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DECOMPOSITION OF TOTAL RISK INTO SYSTEMATIC AND UNSYSTEMATIC PORTIONS: A CASE STUDY FROM TURKISH BANKING SECTOR

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ABSTRACT

Generally, risk can be defined as the variation from the expected return. It is universally accepted that a high return is achieved by taking high risk. Although managers try to achieve high return and profit, they must be careful to control risk as well. In that sense, managers and financial analyst need to know characteristics of risk to minimize it. A company's risk is affected by systematic and unsystematic factors. In this study, we aim to show risk decomposition of Turkish banking sector in that classification. We use Least Median Squares (LMS) beta estimation method. Daily returns (adjusted price for US dollar) for 12 banks listed on the Istanbul Stock Exchange (Borsa Istanbul) are used in the study. 252 days of data belonging a year of 2015 are analyzed.

Key words: Total Risk, Systematic Risk, Unsystematic Risk

JEL Classification: G32

1. Introduction

The main purpose of the strategic management is to deal with uncertainty which is known as risk. Risk management has been more important throught last global financial crisis. Investors need statistical risk information to take financial decisions. Efficient risk management requires to know components of total risk which is divided as systematic and unsystematic. Systematic risk can be classified as market risk, politics risk, inflation risk, interest risk and exchange risk. Unsystematic risk can be classified as industry risk, management risk and operational risk. While a systematic risk is related with the whole

economy and can not be eliminated, the latter is related for the company and can be eliminated. Financial markets are located at the heart of reel economy. Banks are intermediaries between companies and depositors. They have two important and related functions called saving and credit. In that sense, probable banking sector crisis might affect whole industries and households. To prevent from this threat, it is very important to measure and eliminate related these risk permanently.

In this study, we aim to show risk decomposition of Turkish banks. The remainder of the paper proceeds as follows. In section 2, we briefly introduce total risk, systematic risk and unsystematic risk concepts. In section 3, we apply LMS method in empirical studies to find beta coefficient and other statistical techniques to find total, systematic and unsystematic risks. Finally, section 4 concludes the paper.

2. Total Risk, Systematic Risk and Unsystematic Risk

Business risk is identified as firm's return will be less than that expected by the investors. So it is directly related with company's return on investment (Dash, 2011:1-2). The value of any asset, especially stocks or portfolio as, is estimated mostly by CAPM explaining the risk-return relation of any asset. CAPM asserts that non diversifiable risk (or systematic risk) is only one valid factor determining expected returns. This risk is measured by the covariance between the return on this asset and a market portfolio including all available assets in the market. Beta is the name of the factor measuring systematic risk (Ajlouni et al., 2013: 432). CAPM implies that the expected return of stock depends on a single factor (index). According to the model, the beta is a relative risk measure of securities as a part of a well-diversified portfolio (Zaimoviç, 2013: 31). The equation of the model is as follows:

$$E(R_i) = R_f + [E(R_M) - R_f] * \beta_i \quad (1)$$

Where "$E(R_i)$" is the expected return of an asset, "R_f" is the risk-free rate of interest, "β_i" is the sensitivity of the expected asset returns to market returns, "$E(R_M)$" is the expected market returns, "$E(Ri) - R_f$" is the risk premium, "$E(R_M) - R_f$" is the market premium

Under the CAPM model, there are two types of risks: systematic and unsystematic. While the former is related to the marketwide movement and affects all firms and investments, the latter is firm-specific and affects only one firm or stock. Thus, while there is no way to eliminate systematic risk with portfolio diversification, it is possible to remove unsystematic risk with proper diversification (Simonoff, 2011: 1). "A measurement of systematic and unsystematic risk is needed from which the percentage of total risk accounted for by each can be

calculated" (Hodveth and Tedder, 1978: 135). β_i is conceived as a measure of systematic risk and can be calculated as:

$$\beta_{iM} = \text{Cov}(R_i, R_M) / \sigma^2(R_M) \quad (2)$$

where "R_i"is the return of asset i, "R_M"is the return of the market, "σ^2" is the variance of the returns of the market, "Cov (R_i, R_M)" is the covariance between asset i and market returns

While the systematic risk is denoted by beta, unsystematic risk is displayed by the error term of the reggesion application of CAPM (Allen et al., 2009: 2).

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_{mt} - R_{ft}) + \varepsilon i \quad (3)$$

As "βim" gives a measure of asset i's systematic risk, "Rmt – Rft" gives the premium per unit of systematic risk. In that sense, the risk premium on asset i equals the amount of its systematic risk times the premium per unit of the risk. Security Market Line (SML) shows the relation between an asset's premium an its market beta. So, given an asset's beta, its expected return can be measured. It is possible to decompose an asset's return into three pieces as; "beta, sigma and alpha" where under the conditions of E [εi] = 0 and Cov [Rm , εi] = 0.

An asset's systematic risk can be measured by beta and an asset's non-systematic risk can be measured by sigma (ε_i). We know from the model that, an asset's systematic risk is uncorrelated with its non-systematic risk. An alpha term (α_i) is a constant term and measures an asset's return in excess of its risk-adjusted award according to the CAPM. Moreover, alpha (α_i) should be zero for all assets as well. It is possible to decompose risk and return of an asset's as follows (Copeland and Weston, 1992: 199):

		systematic component		unsystematic component	
$R_{it} - R_{ft}$	=	$\beta_{im}(R_{mt} - R_{ft})$	+	ε_i	(4)

Total risk		systematic risk		unsystematic risk	
	=		+		
Var [R_{it}]		B^2_{im} Var [R_m]		Var [ε_i]	(5)

In measuring risk, it is desirable to determine what portion associated with the market (systematic risk) and what portion associated with the company (unsystematic risk) itself (Hodveth and Tedder, 1978: 135). In the next section, we will decompose of stocks'

systematic and unsystematic component for calculating assets' beta, assets' variance and market index's variance.

3. Empirical Analysis

3.1. Data and Formulas

We tried to decompose systematic and unsystematic risk of 12 banks from Turkish financial market. They have traded on Istanbul Stock Exchange (BIST). To decompose systematic and unsystematic risk of these stocks, we need beta and variance values as an input for formula 5. We estimate betas of stocks to use daily returns (adjusted price for US dollar) from the Isyatirim database[3]. We used 252 trading days data belonging a year of 2015. To calculate for stocks daily return; I used the formula as belowed:

$$R_i = \frac{\mathrm{R_{it}} - R_{it-1}}{\mathrm{R_{it-1}}} \quad (6)$$

where "R_i" is a daily return of share i, "R_{it}" is a closing price of share i in t date and "R_{it-1}" is a closing price of share i in t - 1 date

To calculate the Index (BIST 100) daily return; I used the following formula :

$$R_{bist\,100} = \frac{\mathrm{Bist\ 100_t} - \mathrm{Bist\ 100_{t-1}}}{\mathrm{Bist\ 100_{t-1}}} \quad (7)$$

Where "$R_{bist100}$" is a average return for market, "$Bist100_t$" is a market return in t date, "$Bist100_{t-1}$" is a market return in t-1 date.

A risk is related to the existence of the probability of expected return. Volatility of expected return creates this probability and standard deviation is the most commonly used method for risk measurement (Allen et al., 2009: 2). To calculate variance of stocks daily return and index return, I used the following historical volatility formula:

$$\sigma^2 = \frac{1}{n-1}\sum_{i=1}^{n}(Ri - Raverage)^2 \quad (8)$$

To calculate annualized volatility, we multiplied standard deviation by square root of 252 trading days. We used BIST 100 index as a market index.

3.2. Empirical Results

The CAPM is a general equilibrium model. The aim of the model is to measure the future expected returns and beta values. However, the data used in the model belongs to the past. Therefore, the CAPM is an ex-post analysis of ex-ante expectations. Under the CAPM,

[3] http://www.isyatirim.com.tr/LT_isadata2.aspx. (17.01.2016)

historical data is assumed as proxies for future expectations. (Milionis and Patsouri, 2011: 6–7). In this study, we prefer to use one of the robust regression techniques, the LMS (Least Median Squares), for calculating beta coefficient[4]. Beta is estimated as the slope coefficient in the regression as follows:

$$R_i = \alpha_i + \beta_i R_m + \varepsilon \quad (9)$$

Stata 10.1 package is used to estimate the model. We analyze 12 banks which have been traded on BIST. According to the our analysis; we had below results for beta measurement.

Table 1.Systematic risk measurement: LMS Beta of 12 Banks

	STOCKS	NAME OF BANKs	LMS BETA
1	AKBANK	Akbank	1,5625000
2	ALBRK	Albaraka Türk	0,8524000
3	DENIZ	Denizbank	0,4873410
4	FINBN	Finansbank	0,9934426
5	GARAN	Garanti Bankası	1,5213270
6	HALKB	Halkbank	1,6863350
7	ICBCT	Çin Ticaret ve Endüstri Bankası	0,4860140
8	ISCTR	İşbankası	1,5129530
9	KLNMA	Kalkınma Bankası	0,3538461
10	SKBNK	Şekerbank	0,6637931
11	VAKBN	Vakıfbank	1,6102940
12	YKBNK	Yapı ve Kredi Bankası	1,3820760

Table 2. Decomposition of total risk of (%)

	STOCKS	Total risk $Var [R_{it}]$	Systematic Risk $B^2_{im} Var_{[Rm]}$	Unsystematic Risk $Var [\varepsilon_i]$	Unsystematic risk / Total Risk
1	AKBANK	0,395410839	0,119931641	0,037474859	0,23807695
2	ALBRK	0,242821474	0,035692799	0,083112201	0,699568209
3	DENIZ	0,516577894	0,011667011	1,043367989	0,988941588
4	FINBN	0,355449937	0,048481861	0,380296139	0,886930158
5	GARAN	0,35550914	0,113694346	0,465708654	0,803773287
6	HALKB	0,269280223	0,139695183	0,064887817	0,31717111
7	ICBCT	0,284231613	0,011603561	0,070481439	0,858639693
8	ISCTR	0,350665323	0,112446152	0,049899848	0,30736728
9	KLNMA	0,456962875	0,006150672	0,504133328	0,987946571
10	SKBNK	0,381089743	0,02164508	0,12136592	0,848647449
11	VAKBN	0,385149653	0,127380829	0,068186171	0,348658877
12	YKBNK	0,339133218	0,093833426	0,052351574	0,358118644

[4] For details of LMS method, a reader can look at Alp and Bilir (2015).

A beta less than one means that the security will be less volatile than the market. A beta greater than 1 indicates that the security's price will be more volatile than the market. A beta of one indicates that the security's price will move with the market. As seen from Table 1, half of banks have beta values which are greater than 1. These banks are called as AKBANK, GARANTIBANK, HALKBANK, ISBANK, VAKIFBANK and YAPI KREDI BANK. While HALKBANK and VAKIFBANK are publicly owned companies, the others are Turkish biggest privately owned banks. According to the Turkish Banking Association Databases[5], these banks are the biggest six of first seven banks in terms of total assets. The first bank is called ZIRAATBANK which is publicy owned company and not traded in BIST.

As seen from the Table 2, 5 of 12 banks have greater systematic risk than unsystematic risk. These results are parallel with our expectation. There were two governmental election in 2015. In that sense, these higher systematic risk results can be explained by especially politic risk creating uncertainty about main economic factors such as interest rates and exchange rates. However, without any political risks like two governmental elections, it is more probable for these banks to have greater systematic risks than unsystematic risks because we think that they manage their firm-specific risk more effectively in any way. These banks are called AKBANK, HALKBANK, ISBANK, VAKIFBANK and YAPI KREDI BANK. All these banks have beta values greater than 1. Moreover, these banks are also 5 of 7 biggest banks of Turkish banking sector in terms of total assets. Only GARANTIBANK third greatest bank in Turkey for total asset has greater unsystematic risk rather than systematic risk. This is unexpected results for us. However, in 2015, BBVA had unique managerial control of GARANTIBANK. We think that, stock price may be affected from these merger processIn our analysis, totally 7 of 12 banks have greater unsystematic risk than systematic risk. Unsystematic risk is related with better management mostly. Because it is firm specific unanticipated events. In that sense, it can be eliminated by effective managerial actions. For better diagnosis, industrial, managerial and operational risk can be studied separately.

4. Conclusion

In our analysis, we isolated total risk of 12 banks as systematic and unsystematic. These banks have traded on Istanbul Stock Exchange. We used 252 daily return to estimate beta and volatility. We used LMS method for beta estimation. We reached two main conclusions.

[5] https://www.tbb.org.tr/tr/banka-ve-sektor-bilgileri/istatistiki-raporlar/eylul--2015---aktif-buyukluklerine-gore-banka-siralamasi/2487. (17.01.2016)

Firstly, the biggest six of total 12 banks have a beta value which is greater than 1. It means that, these stocks have higher return and risk. Moreover they are more volatile than market index. These six banks are also the biggest six of first seven banks of Turkey as well. Secondly, five of these six banks' systematic risk are higher than their unsystematic risk. So we think that, these biggest banks have managed their unsystematic risk more effectively than smaller ones. But on average, unsystematic risk of Turkish banking sector has the proportion of %64 of the total risk in this sector. Although big proportion of this ratio comes from smaller banks, it must be decreased by better management process. Our analysis consist of one year period in which there were two governmental election. We think that, new analysis should be made to take longer period and compare pre and post crisis periods effectively.

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