Did 2008 Crisis Affect Systematic Risks of the Sectors? The Case of Turkey[1]

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ABSTRACT

This study examines the effects of the 2008 financial crisis on the betas of four sectors in Borsa Istanbul (BIST) separately as pre-crisis, crisis and post-crisis period. Systematic risks (betas) of these four sectors are calculated through CAPM model with the dummy variable, which includes crisis information exogenously. Afterwards, CAPM was estimated separately for three periods (pre-financial crisis, crisis period and post-crisis) and time varying betas were obtained. Thus, it was determined which sector stocks were perceived as more risky/reliable in crisis period by financial investors. Findings show that service sector stocks are perceived as more reliable and financial sector stocks are perceived riskier by financial investors in crisis period with a decrease in risk appetite.

Keywords: Investor Behaviour, CAPM with Dummy Variable, Financial Crisis

JEL Classification: G01, G12, G41

2008 Krizi Sektörlerin Sistematik Riskini Etkiledi mi? Türkiye Örneği

ÖZ

Bu çalışma, 2008 finansal krizinin Borsa İstanbul (BIST)'da bulunan dört sektörün betaları üzerindeki etkilerini kriz öncesi, kriz ve kriz sonrası dönem olarak ayrı ayrı incelemektedir. Kriz bilgisini modele dışsal olarak dahil eden Kukla değişkenli CAPM aracılığı ile bu dört sektörün sistematik riskleri (betaları) hesaplanmıştır. Daha sonra CAPM, üç ayrı dönem (Finansal kriz öncesi, kriz dönemi ve kriz sonrası) için ayrı ayrı tahmin edilerek değişen betalar elde edilmiştir. Böylece, kriz dönemlerinde finansal yatırımcıların hangi sektör hisse senetlerinin daha riskli/güvenilir olarak algıladıkları tespit edilmiştir. Bulgular, risk iştahında bir azalış olduğu kriz dönemlerinde, hizmet sektörü hisse senetlerinin finansal yatırımcılar tarafından daha güvenilir, mali sektör hisse senetlerinin ise daha riskli olarak algılandığını göstermektedir.

Anahtar Kelimeler: Yatırımcı Davranışı, Kukla Değişkenli CAPM, Finansal Kriz

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1. INTRODUCTION

Investors direct their investments to different stocks or different sectors in order to manage their risks better. On the other hand, stocks and sectors react differently to markets in different economic periods. Therefore, investors need to know the sensitivity of stocks and sectors to the market as well as diversification. Because this information will help investors make more accurate diversification and therefore take more accurate investment decisions.

When investors invest in stocks, they face two risks: systematic risk and non-systematic risk. This is the total risk of investors. While non-systematic risks are the risks originating from the company itself, systematic risks are those arising from outside of the firm like general economic and political conditions (Karan, 2013: 154-157). Hence, although the companies manage themselves in the best way and face very few problems, the risks arising from outside of the company may negatively affect the company and thus investor.

As the crises affect many economic indicators such as exchange rate and interest, it is obvious that systemic risk will be affected from crises. Therefore, crisis periods change the return expectations of investors and affect them negatively. In this case, systematic risk need to be measured. Capital Asset Pricing Model (CAPM) is used to measure systematic risk. According to CAPM, the systematic risk is the magnitude of the correlation between the price of the stock and the market price, and its measure is the beta coefficient (Korkmaz and Ceylan, 2010: 534-535).

According to the Financial Asset Pricing Model (CAPM), the additional rate of return that is required on the risk-free interest rate to hold a risky financial instrument depends on the risk of the asset as well as on the risk appetite. If investors are risk-neutral, they will demand a lower risk premium for an asset that is held at a constant risk, as they will have a higher risk appetite than when they are risk-neutral or they avoid risk. Similarly, as the risk appetite will be higher in a period in which the expectations for the macroeconomic outlook are positive, the risk premium for a risky asset will be lower as well. On the contrary, risk appetite will be lower in times of negative macroeconomic outlook (in times of crisis). Thus, when the risk level is given, the risk premium requested for a risky asset will be higher (Kalafatcilar and Keles, 2011). Kalafatçılar and Keleş (2011) stated in their study that, VIX, Credit Suisse, BIS S&P indices, which represent risk appetite, indicate a high risk appetite between the years 2004 – 2008 while sharp decrease in risk appetite during 2007-2009 period when the financial crisis began to become more pronounced. In the study, where Kumar and Persaud (2002) accepted that all investors have the same but a varying risk appetite instead of assumption of the ability of investors to borrow and lend in an unlimited amount with risk-free interest rate in the standard CAPM, it is stated that in a case of a decrease in risk appetite, investors will move away from more risky assets and be willing to have more to reliable assets.

In this context, the related literature that tries to measure the systematic risks of stocks is quite extensive. Moreover, in this literature, systematic risks of stocks belonging to different sectors are examined and compared. However, there is no study in the related literature about how systematic risks of stocks belonging to different sectors differ, especially during crisis periods when the risk appetite of investors changes.

In this study, for October 2005 and March 2018 period, the beta coefficients of the stocks in the four sectors of Borsa İstanbul are calculated by CAPM with special attention to the behaviour of stock investors during the financial crisis period. In this context, the model is estimated for three separate periods (before the financial crisis, during the crisis and after the crisis). Thus, the goal is to make an analysis to find the sectors to which financial investors turn to with regards to their high and low risk appetite. In other terms, which sector's stock is more risky or reliable after a change in risk appetite will be determined by stock investors. It should be

noted that the change information in the stability of beta parameters, which we estimate econometrically, is exogenously included in the CAPM model. However, there are also models that endogenously include this information into the model. Intuitively, our expectation is that financial sector stocks will be seen as more risky by investors during the crisis. On the contrary, service and industrial stocks are relatively less risky. This constitutes the hypothesis of our study.

With the above in mind, the rest of the study is organized as follows. Section 2 presents the related literature. In section 3 the theoretical framework of the CAPM with dummy variable will be addressed. Section 4 describes data and the empirical findings. Concluding remarks are presented in section 5.

2. RELATED LITERATURE

In the literature, it is observed that there are many local and foreign studies on beta (systematic risk) such as beta change, estimation, level, determinants, empirical testing and beta calculation by crisis and sector. In this part of the study, first of all, the studies that are thought to be useful in shaping the study are included. Then, studies measuring the relationship between crisis periods, sectors with beta are examined.

One of the studies examining beta changes by sectors with alternative econometric modeling techniques is the study of Abiyev (2015). This study estimated the time-varying beta values of 20 sectors for Turkish industry portfolios by using weekly data and five different modeling techniques for the period 2002-2013. According to the results obtained, beta values (systematic risk) for each sector changed over time instead of staying constant. The study stated that among alternative modeling techniques to OLS, the random walking process, which is estimated by Kalman filter is the best method that describes the time varying systematic risks of sectors.

Bajpai and Sharma (2015) empirically tested CAPM with alternative econometric modeling techniques by using the 10-year daily data of the Indian Stock Exchange between 2004 and 2013. In this study, rolling regression model is developed by subtracting the intercept term used in cross sectional regression equation and compared with traditional model. The results of this study revealed that CAPM is very important for the Indian Stock Exchange and the developed model performs better than the traditional model.

There are also studies in the literature where the systematic risk level is calculated based on sectors and the CAPM is empirically tested using different methods. Hammoudeh and Al-Gudhea (2006) tried to determine how the sectors are affected in the stock market of Saudi Arabia in the periods of rise and fall, by considering the beta coefficients. For this purpose, they used six weekly industry indexes (Industry, Bank, Service, Electricity, Agriculture and Cement) and general index data between 1994 and 2004. Their studies revealed that in the periods of the market's decline as beta coefficients are affected more than other sectors investment should not be made in the service and banking sectors but investment should be made to agriculture sector as beta coefficient is affected less. They stated that investment should be made in industry, electricity and cement sectors during the rising periods of the market. Weerakhajornsak (2007) analyzed the beta coefficients of stocks in the Thai Stock Exchange energy sector within the framework of CAPM. This study revealed that all of the energy sector companies have a positive beta and a large part (about 67%) of beta coefficients is less than 1. Accordingly, it is stated that the energy sector is a suitable sector for long-term investments and risk-aversive investors who cannot take the risk. Emphasizing that investors are directing their investments to different sectors for risk optimization and Financial Asset Pricing Model (CAPM), which helps investors in measuring systematic risk, comes to the fore, Usta and Demireli (2010), measured the risk of

a portfolio in the ISE. Usta and Demireli (2010) measured the risk of a portfolio in and determined systematic risk level of the market after they separated risk level as systematic and non-systematic risk. According to this study, while the companies operating in the same sector have almost the same systematic risk, it is observed that the non-systematic risks differ as to the decisions taken by the companies especially related to their own activities.

In the literature, it is seen that there are studies in which factors affecting CAPM are also discussed. These studies are as follows. Tetik and Uğur (2010) analyzed the effects of the range of return in the sectors on beta coefficients by using the 5-year data of the industrial, financial, service and technology sectors in the ISE, covering the years 2002, 2006, in three different intervals: daily, weekly and monthly. As a result of the analysis made on the basis of daily data, it is found that all sectors' sensitivity to the market is less than 1, and the sector with the highest sensitivity among the sectors is found to be the financial sector. The reason why the financial sector is most affected by the changes in the market is explained by the fact that sector is affected from economic variables like the interest rate, the exchange rate, the amount of money, etc. easily and the demand for this sector is directly related to these economic variables as well. The average betas (excluding the monthly average beta of the financial sector) obtained with weekly and monthly data are found to be less than 1. And also, as a result of the analyzes made with weekly and monthly data, the highest average beta is found for financial sector. Apart from the financial sector, it is determined that the other three sectors are affected in the same way by the developments in the market. However, the lowest average beta coefficient for all intervals is in the industrial sector. They explained that this situation is related to indirect impact of economic variables like interest rate, exchange rate, the amount of money, etc. and relatively stable demand for this sector.

Tanrıöven and Aksoy (2011) analyzed the determinants of the systematic risk on a sectoral basis by using the financial data of the companies traded in BIST for the period 1997-2008. In the study using unbalanced panel regression method, it is determined that there are positive relationships between debt ratios, sales growth affects beta in most sectors and price/earnings and leverage ratios are not very effective on beta. Gümrah and Konuk (2018) investigated the change of bank betas and the factors explaining this change. In this study, in which 12 banks traded on BIST, are discussed, Multivariate Generalized Autoregressive Conditional Variable Variance (BEKK-GARCH) and multivariable regression analysis methods are used. The results of this study show that the banking sector beta approaches to 1 over time. This study emphasized that the risk-free interest rate is the factor that explained change in beta. It can be said that the number of studies Considering the crisis periods, where sectoral betas are calculated is less than the others. In this study, the effects of the crisis on the sector betas are studied by analyzing different periods. Therefore, in this section, the studies that took into consideration the periods of crisis and investigated the effects of these periods on betas are also mentioned.

Mirza and Simatupang (2004) analyzed the systematic risk of the banking sector in America, Western Europe and South East Asia comparatively. In the study, considering the 1998 South East Asian crisis, between March 1994 and June 1997 is stated as pre-crisis period the, July 1997 and December 2000 as the crisis period and finally between January 2001 and March 2003 as the post-crisis period. It is found that the beta coefficients of the portfolios created from Asian banks in all three periods are approximately three times higher than the average betas of the market and thus much more risky. However, in the USA and Europe, beta coefficients are determined to be higher in the periods after the crisis compared to previous periods.

Choudhry's study (2005), is an empirical one investigating the impact of the 1997-1998 Asian financial crisis on the time varying betas of Malaysia and Taiwan firms. In order to see this effect and variation, 10 companies are selected from both countries and the multivariate

BEKK-GARCH model is used to create time varying betas of companies. The results show that beta is time varying. The effects of the financial crisis and the post-crisis era are observed in 20 companies' time varying betas. Another result found in this study is that Malaysian firms are more affected than Taiwan firms. Tanrıöven and Aksoy (2009) studied the impact of the crisis on the real sectors in Turkey. In this study, which covers the period of 1996-2009, the financial data of 113 companies belonging to 10 sectors are examined. As a result, although the affection level between sectors is different, it is demonstrated that all firms are affected by crisis periods.

Çelik (2013) examined the impact of 2007-2009 global crisis on the sector beta values in BIST. For this, the BIST-30 and the industry indices for the period of January-2005-December 2009 were used. The data are separated as pre-crisis and crisis periods and the effects of structural breaks during the crisis on the sector's beta coefficients were tried to be measured The findings obtained, supported beta variation for most sectors. Dimitriou et al. (2013) examined empirically the infectious effects of the global financial crisis by considering the period of 1997-2012. For this, besides the USA, BRICS countries (Brazil, Russia, India, China and South Africa) were taken into consideration. According to this study, the crisis originating from the USA in the early stages of the crisis did not have an infectious effect for most BRICS countries. However, it was observed that there was a change in investors' risk appetite after the collapse of Lehman Brothers, and the correlation between all BRICS countries and US markets increased especially after 2009.

Kaderli et al. (2013) calculated the beta coefficients of the sector index in BIST for the period 2010-2012 after the crisis. They found that beta coefficients of some sector indices are higher than other sectors. It was emphasized that the sectors with the highest systematic risk are banking, sports and transportation sectors while the sectors with the least risk are informatics, investment partners and trade sector. They also stated that investors should not invest in companies operating in the banking, sports and transportation sectors during periods when the market index is likely to decrease. In addition, it was emphasized that sector companies with low risk should exist in investors' portfolios in this period. Büberkökü (2018) investigated the impact of the 2007-2008 financial crisis on the time varying systematic risk level of deposit banks. In this study, in which the January-2002-February-2015 period was divided into three (pre-crisis, crisis and post-crisis), it was stated that the systematic risk level of two large, small and medium-scale banks increased significantly during the crisis. In addition, in this study, where the stationarity properties of beta coefficients of all banks were analyzed, it was observed that the beta of banks were stationary at the level.

Briefly, the studies discussed in this section showed that CAPM is important for markets and investors, beta varies over time and sectors and some company financial data is effective on betas. In addition, it is understood that the crises experienced are very effective on the sector betas of the countries and affect the systematic risk differently as well. In this study, the effects of the crisis on four sector betas are investigated separately for pre-crisis, crisis and post-crisis periods.

3. MODEL: CAPM WITH DUMMY VARIABLES

The risk premium structure of the CAPM model can be expressed as follows.

$$ER_{i,t} - r_{f,t} = \beta_i (ER_{m,t} - r_{f,t}) + \varepsilon_{i,t} \qquad (1)$$

In Equation 1, $ER_{i,t}$ represents the expected rate of return of the stock. In this study in which CAPM analysis is evaluated as sectoral, $ER_{i,t}$ is the return of i's sector stocks at time t.

$ER_{m,t}$ is the expected return of the market portfolio. $r_{f,t}$ represents the risk-free rate of return, while β_i is a systematic risk measure that cannot be solved by portfolio diversification. β_i measures how much the return of sector stocks at time t moves with the market return. $\beta_i \rangle 1$ represents a risky stock, $\beta_i < 1$ while representing a low-risk stock. For the purposes of estimation, CAPM is generally expressed as:

$$R_{i,t} - r_{f,t} = \beta_i (R_{m,t} - r_{f,t}) + \varepsilon_{i,t} \quad (2)$$

In equation 2, $R_{i,t}$ and $R_{m,t}$ are the observed return rates. Equation 2 is known as the empirical equivalent of the theoretical CAPM model. If CAPM is provided, no constant term is expected in this model (Gujarati, 2011). The traditional, unconditional CAPM used to evaluate portfolio performance has the disadvantage of ignoring the changing structure of the economy. Consequently, Betas can be miscalculated and misinterpreted. It is recommended to use a conditional CAPM model in which betas may change over time (Masset and Weisskopf, 2010). In this context, CAPM, which includes information during the financial crisis period, can be expressed as follows:

$$R_{i,t} - r_{f,t} = \beta_i (R_{m,t} - r_{f,t}) + D_{FC,t} (\beta_i^{FC} (R_{m,t} - r_{f,t})) + \varepsilon_{i,t}$$

$$i = service, financial, industrial, technology$$

$$m = Bist100$$

For convenience, in Equation 3, $(R_{i,t} - r_{f,t})$ represents the portion of the i's sector stock return rate[2] that exceeds the risk-free return, whereas $(R_{m,t} - r_{f,t})$ represents the portion of the market return ratio that exceeds the risk-free return. The first term on the right side of the equation is the initial CAPM, while the second term represents a $D_{FC,t}$ slope dummy term that takes the value 1 during the crisis period. $\varepsilon_{i,t}$ is the non-systematic risk term. The fact that the term $D_{FC,t}$ is statistically significant in this model shows that there is a structural break in the systematic risk of sector-based stocks.

It is important to include a dummy variable in the model as, the systematic risk (β_i) of i's sector stocks varies significantly during the crises. In the initial model, the β_i's have a significantly positive value. However, the positive and negative value of the beta-dummy (β_i^{FC}) in the crisis period will give a clue as to which sector-based stocks will increase and decrease the systematic risk.

4. DATA AND FINDINGS

In this section, we analyse which sector-based stocks are more risky or reliable, when there is a change in risk appetite of stock investors. The data used in study covers monthly data

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[2] The return rate is expressed in $R_{i,t} = \dfrac{P_{i,t} - P_{i,t-1}}{P_{i,t}} * 100$. Where $P_{i,t}$ is the index value representing prices in i's sector.

from October 2005 to March 2018. The variables are the return rates of services (BISTH), financial (BISTM), industrial (BISTS), technology (BISTT) and Bist-100 (BIST100) respectively. Data of these variables were obtained from the CBRT databases. The following figure shows the return rates of services (BISTH), financial (BISTM), industrial (BISTS), technology (BISTT) and Bist-100 (BIST100) respectively.
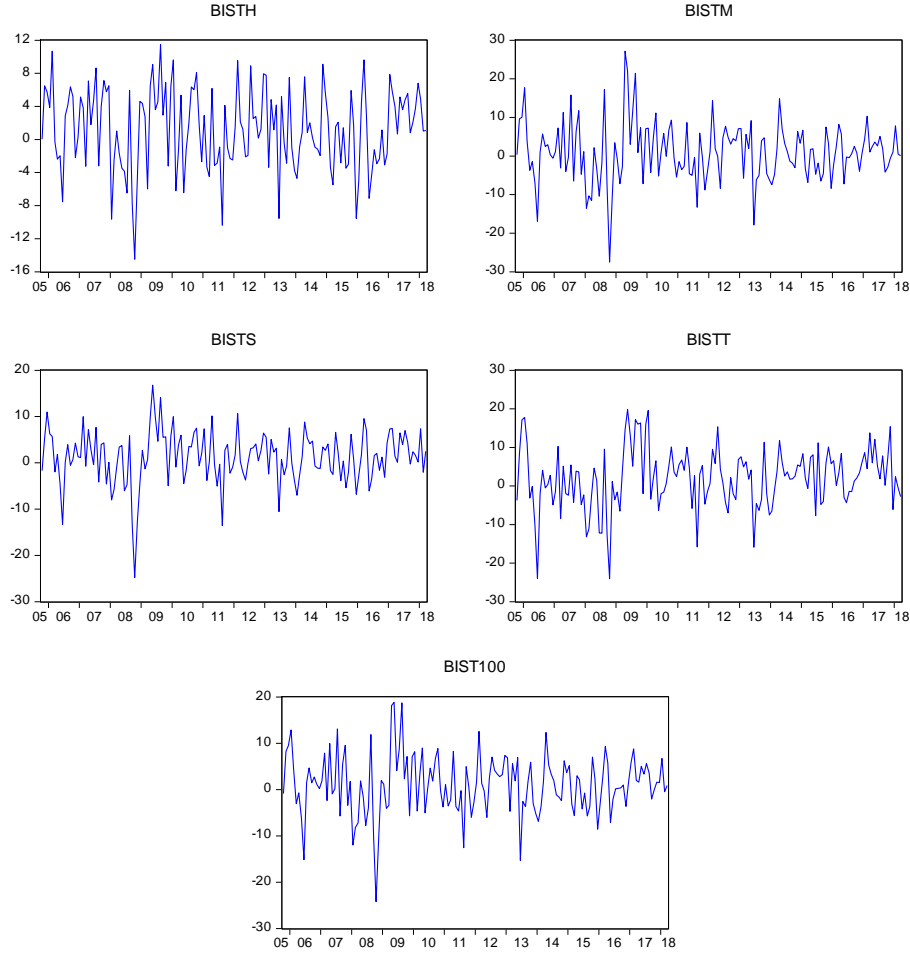

Figure-1: Service (BISTH), Financial (BISTM), Industrial (BISTS), Technology (BISTT) and Bist-100 (BIST100) Return Rates

In this study, the periods affected by the global financial crisis of 2008 of Turkey's economy are shown, which are separated in a similar way to that of Tetik and İvrendi (2013). Thus, we evaluated before November 2007 as the pre-crisis period, the November 2007-January 2010 as crisis period, and after January 2010 as the post-crisis period. In the model, it was checked whether the series are stationary at logarithmic level before proceeding to the estimation section. Table 1 shows as the whole and other separated period ADF test results of all indexes.

Table 1: Stationary Tests of Indices by Periods

Indexes	Whole Period	Pre-Crisis Period	Crisis Period	Post-crisis period	Davidson and Mackinnon Critical Values		
					%1	*%5*	*%10*
BISTH	-10.13	-4.43	-3.67	-8.69	-3.43	-2.86	-2.57
BISTM	-9.50	-4.13	-3.63	-8.51	-3.43	-2.86	-2.57
BISTS	-8.60	-4.06	-2.66	-7.99	-3.43	-2.86	-2.57
BISTT	-8.48	-3.17	-2.72	-8.17	-3.43	-2.86	-2.57
BIST100	-9.44	-4.13	-3.46	-8.59	-3.43	-2.86	-2.57

According to the results of the ADF test in Table 1, all variables were found to be stationary at the 10% significance level. Afterwards, beta coefficients of stocks in four sectors in Borsa İstanbul were calculated by means of CAPM with dummy variable. Thus, it is determined in which sector there is a structural break in the systematic risks of stocks. Table 2 shows the estimation findings.

Table 2: CAPM with Dummy Variables

CAPM $R_{i,t} - r_{f,t} = \beta_i (R_{m,t} - r_{f,t}) + D_{FC,t}(\beta_i^{FC}(R_{m,t} - r_{f,t})) + \varepsilon_{i,t}$ $i = service, financial, industrial, technology \quad m = Bist100$		
Whole Period		
$R_{i,t} - r_{f,t}$	β_i	β_i^{FC}
services	0.74 (0.00)	-0.18 (0.00)
financial	1.11 (0.00)	0.08 (0.01)
industrial	0.81 (0.00)	-0.01 (0.85)
technology	0.89 (0.00)	0.07 (0.58)

A structural break in the systematic risk criterion of services and financial indexes were detected when the CAPM with dummy variable estimation results were examined. This finding is a hint that the betas estimated for services and financial index are time varying. This finding can be said to similar with the findings of Choudhry (2005), Tanrıöven and Aksoy (2009), Çelik (2013). However, no structural breaks were detected in the systematic risk criterion for the industrial and technology indexes. In the light of this information, the pre-crisis, crisis period and post-crisis estimates for each index were estimated separately by CAPM. Thus, the magnitude of changes in systematic risk for each index was examined. This information is given in Table 3.

Optimum Ekonomi ve Yönetim Bilimleri Dergisi, Cilt 7, Sayı 2- http://dergipark.org.tr/optimum

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Table 3: CAPM Pre-Crisis, Crisis and Post-Crisis Period

CAPM $R_{i,t} - r_{f,t} = \beta_i (R_{m,t} - r_{f,t}) + \varepsilon_{i,t}$			
$i = service, financial, industrial, technology \quad m = Bist100$			
	Pre-Crisis	**Crisis**	**Post-Crisis**
$R_{i,t} - r_{f,t}$	β_i	β_i	β_i
services	0.60 (0.00)	0.57 (0.00)	0.80 (0.00)
financial	1.16 (0.00)	1.19 (0.00)	1.09 (0.00)
industrial	0.76 (0.00)	0.81 (0.00)	0.83 (0.00)
technology	1.17 (0.00)	1.00 (0.00)	0.78 (0.00)

When Table 3 is evaluated in general, it is seen that the financial sector is the sector with the highest sensitivity among the four sectors (Service, Financial, Industrial and Technology) in all three periods (Pre-crisis, crisis and post-crisis). This finding is similar to the findings in Mirza and Simatupang (2004), Hammoudeh and Al-Gudhea (2006), Tetik and Uğur (2010), Kaderli et al. (2013). On the other hand, among the four sectors, it can be stated that the service sector is the least sensitive to the market due to beta values of less than one in all three periods.

According to Table 3, systematic risk for the service sector in three different periods is below one (1) level. So, it can be said that the service sector is less sensitive to the market in all periods. On the other hand, the systematic risk of the service sector in the pre-crisis period is 0.60. During the crisis, this ratio decreased to 0.57. In the post-crisis period, the systematic risk of the service sector rose to 0.80. According to these findings, the market sensitivity of the service sector increased during the pre-crisis and post-crisis periods, but sensitivity decreased during the crisis period. According to Table 3, the highest sensitivity in the service sector emerged after the crisis. In light of this information, it can be said that investors who prefer low risk should prefer service sector more almost for every period.

When the results in Table 3 are considered, the second line shows the systematic risk figures of the financial sector in three different periods. Beta value is above one (1) level for financial sector in three different periods. Therefore, it can be said that the financial sector is very sensitive to the market in all periods. While the beta of the financial sector was 1.16 in the pre-crisis period, the beta increased to 1.19 during the crisis period. In the post-crisis period, which is interpreted as the period that risk appetite increased again, the beta of the financial sector slightly decreased to 1.09 units. These findings indicate that the financial sector is very sensitive to the market and that investors with high risk preferences should prefer financial sector stocks especially after the crisis period. Due to the high sensitivity to the market, it can be said that the stocks of the financial sector reacted more in the crisis period and the investors who invest in these stocks could lose more. This finding supports findings of Tetik and Uğur (2010) and Kaderli et al. (2013).

The third line of Table 3 presents the systematic risk results of the industrial sector for three different periods. For the industrial sector, beta was below one (1) level in three different periods and did not show much change. Accordingly, it can be said that the industrial sector is less sensitive to the market in all periods. This finding can be said to similar with the finding o Tetik and Uğur (2010). While the beta of the industrial sector in the pre-crisis period is 0.76, it increases to 0.81 and then 0.83 in the crisis and post-crisis periods, respectively. According to these findings, the market sensitivity of the industrial sector continued to increase slightly in the

crisis and the post-crisis periods compared to the pre-crisis period. Although the highest sensitivity in the industrial sector emerged after the crisis, this ratio is below one (1). Therefore, it can be said that one of the sectors that investors who prefer less risky and low risk shares in each period will be preferred is the industrial sector.

The fourth row of Table 3 shows the beta results of the technology sector in three different periods. The technology sector has shown a constantly decreasing sensitivity starting from the pre-crisis period to post-crisis period. It is seen that the beta level of the technology sector varies greatly in three different periods. While the systemic risk measure of the technology sector was 1.17 in the pre-crisis period, it decreased to 1.00 and 0.78 in the crisis period and in the post-crisis period, respectively. According to these findings, the technology sector is highly sensitive to the market in the pre-crisis period, one-to-one with the market in the crisis and less sensitive in the post-crisis period. In the light of this information, it can be said that investors who want to invest in stocks that are less affected by the market are more willing to buy technology shares in the post-crisis periods. The risk averse investor should prefer technology stocks less in times of crisis.

5. CONCLUSION

The behaviour of stock investors during the financial crisis has always been an important issue. In this study, with the help of the Capital Asset Pricing Model (CAPM), systematic risks of stocks in four sectors in Borsa Istanbul (BIST) are calculated. In this way, it is tried to determine which sector is preferred or which one should be preferred to invest depending on the risk appetite. For this purpose, three different periods are considered: pre-crisis period, crisis period and post-crisis period.

A risk premium is the additional rate of return requested on the risk-free interest rate to retain a risky financial instrument. According to CAPM, the risk premium depends on the riskiness of the asset as well as the risk appetite.

When investors prefer risky investment instruments (when their risk appetite is higher), they will demand a lower risk premium for fixed risk assets. Similarly, the risk premium for a risky asset will be lower as risk appetite will be higher in a period when the expectations for macroeconomic outlook are positive. In contrast, in times of negative macroeconomic outlook (in crisis periods), risk appetite is lower, so the risk premium for a risky asset will be higher (Kalafatcilar and Keles, 2011).

In this study, monthly returns on services (BISTH), financial (BISTM), industrial (BISTS), technology (BISTT) and Bist-100 (BIST100) are used and it was determined that these returns were stable at the level. Beta coefficients of stocks in four sectors in Borsa Istanbul were calculated and also dummy variable CAPM was estimated. According to the dummy variable CAPM results, a structural break in the systematic risk criterion for service and financial index was determined. However, structural breaks were not detected in the systematic risk criterion for industrial and technology indices.

In this study, the sensitivity of each index to the market in the pre-crisis, crisis and post-crisis periods was calculated with the help of CAPM and the changes were examined. The systematic risk for the service sector in three different periods is less than one (1) level and thus the service sector can be said to be less sensitive to the market in all periods. In addition, it was determined that the market sensitivity of the service sector increased during the pre-crisis and post-crisis periods and the sensitivity decreased during the crisis period. In the light of this information, it can be said that investors who prefer low risk may prefer service sector more in each period.

The systematic risk for the financial sector in three periods is above one (1) level and thus it can be said that the financial sector is very sensitive to the market in all periods. Moreover, the findings suggest that investors with high risk preferences should prefer financial sector stocks, especially at the end of crisis periods. However, it can be said that investors who invest in financial sector stocks before and during crisis periods suffer more losses from the market.

The systematic risk for the industrial sector in all three periods is below one (1) level and has not changed much in all three periods. Accordingly, it can be said that the industrial sector is less sensitive to the market in all periods. According to the findings of the industrial index, the market sensitivity of the industrial sector continues to increase slightly in the crisis and post-crisis periods compared to the pre-crisis period. Therefore, it can be stated that one of the sectors preferred by investors who have low risk shares preference which is less affected by the market in each period is the industrial sector.

While the systemic risk measure of the technology sector is 1.17 in the pre-crisis period, it is 1.00 and 0.78 in the crisis and post-crisis periods, respectively. Shortly, it has been observed that the systematic risk level varies greatly in three different periods for the technology sector. In the light of this information, it can be said that investors who avoid risk, should prefer technology shares less in crisis periods and they may prefer technology companies after the crisis.

In the light of all of the evidence, in crisis period where there is a decrease in risk appetite, financial investors perceive service sector stocks more reliable and financial sector stocks more risky.

6. LIMITATIONS

It is possible to observe auto-correlated heteroscedasticity in time series data involving asset returns such as returns on stocks or foreign exchange. In such a case, the ordinary least squares estimators, being used in our study may be inefficient and t-statistics values may be incorrect. Although we consider time varying betas in our study, it is useful to re-test our hypothesis with models (ARCH, GARCH, etc.) that take this situation into consideration.

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