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DOES IDIOSYNCRATIC VOLATILITY MATTER IN THE EMERGING MARKETS? ISTANBUL STOCK EXCHANGE EVIDENCE

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ABSTRACT

In finance literature, Capital Asset Pricing Model predict only systematic risk is priced in equilibrium and neglect firm specific (idiosyncratic) risk which can be eliminated by diversification. However in real world investors, who are disable to diversify their portfolios, should take into consideration idiosyncratic risk beside of systematic risk in prediction of expected return. In this article, we examine real market conditions in Istanbul Stock Exchange (ISE), an emerging market stock exchange, over the period 2007:01 to 2010:12 by studying market wide and idiosyncratic volatility following the methodology of Campbell et al.(2001). Our findings suggest that, in 2007-2010 period, idiosyncratic volatility is the biggest component of total volatility and shows no trend in this period. Beside that our analyses about the predictive ability of various measures of idiosyncratic risk provide evidence that idiosyncratic volatility is not a significant predictor for future return.

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I. INTRODUCTION

Today, international and domestic financial crisis, risk management, advancing usage of derivatives and increasing financial awareness leads to increase interest for prediction of volatility and its components. On the other hand, there is an ongoing debate in financial literature about which factors drives volatility. Standard asset pricing models such as Capital Asset Pricing Model (CAPM), predict that only systematic risk is priced in equilibrium. It should be noted that full diversification plays an important role in the assumption of the studies carried out for the validity of CAPM.

Malkiel (2003) suggests that 200 stocks may be necessary to the same level of diversification that would be achieved with 20 stocks in 1960's. With remarkable increase in the market volatility, it is obvious that a portfolio of 20 or 30 stocks seems inadequate to diversify investment risk (Xu, 2009). Campbell et al. (2001) suggest that the number of randomly selected stocks needed to achieve relatively complete portfolio diversification is about 50. In terms of Turkish market conditions, Cura and Gokce (2003) find 12-14 stocks, Demirci ve Keskinturk (2007) find 8 stocks and Altay, Ungan and Akdeniz (2003) find 10 stocks would be necessary in order to hold well diversified portfolio.

However in real world, investors cannot diversify their portfolios because of budget and liquidity constraints, taxes, transaction costs etc. Goetzmann and Kuma (2008) show that based on a sample of more than 62,000 household investors in the period 1991-1996 in U.S., more than 25% of the investor portfolios contain only one stock, over half of the investor portfolios contain no more than three stock, and less than 10% of the investor portfolios contain more than 10 stocks. The situation of Turkish investors is not quite different. The fact that average portfolio size of retail investors was nearly 760 U.S. Dollar in 2010, gives opinion about diversification ability of Turkish investors[1]. In light of the foregoing, idiosyncratic risks should be taken into consideration beside of systematic risk in asset pricing.

At this point, what the idiosyncratic risk is and which factors effect idiosyncratic volatility should be remembered. Idiosyncratic risk is defined as the risk that is unique to a specific firm, so it is also called firm-specific risk. By definition, idiosyncratic risk is independent of the common movement of the market (Fu, 2008). A number of studies have investigated which factors such as market capitalization (Rosenberg et al., 1985; Banz, 1981; Fama and French, 1992; Malkiel and Xu, 1997;2002), book to market equity (Fama and French, 1992, 1993, 1996 and 1998), earnings yield (Basu, 1983), cash flow yield (Chan et al., 1991), leverage (Bhandari, 1988; Dennis and Strickland, 2004), sales-price ratio (Barbee et al., 1996), institutional ownership, increased firm focused (Dennis and Strickland, 2004) explain stock returns in addition to firm's systematic risk. For each stock, such variables come together with different combinations and effect idiosyncratic risk of that stock.

Another dimension of volatility is its time varying property. Since idiosyncratic volatility is a component of total volatility, some important studies have dealt with trends of idiosyncratic volatility for different markets and find conflicting evidence relating to rise and fall in the idiosyncratic volatility levels. Campbell et al. (2001) apply monthly data over the 1962-1997 periods and show that average idiosyncratic risk is the most important component of average total volatility which has increased noticeably over the period while market volatility shows

[1] "Turkish Capital Markets Report 2010" published by The Association of Capital Market Intermediary Institutions of Turkey.

no significant trend. Moreover this result relating to US market was confirmed by the study of Malkiel and Xu (2003). Yet more recent evidence, Brandt et al. (2010) suggests that the increase in idiosyncratic volatility through the 1990s was not a time trend but, rather, an episodic phenomenon, at least partially associated with retail investors.

Even reporting different conclusion about time trend, some recent important studies which examine different markets should also be mentioned. Sault (2005) investigates Australian market firm level volatility in 1973 to 2003 period by using Campbell's methodology and found clear downward trend which is confirmed with Hodrick Prescot Filter and OLS tests. Kearney and Poti (2008) study on the markets of the European Monetary Union over the period of 1974-2004 and find that idiosyncratic volatility has upward trend in Euro-zone area. Angelidis and Tessoramatis's (2008) evidence suggests that idiosyncratic volatility based on either large or small market capitalization stocks has been increasing during the 1990's in the UK. Unlike previous studies, Sousa and Serra (2008) find no evidence of a statistically rise in firm specific volatility in Portuguese market over the 1991-2005 period. Bekaert et al. (2010) examine aggregate idiosyncratic volatility in 23 developed equity markets and found no evidence of upward trends when they extend the sample till 2008.

Whether idiosyncratic risk is priced in asset returns has also been the subject of considerable attention in the finance literature. Levy (1978) theoretically shows that idiosyncratic risk affects equilibrium asset prices if investors do not hold many assets in their portfolios. Merton (1987) argues that expected idiosyncratic volatility may explain expected stock returns if investors are under diversified. Therefore, firms with larger total *(or idiosyncratic)* variance require higher returns to compensate for imperfect diversification.

Although some studies find a positive relation between idiosyncratic volatility and expected returns at the firm or portfolio level, often the cross sectional relation has been found insignificant, and sometimes even negative. Malkiel and Xu (2002) find a significantly positive relation between idiosyncratic risk and the cross section of expected returns at the firm level. The discovery by Goyal and Santa-Clara (2003) shows that there is a positive relation between the equal-weighted average stock volatility and the value-weighted portfolio returns from NYSE/AMEX/NASDAQ stocks, and the lagged volatility on the market level may mean no predictability of the expected market returns.

Nevertheless, Ang, Hodrick, Xing and Zhang (2006) find a result that is opposite to the previous studies. Their investigation indicates a substansive puzzle that has a strong negative relation between lagged idiosyncratic volatility and future returns. Guo and Savickas (2006) also report a negative relation between aggregate stock market idiosyncratic volatility and future quarterly stock market returns. Fu (2008) points out that the findings of Ang's et al. (2006) are largely explained by the return reversal of stocks with high idiosyncratic volatility and also finds a significantly positive relation between the estimated conditional idiosyncratic volatilities and expected returns. In this study, Fu employs Exponential Generalized Autoregressive Conditional Heteroskedasticity *(EGARCH)* models and uses out of sample data to capture the time varying property of idiosyncratic risk.

Bali and Cakici (2008) investigate why the existing literature provides conflicting evidence on the link between idiosyncratic risk and the cross section of expected returns. They use different volatility measures *(daily and monthly data)*, weighting schemes *(value-weighted, equal weighted, inverse volatility-weighted)*, breakpoints *(CRSP, NYSE, equal market share)* and samples *(NYSE/AMEX/NASDAQ and NYSE)* and find that no robustly significant relation exists between idiosyncratic volatility and expected return.

Huang, Liu, Rhee and Zhang (2010) take the return reversals into consideration while explaining the relation between idiosyncratic volatility and expected return. Their results suggest that short term return reversals are a primary reason for the negative relation between realized idiosyncratic volatility and stock returns in the subsequent month, with more accurate estimate from the daily data, they confirm that the idiosyncratic risk is positively related to expected returns.

Besides the conflicting results for the US markets, series of studies relating to some other markets also reach divergent conclusions. Ang et al. (2004) prove that their determination of the negative relation between idiosyncratic volatility and expected return are valid for G7 stock market[2]. Angelidis and Tessoromatis (2008) analyze relation of idiosyncratic volatility with return in UK market and report evidence that the idiosyncratic volatility of small stocks predicts the small capitalization premium but has no forecasting power for "pure" market risk or the value/growth spread. Bollen, Skotnicki and Veeraraghavan's (2009) findings suggest that idiosyncratic volatility is not priced in the Australian market. Drew ve Veeraraghavan's (2002) study relating to Hong Kong, Indian, Malaysia and Philippines markets and Drew, Marsden and Veeraraghavan's (2007) study relating to New Zelland market find evidence of a negative relationship between firm size and a stocks idiosyncratic volatility. They also find that high idiosyncratic volatility firms have high betas and generate low earnings.

Following the adoption of related regulations launched in the beginning of 1980's, the ISE was officially established in 1985 and started its operations on 1986. ISE has made a great progress in its short history. The number of corporations whose shares are traded on the ISE equities market was 80 by the end of 1986, the year in which the ISE was established. By the end of 2010, there are 338 corporations traded on ISE. Market capitalization, which was only 938 million US Dollar by the end of 1986, reached 308 billion US Dollar by the end of 2010.

In 2010, the daily average trading volume has been 1,703 million US Dollar and total trading volume has been 425.7 billion US Dollar. This figure indicates an increase of 34.6% in Dollar terms over the previous year. There are approximately one million investors and the ratio of equities owned by foreign customers to total equities in custody is 66.8% by the end of 2010.

With a market capitalization of US$ 308 billion, the ISE ranks 14th among emerging markets in terms of market capitalization. ISE maintains its position as the most developed and liquid exchange in its region, ranks 6th among the emerging markets in terms of stock trading value and 3rd in terms of bond trading value. The total amount of funds rose through the ISE from its establishment in1986 to the end of 2010 totaled US$ 48.6 billion.

In 2010, the return of the ISE-100 Index on US dollar basis was registered as 21% while the returns of the MSCI Developed Markets and the MSCI Emerging Markets indexes[3] were 10% and 16%, respectively. Following Figure 1 shows performance of ISE National 100 Index over against MSCI Developed and MSCI Developing Indexes.

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[2] Canada, France, Italy, Japan, US and UK.

[3] Canada, France, Italy, Japan, US and UK.

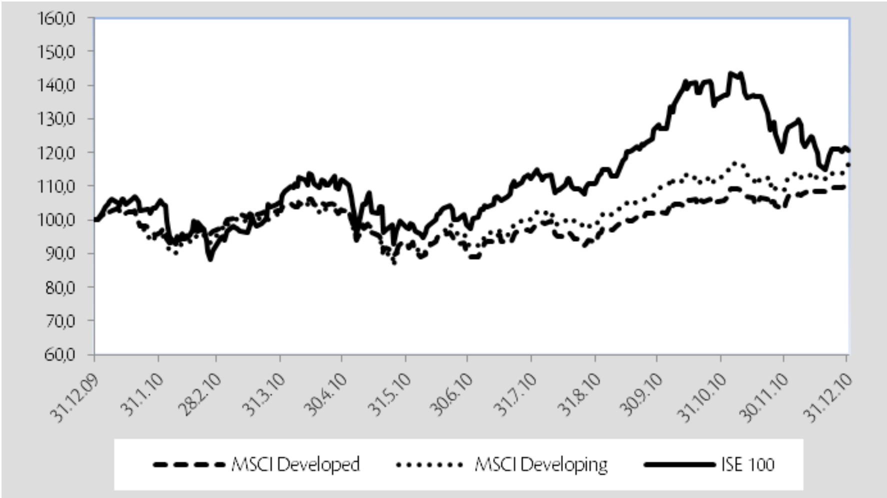

FIGURE 1. ISE NATIONAL 100 AND MSCI INDEXES.

Source: Bloomberg

The main indicator of the Stock Market is the ISE-100 Index, constituted of 100 companies traded on the National Market and real estate investment trusts, venture capital investment trusts on the Collective Products Market, with high market capitalization and liquidity. ISE 100 Index was among the best performing indexes in 2010 with 24.9% of return in TL terms.

As an emerging market, Istanbul Stock Exchange (ISE) shows high volatile character in its short history and has huge rate of foreign investors' ownership in stock market so that, analyzing idiosyncratic volatility on ISE is critically important especially for investors and other parties. In this context, our study aims to introduce structure and behavior of idiosyncratic volatility and find evidence that even if idiosyncratic volatility is the variable to be used in calculation of expected return in ISE. Therefore, we have dealed with answers of some specific questions such as, what is the ratio of idiosyncratic volatility in total volatility, what kind of relationship exist between idiosyncratic volatility and market volatility, does market capitalization of a firm effect idiosyncratic volatility, is there a time trend of idiosyncratic volatility and what is the predictive ability of idiosyncratic volatility for future return.

The paper proceeds as follows: Section 2 provides brief information about measuring idiosyncratic risk. Section 3 presents empirical evidence and in Section 4, the findings will be explained and finally our conclusions and evaluations will be given in 5th Section.

II. MEASURING IDIOSYNCRATIC RISK

Idiosyncratic volatility is unobservable and model dependent; therefore one of the wide used method in literature is Campbell et al.'s (2001) *Indirect Method* which uses the market model under the assumption that the betas of all securities are one and calculates idiosyncratic return as the difference between stock and market return.

A. Indirect Method

Campbell et al.'s (2001) Indirect method decomposes the return on a "typical" stock into three components: the market wide return, an industry specific residual and a firm-specific residual. Based on this return decomposition, they construct time series of volatility measures of the three components for a typical firm. So, they can define volatility measures that sum to the total return volatility reach firm specific risk series without having to keep track of covariances and without having to estimate betas for firms or industries.

Goyal and Santa Clara (2003), Guo and Savickas (2003) and Angelidis and Tessoramatis (2008) compute the monthly variance of a portfolio *p* using within-month daily return data as,

$$V_{pt} = \sum_{d=1}^{d_t} r_{pd}^2 + 2\sum_{d=2}^{D_t} r_{pd} r_{pd-1} \tag{1}$$

By using the approach proposed by French et al. (1987). In this equation, D_t is the number of days in month *t* and r_{pd} is the portfolio's return on day *d*. Surprisingly, the equation above do not compute the stock variance accurately, since it does not demean the returns. However for short holding periods, because of the impact of the subtracting the means is minimal, so it may be omitted of the monthly variance computation, as French et al (1987) and Goyal and Santa Clara (2003) stated. Nonetheless French et al. (1987) pointed out that non-synchronous trading of securities causes daily portfolio returns to be autocorrelated, particularly at on lag one. So, the second term of the *Equation 1* adjusts the variance to the autocorrelation of the stock returns (Angelidis and Tessaromatis, 2008).

In this context, the calculation of the average equal-weighted total variance at month *t*, TV_t^{Equal} is,

$$TV_t^{Equal} = \frac{1}{N}\sum_{i=1}^{N_t} V_{i,t} \tag{2}$$

Alternatively, it is also possible to calculate total variance on market value-weighted basis TV_t^{Value} as follows:

$$TV_t^{Value} = \sum_{i=1}^{N} \omega_{i,t} V_{i,t} and \omega_{i,t} = \frac{v_{i,d_{t-1}}}{\sum_{i=1}^{N} v_{i,d_{t-1}}} \tag{3}$$

Where N is the number of stocks during month *t*, while $v_{i,d_{t-1}}$ is the market capitalization of stock *i* in day *d* in month *t-1*.

While Xu and Malkiel (2001) suggest that the value-weighted aggregate volatility of individual stocks consists of the volatility imparted by movements in the broad market index and aggregate idiosyncratic volatility, Angelidis and Tessoramatis (2008) point out that using the market model under the assumption that the betas of all securities against the market is one, the variance of stock *i* at time *t*, $V_{i,t}$, can be decomposed in two parts: a systematic part which equals to the variance of the market, MV_t and an idiosyncratic part which equals to the variance of the idiosyncratic return, $IV_{i,t}$.

$$V_{i,t} = MV_t + IV_{i,t} \tag{4}$$

Therefore, the aggregate idiosyncratic variance is calculated as follows:

$$IV_t = TV_t - MV_t \tag{5}$$

Where TV_t is the aggregate total volatility calculated from individual stock's variance, (Equations 2 or Equation 3) and MV_t is the variance of the market. The average equally weighted idiosyncratic variance is defined as follows:

$$IV_t^{Equal} = TV_t^{Equal} - MV_t \tag{6}$$

And the average value weighted idiosyncratic variance as follows:

$$IV_t^{Value} = TV_t^{Value} - MV_t \tag{7}$$

III. THE EMPIRICAL STUDY

A. Data and Methodology

Closing prices and market capitalizations are collected from ISE and return of each stock is calculated on daily basis. We employ with the companies in ISE National-100 Index which constitute 78% of total trading volume and 80% of total capitalization as of December 31th 2010.

We measure idiosyncratic risk with indirect method by following Campbell's (2001), Goyal and Santa Clara (2003) Guo and Savickas (2006) and Angelidis and Tessoramatis (2008) in 01.01.2007-31.12.2010 period. The sample includes 135 different stocks, some of which in the meanwhile added to or dropped from the Index.

Average idiosyncratic risk is calculated on monthly basis with daily returns of stocks which are traded on every trading day on that month. Bali and Cakici (2008) state that realized idiosyncratic volatility measure obtained from monthly data is a more accurate proxy for the expected future volatility than the idiosyncratic volatility measure obtained from daily data.

Points to be considered in our analysis as follows:

- Monthly return variance of each stock traded in ISE National-100 Index is calculated for each month by using *Equation 1*,
- For monthly average variance calculation, we include all stocks which are traded all trading days in that month. *Equation* 2 and *Equation* 3 are used in calculation of equally and value weighted average variance. In calculation of value weighted average variance we take into account market capitalization of the stock as of last day of previous month.
- We classified the stocks considering market capitalization of previous month into three portfolios for each month, BIG, SMALL and ALL. For the creation of size portfolios, we use median by following Fama and French (1993).
- Monthly market variance *(MV)* is calculated with daily closing value of the Index.
- *Equation* 6 and *Equation* 7 are used to gather equally and value weighted idiosyncratic variance series of BIG, SMALL and ALL portfolios.

IV. FINDINGS

A. Descriptive Statistics

Following Table 1 presents descriptive statistics on the various measures of volatilities based on BIG, SMALL and ALL stocks and ISE National 100 Index which is assumed as market portfolio in the period of 01.01.2007-31.12.2010.

TABLE 1 - DESCRIPTIVE STATISTICS*

	Mean	*Median*	*Max*	*Min*	*S.D.*	*Skew*	*Kurt.*	*J.B.*	*AR1*	*AR6*	*AR12*
TV_{ALL}^{Equal}	0.0245	0.0197	0.1193	0.0050	0.0187	3.19	15.62	399.603	0.507	0.009	-0.103
TV_{BIG}^{Equal}	0.0246	0.0195	0.1175	0.0058	0.0185	3.02	14.89	355.827	0.428	0.009	-0.087
TV_{SMALL}^{Equal}	0.0243	0.0203	0.1210	0.0042	0.0199	2.89	13.43	284.338	0.527	0.009	-0.144
TV_{ALL}^{Value}	0.0223	0.0178	0.1145	0.0051	0.0177	3.34	16.98	480.346	0.537	0.025	-0.119
TV_{BIG}^{Value}	0.0210	0.0165	0.1088	0.0046	0.0169	3.33	16.96	478.692	0.529	0.032	-0.12
TV_{SMALL}^{Value}	0.0013	0.0010	0.0057	0.0002	0.0010	2.47	10.51	161.789	0.458	-0.123	-0.078
IV_{ALL}^{Equal}	0.0240	0.0369	0.1172	0.0049	0.0183	3.19	15.69	403.248	0.498	0.007	-0.102
IV_{BIG}^{Equal}	0.0242	0.0192	0.1154	0.0057	0.0181	3.02	14.91	356.892	0.417	0.007	-0.085
IV_{SMALL}^{Equal}	0.0239	0.0199	0.1189	0.0041	0.0196	2.88	13.42	283.517	0.519	0.007	-0.144
IV_{ALL}^{Value}	0.0218	0.0175	0.1124	0.0050	0.0174	3.35	17.08	486.009	0.529	0.024	-0.116
IV_{BIG}^{Value}	0.0205	0.0161	0.1067	0.0045	0.0165	3.34	17.06	484.549	0.52	0.031	-0.117
IV_{SMALL}^{Value}	0.0008	0.0007	0.0036	0.0001	0.0007	2.11	8.35	92.793	0.162	-0.254	0.031
MV	0.0005	0.0003	0.0022	0.0001	0.0005	2.64	7.60	142.145	0.625	0.051	-0.093

Source: Authors' calculation

** TV is the total variance, IV is the idiosyncratic risk, while MV is the variance of the market. "SD" is the standard deviation, "Skew" is the skewness, "Kurt" is the kurtosis. "J.B" is the Jarque-Bera statistic. AR1, AR6 and AR12 are the autoregressive coefficients of order 1, 6 and 12 respectively.*

Table 1 shows that idiosyncratic volatility is the largest component of total volatility irrespective of the size and employed weighting scheme, similar to findings of Campbell et al. (2001), Goyal and Santa Clara (2003) for the US market and Angelidis and Tessaromatis (2008) for the UK market. The average idiosyncratic volatility represents between *64.62%* and *98.17%* of total average volatility and therefore market variance is only fraction of the total variance.

Equally weighted total variances of BIG and SMALL stocks take very similar values. On the contrary, variance of SMALL stocks is only 4% of variance of ALL stocks in value weighted volatility calculation. The reason of this difference between weighting schemes is that SMALL stocks take very low weights because of their very small sizes in value weighted calculation, while they show similar volatilities as compared with BIG and ALL in equally weighted calculation. Although there are empirical findings which display that small sized stocks have high volatility, we reach divergent finding of positive relation between size and idiosyncratic volatility.

B. Correlation Analysis for ISE Portfolios

Table 2 reports the correlation between the various risk measures of the ISE-100 ALL, BIG and SMALL portfolios for 2007-2011 period.

TABLE 2. CORRELATION MATRIX*.

	TV^{Equal}_{ALL}	TV^{Equal}_{BIG}	TV^{Equal}_{SMALL}	TV^{Value}_{ALL}	TV^{Value}_{BIG}	TV^{Value}_{SMALL}	IV^{Equal}_{ALL}	IV^{Equal}_{BIG}	IV^{Equal}_{SMALL}	IV^{Value}_{ALL}	IV^{Value}_{BIG}	IV^{Value}_{SMALL}
TV^{Equal}_{ALL}	1.000											
TV^{Equal}_{BIG}	0.940	1.000										
TV^{Equal}_{SMALL}	0.937	0.767	1.000									
TV^{Value}_{ALL}	0.900	0.925	0.775	1.000								
TV^{Value}_{BIG}	0.884	0.922	0.748	0.999	1.000							
TV^{Value}_{SMALL}	0.895	0.953	0.953	0.760	0.728	1.000						
IV^{Equal}_{ALL}	1.000	0.939	0.937	0.898	0.881	0.896	1.000					
IV^{Equal}_{BIG}	0.939	1.000	0.765	0.923	0.920	0.731	0.938	1.000				
IV^{Equal}_{SMALL}	0.935	0.763	1.000	0.770	0.743	0.954	0.935	0.761	1.000			
IV^{Value}_{ALL}	0.898	0.924	0.773	1.000	0.999	0.759	0.897	0.922	0.768	1.000		
IV^{Value}_{BIG}	0.882	0.921	0.745	0.999	1.000	0.727	0.880	0.919	0.740	0.999	1.000	
IV^{Value}_{SMALL}	0.659	0.474	0.766	0.478	0.443	0.855	0.667	0.480	0.775	0.484	0.448	1.000
MV	0.697	0.687	0.639	0.693	0.692	0.539	0.685	0.675	0.627	0.681	0.680	0.095

Source: Authors' calculation

** This table reports the bivariate correlation between the various variance measures, which are log-transformed.*

The correlation between the equally and value weighted total and idiosyncratic volatility are almost 1 *(99.98%)*. Correlations change between *95.40%* and *77.46%* when the weighting scheme is changed for the same portfolio *(BIG, SMALL or ALL)* and same measure *(total or idiosyncratic)*. But correlations between total and idiosyncratic volatilities appear by the range of *99.98%* and *85.53%*, when all the other things are constant. We believe that high correlations are resulted from high percentages of idiosyncratic volatility in total volatility.

On the other hand, correlations between variance of the individual stocks *(total or idiosyncratic)* and market variance are relatively low. These correlations which are shown at the last row of the table change by the range of *69.70%* to *9.50%*.

At the same time, our correlation matrix gives chance to analyze size effect. Regarding to high correlations, total volatility measures of BIG stocks are similar to ALL stocks' *(Equally-weighted: 93.96%; Value-weighted: 99.98%)*. SMALL stocks have relatively low correlation between ALL stocks when it is value-weighted *(75.97%)*.

In summary, we arrive at a conclusion that BIG, SMALL and ALL stocks have similar volatility structure on the basis of high correlations. But SMALL stocks show relatively lower volatility when their market value weights are taken into consideration.

C. Results of the Idiosyncratic Models Relating to Size Effect

In order to measure influence of idiosyncratic volatility of BIG and SMALL stocks on total volatility and find which weightening scheme captures behavior of size effect more accurately, we follow Angelidis and Tessaromatis (2008) and employ following regressions[4]. In this regard, given the evidence presented in Table 1 that volatility display large skewness and kurtosis, we log transform the variance measures[5]. Regression on equally weighted volatility is as follows;

$$TV_{ALL}^{Equal} = 0.0435 + 0.5277^{*} IV_{BIG}^{Equal} + 0.4593^{*} IV_{SMALL}^{Equal} + 0.0067^{*} MV + 0.0348 \quad (8)$$

(0.4178) (0,000) (0,0000) (0,4662) (R^2:99,66%)

Because of insignificant coefficient of market variance at any confidence level, we dropped MV from the model and reperform as follows:

$$TV_{ALL}^{Equal} = 0.0139 + 0.5319^{*} IV_{BIG}^{Equal} + 0.4614^{*} IV_{SMALL}^{Equal} + 0.0346 \quad (9)$$

(0.6895) (0,000) (0,0000) (R^2:99,66%)

Eliminating the market variance from the model does not affect the value of adjusted R square because of limited effect of market variance *(MV)* on total variance of ALL stocks. A regression between total volatility and volatility based on LARGE and SMALL stocks shows that for the equally weighted volatility, LARGE stock volatility accounts for *53.19%* of its movements while the remaining *46.14%* is due to SMALL stock volatility *(R^2=99.66%)*. The regression value weighted Eliminating the market variance from the model does not affect the value of adjusted R square because of limited effect of market variance *(MV)* on total variance of ALL stocks. A regression between total volatility and volatility based on LARGE and SMALL stocks shows that for the equally weighted volatility, LARGE stock volatility accounts for *53.19%* of its movements while the remaining *46.14%* is due to SMALL stock volatility *(R^2=99.66%)*. The regression value weighted is:

[4] Values under the coefficients show the *p*-values.

[5] The log transformation reduces both skewness and kurtosis and brings the distribution closer to the normal.

$$TV_{ALL}^{Value} = 0.3300 + 0.9272^{*} IV_{BIG}^{Value} + 0.0336^{*} IV_{SMALL}^{Value} + 0.0362^{*} MV + 0.0162 \quad (10)$$

(0,0000) (0,0000) (0,0000) (0,0000) (R^2=%99,93)

In value weighted analysis, since market variance (MV) is a significant predictor, we keep it in the model. The corresponding estimates for the value weighted total volatility is 92.72% due to LARGE stocks volatility (R^2=99.93%).

Regressions of equally weighted ISE portfolios *(Equation 8 and Equation 9)* reveal almost equal residual terms. Besides, regression of value weighted ISE portfolios demonstrates lower residual terms as given in Equation 10. In this respect, the determination coefficient (R^2) of *Equation 10* is slightly higher than *Equation 8* and *Equation 9* due to the minor decreases in the residual terms.

Table 3 set below shows the results of stationary tests using the Dickey and Fuller (1979) and Philips-Perron (1988) tests.

TABLE 3 - STATIONARY TESTS*.

	ADF Statistics				***Phillips-Perron Statistics***			
	Intercept		***Intercept and Trend***		***Intercept***		***Intercept and Trend***	
	t-stat	***p-value***	***t-stat***	***p-value***	***t-stat***	***p-value***	***t-stat***	***p-value***
TV_{ALL}^{Equal}	-3.77	0.0060	-3.83	0.0235	-3.72	0.0068	-3.71	0.0312
IV_{BIG}^{Equal}	-4.33	0.0012	-4.38	0.0057	-4.27	0.0014	-4.30	0.0070
IV_{SMALL}^{Equal}	-3.86	0.0046	-3.94	0.0181	-3.88	0.0044	-3.95	0.0174
TV_{ALL}^{Value}	-3.75	0.0063	-3.86	0.0220	-3.70	0.0073	-3.82	0.0242
IV_{BIG}^{Value}	-3.91	0.0040	-4.03	0.0143	-3.85	0.0048	-3.98	0.0160
IV_{SMALL}^{Value}	-4.80	0.0003	-4.74	0.0021	-4.78	0.0003	-4.71	0.0022
MV	-3.59	0.0098	-3.99	0.0154	-3.54	0.0111	-3.97	0.0168

Source: Authors' calculation

This table reports unit root tests for the log-transformed risk measures.

The hypothesis of the presence of a unit root for all volatility measures is rejected at 5% confidence level, whether we include a trend or not.

D. Results of the Trend Analysis

Figure 3 shows equally and value weighted idiosyncratic variances of BIG, SMALL and ALL portfolios and market variances on monthly basis.

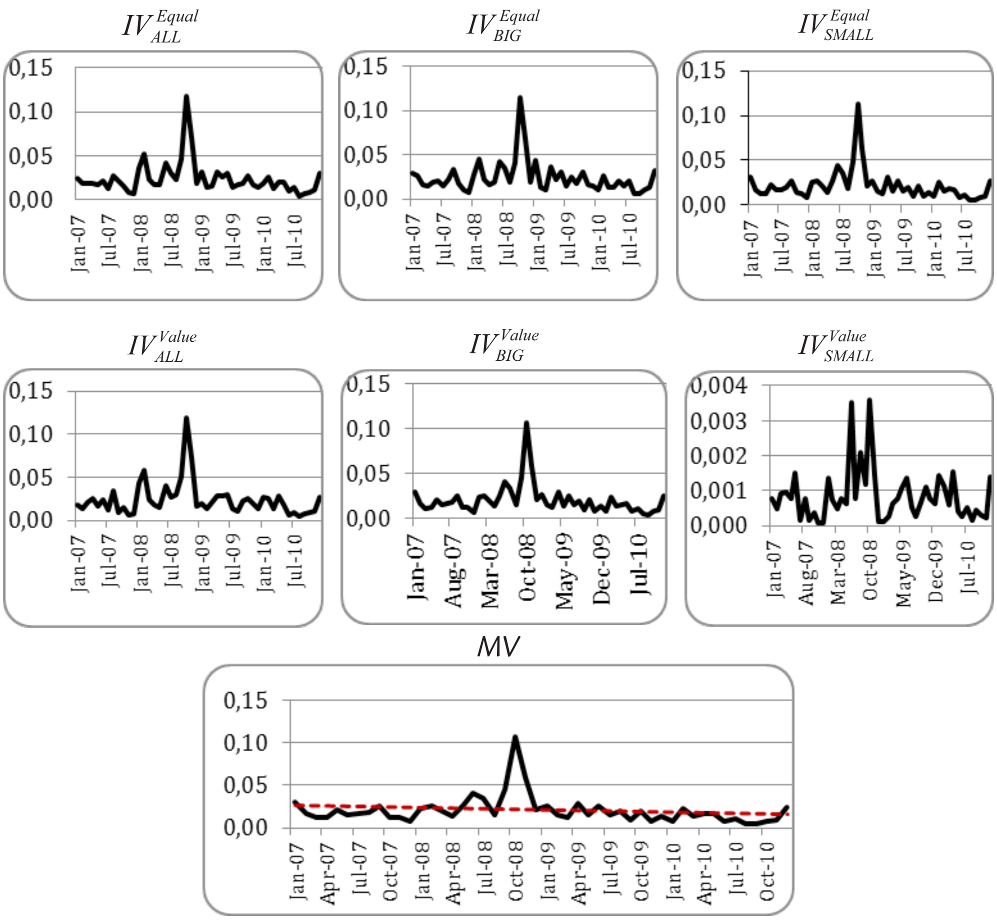

FIGURE 2. GRAPHICAL ANALYSIS OF VALUE WEIGHTED AND EQUALLY WEIGHTED IDIOSYNCRATIC RISK.

Source: Authors' calculation

As graphs show, there is not an observable trend in all idiosyncratic and market variances. But the dashed line in graph of market variance points a slightly decreasing trend. On September 2008 reveals a huge peak, which is thought as effect of World Economic Crisis in 2008 to the ISE, formed in each graph. As of January 2009, the peaks turn to usual level and fluctuate in narrow band until 2010. Generally all types of variances have similar movements except value weighted idiosyncratic variance graph. In this regard, given the evidence presented in Table 2 that correlation between value-weighted idiosyncratic variance of SMALL stocks and ALL stocks was *48.35%*, and market variance was *9.5%*.

Due to the difficulty in determining presence of any trend graphically, we follow Guo and Savickas (2003) and Angelidis and Tessaromatis (2008) and estimate the following linear trend model:

$$\mathrm{Ln}\left(\mathrm{V_t}\right) = \pm + \mathrm{bTime} + \mathrm{cLn}\left(\mathrm{V_{t-1}}\right) + \mathrm{e_t} \qquad (11)$$

where $\mathrm{V_t}$ is the corresponding volatility measure. Table 4 shows the estimated parameters and the corresponding Newey-West (1987) adjusted p-values.

TABLE 4 - LINEAR TREND MODEL.

	α	b	c	R^2 *Adj.*
IV_{ALL}^{Equal}	-3.6884	-0.0089	0.4791	23.51%
p-value	0.0000	0.4073	0.0009	
IV_{BIG}^{Equal}	-3.7106	-0.0082	0.3759	14.25%
p-value	0.0000	0.3909	0.0115	
IV_{SMALL}^{Equal}	-3.6956	-0.0104	0.4719	22.64%
p-value	0.0000	0.3916	0.0010	
IV_{ALL}^{Value}	-3.7513	-0.0113	0.4717	25.98%
p-value	0.0000	0.2880	0.0012	
IV_{BIG}^{Value}	-3.8100	-0.0117	0.4443	23.74%
p-value	0.0000	0.2618	0.0024	
IV_{SMALL}^{Value}	-7.4443	0.0006	0.3141	5.57%
p-value	0.0000	0.9630	0.0355	
MV	-7.4287	-0.0235	0.4798	30.94%
	0,0000	0,0864	0,0006	

Source: Authors' calculation

Coefficient of the trend variable (b) of all measures of idiosyncratic volatility is not statistically significant. Verifying graphical analysis, this finding shows that idiosyncratic volatility had not a rising or falling trend in period of 2007-2010. On the other hand, coefficient (b) of market variance is negative and statistically significant at 10% confidence level. This finding points out a very slow decreasing trend of market volatility in period of 2007-2010.

Our finding about time trend of idiosyncratic volatility of ISE is consistent with Sousa and Serra's finding (2008) which report no significant increase in firm specific volatility in Portuguese market and inconsistent with Campbell et al.'s (2001) and Angelidis and Tessaromatis's (2008) studies which report that idiosyncratic risk in US and UK markets rose during last decades.

E. Investigating the Forecasting Ability of Idiosyncratic Risk

Contrary to standard asset pricing theories which claim that idiosyncratic risk is not priced because of diversification ability of investors, it is possible to test whether idiosyncratic risk is a significant predictor or not, in forecasting of future return. By following Goyal and Santa Clara (2003) and Angelidis and Tessaromatis (2008) we investigate the relationship between volatility and subsequent stock returns in ISE, by regressing value and equally weighted market stock returns on various measures of lagged volatility.

$$r_{t+1} = \pm + {}^{2} X_t + \mu_{t+1} \qquad (12)$$

Where r_{t+1} is the log return of the market portfolio at month *t+1* and X_t includes different combinations of monthly market and idiosyncratic volatilities. Because of difficulties of each month portfolio return calculation resulted from stocks added to and dropped from the Index, we studied with 59 stocks which are continuously traded in 2007-2010 period and calculated idiosyncratic volatility with on the basis of equally weighted and value weighted. Considering that our 59 stocks are the biggest stocks in terms of size, liquidity, and trading volume, we did not reform BIG, SMALL and ALL portfolios. So, our findings do not give information about size effect of forecasting ability of idiosyncratic volatility.

Following Table 5 presents the regressions *(Equation 12)* results of the equally and value weighted market return on lagged measures of market and idiosyncratic volatility.

TABLE 5 - FORECASTS OF EQUALLY AND VALUE WEIGHTED MARKET RETURN.

Equation	*Constant*	*$LnIV^{Equal}(-1)$*	*$LnIV^{Value}(-1)$*	*LnMV(-1)*	*Adj. R^2*
1	-0.0159	-0.0032			-0.12%
p-value	0.4543	0.3911			
2	-0.0084	-0.0028		0.0005	-0.74%
p-value	0.7411	0.5124		0.8838	
3	-0.0031			-0.0007	-0.46%
p-value	0.8976			0.7955	
4	-0.0176		-0.0035		-0.05%
p-value	0.3917		0.3210		
5	-0.0029		-0.0045	0.0023	-0.4%
p-value	0.9125		0.2841	0.5270	
6	0.0030			0.0000	-0.04%
p-value	0.9059			0.9972	

Source: Authors' calculation

Our regression analysis relating to relationship of idiosyncratic risk and return in ISE are employed with different combinations and none of the coefficients are found as statistically significant. Moreover, adjusted R squares of the models take negative and low values. As a result, we find that idiosyncratic volatility is not a predictor in forecasting future returns in Turkish market in period of 2007-2010.

At this point, remembering divergent findings in literature helps to evaluate our finding. While Lehman (1990), Campbell (1992), Xu and Malkiel (2001) and Goyal and Santa Clara (2003) and Fu (2009) report a significant positive relationship for US market, Ang et al. (2004) and Guo and Savickas find negative relationship. However, Bali and Cakici's (2008) results indicate that there is no robust evidence for a significant relation between idiosyncratic risk and the cross section of expected returns. Okpara and Nwezeaku (2009) and Bollen et al.'s (2009) findings suggest that idiosyncratic volatility is not priced. In this context, our result is consistent with some of the foregoing evidence that suggested that idiosyncratic risk is not priced.

V. DISCUSSION

As an emerging and volatile market, ISE has shown a great improvement and became attractive for investors and international portfolio managers gradually, producing information about volatility and its components is also crucial. We aimed to analyze the idiosyncratic volatility which is identified as a biggest component of total volatility by empirical evidences regarding different markets in ISE.

In this context, we decompose total volatility into the market wide and idiosyncratic by following Campbell et al. (2001) and Xu and Malkiel (2001)'s Indirect method and investigate the behavior of the idiosyncratic volatility and its pricing ability on monthly basis, in the period of 2007-2010.

Our findings suggest that idiosyncratic volatility is the biggest component of total volatility and show no trend. We also find that small size stocks and big size stocks have similar idiosyncratic risk behavior in the period of 2007-2010. But when the market value weights are taken into consideration, small size stocks show relatively lower volatility contrary to literature. Finally, our analyses about the predictive ability of various measures of idiosyncratic risk provide evidence that idiosyncratic volatility is not a significant predictor for future return.

Since the adequacy of diversification depends on the firm level volatility of the stocks making up to the portfolio and studies about Turkey's stock market have been scarce so far, this paper may originally contribute to the understanding of stock market volatilities in Turkey and affect investment portfolios in this market afterward.

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