Saban Celik (Turkey), Bora Aktan (Turkey), Pınar Evrim Mandaci (Turkey)

The characteristics of bank common stocks within the framework of Capital Asset Pricing Model: evidence from Turkey

Abstract

Understanding of risk and its resultant impact on the returns and evaluation of risk-return relationship are highly important for investors. For this purpose, the fundamental relationship between risk and return is investigated within the framework of the Capital Asset Pricing Model (CAPM) that has been in use the longest and is still the standard in most real-world analyses. Present study mainly (1) gives a short description of the model as well as its extensions, (2) emphasizes the importance of banking sector by analyzing characteristics of bank common stocks, and (3) conducts several positive tests on predictions of Sharpe-Lintner version of the CAPM via bank common stocks, the locomotive shares, listed on the Istanbul Stock Exchange (ISE). Results do not completely support the theoretical relationship between risk and return, which is assumed and predicted by the model.

Keywords: MPT, CAPM, emerging market, banking, ISE.
JEL Classification: G1, G12, G21, E44.

Introduction

The motivation of lying behind the paper is coming from the long standing debate on one of the influential theory of capital markets; that is, Capital Asset Pricing Model[1], hereafter the CAPM. The CAPM has been in use the longest and is still the standard in most real-world analyses, which attempts to explain the relationship between risk and return on a financial security, and this relationship can then be used to determine the appropriate price for the security. The intuition behind the CAPM is the segmentation of asset risk into two components: systematic *(nondiversifiable)* and unsystematic *(diversifiable)* risk. Systematic risk shows how a common stock acts in relation to the market. It then states that the expected return on an asset depends upon its level of systematic risk *(beta)*. The asset's systematic risk is measured relative to the market portfolio. In other words, the relative risk of an asset is that asset's contribution to the risk of a well-diversified portfolio.

The CAPM, originally inspired by John Treynor[2], was developed independently by Sharpe (1964), Lintner (1965 a, b) and Mossin (1966), which follows logically from the Markowitz's (1952) Modern Portfolio Theory (MPT) based on the mean-variance decision criteria and Tobin (1958) Separation Property[3]. In his seminal paper, Markowitz assumed that investors were utility maximizers who maximize their expected return at a given level of risk or minimize the risk at a given level of expected return. More rigorously, we may state this as: If portfolio X dominates Y, Expected Return $[X] \geq$ Expected Return $[Y]$ and standard deviation of $[X] \leq$ standard deviation of $[Y]$ in a way that at least one inequality is certain to hold. Jensen (1972, p. 4) pointed out the underlying assumptions of MPT and CAPM as follows:

"(1) All investors are single-period expected utility of terminal wealth maximizers who choose among alternative portfolios on the basis of mean variance (or standard deviation) of return; (2) All investors can borrow or lend an unlimited amount at an exogenously given risk free rate of interest Rf, and there are no restrictions on short sales of any asset; (3) All investors have identical subjective estimates of the means, variances and covariances of return among all assets; (4) All assets are perfectly divisible and perfectly liquid, i.e., all assets are marketable and there are no transactions cost; (5) There are no taxes; (6) All investors are price taker; and (7) The quantities of all assets are given."

The CAPM is important because it was the first equilibrium asset pricing model that hinges on mean-variance portfolio selection under uncertainty. It provides the relationship between investment's systematic risk and its expected return. Using Markowitz mean-variance algorithm, the algebraic condition on asset weights can be solved in mean-variance efficient portfolios. The CAPM turns this algebraic statement into a testable prediction about a linear relation between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market of all assets. An extensive body of empirical research has provided evidence contradicting the prediction of Sharpe-Lintner and Black's Zero-Beta CAPM that the cross-section of expected returns is linear in beta. The distinctiveness of the study as a part of general research is to conduct different tests on the highly traded bank common stocks (non-financial firms were neglected in most studies, e.g., Akdeniz et al. (2000)) in order to avoid pre-

[1] In this paper, we focus on the empirical context of standard CAPM that is also known as Sharpe-Lintner version, in addition, we briefly mention on its extensions for pedagogical reasons.

[2] See Sharpe (1964) and Jensen (1972) for a detail explanation.

[3] Tobin showed that allocation of funds among investors could be seen as two independent tasks: the allocation among so-called risky assets and the assets that produce certain amount of return without bearing any risk, so-called risk free assets.

sumed systematic risk factors other than beta and employed a group of several tests, which are examined independently in the literature in one paper.

The aims of this paper are (1) to give a short description of CAPM and its extensions, (2) to emphasize the importance of banking sector through analyzing characteristics of bank common stocks, and (3) to conduct several positive tests on predictions of Sharpe-Lintner version of the CAPM via bank common stocks, the locomotive shares, listed on the Istanbul Stock Exchange (ISE) for investors. Therefore, this paper is organized as follows: After a brief introduction and literature review, Section 2 discusses the banks and the banking system in Turkey as an emerging market. Section 3 presents the data and the methodology as well as the empirical results whilst the concluding remarks end the paper in the last section.

1. Literature review

During the past four decades, the finance discipline has developed more theory on the measurement of risk and its use in assessing returns. The two key components of these theories are beta, which is a measure of risk, and the CAPM, which uses beta to estimate return (Aktan et al., 2009). The CAPM has been subject of several empirical tests based on three implications of the relation between expected return and market beta implied by the model. First, expected returns on all assets are linearly related to their betas, and no other variable has marginal elucidatory power. Next, the beta premium is positive, meaning that the expected return on the market portfolio exceeds the expected return on assets whose returns are uncorrelated with the market return. Last, assets uncorrelated with the market have expected returns equal to the risk-free interest rate, and the beta premium is the expected market return minus the risk-free rate (Fama and French, 2004).

Some early empirical studies (Black, Jensen and Sholes, 1972; Fama and MacBeth, 1973; Sharpe and Cooper, 1972; Litzenberger and Ramaswamy, 1979; Gibbons, 1982; Chan and Lakonishok, 1993) on the CAPM are reasonably supportive of the basic tenet of the model. Black, Jensen and Sholes (1972) found that the higher beta risk and higher return go together over the period of 1931-1965. Fama and MacBeth (1973) also found that over the period of 1935-1968 beta and returns were positively related for entire period and for eight of nine sub-periods as well as the relationship to be linear, and unsystematic risk did not affect returns. Chan and Lakonishok (1993) pointed out that over the period of 1926-1991 betas are a useful guide to risk in extreme market conditions, with the riskiest firms performing far worse than the market as a whole, in the ten worst months for the market between those years. A more recent paper for the CAPM and beta is by Kothari, Shanken and Sloan (1995). The authors found, by using annual returns contrary to monthly returns for computing betas over the period of 1927-1990, that there was a strong relationship between beta and returns.

The expediency of beta as the single measure of risk has been criticized by some disputes. Primary, conceptually that beta is the most efficient measure of systematic risk for individual securities. Hence, some academics such as Chen, Roll, and Ross (1986) argued for measuring systematic responsiveness to several macroeconomic variables. Next, other academics such as Lakonishok and Shapiro (1986) found empirical evidence that security returns were affected by various measures of unsystematic risk. Ultimately, some other academics such as Fama and French (1992) stated that recent empirical evidence indicates the absence of a systematic relationship between beta and security returns. The first two criticisms put forward that beta lacks efficiency and completeness as a measure of risk and the last one implies either that there is no risk-return trade-off or beta is not a measure of risk. Some other empirical investigation of relevant risk factors that explain cross-sectional expected returns force academics to study some other factors such as firm size (Banz, 1981); the *E*/*P* (Basu, 1977; 1983); leverage (Bhandari, 1988); book to market value (Chan, Hamao, and Lakonishok, 1991) among others in line with the market beta. A number of studies (Basu, 1977; Roll, 1977; Banz, 1981; Fama and French, 1992, 1993, 1996, 2004, 2006) showed that variables such as low *P*/*E* ratios, size and past sales growth explained returns even after controlling for systematic risk. Roll (1977), in a seminal critique, argued that CAPM is not a reasonable model, because a true market portfolio consisting of all risky assets can not be observed or owned by investors. Furthermore, empirical tests of CAPM are infeasible because proxies for the market portfolio may not be mean-variance efficient, even if the true market portfolio is, and vice versa. Fama and French (1992) reported that there was no relationship between beta and returns in the US over the period of 1963-1990 and there was only a week relationship over the 1941-1990 period. They also pointed out that small market capitalization firms, and those whose book value is high in relation to their price, earn higher returns.

To assess the validity of the test, one important question is the stability of the measure of systematic risk. However, empirical investigations (Fabozzi and Francis, 1977, 1979; Faff et al., 1992; and Chen, 1982) found that the betas tend to be volatile over time and challenged the assumption of constant beta coefficient. Thus, to obtain a reliable test of the

CAPM, we should take into account the stylized fact that beta is non-stationary. Fama and French (1992) found that firm size and book to market value of equity ratio displace beta in explaining security returns. This finding may be at least partially attributable to a possible misestimating of beta, since Fama and French use a constant risk market model that does not adjust for the possible variation in risk of securities between bull and bear markets. Kim and Zumwalt (1979), Fabozzi and Francis (1977, 1979) showed the changes in beta and abnormal return (alpha) over bull-bear and up-down markets on individual stocks and mutual funds.

The Test of the Model generally concentrates on its three most prominent conclusions: (1) the alpha for every asset equals zero (first-pass regression), (2) there is a linear relationship between an asset's beta and its return (second-pass regression), and (3) beta completely summarizes expected returns (in the second-pass regression, more explanatory variable can be added in order to observe whether it has an exploratory power on stock return). In accordance with the related literature we combine some other tests conducted on stock returns and prepare the following list of tests[1]: (1) testing the expected abnormal return, (2) testing the asset systematic risk level against $\beta = 1$, (3) joint test of alpha and beta, where $\alpha = 0$ and $\beta = 1$, (4) testing prediction power of the CAPM, (5) estimating security market line, (6) testing structural test of beta, and (7) stability of beta over the market cycle.

Table 1. Theoretical development of CAPM and its major extensions

Model	Originator	Theoretical ground
*Modern portfolio theory**	Markowitz (1952)	Mean-variance optimization introduced
*Separation property**	Tobin (1958)	Referring to allocation of funds can be separated into risk free and risky investment
Original CAPM	Treynor (unpublished) Sharpe (1964) Lintner (1965) Mossin (1966)	See the assumption above
Zero-beta CAPM	Black (1972)	Relaxing the assumption of borrowing and lending at risk free rate
Intertemporal CAPM	Merton (1973)	Relaxing the assumption of single period model
Three-moment CAPM	Kraus and Litzenberger (1976)	Extending the mean variance based CAPM into three moment mean variance skewness CAPM
*Arbitrage pricing model***	Ross (1976)	APT differs from CAPM in the sense that the former depends on the assumption that arbitrage opportunities are precluded in rational equilibrium of capital markets and does not require the mean variance efficiency
General CAPM	Levy (1978) Merton (1987) Markowitz (1990) Sharpe (1991)	Relaxing the assumption of no transaction costs
Consumption-based CAPM	Breeden (1979)	In contrast to using beta from investment portfolio, in CCAPM consumption beta is used which co-varies with consumption per capita growth
Three-factor model	Fama and French (1993)	Taking security characteristic such as size and value factor into consideration
Liquidity-based CAPM	Pastor and Stambaugh (2003) Acharya and Pedersen (2005)	Consider the impacts of both the level and the risk of liquidity on security pricing

Notes: * Pre-CAPM development, ** APT is not equilibrium model rather it is built on "no arbitrage principle".

2. Banks and the banking system in Turkey

Banks not only play a critical role in allocation of economic resources but they also are key players in the provision of capital and, hence, in stimulating economic development especially in emerging markets like Turkey. Financial system in Turkey is largely dominated by banks which many transactions and activities in both money and capital markets are carried out therefore; its banking sector is virtually synonymous with the entire system on account of the country's economic and historical development. As of December 2007, the size of the banking industry was 75.7 percent of total financial sector in Turkey (BRSA, 2007). While the financial system is dominated by the banking sector, there has been a recent increase in the number and size of non-bank financial institutions such as Special Finance Institutions, Leasing and Factoring Companies, Consumer Finance Companies, Private Pension Funds

[1] The methodology of these tests has been mostly adopted from the lectures notes of Eric Zivot, University of Washington.

and Insurance Companies, Real Estate Investment Trusts, and Intermediaries in the capital markets.

Banks operating in Turkey can be classified into three main groups as those with the permission to accept deposits (commercial or deposit banks), those not accepting deposits (non-deposit or development and investment banks) and participation banks which are based upon interest-free banking (Profit/Loss Sharing). Besides, each group can be divided into three sub-groups such as state-owned, privately-owned, and foreign banks according to their ownership structures.

Recent economic reforms as well as financial reforms providing positive atmosphere and attractiveness for growth encouraged many foreign banks to enter into the sector with full banking activities while forced existing banks to restructure their organizations, operations and activities. Similarly, Turner (2006) point outs that over the past decade, the banking systems in emerging markets have been transformed by three major trends – *privatization*, *consolidation* and *the entry of foreign banks* on a large scale. As of 2007, the number of banks operating in Turkey was fifty. Thirty-three of them were in deposit banks group, thirteen of them were investment banks and four of them were participation banks. Among deposit banks, there were 3 state-owned banks, 11 privately-owned banks, 18 foreign banks and one bank, under the supervision of the Savings Deposit Insurance Fund (SDIF) with 7801 branches including those abroad (Rybak and Aktan, 2008; BAT, 2008a)[1]. In addition, 17 of the banks are listed on the Istanbul Stock Exchange (ISE)[2].

By the end of 2007, total assets of the banking sector amounted to TRY 561 billion ($484 billion). The ratio of total assets to Gross Domestic Product was about 66 percent. Shareholders' equity and the free shareholders' equity (shareholders' equity-permanent assets-nonperforming loans after provisioning) continued to increase. Shareholders' equity amounted to TRY 73 billion ($63 billion), free shareholders' equity amounted to TRY 51 billion ($44 billion). The ratio of shareholders' equity to total assets was about 13 percent. Return on equity in the banking system realized as about 19.5 percent and average capital adequacy ratio of deposit banks were 17.4%.

Growth in the banking sector, causes changing in its balance sheet structure, increasing in loan demand, strengthening of its financial structure, and improvement in its profitability performance, as well as growth potential of Turkey and the sector, all attracted foreign direct investments to the Turkish banks and other financial institutions. As a result, market value of financial institutions traded in the ISE increased to $117 billion by breaking a record. Within the year in May, T. Halk Bankası A.S., a state-owned commercial bank, went to public by selling 21.7 percent of its shares and thus, publicly traded deposit banks rose to 13 in the stock exchange (BAT, 2007; 2008b).

As of December 2007, first five[3] and first ten[4] major banks, including three of ten state-owned deposit banks, held 62 percent and 85 percent of the total assets of the banking sector respectively. However, the total share of the five major banks representing the concentration in the Turkish banking system is smaller than the share representing the concentration in most OECD countries.

3. Data and methodology

Based on assumptions mentioned above, Sharpe and Lintner advanced CAPM further by introducing the following equation which relates the excess return on an individual asset with its sensitivity to the market's excess return[5]:

$$E(\mu_i) = r_f + \beta_i \left(E(\mu_M) - r_f\right),$$

where $\beta_i = \dfrac{cov(\mu_M, \mu_i)}{var(\mu_M)} = \dfrac{\rho_{m,i} \times \delta_i}{\delta_m}$; r_f - risk-free rate; $E(\mu_i)$ - expected return of asset *i*; and $E(\mu_M)$ is expected return of market portfolio.

In this study, bank common stocks[6] listed on the ISE are analyzed within the context of MPT and the CAPM. Weekly returns of common stocks are calculated as follows:

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[1] Turkish banking sector experienced several difficulties, on account of their own excessive risk-taking behavior within the last 25 years. In the period of 1999-2003 in which the banking system underwent the restructuring, 20 banks were transferred to the SDIF with their liabilities due to their deteriorated financial structure, 8 banks were terminated and liquidated. In the same period, 11 banks mergers occurred in the sector including the buying of some banks under the SDIF administration.

[2] **Commercial (deposit) banks**: Akbank, Alternatifbank, Denizbank, Finansbank, Fortis Bank, Garanti Bankası, Halk Bankası, İş bankası, Şekerbank, Turk Ekonomi Bankası, Tekstilbank, Vakıfbank, Yapı ve Kredi Bankası. **Development and investment (non-deposit) banks**: TSKB and T. Kalkinma Bankası. **Participation (interest-free) banks**: Albaraka Turk, Asya Katilim Bankasi.

[3] Ziraat bankası (1863-state-owned), İş Bankası (1924), Akbank (1948), Garanti Bankası (1946), and Yapı ve Kredi Bankası (1944).

[4] Vakıfbank (1954-state-owned), Halkbank (1938-state-owned), Finansbank (1987), Denizbank (1997) and HSBC (1990).

[5] For simplicity, we are not intended to derive any model mentioned in this paper. For insightful explanation regarding the logic of the model and its assumptions, see Fama and French (2004), Perold (2004) and Galagedera (2007).

[6] Akbank (AKBNK), Asya Katılım Bankası (ASYAB), Alternatifbank (ALNTF), Denizbank (DENIZ), Finansbank (FINBN), Fortisbank (FORTS), Garantibank (GARAN), Isbank (C) (ISCTR), Sekerbank (SKBNK), Türkiye Ekonomi Bankası(TEBNK), Türkiye Kalkınma Bankası (TKBNK), Türkiye Sınayi Kalkınma Bankası (TSKB), Tekstilbank (TEKST), Vakıflarbankası (VAKBN), Yapı Kredi Bankası (YKBNK).

$$R_t = \ln(1 + r_t) = \ln\left(\frac{P_t}{P_{t-1}}\right),$$

where R_t denotes the continuously compounded weekly geometric returns, r_t denotes the simple weekly returns and $P_{t,t-1}$ denotes the price of common stocks at time t and t - 1. The period of analysis is from 2002-1 to 2007-52 (from the first week of 2002 to last week of 2007). All returns are adjusted to stock splits and dividends. In the period of analysis 310 weekly returns are calculated for those which were active traded in ISE whereas the numbers of observations differ for ASYAB (85), DENIZ (168) and VAKBN (109) due to their starting date of listing in ISE. ISE100 Index is determined as a proxy of market portfolio and central bank overnight interest rate is determined as a proxy of risk-free rate. These data are obtained from ISE and Central Bank of the Republic of Turkey. Using the market model regression for each asset, the following model regression employed so-called first-pass regression:

$$\mu_{it} - r_f = \alpha_i + \beta_i(\mu_{Mt} - r_f) + \varepsilon_{it}, \quad \begin{vmatrix} \varepsilon_{it} \approx iid\ N(0,\delta^2) \\ cov(\varepsilon_{it}, \mu_{Mt} - r_f) = 0\ or \\ \varepsilon_{it}\ is\ independent\ of\ \mu_{mt} - r_f \\ t = 1,2,...,T \end{vmatrix}. \quad (1)$$

In the first pass-regression, the term μ_{it} is stock i return at time t; r_f is risk free rate; μ_{mt} is index return which is used as proxy for market portfolio; α_i and β_i are parameters of the model employed and ε_{it} is the error term which has mean zero and constant variance. In addition, error term should be uncorrelated with risk premium. In the CAPM world, the parameters are stable and hypothetically α_i should be equal to zero and beta should not be equal to zero (sign of the beta can be negative or positive depending on market's up and down condition). It is going to be examined time varying model in the forthcoming tests as well.

Table 2. Descriptive statistics of stocks analyzed

Banks	Obs.	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Jarque-Bera (Prob.)
RFREE	310	0.005842	0.005945	0.007763	0.003188	0.001628	-0.129414	1.550514	28.00334	0.000001
ISE100	310	0.006573	0.007757	0.198270	-0.149890	0.039403	0.088684	5.149443	60.08270	0.000000
AKBANK	310	0.008026	0.006873	0.218254	-0.166446	0.053688	0.177142	3.905468	12.21128	0.002230
ALNTF	310	0.006015	1.56E-17	0.386417	-0.244453	0.059938	0.890960	9.347654	561.4610	0.000000
ASYAB	85	0.012508	0.011834	0.115602	-0.141970	0.049417	-0.254918	3.483266	1.747739	0.417334
DENIZ	168	0.007652	7.94E-17	0.252997	-0.132598	0.051840	0.901144	6.561181	111.5117	0.000000
FINBN	310	0.010531	1.01E-16	0.398208	-0.223144	0.060447	0.701854	8.991802	489.1811	0.000000
FORTS	310	0.011758	0.006100	0.212333	-0.184093	0.052460	0.692830	5.236818	89.42741	0.000000
GARAN	310	0.009035	0.006827	0.247476	-0.176819	0.059032	0.225304	4.209580	21.52086	0.000021
ISCTR	310	0.006159	1.07E-16	0.350202	-0.146891	0.058592	0.682794	6.440357	176.9698	0.000000
SKBNK	310	0.011305	0.007782	0.577517	-0.373966	0.081237	1.248378	14.71371	1852.829	0.000000
TEBNK	310	0.012703	0.008989	0.278578	-0.198972	0.061555	0.258465	4.235070	23.15462	0.000009
TEKST	310	0.009258	5.20E-17	0.355684	-0.256430	0.067924	0.699003	7.320337	266.3382	0.000000
TKBNK	310	0.005283	4.68E-17	0.253915	-0.207639	0.063049	0.672587	5.576151	109.0948	0.000000
TSKB	310	0.010549	0.008850	0.291352	-0.187463	0.055951	0.608572	6.339265	163.1650	0.000000
VAKBN	109	0.008811	0.013699	0.205512	-0.158824	0.055122	0.169997	4.624328	12.50792	0.001923
YKBNK	310	0.007364	0.005617	0.430466	-0.292670	0.067337	0.320345	9.323945	521.8691	0.000000

Note: Descriptive statistics of all stocks and indexes are provided for interested readers and raw data can also be provided upon the request. It should be noted that it is not possible to gain adjusted weekly return from any institutions in Turkey. This adjustment requires quite long time to prepare so that authors may provide them to those who want to analyze and work on it through more advanced tools and methodologies.

Table 3. First-pass regression results

$$\mu_{it} - r_f = \alpha_i + \beta_i(\mu_{Mt} - r_f) + \varepsilon_{it}$$

Banks	Alpha (Standard error)	t-stat. (α) [Prob (t-stat)]	Beta (Standard error)	t-stat. (β) [Prob (t-stat)]	F-statistic [Prob(F-statistic)]	R^2 [Adjusted R^2]	Durbin-Watson stat.
AKBNK T=310	0.001364 (0.001728)	0.789296 (0.4305)	1.122760 (0.043839)	25.61090 (0.0000)	650.8117 (0.000000)	0.680471 (0.679433)	2.017744
ALNTF T=310	-0.000453 (0.002664)	-0.170084 (0.8651)	0.953000 (0.067552)	14.10772 (0.0000)	199.0279 (0.000000)	0.392538 (0.390566)	2.155063
ASYAB T=85	0.006523 (0.004210)	1.549174 (0.1251)	0.892627 (0.121245)	7.362179 (0.0000)	54.20168 (0.000000)	0.395051 (0.387763)	2.176825
DENIZ T=168	0.002700 (0.003664)	0.736679 (0.4624)	0.655386 (0.110750)	5.917727 (0.0000)	35.01949 (0.000000)	0.174209 (0.169235)	1.929352
FINBN T=310	0.004101 (0.002728)	1.503033 (0.1339)	0.935766 (0.069189)	13.52479 (0.0000)	182.9200 (0.000000)	0.372607 (0.370570)	2.153496
FORTS T=310	0.005497 (0.002284)	2.407054 (0.0167)	0.859323 (0.057919)	14.83661 (0.0000)	220.1250 (0.000000)	0.416805 (0.414911)	2.075780
GARAN T=310	0.001870 (0.001799)	1.039243 (0.2995)	1.267018 (0.045622)	27.77226 (0.0000)	771.2986 (0.000000)	0.714629 (0.713703)	1.990688
ISCTR T=310	-0.001085 (0.001609)	-0.673982 (0.5008)	1.302139 (0.040814)	31.90432 (0.0000)	654.5059 (0.000000)	0.767702 (0.766948)	1.850267
SKBNK T=310	0.004920 (0.004156)	1.183905 (0.2374)	0.915026 (0.105396)	8.681751 (0.0000)	75.37279 (0.000000)	0.196604 (0.193996)	2.064823
TEBNK T=310	0.006347 (0.002869)	2.212717 (0.0277)	0.902158 (0.072745)	12.40157 (0.0000)	107.7051 (0.000000)	0.333043 (0.330878)	2.235394
TEKST T=310	0.002646 (0.003132)	0.844837 (0.3989)	1.017466 (0.079430)	12.80964 0.0000	164.0868 (0.000000)	0.347578 (0.345459)	1.899336
TKBNK T=310	-0.000871 (0.003103)	-0.280555 (0.7792)	0.811019 (0.078688)	10.30680 (0.0000)	106.2302 (0.000000)	0.256452 (0.254038)	2.232329
TSKB T=310	0.004261 (0.002518)	1.692461 (0.0916)	0.871976 (0.063844)	13.65800 (0.0000)	186.5409 (0.000000)	0.377200 (0.375178)	2.025083
VAKBN T=109	0.002830 (0.003353)	0.843987 (0.4006)	1.216022 (0.095515)	12.73127 (0.0000)	162.0851 (0.000000)	0.602356 (0.598640)	2.450559
YKB T=310	0.000242 (0.002628)	0.091916 (0.9268)	1.247781 (0.066636)	18.72528 (0.0000)	350.6360 (0.000000)	0.532367 (0.530849)	2.187735

Note: In the market model framework, the regression is employed for each asset with Ordinary Least Square algorithm. Durbin-Watson statistic is also provided to demonstrate serial correlation among returns. As it seen that the returns do not show significant serial correlation as it is close to 2. Throughout this paper E-views as econometric software is used to support the required calculations.

3.1. Testing the expected abnormal return. Expected abnormal return on an asset which is depicted in equation (1) as alpha, should hypothetically be zero in equilibrium. The value of alpha leads the conclusion for an asset that positive alphas are seen as a good deal on the contrary of negative alpha. It should be underlined that there should not be any deviation for the value of alpha in equilibrium. To investigate the hypothetic value of alpha against zero can be formulated as the following in the form of two side test[1]:

Null hypothesis[2]: $H_n : \alpha = 0$ [expected abnormal return is equal to zero].

Alternative hypothesis: $H_a : \alpha \neq 0$ [expected abnormal return is NOT equal to zero].

[1] Gibbons, Ross and Shanken (1989) developed a methodology to jointly test alphas whereas it is not employed in this paper due to limited number of assets.

[2] For rejecting null hypothesis, the estimated value of α is required to have a value that is much or less than zero. To determine how big the estimated value of α needs to be rejected, the t-statistic can be employed: $t_{\alpha=0} = \frac{\hat{\alpha} - 0}{se(\hat{\alpha})}$ $\left| \begin{array}{l} \hat{\alpha} : estimated\ alpha \\ se(\hat{\alpha}) : estimated\ STANDARD\ error \end{array} \right.$.

Table 4. Test of alpha: $\alpha = 0$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	FORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
$\lvert t_{CAL} \rvert$	0.71	0.17	1.55	0.74	1.50	2.41	1.04	0.67	1.18	2.21	0.84	0.28	1.70	0.84	1.19
$t_{0,025,T-2}$	1,96	1,96	2	1,98	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1.96	1.98	1.96

Note: $t_{0,05,308} \cong 1.645$; $t_{0,10,308} \cong 1.282$; $t_{0,05,83} \cong 1.658$; $t_{0,10,83} \cong 1.289$; $t_{0,05,166} \cong 1.642$; $t_{0,10;166} \cong 1.282$; $t_{0,05,107} \cong 1.658$; $t_{0,10,107} \cong 1.289$.

Among stocks that are analyzed in this paper, alpha values for FORTS (0.005497) and TEBNK (0.006347) have t-statistics 2,41 and 2,21 respectively which are higher than the corresponding theoretical value of t-distribution at 5% significance level. Apparently, the alpha values do not invalidate CAPM for the rest of the stocks. However, deviation of alpha from the theoretical value is important consideration at equilibrium. The time series regression results for this test give almost similar findings with the previous tests conducted in the literature. The period of return calculation (weekly) and the number of observation (310) may lead these results for the fact that in the short time period the information that arrives has a noise. It means that investors may not be fully rational to adjust the relevant information in such a short time. Hence, it will take time for a stock to be converged to its fair value. The point here is that how long this time is and in which pattern investors adjust relevant information into price. There is not an existed theory to describe pattern of intrinsic value of a stock in the literature which can be well fit within the realistic framework.

3.2. Testing the asset systematic risk level against $\boldsymbol{\beta}$ = 1. Beta, systematic risk indicator, measures the undiversifiable risk that is not taken away through diversification and the only relevant risk that should be compensated by investors. The inference coming out from beta is that the higher beta shows greater variability than market portfolio whose beta equals one. Testing the hypothesis that whether the asset has the same level of systematic risk so that required higher returns, the appropriate null and alternative hypotheses can be formulated as follows[1]:

Null hypothesis[2]*:* $H_n : \beta = 1$ [Systematic risk of given asset is equal to market portfolio's systematic risk].

Alternative hypothesis: $H_a : \beta \neq 1$ [Systematic risk of given asset is NOT equal to market portfolio's systematic risk].

Table 5. Test of beta: $\beta = 1$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	FORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
$\lvert t_{CAL} \rvert$	0.06	0.70	0.88	3.11	0.93	2.43	5.85	6.62	0,81	1,34	0.22	2.40	2.005	2.26	3.72
$t_{0,025,T-2}$	1,96	1,96	2	1,98	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1.96	1.98	1.96

Note: $t_{0,05,308} \cong 1.645$; $t_{0,10,308} \cong 1.282$; $t_{0,05,85} \cong 1.658$; $t_{0,10,85} \cong 1.289$; $t_{0,05,168} \cong 1.642$; $t_{0,10,168} \cong 1.282$; $t_{0,05,109} \cong 1.658$; $t_{0,10,109} \cong 1.289$.

[1] It should be noted that this test is not testing linearity of beta with average return. In the second pass regression it will be described how to conduct beta-expected return linearity test.

[2] The data cast doubt on this hypothesis if the estimated value of β is much different from one. This hypothesis can be tested using the t-statistic:

$$t_{\beta=1} = \frac{\hat{\beta} - 1}{se(\hat{\beta})} \quad \left| \begin{array}{l} \hat{\beta} : estimated \quad beta \\ se(\hat{\beta}) : estimated \quad STANDARD \quad error \end{array} \right.$$

which measures how many estimated standard errors the least squares estimate of β is from one. The null hypothesis is rejected at e.g. the 5% level if $\lvert t_{\beta=1} \rvert > t_{0,025,T-2}$ (two-side test).

Testing whether betas are at the same level of risk as the market index against the alternative that the risk is different from the market is not a test to validate CAPM. The reason of conducting such a test is of interest to examine the given stocks performance with the proxy of theoretical market portfolio. The implications, however, play important role in describing the stocks' risk characteristics against a well known benchmark. The low betas imply that the variability of observed stock returns is higher than that of benchmark which leads to conclusion that common stocks of DENIZ, FORTS, GARAN, ISCTR, TKBNK, VAKBN and YKB are not as volatile as benchmark index. In case of DENIZ, FORTS and TKBNK, there is low compensation for risk premium since their betas are lower than benchmark index, on the contrary, there is high risk premium for GARAN, ISCTR, VAKBN and YKB. For practical implication, the banks which have high betas compensate the high reward for bearing risk on their common stocks. It is not surprising that these banks are, among others, the biggest in terms of market capitalization and probably give the positive signal for future prospects.

3.3. Joint test of alpha and beta $\alpha = 0$ and $\beta = 1$. To consider how well a model fits to the given data, it is usually looked how much deviation observed between restricted model and unrestricted model. Therefore, under the joint test of alpha and beta, we assume that restricted model parameters should be equal to zero and one for alpha and beta, respectively. For this reason, we hypothesize that both β and α have the same risk characteristics as the market index, as a result the following form of joint test can be conducted:

Null hypothesis[1]*:* $H_n \ : \alpha = 0$ and $\beta = 1$.

If CAPM does not hold (in other words at equilibrium in CAPM world), the asset has different risk characteristic than the market index or both, the null hypothesis can be rejected under the following alternative:

Alternative hypothesis:

H_a: $\alpha \neq 0$ or $\beta \neq 1$ or $\alpha \neq 0$ and $\beta \neq 1$.

Table 6. Joint test of alpha and beta, $\alpha = 0$ and $\beta = 1$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	FORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
F_{CAL}	4,09	0.26	1,47	4,94	1,49	5,53	18,07	27,43	0,97	3,19	0,39	2,97	3,26	3,06	6,96
$F_{0,95}(q,T-2)$	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07

Notes: $F_{0,90}(2,308) \cong 2.30$; $F_{0,975}(2,308) \cong 3.69$; $F_{0,90}(2,166) \cong 2.35$; $F_{0,975}(2,166) \cong 3.80$; $F_{0,90}(2,107) \cong 2.35$; $F_{0,975}(2,107) \cong 3.80$; $F_{0,90}(2,83) \cong 2.35$; $F_{0,975}(2,83) \cong 3.80$.

The estimated values of alpha and beta are provided in Table 3. As a result of joint test of alpha and beta, we rejected the predetermined value of desirable model parameters (alpha is zero and beta is one) for AKBNK, DENIZ, FORTS, GARAN, ISCTR, TEBNK, TSKB and YKB. However, it should not be understood that the fundamental value of beta should be equal to one, rather it is of interest to see how different characteristics of a stock have relevance to a theoretical framework of CAPM. In practical manner, it should not be thought that such test can explain why these stocks' performance deviates from what CAPM assumes, rather it is highly reasonable to see the current picture of these stocks within the frameworks of CAPM.

3.4. Testing prediction power of CAPM. The expected return-beta relationship can be represented through Security Market Line (SML) which depicts a benchmark for the evaluation of investment performance. SML portrays individual asset risk premiums as a function of asset risk. Consider the SML equation for CAPM. The SML implies that there is a simple positive linear relationship between expected returns on any asset and the beta of that asset with the market portfolio. High beta assets have high expected returns and low beta assets have low expected returns. This linear relationship is tested by dividing the sample into two equal subsamples. Fama and MacBeth (1973) and Pettengill et al. (1995) are two standard test methodologies to test unconditional and conditional linearity between risk and expected return in the literature. However, we will apply a modified approach to test linearity of expected return and beta relationship. The betas from first subsample calculated so-called ex-post beta to forecast expected

[1] This type of joint hypothesis is easily tested using so-called F-test. The idea behind the F-test is to estimate the model imposing restrictions specified under the null hypothesis and compare the fit of the restricted model to the fit of the model with no restrictions imposed.

returns for the second subsample. As a proxy of ex-ante expected returns, the excess average asset returns are calculated. In the second-pass regression, ex-post beta is used as explanatory variable while ex-ante excess average asset returns are used as dependent variable.

Table 7. Betas and average excess return

	Ex-post beta (full sample)	Ex-post beta (first subsample)	Ex-post beta (second subsample)	Average excess return (full sample)	Average excess return (first subsample)	Average excess return (second subsample)
AKBANK	1,12	1,30	1.01	0.003673	0.002047	0.005299
ALNTF	0.95	0.75	1.07	0.001662	0.002867	0.000457
ASYAB	0.89	0.60	0.26	0.009450	0.003964	0.013418
DENIZ	0.65	0.32	-0.06	0.004737	-0.000027	0.009501
FINANSBANK	0,94	0.36	1.27	0.006178	0.003335	0.009020
FORTISBANK	0,86	0.88	0.85	0.007405	0.006351	0.008459
GARANTIBANK	1,26	1.29	1.25	0.004682	0.007167	0.002196
ISC	1,30	1.32	1.29	0.001805	0.001209	0.002401
SEKERBANK	0,91	1.02	0.85	0.006951	0.010328	0.003575
TEB	0.90	1.36	0.63	0.008349	0.010763	0.005936
TEKSTILBANK	1.02	0.95	1.05	0.004904	0.007567	0.002242
TKBNK	0.81	0.78	0.82	0.000929	0.004438	-0.002580
TSKB	0.87	1.16	0.70	0.006196	0.008639	0.003753
VAKBN	1.22	1.11	0.07	0.005888	0.005429	0.006242
YKB	1,07	1.01	1.38	0.003011	0.004304	0.001718
ISE100	1	1	1	0.002219	0.002852	0.001587

Note: ISE100 Index is used as a proxy for market portfolio so that its beta theoretically is 1. $\text{cov}(R_{ise100}, R_{ise100}) / \text{var}(R_{ise100}) = 1$.

Following regression is employed for second-pass regression:

$$\left(\hat{R}_i\right) = \tau + \varphi\left(\hat{\beta}_i\right), \quad (2)$$

where $\left(\hat{R}_i\right)$ is average excess stock i return in the second subsample as an estimate of ex-ante expected return; τ and ϕ are parameters of second-pass regression; $\left(\hat{\beta}_i\right)$ is beta for stock i in the first subsample.

Table 8. Second-pass regression (1)

	Alpha (Standard error)	t-stat (α) [Prob (t-stat)]	Beta (Standard error)	t-stat (β) [Prob (t-stat)]	F-statistic [Prob(F-statistic)]	R-squared [Adjusted R-squared]	Durbin-Watson stat.
Second-pass regression result	0.009622 (0.003099)	3.104991 (0.0084)	-0.005116 (0.003097)	-1.652241 (0.1224)	2.729901 (0.122420)	0.173549 (0.109975)	2.257015

Coefficient of linear relation coming out from the second-pass regression (-0,005) is not statistically different from zero and the variation that is explained by betas (17%) is not enough indicators to explain cross sectional expected return among assets analyzed in this research. The interesting conclusion is that the difference between R-Square and Adjusted R-Square (17%-11%) emphasizes that the econometrical model is not well fit to explain the relation between the variables we examined. Results imply that the prediction based on the past data (returns and betas) does not have predictive information for future prospect. In other words, it is easily seen that the coefficient of ex-post beta has no explanatory power on excess average asset returns at all. Second pass regression has no statistical meaning because of the limited number of assets analyzed in this research. Yet it is no guarantee to conclude that it will make sense to increase the number of assets to validate the CAPM. That is why some academics such as Gursoy and Rejepova (2007) worked on portfolios rather than individual stocks to test the linear prediction of the CAPM.

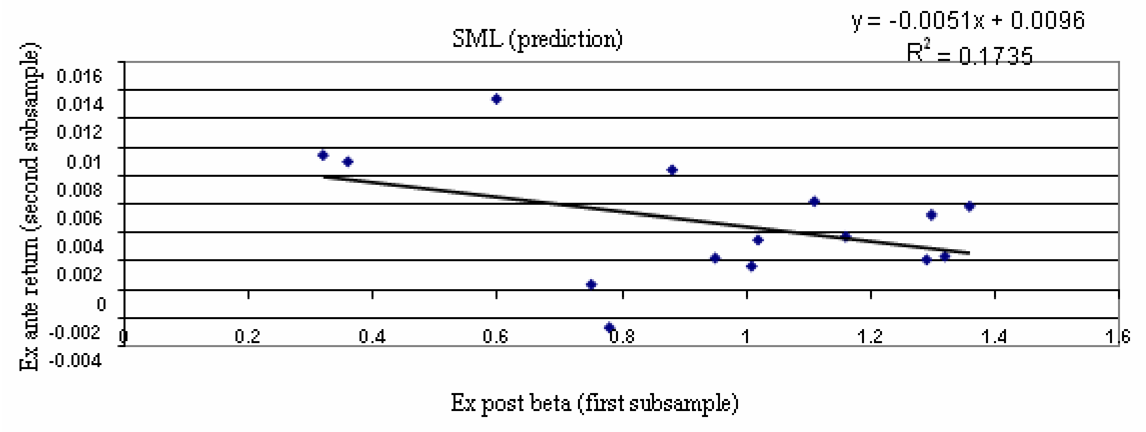

Fig. 1. Security market line (prediction)

The prediction of SML, as it is depicted in Figure 1, is downward sloping which contracts to fundamental relation between expected return-beta linearity. Working with portfolios instead of individual assets may validate a positive relation, upward sloping, whereas such methodology overly simplified the exact characteristics of individual assets. That is why portfolio return is not used in the scope of this paper.

3.5. Estimating Security Market Line. Estimating Security Market Line is straightforward. In the previous test we divided the sample into two equal-size subsamples. In this case, sample averages of the excess return on each of the assets, $\left(R_i \overset{\mapsto}{-} r_f \right)$, sample estimates of beta coefficients of each of the assets, β_i, sample average of the excess return of the market index, $\left(R_M \overset{\mapsto}{-} r_f \right)$, are calculated from the full sample and the following regression is conducted:

$$\left(R_i \overset{\mapsto}{-} r_f \right) = \lambda_0 + \lambda_1 (\beta_i), \ldots\ldots \quad (3)$$

where λ_0 and λ_1 are coefficients of regressions that should be tested against $\lambda_0 = 0$ and $\lambda_1 = \left(R_M \overset{\mapsto}{-} r_f \right)$.

Table 9. Second-pass regression (2)

	Alpha (Standard error)	t-stat (α) [Prob(t-stat)]	Beta (Standard error)	t-stat (β) [Prob (t-stat)]	F-statistic [Prob(F-statistic)]	R-squared [Adjusted R-squared]	Durbin-Watson stat.
Second-pass regression result	0.008668 (0.003726)	2.326147 (0.0368)	-0.003669 (0.003727)	-0.984621 (0.3428)	0.969478 (0.342782)	0.069400 (-0.002185)	2.463118

To test second-pass regression (2) null hypothesis, we simply employ t-test as follows:

$\lambda_0 = 0{,}008668$, $\lambda_1 = -0{,}003669$ and $\left(R_M \overset{\mapsto}{-} r_f \right) = 0{,}002219$ and null hypotheses are $\lambda_0 = 0$ and $\lambda_1 = \left(R_M \overset{\mapsto}{-} r_f \right)$, *t*-statistic at 5% significance level for $\lambda_0 = 0$ is

$t_{\lambda=0} = \dfrac{\hat{\lambda}_0 - 0}{se(\hat{\lambda}_0)} = 2.326147$ and similarly, *t*-statistic at 5% level for $\lambda_1 = \left(R_M \overset{\mapsto}{-} r_f \right)$ is

$$t_{\lambda_1 = \left(R_M \overset{\mapsto}{-} r_f \right)} = \frac{\hat{\lambda}_1 - \left(R_M \overset{\mapsto}{-} r_f \right)}{se(\hat{\lambda}_1)} = 1.8 .$$

Table 10. Second-pass regression (2) test results

	$\lvert t_{CAL} \rvert$	$t_{0,025,T-2}$	Decision rule: Ho is rejected if	Inferences
Second-pass regression (2)	2.326147	1.77	$\lvert t_{CAL} \rvert > t_{0,025,T-2}$	$\lambda_0 = 0$ is rejected
Second-pass regression (2)	1.8	1.77	$\lvert t_{CAL} \rvert > t_{0,025,T-2}$	$\lambda_1 = \left(R_M \overset{\mapsto}{-} r_f \right)$ is rejected

Second-pass regression (2) results do not support the linear relationship between average excess return which is used as a proxy for expected excess return and ex-post betas (in theory ex-ante betas are linked with expected return). It is precisely calculated that alpha (0,009) and beta (-0,003) are not equal to null hypothesis which are zero for alpha and average excess return (0,002) for beta at 5% significance level. More important is the fundamental relation between expected return and beta which linear relation in upward sloping is not confirmed. It is rigorously depicted in Figure 2. As it is seen, the hypotheses of $\lambda_0 = 0$ and $\lambda_1 = \left(\overset{\mapsto}{R_M} - r_f \right)$ are rejected at 5% significance level. It is concluded from the second-pass regression that SML which is upward sloping showing that the more risk is reward by more expected return is not supported. The reason behind such results can be partially explained by error in variable problem, that is, the betas calculated in first-pass regression are not free of error that is why they produce such inconsistency with the fundamentals.

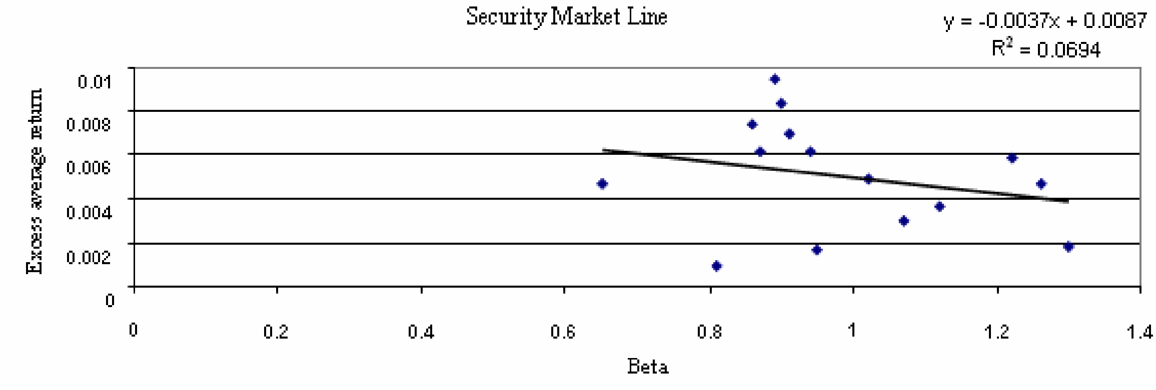

Fig. 2. Security Market Line

3.6. Testing structural test of beta. One of the interesting questions taken place in the literature, as it is shown above, is the structural change of beta over some periods. The reason behind this investigation is that beta is assumed to hold constant in the CAPM world. However, as the characteristics of assets differ from time to time, it is logical to expect that beta may change over shorter time period. It should be underlined that CAPM does not propose any certain holding time period (it is single period model) for the investment made. For this reason, the following test methodology employed should not be seen as the one that theory proposed. There are two cases of interest: (1) β may differ over the two subsamples; and (2) both α and β may differ over the subsamples.

3.6.1. Testing structural change in β only. If α is the same, but β is different over the two subsamples, then we really have two excess return market model regressions which are as follows:

$$\mu_{it} - r_f = \alpha + \beta_1\left(\mu_{Mt} - r_f\right) + \varepsilon_{it,} \quad t = 1,\ldots\ldots,T_H,$$

$$\mu_{it} - r_f = \alpha + \beta_2\left(\mu_{Mt} - r_f\right) + \varepsilon_{it,} \quad t = T_{H+1},\ldots.,T.$$

These models share the same intercept α but have different slopes $\beta_1 \neq \beta_2$. We can capture such a model very easily using a "step dummy variable" defined as

$$d^T = 0, \; t \leq T_H$$
$$\quad = 1, \; t > T_H$$

and rewriting the regression model as

$$\mu_{it} - r_f = \alpha + \beta\left(\mu_{Mt} - r_f\right) + d^T \quad \left(\mu_{Mt} - r_f\right) + \varepsilon_{it}$$
$$t = 1,..,T. \qquad (4)$$

The model for the first sub-sample when $d^T = 0$ is

$$\mu_{it} - r_f = \alpha + \beta\left(\mu_{Mt} - r_f\right) + \varepsilon_{it} \quad t = 1,\ldots,T_B.$$

The model for the second subsample when $d^T = 1$ is

$$\mu_{it} - r_f = \alpha + \beta\left(\mu_{Mt} - r_f\right) + \quad d^T\left(\mu_{Mt} - r_f\right) + \varepsilon_{it}$$
$$= \alpha + \left(\beta + \quad\right)\left(\mu_{Mt} - r_f\right) + \varepsilon_{it}$$

$$t = T_{B+1},\ldots,T.$$

It should be noted that the "beta" in the first sample is $\beta_1 = \beta$ and the beta in the second subsample is $\beta_2 = \beta + \varphi$.. If $\varphi < 0$, the second subsample beta is smaller than the first sample beta and if $\varphi > 0$, the first sample beta is larger than the second subsample beta. We can test the constancy of beta over time by testing whether $\varphi = 0$ in the following formation:

H_n[1]: (beta is constant over time) $\varphi = 0$ versus H_a: (beta is not constant over time) $\varphi \neq 0$.

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[1] The test statistic is simply the t-statistic: $t_{\varphi=0} = \dfrac{\hat{\varphi} - 0}{SE\left(\hat{\varphi}\right)} = \dfrac{\hat{\varphi}}{SE\left(\hat{\varphi}\right)}$.

And we reject the hypothesis $\delta = 0$ at the 5% level if $\left| t_{\delta=0} = 0 \right| > t_{0.025,T-3}$.

Table 11. Test of beta stability: $\varphi = 0$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	FORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
$\lvert t_{CAL} \rvert$	8.98	16.20	9.93	13.06	17.99	11.90	11.05	10.61	18.17	11.37	11.24	13.58	11.88	10.42	23.57
$t_{0,025,T-2}$	1,96	1,96	2	1,98	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1.96	1.98	1.96

Note: $t_{0,05,308} \cong 1.645$; $t_{0,10,308} \cong 1.282$; $t_{0,05,85} \cong 1.658$; $t_{0,10,85} \cong 1.289$; $t_{0,05,168} \cong 1.642$; $t_{0,10,168} \cong 1.282$; $t_{0,05,109} \cong 1.658$; $t_{0,10,109} \cong 1.289$.

As a conclusion of results depicted in Table 10, the betas are not stable over the two predetermined periods (equal size) for all assets analyzed in this research. Allowing beta to be different over the two samples and holding alpha constant imply that there are statistically significant differences in the slope of regression equation whereas there is nothing to say about the constant term, alpha, so that the following test is going to be conducted.

3.6.2. Testing structural change in α and β. In the previous test, the structural differences were examined while constant term held constant. In case of conducting appropriate test where both α and β are allowed to be different over the two subsamples, the following formation can be employed:

$$\mu_{it} - r_f = \alpha_1 + \beta_1(\mu_{Mt} - r_f) + \varepsilon_{it}, \quad t = 1,...,T_H,$$

$$\mu_{it} - r_f = \alpha_1 + \beta_2(\mu_{Mt} - r_f) + \varepsilon_{it}, \quad t = T_{H+1},...,T.$$

The dummy variable specification in this case is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varphi_1 d^T + \varphi_2 d^T(\mu_{Mt} - r_f) + \varepsilon_{it}$$

$$t = 1,...,T. \qquad (5)$$

When $d^T = 0$ the model becomes

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varepsilon_{it}, \quad t = 1,...,T_H$$

such that $\alpha_1 = \alpha$ and $\beta_1 = \beta$.

When $d^T = 1$ the model is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + {}_1 d^T + {}_2 d^T(\mu_{Mt} - r_f) + \varepsilon_{it}$$

$$= (\alpha + {}_1) + (\beta + {}_2)(\mu_{Mt} - r_f) + \varepsilon_{it},$$

$$t = T_{H+1},...,T$$

such that $\alpha_2 = \alpha + \varphi_1$ and $\beta_2 = \beta + \varphi_2$.

The hypothesis of no structural change becomes:

H_n: $\varphi_1 = 0$ and $\varphi_2 = 0$ versus H_a: $\varphi_1 \neq 0$ and $\varphi_2 \neq 0$.

Table 12. Test of beta stability: $\varphi_1 = 0$ and $\varphi_2 = 0$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	ORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
F_{CAL}	40.8	130.67	49.27	86.36	162.5	71.32	61.8	56.12	165.95	66.57	63.95	92.19	72.01	53.22	276.76
$F_{0,95}(q,T-2)$	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,07

Note: $F_{0,90}(2,308) \cong 2.30$; $F_{0,975}(2,308) \cong 3.69$; $F_{0,90}(2,166) \cong 2.35$; $F_{0,975}(2,166) \cong 3.80$; $F_{0,90}(2,107) \cong 2.35$; $F_{0,975}(2,107) \cong 3.80$; $F_{0,90}(2,83) \cong 2.35$; $F_{0,975}(2,83) \cong 3.80$.

The evidence coming out from testing structural differences in both alpha and beta indicates that there is statistically significant shift in both samples. The underlining differences occur mainly due to rapid changes in Turkish banking sector, whereas the exact causality lying behind these changes requires more detailed analysis which is not in the scope of the present paper.

3.7. Stability of beta over the market cycle. Stability of beta has taken considerable attention over the market fluctuations as well. An 'up market' condition is defined for an asset as positive excess return, $\mu_{Mt} - r_f > 0$, and 'down market' as negative excess return, $\mu_{Mt} - r_f < 0$. The question that leads such investigation is how an asset's systematic risk changes depending upon market fluctuations. Since systematic risk of asset is the only relevant risk indicator, it would be an attractive asset to hold in case of having beta greater than one in 'up market' and less than one in 'down market'. Formation regarding the test of this question can be done through the following dummy variable specification:

$$d_{up}^{T} = 1, \; \mu_{Mt} - r_f > 0$$
$$\quad\; = 0, \; \mu_{Mt} - r_f \leq 0,$$

where d_{up}^{T} divides the sample into "up market" movements, and "down market" movements. The regression that allows beta to differ depending on the market cycle is then:

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \quad d_{up}^{T}(\mu_{Mt} - r_f) + \varepsilon_{it}$$
$$t = 1,...,T \; . \qquad (6)$$

In the down market, when $d_t^{up} = 0$, the model becomes:

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varepsilon_{it}$$

and β captures the down market beta; and in the up market, when, $d_{up}^{T} = 1$, the model is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varphi \, d_{up}^{T}(\mu_{Mt} - r_f) + \varepsilon_{it}$$
$$= \alpha + (\beta + \varphi)(\mu_{Mt} - r_f) + \varepsilon_{it}$$

such that $\beta + \varphi$ captures the up market beta. The hypothesis that beta does not vary over the market cycle is H_n[1]: $\varphi = 0$ versus H_a: $\varphi \neq 0$.

Table 13. Testing stability of beta over the market cycle: $\varphi = 0$

	AKBNK	ALNTF	ASYAB	DENIZ	FINBN	FORTS	GARAN	ISCTR	SKBNK	TEBNK	TEKST	TKBNK	TSKB	VAKBN	YKB
Obs.	310	310	85	168	310	310	310	310	310	310	310	310	310	109	310
$\lvert t_{CAL} \rvert$	0.30	0.81	0.62	0.70	1.81	0.67	0.47	2.74	0.35	1.18	1.26	1.27	0.19	0.01	1.83
$t_{0,025,T-2}$	1,96	1,96	2	1,98	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1.96	1.98	1.96

Note: $t_{0,05,308} \cong 1.645$; $t_{0,10,308} \cong 1.282$; $t_{0,05,83} \cong 1.658$; $t_{0,10,83} \cong 1.289$; $t_{0,05,166} \cong 1.642$; $t_{0,10;166} \cong 1.282$; $t_{0,05,107} \cong 1.658$; $t_{0,10,107} \cong 1.289$.

ISCTR's beta, among all common stocks analyzed in this research, is not stable over market cycle in Istanbul Stock Exchange. Testing hypothesis that ISCTR's beta in the up market is higher than one is also statistically significant. Regression output for ISCTR is:

$$\mu_{isctr} - r_f = -0.006 + 1.13(\mu_{Mt} - r_f) + 0.34 d_{up}^{T}(\mu_{Mt} - r_f).$$

Here $\varphi = 0.34$ with a standard error of d_{up}^{T} 0.12 is statistically different from zero. To test that the beta in the up market is higher than 1 requires the estimated standard error for $\hat{\varphi} + \hat{\beta}$ which is equal to $\sqrt{\hat{\text{var}}\left(\hat{\varphi} + \hat{\beta}\right)}$. As a result of calculation not shown here $t_{\varphi+\beta=1} = \frac{1.46997 - 1}{0.0735} = 6.39$ indicating that the hypothesis of ISCTR's beta less than or equal to 1 in the up market condition is rejected.

Table 13 shows clear evidence that betas do not vary over the market movements except for ISCTR. In the light of previous studies (Bhardwaj and Brooks, 1993; Fabozzi and Francis, 1977, 1979) which analyzed the US stock market, our study shows that bank common stocks do not experience the potential impact of up and down market fluctuations. Such investigation shows that there is not statistically significant shift in betas depending upon the fluctuations. The inference coming out from these results can be partially explained with the market efficiency of the stocks due to their high trading volume in the market. On the other hand, there is no enough evidence to explain why stability of ISCTR's beta does vary over the market movement. However, the shareholder structure of Isbank, issuer of ISCTR, may play a determining role in describing its stocks movements in up and down markets.

Concluding remarks

Economics, just like the other field of sciences, develops its own models by simplifying reality and forming mathematical equations that define the given

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[1] This can be tested with simple t-statistic $t_{\varphi=0} = \frac{\hat{\varphi}}{SE\left(\hat{\varphi}\right)}$. If the estimated value of φ is found to be statistically greater than zero we might then want to go on to test the hypothesis that the up market beta is greater than one. Since the up market beta is equal to $\beta + \varphi$, this corresponds to testing :

H_n : $\beta + \varphi \leq 1$ versus $\beta + \varphi > 1$, Which can be tested using t-statistic:

$$t_{\beta+\varphi=1} = \frac{\hat{\beta} + \hat{\varphi} - 1}{SE\left(\hat{\beta} + \hat{\varphi}\right)}$$

Since this is a one-side test we will reject the null hypothesis at the 5% level if $t_{\beta+\varphi=1} < -t_{0.05,T-3}$.

reality in scientific jargon. In the case of CAPM, we accept the predictions to be true as long as we adopt the relevant assumptions, which the model is based on, and believe in their validity. A model should not be judged by its simplified assumptions but rather it should be assessed by looking at how accurate its predictions are. Otherwise, there would not be any usefulness of it. However, the model is an elegant one and its testability gives meaningful insight about the structure of the market and the reactions of investors. For these reasons, the usefulness of testing the CAPM may shed considerable lights on stock returns analyzed in this paper. Our study accentuates the theoretical and empirical content of the CAPM by mentioning its extensions and applying several empirical investigations concerning its validity and predictions on bank common stocks in Turkey. These locomotive stocks were precisely selected on the grounds that non-financial firms have different characteristics than others and not enough attention was paid to the fluctuations of their shares. Therefore, this paper may fill the gap at this context.

Theory, especially the one that imposes several simplified assumptions, as a snapshot of complicated reality should not be seen as the best description of real life. The fundamental problem regarding the empirical failure of the CAPM is not standing on its validity but rather on its testing methodology. Academics simply try to test a model in a sample in which none of its assumptions fully hold. However, it should not be understood that it is useless to test it for the fact that it helps us to explore the structure of the market and its dynamics.

Our study indicates that there is no enough evidence to underline the fundamental results of linearity between risk and expected return which is assumed and predicted by the CAPM. Testing structural differences related to alpha and beta leads to the conclusion that there is statistically significant shift in returns mainly based on rapid changes in Turkish banking sector. According to empirical investigation of time varying beta, the betas of stocks analyzed in this research do not vary depending upon market's up and down condition except for the ISCTR, which contradicts to the existing literature. The main reason lying behind such inference can be partially explained with market efficiency of these stocks due to their high trading volume. Even though, the empirical results do not support the truism of linearity between risk and return, further research is needed to examine it via non-parametric methodologies. Because of non-linear interactions, there might be a possible, fundamentally true, linear relationship.

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