the true value of each asset. The reason is that the price of the asset purchased for pursuing "hedging" transaction is bound to be raised artificially and deviate from its true value. As a result, the so-called equilibrium point reflecting the true value deduced from CAPM model hardly exists.

3) With the rapid development of financial markets, abnormalities continually emerge. Such as abnormal returns associated with the scale, price-earnings ratio, year-end effect, undue fluctuation, overreaction of option price, and equity premium, etc.. These abnormalities cannot be explained by CAPM.

2.2 Analysis of various empirical tests of the CAPM

Let us consider for a moment what testability means. A model consists of (i) a set of assumptions, (ii) logical/mathematical development of the model through

manipulation of those assumptions, and (iii) a set of predictions. Assuming the logical/mathematical manipulations are free of errors, we can test a model in two ways, normative, and positive. Normative tests examine the assumptions of the model, while positive tests examine the predictions.

The CAPM implications are embedded in two predictions: 1) the market portfolio is efficient, and 2) the security market line (the expected return-beta relationship) accurately describes the risk-return trade-off, that is, alpha values are zero. The central problem in testing these predictions is that the hypothesized market portfolio is unobservable. The "market" portfolio includes all risky assets that can be held by investors. This is far more extensive than an equity index. It would include bonds, real estates, foreign assets, privately held businesses and human capital. These assets are often traded thinly or (for example, in case of human capital) not traded at all. It is difficult to test the efficiency of an observable portfolio, let alone an unobservable one. These problems alone make adequate testing of the model infeasible. Moreover, even small departures from efficiency in the market portfolio can lead to large departures from the expected return-beta relationship of the SML, which would negate the practical usefulness of the model.

Most of the early tests of the CAPM employed the methodology of first estimating betas using time series regression and then running a cross sectional regression using the estimated betas as explanatory variables to test the hypothesis implied by the CAPM.

Tests by Lintner

Using this approach one of the first tests of the CAPM was conducted by Lintner, which is reproduced in Douglas (1968). Using data from 1954-1963, Lintner ran the following regression: $R_t = \alpha + bR_{mt} + e_t$where $R_t = (N * 1)$ vector of asset returns

R_{mt} = return on the market portfolio

b = (Nx1) vector of estimated betas

Lintner then ran the following second pass regression:

$$R = a_1 + a_2 b + a_3 S_e^2 + \eta$$[24]

where S_e^2= (NxN) matrix of residual variance (i.e. the variance of e in the first pass regression).

The testable implications of the CAPM are that $\alpha_1 = R_f;\ \alpha_2 = \big(E[R_m] -$ *Rf* and *α3=0.*

However, Lintner found that the actual values did not confirm with the theoretical values. α_1 was found to be much larger than R_f or even R_{om}, α_2 was found to be statistically significant but had a lower value than expected and α_3 was found to be statistically significant as well. Thus Lintner's results seem to be in contradiction to the Capital Asset Pricing Model.

Fama and MacBeth (1973)

Fama and MacBeth (1973) performed one classic test of the CAPM. They combined the time series and cross-sectional steps to investigate whether the risk premium of the factors in the second pass regression were non-zero. Forming 20 portfolios of securities, they estimated betas from a time-series regression similar to Lintner's methodology. However, they then performed a cross-sectional regression for each month over the period 1935-1968. Their second pass regression was of the following form: $R_t = \gamma_{0t} + \gamma_{1t}\beta - \gamma_{2t}\beta^2 + \gamma_{3t} S_e + \eta_t$[25]

If the standard CAPM was true then we should have the following:

$E[\gamma_{0t}] = R_f$

$E[\gamma_{1t}] > 0$ as the market risk premium should be positive

$E[\gamma_{2t}] = 0$ as the securities market line (SML) should be linear, i.e. the relationship between return and the relevant risk should be linear.

$E[\gamma_{3t}] = 0$ as the residual risk should not affect asset returns.

All of the above should be true if the standard CAPM is to hold.

Fama and MacBeth (1973) found that γ_3 was statistically insignificant and its value remains very small over several sub-periods. Thus, in contrast to Lintner,

[24] Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

[25] Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

they find that residual risk has no effect on security returns. Miller and Scholes (1972) showed that residual risk would act as a proxy for risk if beta had a large sampling error. This fact might reconcile Lintner's and Fama and MacBeth's results, as the latter's estimate for beta had much less sampling error due to their use of asset portfolios. Fama and MacBeth further found that γ_2 is not statistically different from zero. Moreover, they found that the estimated mean of γ_1 is positive as predicted by the model. They also find that γ_0 is statistically different from zero. However, their intercept is much greater than the risk free rate and thus this would indicate that the standard CAPM might not hold.

Tests by Black, Jensen and Scholes (1972)

Black, Jensen and Scholes (1972) performed another classic test of the Capital Asset Pricing Model employing time-series regression. They ran the following familiar time series regression:

$$Z_t = \alpha + \beta Z_{mt} + \varepsilon_t$$[26]

As observed before, the intercept should be zero according to the CAPM. Black et al. used the return on portfolios of assets rather than individual securities. Time series regression using returns on individual assets may give biased estimates, as it is likely that the covariance between residuals may not equal zero. This is not generally true with portfolios as they utilize more data. The results from the BJS time series regressions show that the intercept term is different from zero and in fact is time varying. They find that when β <1 the intercept is positive and that it is negative when β >1. Thus, the findings of Black et al. violate the CAPM.

Tests by Stambaugh (1982)

Stambaugh (1982) employs a slightly different methodology. From the market model we have

$$R_t = \alpha + \beta(R_{mt}) + e_t$$[27]

if the CAPM was true then the intercept in the above equation should be constrained and should in fact be:

[26] Black, F. 1972. Capital Market Equilibrium with Restricted Borrowing // Journal of Business, 45, 444–454.
[27] Jensen M. 1969. Risk, the pricing of capital assets, and the evaluation of investment portfolios. // Journal of Business, XLII, 167-247.

$$\alpha = \kappa(1-\beta)$$[28]

where $\kappa = R_f$(under the Sharpe-Lintner CAPM) or $\kappa = R_{0m}$ (under the Black's version of CAPM).

Stambaugh (1982) then estimates the market model and using the Lagrange multiplier test finds evidence in support of Black's version of CAPM but finds no support for the standard CAPM.

Tests by Gibbons (1982)

Gibbons (1982) uses a similar method as the one used by Stambaugh (1982) but instead of the LM test uses a likelihood ratio test. He uses the fact that if the CAPM is true then the constrained market model should have the same explanatory power as the unconstrained model, but if the CAPM is invalid then the unconstrained model should have significantly more explanatory power than the constrained model. Using this test, Gibbons rejects both the standard and the zero beta CAPM.

Miller and Scholes (1972)

Miller and Scholes (1972) in their paper "Rates of return in relation to risk" discuss the statistical problems inherent in all the empirical studies of the CAPM. They point out that the CAPM in time series form is:

$$R_t = R_{ft} + \beta\left(R_{mt} - R_{ft}\right) \; or \; R_t = (1-\beta)R_{ft} + \beta R_{mt}$$[29]

and thus if the riskless rate is non-stochastic then the CAPM can easily be tested by finding whether the intercept is significantly different from $(1-\beta)R_{ft}$. However, if R_{ft} varies with time and moreover is correlated with R_{mt}, then we inevitably encounter the problem of omitted variable bias and thus the estimated betas will be biased.

Miller and Scholes (1972) then using historical data find that R_{ft} and R_{mt} are negatively correlated. Intuitively, a rise in the interest rates is conducive to stock market declines. They then prove that if R_{ft} and R_{mt} are negatively correlated then

28 Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

29 Miller K., Leiblein M. Corporate Risk- Return Relations: Returns Variability versus Downside risk. Academy of Management Journal. 1996, V. 39, №1

this will lead to an upward bias in the intercept and further the slope will be biased downwards. This is in fact what many empirical studies find and thus the fact that many studies reject the CAPM does not imply that it does not hold.

Another factor that may bias the intercept upward and the slope downwards is the presence of heteroskedasticity. However, Miller and Scholes find no evidence of heteroskedasticity.

Miller and Scholes then go on to show the biases that one may encounter in the two stage regressions used by Lintner and Douglas and by Fama and MacBeth (1973). The problem in this methodology is that estimated betas instead of the true

betas are used in the second pass regressions and thus any error in the first stage is carried to the second stage. Miller and Scholes show that this 'errors-in-variables problem' will bias the intercept upward and the slope downwards.

Another possible problem in many tests of the CAPM arises due to it being a single-period model. Most tests of the CAPM use time series regression, which is only appropriate, if the risk premium and betas are stationary, which is unlikely to be true.

Fama and MacBeth (1973) in their paper incorrectly state that there are three testable implications, namely that the relationship between expected returns and beta is linear; that beta is a complete measure of risk; and that given risk averseness, higher return should be associated with higher risk, i.e. $E[R_m] - E[R_{om}] > 0$.

On the contrary, the famous paper of Black, Jensen and Scholes does not even mention the possible efficiency of the market portfolio and concludes that the relationship between expected returns and beta is not linear. This conclusion is enough to prove that the proxy used by BJS does not lie on the sample efficient frontier. If on the other hand, the proxy had been on the efficient part of the frontier than BJS would have found a linear relationship between mean returns and beta. This is all in accordance with efficient set mathematics. The relevant testable implications of the Sharpe-Lintner CAPM can be illustrated by means of the figure

below. In the figure, m* is the tangent portfolio. If m is used as the proxy, then the return on the asset is given by

$$R_j = R_z + \beta_j(R_m - R_z)^{30}$$

On the other hand, if m* is used as the proxy, then the return on the asset is given by

$$R_j = R_z + \beta_j^*(R_m^* - R_z)^{31}$$

It should be noted that since efficient orthogonal portfolios are unique, β_z^* should be non-zero.

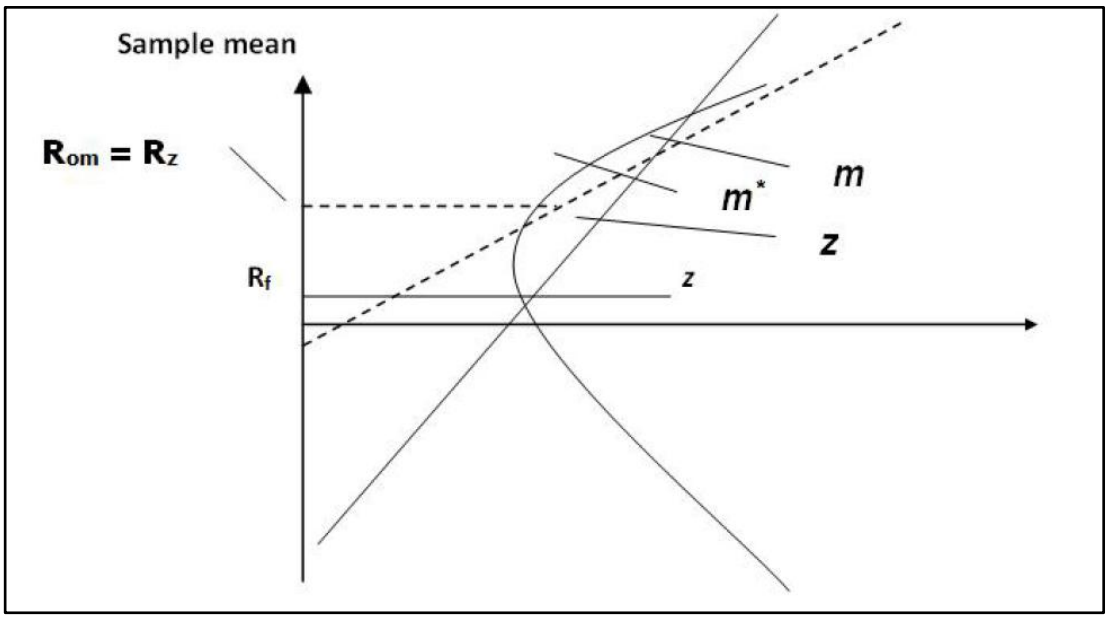

Figure 2 Linear relationship between mean returns and beta[32]

Since each individual will invest partly in the riskless asset and partly in the tangent portfolio m*, thus the principle testable hypothesis of the Sharpe-Lintner CAPM is that the ex-ante efficient tangent portfolio is the market portfolio. On the other hand, as already mentioned, BJS by using a market proxy estimated the following regression:

30 Fama, E. F., K. R. French The CAPM is Wanted, Dead or Alive// The Journal of Finance, December 1996, V. 51, Issue 5, pp. 1947-1958

[31] Fama, E. F., K. R. French The CAPM is Wanted, Dead or Alive// The Journal of Finance, December 1996, V. 51, Issue 5, pp. 1947-1958

[32] Copeland, T., and Weston, J. 1992. Financial Theory and Corporate Policy // Addison–Wesley Publ. Co. Cuthbertson, K. 1996. Quantitative Financial Economics. Stock, Bonds and Foreign Exchange // JohnWiley & Sons.Sharpe, 1964, Lintner, 1965 Sharpe, W. 1964. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk // Journal of Finance, 19, 425–442. Lintner, J. 1965. The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets // Review of Economics and Statistics, 47, 13–37.

$$R_j - R_f = \alpha + \gamma\beta_j + \varepsilon_j$$[33]

They found that α was not only greater than zero but was also highly variable. Moreover, they found that γ was less than $R_m - R_f$. On the basis of these results, they rejected the standard CAPM.

Fama and MacBeth (1973) in their study use the Fisher's Arithmetic index (an equally weighted portfolio of all the stocks in the NYSE) as their proxy. This portfolio is not even close to the value-weighted portfolio and thus should not have been used as a market proxy. Thus the conclusions of Fama and MacBeth (1973) are also not immune to suspicion. It is clear that there will always exist a portfolio in the tangency position but it is not clear at all whether this portfolio is the value-weighted average of all assets, i.e. the market portfolio.

Summary of Chapter 2

In summary, CAPM faces many challenges when put into practice due to the strict assumptions. They are in short followings:

1) Under the theoretical framework of CAPM, transactions will not occur.
2) CAPM is contradictory to the portfolio theory.
3) With the rapid development of financial markets, abnormalities continually emerge.

Lots of the early tests of the CAPM employed the methodology of first valuating betas using time series regression and then running a cross sectional regression using the estimated betas as explanatory variables to test the hypothesis referred by the CAPM.:

Tests by Lintner

Using this approach one of the first tests of the CAPM was conducted by Lintner, which is reproduced in Douglas (1968).

Tests by Fama and MacBeth

33 Banz R. The Relationship between Return and Market Value of Common Stocks// Journal of Financial Economics, 1981, March, 9, pp. 3-18

Fama and MacBeth (1973) performed one classic test of the CAPM. They combined the time series and cross-sectional steps to investigate whether the risk premium of the factors in the second pass regression were non-zero.

Tests by Black, Jensen and Scholes,Black, Jensen and Scholes (1972) performed another classic test of the Capital Asset Pricing Model employing time-series regression.

Tests by Stambaugh .Stambaugh (1982) then estimates the market model and using the Lagrange multiplier test finds evidence in support of Black's version of CAPM but finds no support for the standard CAPM.

Tested by Gibbons Gibbons (1982) uses a similar method as the one used by Stambaugh (1982) but instead of the LM test uses a likelihood ratio test.

Tests by Miller and Scholes . Miller and Scholes (1972) in their paper "Rates of return in relation to risk" discuss the statistical problems inherent in all the empirical studies of the CAPM.

CHAPTER 3 EMPIRICAL STUDIES OF THE POSSIBILITY OF USING THE CAPM IN EMERGING MARKETS

3.1 Critique of the CAPM and alternative risk measures

The CAPM has been criticized in many studies for the assumptions of unrestricted risk-free borrowing and lending, investors are maximizing one-period investment and focus only on risk and return of one-period portfolio, whether market Betas explain the expected returns, and the proxy of market portfolio of all risky assets. Furthermore, Fama and French (1997) find evidence that the estimates of the cost of equity capital for specific industries using the CAPM are imprecise with standard errors of more than 3 percent per year, due to uncertainty about the true expected risk premiums and imprecise estimates of industry betas. They argue that the estimates of the cost of equity are surely even less precise for individual firms and projects.

Fama and French (2004) illustrate that CAPM equation measures a relation between the expected returns of an asset and the market portfolio return. However, the market portfolio is criticized because it is based on unrealistic assumptions such as one-period investment, and unrestricted risk-free borrowing and lending. Fama and French (2004) conclude that most of the important models are built on unrealistic assumptions, which must be practically tested.

Unrestricted Risk-Free Borrowing and Lending

Black (1972) asserts that the possibility of borrowing and lending unlimited funds at a risk free is unrealistic and develops another version of the CAPM without risk-free borrowing or lending. Black (1972) results show that unrestricted short sales of risky assets will lead to efficient market portfolio. The market portfolio is simply consisting of the efficient portfolios, which investors select from the efficient frontier in case there is no risk free asset.

Relation between Market Beta and Expected Return

The different versions of the CAPM developed by Sharpe, Lintner and Black agree that market portfolio is the efficient portfolio that will trade off between risk and return. This indicates that variability in the security and portfolio expected

returns will be only explained by changes in market beta and not any other variables.

To test whether market Betas explain expected returns, the following empirical work starting in the late 1970s is reviewed. The studies criticize the CAPM and the developed version of the CAPM by Black (1972) and argue that the variability in expected return is unrelated to market beta.

Basu's (1977) finds that the earnings per price ratio provides different evaluation for the common stocks from the CAPM, and argues that the common stocks with high earnings per price ratio have higher future returns than estimated by the CAPM. Likewise, Banz (1981) finds a relation between firm size and its average return and shows that the average return for small size firm stocks, measured by price multiplied by outstanding shares as proxy for market capitalization, is higher than measured by the CAPM. Thus, the size effect of Banz (1981) finds that small size firm stocks have higher average returns than large size firm stocks given their estimated beta. Similarly, Bhandari (1988) argues that highly leveraged firms generate high returns relative to their market Betas, and reports empirical evidence that high debt ratios, proxied by the debt book value to equity market value, are high returns relative to market beta. In U.S.A. firms, Statman (1980) and Rosenberg, Reid, and Lanstein (1985) document that the average returns on stocks are positively related to the ratio of a firm's book value of common equity to its market value, in other words, firms with high ratio of book value of common stock to the market value of equity have high average returns that are not explained by their betas. Chan, Yasushi, and Josef (1991) also find that there is a strong relation between the book to market equity ratio and the cross-section of average returns on Japanese stocks.

Ball (1978) determines a prime limitation of the CAPM is that market betas are imperfect and insufficient to explain the change in expected returns, and suggests that earnings to price, debt to equity and book-to-market ratios are good determinants for the expected returns. On the other hand, Kothari, Shanken, and Sloan (1995) support the Sharpe and Lintner version of CAPM and argue that the

insignificant relation between the average return and beta suggested by some studies may refer to some limitations or luck and could not be generalized. But Fama and French (2004) argue that there is strong evidence that other variables like size, leverage, book-to-market equity, and earnings-price ratios can explain the variation in expected return which beta fails to interpret.

Fama and French (1992) confirm that size, earnings-price, debt-equity and book-to-market ratios can be used along with the market beta to explain the variation in stock returns using cross section regression approach. Using the time-series regression approach on portfolios sorted according to stock price ratios, Fama and French (1996) report the same result.

Three Factor Model

Fama and French (1993) propose a three-factor model for expected returns, in their model they add two factors to the CAPM to explain better the returns of the portfolio. Fama and French (1993) include the size and book-to-market equity to the market risk in order to better measure the return of the stock. Small stocks and stocks with high book to market ratio as proxy for firm value reflect risks that are not explained by beta the market systematic risk and market return. Empirically, they provide evidence that the covariance between returns is higher for small firms stocks than the covariance of returns in large size firms, and similarly, covariance of returns is higher for high value stocks measured by the book to market ratio than the covariance of returns in a low book to market stocks. Therefore, the three factor model includes the firm size, value of firm and the market risk factor used in the CAPM.

Investors Care about Mean and Variance for Only Single-Period Portfolio

Fama and French (2004) clarify that the CAPM is based on a number of unrealistic assumptions; one of these assumptions is that investors focus only on measuring the risk (variance) and return (mean) of one-period portfolio returns which is an extreme assumption. It is reasonable that investors also focus on how their portfolio return interacts with their income and future investment opportunities, so a portfolio's return variability fails to capture important

dimensions of risk. Accordingly, market beta is not completely describing an asset's risk, and the differences in beta are unable to clarify all the differences in the expected return. Consequently, other versions are evolved as an extension for the CAPM in attempt to explain the average returns.

ICAPM as an Extension of the CAPM

Merton's (1973) intertemporal capital asset pricing model (ICAPM) is an extension of the CAPM. The ICAPM has a different assumption about investor objectives. In the CAPM, investors care only about the wealth their portfolio produces at the end of the current period. In the ICAPM, investors are not only concerned about their end-of-period payoff, but also with the opportunities they will have to consume or invest this payoff. Thus, when choosing a portfolio at the current time, ICAPM investors consider how their wealth in the future might vary with future variables, including their income, the prices of consumption goods and the nature of portfolio opportunities in the future, and also provides future expectations. Therefore, Merton's (1973) ICAPM shows that investors act to maximize the expected utility of lifetime consumption and who can trade continuously in time. The assumption of continual trading in assets through time is not assumed in the traditional model. The author shows that, unlike the one-period model, current demands are affected by the possibility of uncertain changes in future investment opportunities.

Fama (1996) comments on Merton's (1973) paper in which Merton developed an intertemporal model (the ICAPM) that uses utility maximization to get exact multifactor predictions of expected security returns. Fama (1996) shows that Merton gets exact results without assuming the market portfolio is perfectly diversified. Fama finds Merton's approach difficult due to the continuous-time methods used, and concludes that as in the CAPM, the relation between expected return and multifactor risks in the ICAPM is the condition on the weights for securities that holds in any multifactor-efficient portfolio, applied to the market portfolio M. And just as market equilibrium in the CAPM requires that M is efficient portfolio that trade-off between the risk and return of the portfolio, in the

ICAPM, market prices indicate that portfolio M is multifactor-efficient. Fama (1996) shows that Merton's ICAPM can be built on similar intuition like the powerful intuition of the CAPM which centers on Markowitz (1959) concept of mean-variance-efficiency. ICAPM investors hold multifactor-efficient portfolios that generalize the notion of portfolio efficiency. Like CAPM investors, ICAPM investors dislike wealth uncertainty, but ICAPM investors are also concerned with hedging more specific aspects of future consumption-investment opportunities, such as the relative prices of consumption goods and the risk-return tradeoffs they will face in capital markets. Furthermore, ICAPM investors demand high expected return and low risk like the CAPM investors. However ICAPM investors also care about the movement of the returns of the portfolio with other dynamic variables. Therefore the optimal portfolio will be a factor in many variables and have largest range of possible expected returns.

The Market Proxy Problem

Finding a reasonable proxy for the market portfolio that is on the minimum variance frontier is one of the main problems that will rise when applying the CAPM, that is, identifying which risky assets that should be included in the risky portfolio to be used as a proxy for the market portfolio will be the main concern. As suggested in the literature, the market portfolio of all risky assets should include stocks, bonds, coins, real estate, art, stamps, antiques, and any other marketable risky asset.

For example, Roll (1977) argues that it is not theoretically clear which assets should be included in the market portfolio, and most studies use unreliable proxies that does not reflect the true market portfolio, therefore, the CAPM could not be verified. On the other side, Stambaugh (1982) tests the CAPM using wider range of market portfolios that includes more risky assets, such as; U.S. common stocks, corporate and government bonds, preferred stocks, real estate and other assets, and finds that tests of the CAPM are not sensitive or varying with the inclusion of other assets and extending the market portfolio beyond the common stocks. Fama and French (2004) comment on Stambaugh's (1982) results regarding insensitivity of

market portfolio returns to adding ore types of risky assets beyond the common stock, that the market proxies used are limited to U.S. assets. If international capital markets are open, the market portfolio should include international assets. Fama and French (1998) find, however, that betas for an international stock market portfolio are unable to clarify why stocks with high book-to-market or high earnings-price ratios have higher average returns around the world.

Since the introduction of the CAPM many studies attempt to test it empirically and criticize the assumptions of the theory, as a result many other versions of the CAPM have been developed to overcome the unrealistic assumptions.

Black (1972) develops another version of Sharpe and Lintner CAPM by relaxing one of the CAPM assumptions, and shows that borrowing with the risk free rate is not a practical or realistic assumption. Instead, Black (1972) allows for the use of the unrestricted short sales of risky assets. Breeden (1979) and Lucas (1978) extend the traditional CAPM and develop the Consumption Capital Asset Pricing Model (CCAPM) which links between consumption and stock returns, thus, it relies on the aggregate consumption in order to understand and predict future asset prices instead of the market portfolio's return in the traditional CAPM. Breeden, Gibbons, and Litzenberger (1989) examine the empirical implications of the consumption-oriented capital asset pricing model (CCAPM), and compare its performance with a model based on the market portfolio.

Merton (1973) develops an extension of the CAPM, the Intertemporal Capital Asset Pricing Model (ICAPM) that uses utility maximization to get exact multifactor predictions of expected security returns. The CAPM assumes that investors choose portfolios that produces return in the future while in the ICAPM investors are concerned not only with their end-of-period payoff, but also with the opportunities they will have to consume or invest the payoff. Thus, when choosing a portfolio at time t-1, the ICAPM investors consider how their wealth at time t might vary with future variables including labour income, the prices of consumption goods and the nature of portfolio opportunities at t.

Fama and French (1993 & 1996) propose a three-factor model for estimating the expected returns of risky assets; their model includes more factors that affect the variability in portfolios average return than in the Sharpe-Lintner version. The three factors model includes the firm size, book-to-market equity ratio and other price ratios.

Finally, an important version for the CAPM is the Arbitrage pricing theory, which will be discussed in more details in the next section.

An Overview of the Ross Arbitrage Pricing Theory

Although the CAPM has been one of the most frequently used and useful theory, but many empirical studies point out some drawbacks and limitations in the model as the relation between risk, which is measured by Beta, and the asset return. Some empirical evidences indicate that additional risk variables or different risk proxies should be taken into consideration and added to the model. In addition, many studies criticize the tests of the model and its ability to estimate the return of the portfolio and capture the variability in its expected return.

Those studies refer this problem to the market return proxy and the dependence on a market portfolio of risky assets that is not verified and the problem of borrowing and lending at the risk free rate.

Banz (1981) shows that portfolios consisting of stocks of small size firms, that indicate low market capitalization, have better performance than large stock portfolios on a risk adjusted basis. Similarly, Basu (1977) documents that stocks with low price-earnings ratio outperform high stocks. Fama and French (1992) demonstrate that value stocks measured by high book value-to- market price ratios stocks tend to produce higher risk adjusted returns than growth stocks proxied by low book-to-market ratios, and these return differentials occur in an efficient market. The CAPM empirical problems may reflect theoretical failings as a result of many simplified assumptions, and raise the need for an alternative asset pricing theory.

Shanken (1982) argues that the CAPM is not truly testable in a strict sense. Much of this acceptance can be attributed to the persuasive analysis of Roll (1977),

who argues that the CAPM is not testable unless the market portfolio of all assets is used in the empirical test. The APT of Ross has been proposed as a testable alternative to the CAPM. Roll and Ross (1980) explain that the APT demonstrates that since any market equilibrium must be consistent with no arbitrage profits, then every equilibrium will be characterized by a linear relationship between each asset's expected return and its return's response amplitude, or loadings, on the common factor. Huberman and Wang (2005) show that the APT was developed primarily by Ross (1976a, 1976b). It is a one-period model in which every investor believes that the stochastic properties of returns of capital assets are consistent with a factor structure. Ross (1980) argues that if equilibrium prices offer no arbitrage opportunities over static portfolios of the assets, then the expected returns on the assets are approximately linearly related to the factor loadings. The factor loadings, or betas, are proportional to the returns' covariances with the factors.

Reilly and Brown (2003) illustrate that the APT differs from the CAPM in that it is less restrictive in its assumptions. It assumes that each investor will hold a unique portfolio with its own particular array of *beta*s, as opposed to the identical "market portfolio", while the CAPM designated a single risk factor which is the market risk in order to explain the volatility of returns for an individual security or portfolio of securities. The main difference between the two models, the CAPM and the APT, is that the latter includes more risk factors or multiple dimensions of risk inherent in the investments while the CAPM relies on a single market risk factor which is the systematic investment risk when estimating individual securities return or portfolio returns.

Basics of the APT Model

A brief discussion for the assumptions and critiques of the model are provided below. The theory assumes that asset returns can be estimated by depending on a random process shown by a various number of risk factors included in the model and are expected to affect the returns generated by all assets. For example, these multiple risk factors may consist of, inflation, changes in interest rates, growth in

gross domestic product (GDP), or political and economic events, that are expected to strongly affect the returns of all assets.

The APT contends that there are many such factors that affect returns, in contrast to the CAPM, where the relevant risk to measure is the covariance of the asset with the market portfolio (presented by the asset's *beta*).

The beta measures the sensitivity of each asset return to the market portfolio return, or how the security return reacts to a specific single common factor.

Assumptions of the Model

Reinganum (1981) addresses three assumptions. First, capital markets are perfectly competitive. Secondly, investors always prefer more wealth to less wealth with certainty. And lastly, the stochastic process generating asset returns can be represented as a K- factor model. The major assumptions, which are used in the development of CAPM, and are not required in the APT: 1) Investors have utility functions, 2) Normally distributed security retrns. 3) An efficient market portfolio that contains all risky assets.

Roll and Ross (1980) determine the differences between CAPM and APT, the APT is based on a linear return generating process as a first principle, and it requires utility assumptions nor is it restricted to a single period. Though consistent with every conceivable prescription for portfolio diversification, no particular portfolio plays a role in the APT. Unlike the CAPM, there is no requirement that the market portfolio be mean variance efficient. The authors go further that there are two major differences between the APT and the original Sharpe diagonal model, a single factor-generating model. First, the APT allows more than just one generating factor. Second, the APT demonstrates that since any market equilibrium must be consistent with no arbitrage profits, every equilibrium will be characterized by a linear relationship between each asset's expected return and its return's response amplitudes, or loadings, on the common factor.

Critique of the Arbitrage Pricing Theory

The Arbitrage Pricing Model considers multiple risk factors that are expected to have impact on the returns of all assets. When the APT is applied, these risk

factors are not identified. Regarding the testability of the APT, for example, Shanken (1982) examines whether the APT is more susceptible to testing than the CAPM and argues that each of the models has a problem with testing, specifically, to test the CAPM, the true market portfolio should be used; whereas, and to test the APT, the relevant factor that affects security returns should be identified.

Dybvig and Ross (1985) argue that the APT has been proposed as an alternative to the mean-variance CAPM. Their paper considers the testability of the APT and points out the irrelevance for testing of the approximation error. Shanken (1985) responds that it is a set of equilibrium APT pricing models that are testable but arbitrage-based models are not testable. In other words, Dybvig and Ross (1985) have shifted the focus to equilibrium models that are testable and they ignore the differences between these models and the original arbitrage theory.

3.2 A review of empirical studies of 'risk-return' concept in emerging markets

Specific problems arise in the application of CAPM developing capital markets, which is rather difficult to justify the parameters of the model (risk-free rate of return, market risk premium, beta coefficient) on the local capital market data due to the lack of information efficiency and low liquidity of traded assets.

A number of empirical studies proved incorrect use of the CAPM is in emerging markets compared to developed .There are particular emerging markets - the importance of specific risks associated with the state policy of regulation of the economy, with an institutional investor protection and corporate governance. In view of the correlation between emerging markets and the global capital markets, these risks are not eliminated by diversification of global capital investor.

Another problem emerging markets - the absence of stationary and dynamic changes due to the liberalization of the local capital markets.

Beckert and Harvey show that it is necessary to developed and developing markets in assessing the required yield viewed from different positions as to consider the degree of local market integration in the global financial market. The

degree of integration is not constant, changing with time. It affects the formation rates of return.

In the 1995 Beckert says that the existence of barriers to capital flows and the implementation of international investment automatically mean that the risk factors for the emerging markets are different from the risk in developed countries.

In the work proved that the level of integration in the global capital market (or the existence of barriers to the movement of capital) should determine the choice of cost justification model on equity.

An alternative view is proved in Rouwenhorst [Rouwenhorst, 1999]. The author came to the conclusion that in terms of factors influence the difference between developed and emerging markets there. Factors explaining the return on equity, which were significant in the developed and emerging markets. These factors include:

- size of the company;
- variables that reflect the degree of operational and financial risk;
- liquidity of the shares;
- growth prospects.

Active research on testing the CAPM modifications taking into account the underdeveloped capital markets held in South America (Argentina, Brazil, and Venezuela). Selecting the modification recommended linked to the degree of development of the local financial market and its integration into the global capital market.

Model Godfrey- Espinosa focuses on the calculation of beta - rate and market risk premium according to the local market with the introduction of the country risk premium (CRP) in adjusting the global rate of risk-free yield, and in order to avoid double the risk of accounting of the premium for the risk of investing correction factor (1-R2), where R2 - determination coefficient of the regression equation relating the profitability of the company in the local market to the variability of the country risk premium.

	The degree of market integration		
The reliability of local data for the calculation of the risk premium and beta		High	Low
	High	Global CAPM	Local CAPM
			Adjusted local CAPM
	Low	Hybrid CAPM	
		Godfrey-Espinosa Model	

Figure 3 Modifications SARM depending on the degree of integration and segmentation[34]

In the Gonzales tested the CAPM model on a sample of companies whose shares are traded on the Stock Exchange of Caracas (Venezuela). Using the regression method on data for the 6-year period (1992-1998.), the author concludes that in Venezuela CAPM does not work. [35]

This conclusion is mainly done as a result of the rejection of the hypothesis that the positive relationship between risk and return of the shares. However, the results of research Gonzalez F. showed that, first, the relationship between risk (as a measure which used the beta coefficient) and yield is linear, and, secondly, the systematic risk - is not the only factor that affects the expected return equity.

Similar results were obtained in studies M. Omran in the Egyptian capital market. The sample included 41 companies with the most liquid shares. Data panel was formed for the period December 2001 to December 2002 on the basis of logarithmic returns of shares received on weekly observations.

Empirical tests Omran M. indicate that the market risk is a significant factor in explaining the expected return on shares of Egyptian companies. The revealed paradox research - profitability of the portfolio made up of shares of companies with low betas (basically, these are companies that produce consumer goods, and financial services) is higher than the return on a portfolio of stocks of companies of construction, textile sector and the sector of hotel business with a high values of

[34]

[35] Gonzalez M. CAPM Performance in the Caracas Stock Exchange from 1992 to 1998// International Review of Financial Analysis, № 10, 2001, pp. 333–341

the beta coefficient. According to the author, the reason for this discrepancy is the state nationalization of 1950-1960-ies., which is affected more negatively the risk of industrial and construction sectors than companies producing consumer goods as well as financial institutions.

An interesting study on the emerging markets, dedicated to the choice of investment risk measures. Typically, such work is carried out testing in several models: CAPM and its alternatives. For example, Hwang and Pedersen tested three models: the classic CAPM and two models that use asymmetric risk measures - LPM-CAPM (Lower Partial Moment CAPM) and ARM (Asymmetric Response Model).

Alternative feature models is that they, according to the authors, suitable for cases of abnormal distribution of returns and illiquid local capital market. The study was conducted on a sample of 690 companies growing markets for 10-year time period (April 1992 - March 2002). The results of this work, Pedersen and Hwang S. C. have concluded that in its explanatory ability of the CAPM is not inferior to alternative models. On cross sample explaining the ability of the MSAR reached 80% on the panel data of weekly and monthly returns, and 55% for daily returns data. Significant advantages of asymmetric measures of risk were not identified. In addition, conducting the analysis, the authors divided the sample of 26 developing countries by region, and then to divide the entire time period of observations at two intervals - before and after the Asian crisis of 1997.

Due to this, Hwang S. Pedersen C. and showed a significant impact on the risk of developing local capital markets, which is consistent with the results presented above.

In a study of Deir Collins tested different risk measures for 42 countries in the developing market: systematic (beta coefficient), total (standard deviation), idiosyncratic, one-sided (unilateral deviation, one-sided factor beta and VaR8), as well as the size of the market (based on the average capitalization of the country), indicators of skewness and kurtosis.

Testing was conducted with the help of the econometric approach (as well as in most of these works) with the position of the international investor in a 5-year time span (January 1996 to June 2001 he) on a weekly return. Depending on the capital market size, liquidity and the development of an initial sample of 42 countries were divided into three groups: the first level - a country with a large capital market size (e.g., Brazil, South Africa, China), as well as with a small size of the market, but economically and information Development; the second level - the smaller emerging markets (Russia), the third level - small markets (such as Latvia, Estonia, Kenya, Lithuania, Slovakia, and others.).

According to the survey results, the markets for some values of beta coefficients turned out smaller than expected, giving a false signal about the existence of a low risk for investors. The conclusion of the work - the beta (and hence the CAPM model) incorrectly applied to the totality of developing countries. D. Collins argues that there is no single risk measure that would suit for any country of the group of developing countries.

For the countries of the first level the most appropriate measure of risk is the coefficient that takes into account the size of the market, for the second level - the one-sided risk indicators (in comparison with other best results showed the VaR), the third level - either standard deviation or idiosyncratic risk. Idiosyncratic risk (idiosyncratic risk) is the part of any of the financial market, which does not depend on the overall level of financial risk that exists in this economy. It referred to as an unsystematic risk, in contrast to systematic risk. [36]

A similar conclusion about the acceptability of different measures of systematic sided risk in countries with excellent performance of the stock market is done in .The analysis of applicability of a number of unilateral measures of risk (BL, HB E-beta) for 27 emerging markets (the sample included Asian and Latin American markets, African and Eastern, including Russia) on the interval 1995-2004. As a global portfolio uses the MSCI index for emerging markets, as the risk-

[36] Collins D. Measuring the Cost of Equity in Frontier Financial Markets // Working paper. University of Cape Town, 2002.

free rate appear ten-year government bonds (T-bond). It is shown that for markets with high asymmetry yield distribution (high coefficient of skewness) is the most appropriate measure of systematic risk is HB-beta. For markets with significant observable supernormal yields, an advantage over other measures of risk has a BL-beta.

Countries with similar geographic and macroeconomic performance in Central and Eastern Europe conducted an empirical study of the benefits DCAPM [Devyris&Jankauskas, 2004]. The analysis of factors forming the return on companies from 8 countries of the former Soviet bloc: the Czech Republic, Slovakia, Hungary, Poland, Slovenia, Estonia, Latvia and Lithuania for the time period 1998 to 2003. The Authors show the importance of unilateral measures of risk, while maintaining the influence of specific risk factors.

Impact of segmentation of the market to the level required yield investors examined Campbell Harvey. It is proved that the cost of capital on the segmented markets will be higher than in the integrated markets, as investors demand more compensation for the fact that they are local, idiosyncratic risk. This suggests that any increase in the degree of financial integration should lead to a reduction in equity capital costs.

Rene Stulz proposed diagnostic parameters to include in the model the "risk-return" global investor award for country risk (country risk premium, CRP).

It is necessary to take into account the degree of integration (the presence of barriers to capital movement), and covariance of return on the local and global markets. Characteristics of formal and informal barriers to the movement of capital observed on the segmented markets are given in Serra’s research.

For example, in research of Bekaert and Harvey based on the model of the dividend yield (the Gordon model), the authors show that the liberalization of segmented capital markets leads to a reduction of cost of equity on average by 50%. A similar study on the basis of the analysis of changes in the dividend yield and growth for 20 developing markets (includes countries of South America, Asia

and Africa) presented in.[37] The external sign of liberalization, the author has chosen a provisional date when foreign investors get the opportunity to buy shares of companies on the local market. The paper shows the reduction of the cost of capital liberalization on average by almost 50%.

The method of event analysis (event study) with the evaluation of the accumulated excess return on the price dynamics of Depositary receipts (ADR) 126 firms from 32 local markets allowed to show for the time period 1985 – 1994 in the decrease in the cost of equity by 42%.

In the work Darila Collins and Mark Abrahamson the analysis of the cost of equity by CAPM model on 8 capital markets of the African continent (Egypt, Kenya, Morocco, etc.) in terms of global investor. The study was conducted with allocation of the 10 major sectors of the economy. Selected two time periods, characterizing different degrees of openness of the economies (1995-1999 and 1999-2002).

The authors show a decrease over time, the risk premium on African capital markets. The greatest changes occurred in Zimbabwe and Namibia, the lowest - in Egypt, Morocco and Kenya. The average value of cost of equity capital for 2002 is approximately 12% in US dollars. Sectors with the largest weight in the economy show the least expensive capital.

Summary of Chapter 3

In summary of this chapter we can see criticizes of CAPM in many studies for the assumptions of unrestricted risk-free borrowing and lending, investors are maximizing one-period investment and focus only on risk and return of one-period portfolio, whether market betas explain the expected returns, and the proxy of market portfolio of all risky assets. The significant assumptions of CAPM, that are used in the development of CAPM. There are several followings assumption of CAPM: Investors have utility functions, normally distributed security returns, an

[37] Henry, Peter B. Capital-Account Liberalization, the Cost of Capital, and Economic Growth// The American Economic Review, V 93, 2, pp 91-96, 2003

efficient market portfolio that contains all risky assets. So, specific challenges and reasons arise in the application of CAPM developing capital markets, that is rather not easy to justify the parameters of the model (risk-free rate of return, market risk premium, beta coefficient) on the local capital market data due to the lack of information efficiency and low liquidity of traded assets.

CONCLUSION

AS the stock market is one of the main sectors of the economy and the CAPM is one of the vital models of valuating of capital assets, learning the history of this model and theories is essential and urgent problems in our country.

If we look at the history of CAPM, it starts from the year of 1952. In that year, Harry Markowitz designed the long-term assessment model of CAPM to determine the cost of capital. It was developed by William Sharpe in 1966 and brought the author the Nobel Prize. The model (as well as the APT) based on the economic model of equilibrium implies that prices of financial instruments reach their true values (values which allow the balancing of demand and supply of assets). In a theoretical sense, the CAPM can be seen as a further development of the theory of Markowitz with additional assumptions about the market participants and information available to them. As noted by Peters: "the CAPM combines the efficient market hypothesis (EMH) and mathematical theory of Markowitz to portfolio models of investor behavior, based on rational expectations in the framework of the overall concept of equilibrium.

The CAPM implications are embedded in two predictions: 1) the market portfolio is efficient, and 2) the security market line (the expected return-beta relationship) accurately describes the risk-return trade-off, that is, alpha values are zero. The central problem in testing these predictions is that the hypothesized market portfolio is unobservable. The “market” portfolio includes all risky assets that can be held by investors. This is far more extensive than an equity index. It would include bonds, real estates, foreign assets, privately held businesses and human capital. These assets are often traded thinly or (for example, in case of human capital) not traded at all. It is difficult to test the efficiency of an observable portfolio, let alone an unobservable one. These problems alone make adequate testing of the model infeasible. Moreover, even small departures from efficiency in the market portfolio can lead to large departures from the expected return-beta relationship of the SML, which would negate the practical usefulness of the model.

CAPM is derived from and is a modified extension of Markowitz portfolio selection model with specific implications for equilibrium asset prices in the capital market.

In summary, CAPM faces many challenges when put into practice due to the strict assumptions. They are in short followings:

1) Under the theoretical framework of CAPM, transactions will not occur.

2) CAPM is contradictory to the portfolio theory.

3) With the rapid development of financial markets, abnormalities continually emerge.

Lots of the early tests of the CAPM employed the methodology of first valuating betas using time series regression and then running a cross sectional regression using the estimated betas as explanatory variables to test the hypothesis referred by the CAPM:

Using this approach one of the first tests of the CAPM was conducted by Lintner, which is reproduced in Douglas (1968).

Fama and MacBeth (1973) performed one classic test of the CAPM. They combined the time series and cross-sectional steps to investigate whether the risk premium of the factors in the second pass regression were non-zero.

Black, Jensen and Scholes (1972) performed another classic test of the Capital Asset Pricing Model employing time-series regression.

Stambaugh (1982) then estimates the market model and using the Lagrange multiplier test finds evidence in support of Black's version of CAPM but finds no support for the standard CAPM. Gibbons (1982) uses a similar method as the one used by Stambaugh (1982) but instead of the LM test uses a likelihood ratio test.

Miller and Scholes (1972) in their paper "Rates of return in relation to risk" discuss the statistical problems inherent in all the empirical studies of t

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