THE RELATIONSHIP BETWEEN ACCOUNTING BETA AND CAPM: EVIDENCE FROM TURKEY

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─Abstract ─

The relationship between the risk and return is the central issue in the field of finance. The capital asset pricing model (CAPM) has long become the standard way to model this relationship. The CAPM and its derivatives have been extensively investigated in the financial literature. As the pure CAPM can only be applied to publicly traded companies, finance researchers have always been interested in finding a way to apply CAPM to companies whose stock price information are not publicly available. One way to apply CAPM to unlisted companies is to use their financials to predict their beta. Therefore, ın studies related to CAPM one of the most actively investigated issues has been the relationship between CAPM's beta and the accounting variables. However, most of these studies are on developed market data. The number of empirical studies on emerging markets is quite limited and there are only a handful of studies on Turkish market data. Therefore, this study aims to contribute to the literature by analyzing the relationship between the accounting variables and systematic risk using Istanbul Stock Exchange data. Our results suggest that only one accounting variable, Operating Leverage, have an association with CAPM's beta.

Key Words: *Accounting Beta, CAPM, Istanbul Stock Exchange, Emerging Markets*
JEL Classification: G11, G14, G32

1. INTRODUCTION

The relationship between risk and return has always been the central theme of financial research. The first signs of academic interest on this relationship date as far back as to 18th century. In his 1738 paper on St Petersburg Paradox, Daniel Bernoulli analyzed this relationship. He probably is the first scientist to realize the benefits of diversification in this relationship. In his paper he implies that "risk-averse" investors will be willing to 'diversify' to maximize their utility. Despite the fast development of capital markets during the first half of the twentieth century (excluding the war periods), we have not seen a noteworthy numerical and analytical model addressing the risk-return trade-off issue up until the beginning of the 1950s. A paper by Markovitz (1952) titled 'Portfolio Selection' marked a magnificent achievement on this topic: Modern Portfolio Theory. Subsequent work has extended and refined Markovitz' approach. Finally, in 1960s capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965) and Mossion (1966) was derived. Since then CAPM, which according to French (2010) brought the risk-return research to 'intellectual maturity', has undoubtedly become the most influential approach in explaining the risk-return relationship.

CAPM asserts that the expected return for a security is related to its *beta*. Beta is a measure of the systematic risk, the risk that cannot be eliminated by means of diversification. In CAPM terms beta is simply the covariance of a security's return with the return from the market portfolio. Dividing this covariance to the market variance standardizes this relationship.

CAPM provides no information regarding the factors that affect beta. This issue has been of interest to finance academicians since the development of CAPM. Many finance researchers have attempted to identify the underlying economic phenomenon that is the determinants of beta. As the accounting data is believed to reflect the underlying economic phenomenon, the relationship between the CAPM beta and accounting variables has been of particular interest to many researchers.

The beta of a security can be estimated by regressing its return against the market return. Therefore, it can be only estimated as long as enough historical return data on that company's stock is available. If a company's stock is not traded in the stock market or if it is newly listed, it is impossible to calculate its beta. This

issue provided researchers another motivation for analyzing the relationship between beta and the accounting variables. If a model properly representing this relationship can be developed, betas of nonpublic or newly listed companies can be estimated.

Although there is a large body of research on the aforementioned topic, these studies mostly concentrated on markets of developed countries. There are relatively few studies on emerging markets and we were able identify only a handful of empirical studies employing Turkish data. Therefore, in this paper we aim to contribute to this line of literature by analyzing the relationship between the accounting variables and systematic risk using Istanbul Stock Exchange data.

The organization of this paper is as follows. The following section explains the association between the market based and accounting based measures of systematic risk and provides a review of the literature on this subject. The methodology and the results of this study are provided in Section 3. The last section concludes and provides suggestions for future work.

2. THE ASSOCIATION BETWEEN THE BETA AND THE ACCOUNTING VARIABLES

CAPM states that return on a security is related to market return in the following way:

$$E(R_i) = r_f + \beta_i(E(R_M) - r_f) \quad \textbf{(1)}$$

Here $E(R_i)$ is the expected return on security i, r_f is the risk free rate, $E(R_m)$ is the expected retrun on the market and β_i is the beta of security i. Empirical version of the above relationship is as follows:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it} \quad \textbf{(2)}$$

Here R_i is the return on security i in period t, R_{Mt} is the return on market portfolio in period t and ε_{it} is the error term. The error term has an expected value of zero and is assumed to be independently distributed across securities. The error term represents factors specific to security i. Therefore, the error term represents the

unsystematic risk of the security *i*. In a well-diversified portfolio the effect of error term will be totally eliminated and the only relevant parameters for security *i*'s risk will be α_i and β_i.

As a consequence, accounting data, which is a summary of all corporate events and managerial decisions, should have no bearing in the determination of a security's systematic risk. In other words, the accounting data summarizes the information needed for the determination of a security's total risk (which is equal to the systematic risk plus the unsystematic risk). As only the systematic part of the total risk is relevant for investors, accounting data is not needed for the measurement of a security's risk.

However, investors closely follow corporate decisions and try to assess the possible results of these decisions. If investors believe that managerial decisions have an effect on a firm's risk level and if they also believe that the results of these decisions is reflected in firm's accounting data, they might use accounting data in forming estimates of a firm's systematic risk level. Therefore, the accounting variables and the beta may somehow be related. Although there has been relatively little research on the theoretical explanation of the above argument, many researchers have attempted to discover the correlation between accounting variables and CAPM's beta through empirical research. Due to the large amount of research on this topic and because of the space limitations a thorough literature review will not be provided here. We will only be able to present some of the most important work in this area of the literature and previous studies on Turkish markets in our review.

One of the first studies analyzing this relationship was conducted by Ball and Brown (1969). They used accounting data (namely, three definitions of income: operating income, net income and earnings per share) of 261 companies listed in New York Stock Exchange for the period between 1946 and1966. The results of their study showed that the accounting income can explain 35 to 40 % of the changes in beta.

Beaver et al (1970) study, which has become basic reference in this field, used seven financial ratios to determine the association between accounting variables and beta. Dividend payout, growth, leverage, liquidity, asset size, variability in

earnings and covariability in earnings were the accounting variables used. Their sample included 307 companies listed in NYSE and sample period was 1947-65. They reported a high degree of association between beta and the following accounting variables: growth, leverage, variability in earnings and covariability in earnings. Their results suggest that accounting data do reflect the underlying events that determine the differential riskiness among securities.

Employing methodologies similar to those of the aforementioned pioneering works, many other studies (to name a few Beaver and Manegold, 1975; Thomson, 1976; Griffin, 1976 and Bildersee, 1979) also found statistically significant relationships between several accounting variables and market determined beta.

Ismail and Kim (1989) analyzed the association between accrual, funds and cash flow based measures of risk and market-based beta. They used a sample of 272 American firms who have complete monthly annual data (which was drawn from COMPUSTAT) for the period between 1966 and 1985. They calculated one accrual based, two funds flow and one cash flow based risk measures and observed their association with CAPM's beta. Their findings indicate that although all calculated risk measures have statistically significant correlation with market based risk measure, the cash flow based risk measure has the strongest and accrual based risk measure has the weakest correlation with it. They also observed that the association is stronger at the portfolio level.

The first study that we are aware of on this topic using Turkish data is Sivacıyan (1985). The most interesting feature of this study is that it was conducted in a period when Turkey had no organized stock exchange. He used a sample of 20 firms and the sample period was 1974 to 1983. The market model was used to calculate beta and the relationship between beta and the following accounting variables was investigated: liquidity, leverage, dividend payout and earnings variability. A moderate degree of association between these variables and market beta was observed. However, as the explanatory power of the model is so low and the standard errors of the parameters were too high, author concluded that these findings are not reliable.

Uysal (1990) analyzed the relationship between the fundamentals and market beta using the data of 42 ISE listed companies. The sample period was 1986 to 1989.

He divided the sample into yearly subsamples. He constructed many alternative models involving different sets of financial ratios to estimate the association between these financial ratios and the market in each subsample. He reported that the explanatory power of the best models for each subsample varied from year to year.

Bekçiğlu et al. (2003) performed a similar study on ISE listed companies from manufacturing and food industry and found weak to moderate association between these companies' fundamentals and beta.

Perk (1989) used a sample of 33 ISE listed companies to analyze the association between fundamentals of these companies and the beta. The sample period is between 1978 and 1988 His methodology was based on Beaver et al.'s (1972) methodology. He divided the total sample to five subsamples to be able to observe periodic variations in the relationship between fundamentals and beta. He was not able to find any significant relationship between the fundamentals he used and the beta in any subsample. Ulusoy (2008) study is another empirical work which could not report any significant relationship between accounting variables and market based risk measures.

To sum, although according to Modern Portfolio Theory accounting variables should not play a role in explaining the market determined risk measures, many empirical work (especially those on developed markets) reported significant association between it and both accrual and fund/cash flow based accounting variables. Empirical results on Turkish data are mixed. However, as there are only a handful of studies on Turkish markets, the results cannot be generalized and more studies are on Turkish market needed to explore this relationship.

2. DATA, METHODOLOGY AND THE RESULTS

Our sample period is between September 1, 2007 and December 31, 2010. The sample consisted of 28 stocks that were continuously listed in ISE in this period. The stocks from financial and insurance sector and the stocks of holding companies were excluded. The price and dividend data and financials of the companies were obtained from İş Yatırım web page (http://www.isyatirim.com.tr). The daily closing levels of ISE-100 index were

also obtained from this site. The sample yielded 832 daily price data and 13 quarterly balance sheet and income statement data for each stock and 832 index levels for ISE-100.

The data for the market capitalization of each stock and of the ISE-100 were obtained from ISE web page.

The returns for each stock and ISE-100 index were calculated using the following formula:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad \textbf{(3)}$$

Here, R_{it} is the return on stock *i* on day *t*, P_{it} and P_{it-1} are the closing prices of stock *i* on *t* and *t-1*. The betas were calculated using Equation 2.

Table 1 presents the results of these regressions.

All betas are positive and significantly different from zero.

Calculated betas were then regressed against the following accounting variables:

- Current Ratio (CR): Current assets divided by current liabilities. This ratio is assumed to represent the liquidity of each company. A negative relationship between this ratio and the beta is hypothized.
- Financial Leverage (FinLev): Total liabilities divided by the total assets. A positive relationship between this ratio and the beta is hypothized.
- Interest Coverage Ratio (ICR): The ratio of earnings before interest and taxes (EBIT) plus interest divided by interest expenses. A negative relationship between this ratio and the beta is hypothized.
- Operating Leverage (OpLev): EBIT divided by net sales. A positive relationship between this ratio and the beta is hypothized.

Table 1 The Results of the Regressions for Estimating Betas

STOCK CODE	ALFA	T	BETA	Standard Error	R-Squared	F	N
AEFES	-8E-05	0,001192	0,511388	0,034361	0,085101	77,11119	831
AKSA	0,000219	0,000885	0,694382	0,025491	0,237577	258,3226	831
ARCLK	-0,00024	0,000793	0,835909	0,022841	0,359978	466,267	831
ASELS	-0,00042	0,00131	0,838425	0,03775	0,171601	171,7256	831
AYGAZ	0,000622	0,000688	0,733494	0,019829	0,36492	476,3477	831
DOAS	3,14E-05	0,000952	0,964344	0,027444	0,341462	429,8491	831
ECILC	-0,00042	0,001065	0,77005	0,03069	0,209094	219,1648	831
EGSER	0,000159	0,001064	0,968284	0,030665	0,295132	347,1063	831
ENKAI	-0,00101	0,00096	0,88474	0,027657	0,300569	356,2485	831
EREGL	-0,00084	0,000858	1,055605	0,024738	0,433319	633,9053	831
FROTO	0,000148	0,000933	0,759518	0,02689	0,250951	277,7373	831
GOLDS	-0,00081	0,001029	0,948677	0,029665	0,30044	356,0314	831
HURGZ	-0,0007	0,000986	0,961342	0,028424	0,324491	398,2229	831
KARSN	-0,00081	0,000832	0,9365	0,023976	0,390505	531,1423	831
KOZAA	-0,00107	0,001395	0,96951	0,040201	0,196294	202,4719	831
KRDMD	-0,00048	0,000865	0,980857	0,02494	0,393759	538,4438	831
MARTI	-7,7E-05	0,000841	0,761225	0,024232	0,292994	343,5502	831
NTTUR	-0,0003	0,000828	0,756283	0,023855	0,296811	349,9143	831
OTKAR	6,58E-06	0,000709	0,702616	0,020419	0,332089	412,1837	831
PETKM	-0,00084	0,00118	0,737089	0,033999	0,16484	163,6237	831
PNSUT	0,00094	0,000857	0,62894	0,024708	0,213893	225,5638	831
SASA	0,000664	0,001034	0,66005	0,029785	0,170969	170,9631	831
TCELL	4,8E-05	0,000696	0,778575	0,020045	0,387842	525,2255	831
TUPRS	0,000249	0,000743	0,809398	0,021415	0,374957	497,3091	831
ULKER	-8,9E-05	0,000622	0,75467	0,017912	0,42709	617,9982	831
VESBE	0,000353	0,001018	0,756406	0,029335	0,21826	231,4547	831
VESTL	-0,00024	0,000894	0,823601	0,025702	0,302099	357,1155	831
ZOREN	-0,00029	0,001105	0,835838	0,031847	0,224362	239,7979	831

- Dividend Payout Ratio (DP): Dividens per share divided by average earnings per share. A positive relationship with beta is hypothized because it is assumed that companies with more unstable earnings will tend to pay lower dividends or will not pay dividends at all.

- Asset Size (AS): The average natural log of total assets. Asset size is assumed have a negative relationship with bet as companies with high asset sizes are more likely to diversify risks arising from their assets.
- Book-to-Market Value (BM): Companies with higher book-to-market values are considered by investors in the market as less risky. Therefore, this variable assumed to have negative correlation with beta.
- Growth (G): The difference between the log of the total assets at the end of the sample and the log of the total assets at the beginning of the sample divided by 13 (the number of quarters in the sample). This variable is assumed to have a positive relationship with beta as the fast growth is usually a major of financial distress.

The following model was obtained from the regression:

$\beta = 0.120 + 0.0417\ CR + 0.0952 OpLev + 0.302\ FinLev - 0.00585\ ICR + 0.308\ G + 0.0231\ AS - 0.0849\ BM - 0.00127\ DP$

Apart from the CR, the sign of all variables are as expected. The model has and R-squared score of 54.3% and an adjusted R-squared of 35.1%. Apart from the OpLev none of the explanatory variables are statistically significant.

We have also run a step-wise regression (using backward elimination procedure). The results are summarized in Table 2.

The best model has only one variable: OpLev. Its R-squared is 34.75% and its adjusted R-squared is 32.24%.

3. CONCLUSION

Many previous studies reported strong association between accounting variables and beta. This finding is especially common for studies on developed markets. However, the results of the studies on Turkish markets (for which there are only a handful of previous studies) are mixed. We were unable to report a significant association between the variables we have used and the beta. However, our results show that at least the direction of the relationship between the variables we have used and the betas were in line with our hypothesis.

Table 2 The Results of the Stepwise Regression

Step	1	2	3	4	5	6	7	8
Constant	0,1204	0,1588	0,1579	0,2298	0,388	0,704	0,6738	0,749
CR	0,042	0,045	0,042					
t	0,94	1,08	1,01					
p	0,359	0,291	0,324					
OpLev	0,095	0,098	0,108	0,116	0,13	0,129	0,141	0,141
t	2,23	2,4	2,72	2,96	3,44	3,43	3,77	3,72
p	0,038	0,026	0,013	0,007	0,002	0,002	0,001	0,001
FinLev	0,302	0,316	0,236	0,156	0,164	0,16	0,12	
t	1,97	2,2	1,91	1,65	1,73	1,69	1,31	
p	0,063	0,04	0,069	0,113	0,097	0,104	0,202	
ICR	-0,0059	-0,0066						
t	-0,87	-1,07						
p	0,397	0,297						
G	0,31							
t	0,32							
p	0,749							
AS	0,023	0,021	0,022	0,025	0,016			
t	1,14	1,12	1,22	1,36	0,93			
p	0,27	0,276	0,237	0,189	0,364			
BM	-0,085	-0,078	-0,057	-0,06	-0,068	-0,053		
t	-1,64	-1,68	-1,34	-1,44	-1,61	-1,37		
p	0,119	0,108	0,193	0,163	0,121	0,183		
OpLev	-0,00127	-0,00127	-0,00117	-0,00113				
t	-1,38	-1,42	-1,31	-1,26				
p	0,182	0,17	0,203	0,22				
S	0,101	0,0989	0,0993	0,0993	0,101	0,1	0,102	0,103
R^2	54,33	54,08	51,44	49,09	45,4	43,36	38,93	34,75
$Adjusted\ R^2$	35,1	38,01	37,57	37,52	35,9	36,28	34,05	32,24
Mallows Cp	9	7,1	6,2	5,2	4,7	3,6	3,4	3,1

Although our sample period is short and the number of stocks in our sample is low, our results may also suggest that Turkish market is not efficient in semi-strong sense.

In future work we will consider the effect of the return interval and sampling period on beta. We will also use major CAPM variation in the calculation beta. We also intend to consider some funds and cash flow measures in determining the accounting variables.

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