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The effects of the stock index futures to the spot stock market: a study for the Istanbul Stock Exchange

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Abstract

One of the fundemantal problems of the Turkish financial market is high volatility and therefore the occurance of relatively shallow market structure. In recent years, the rapid capital flows seen in global markets have resulted in increasing amounts of transactions in futures markets both for investment and speculation. The modelling of any interaction between the spot and futures markets constitutes a great importance with regard to determining the direction of information flow in these markets, price formation and risk measuring.

The aim of this study is to empirically investigate how index futures contracts traded in the Turkish Derivatives Exchange operating since February 2005 affect the price volatility and trade volume in the spot stock market, namely Istanbul Stock Exchange. The analyses are conducted by injecting dummies to the ARCH type models for index return and trade volume series and results indicate no statistically signigicant change in the index volatility, while trade volumes increase in the spot stock market. These results are in line with many of the studies in the literature.

Keywords: *Futures and Spot Markets, Volatility, Trade Volume, ARCH-GARCH, ISE*

Vadeli hisse senedi işlemlerinin spot piyasa üzerine etkisi: İMKB üzerine bir uygulama

Özet

Türk mali piyasalarının en temel sorunlarından biri yüksek volatilite ve buna bağlı olarak oluşan görece sığ finansal piyasa yapısı olarak karşımıza çıkmaktadır. Son yıllarda global piyasalarda oluşan hızlı sermaye akımları beraberinde vadeli işlem piyasalarında gerek yatırım gerekse spekülatif amaçlı işlemlerin artmasına neden olmuştur. Spot ve vadeli piyasalar arasındaki oynaklık etkileşiminin modellenebilmesi bu her iki piyasadaki bilgi akışının yönünün belirlenmesi, fiyat oluşumu ve riskliliğin ölçülebilmesi açısından büyük önem arz etmektedir.

Bu çalışmanın amacı Şubat 2005'den bu yana faaliyet gösteren Vadeli İşlemler ve Opsiyon Borsası (VOB)'nda işlem gören endeks vadeli işlem sözleşmelerinin spot hisse senedi piyasasındaki fiyat oynaklığını ve işlem hacmini ne şekilde etkilediğini belirlemektir. ARCH ailesi modelleri içerisine açıklayıcı kukla değişken eklenerek yapılan analiz sonucunda İMKB-30 Endeks vadeli işlemlerinin başlamasıyla birlikte spot hisse senedi piyasası oynaklığında istatistiki açıdan anlamlı herhangi bir değişim gözlenmezken,

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işlem hacminin arttığı görülmüştür. Bu sonuçlar literatürde yer alan birçok çalışma ile paralellik göstermektedir.

Anahtar Sözcükler: *Vadeli ve Spot Piyasalar, Oynaklık, İşlem Hacmi, ARCH-GARCH, İMKB*

1. Introduction

Futures contracts in any market are designed to manage and minimize risk (hedging) in the spot market. Derivative markets also contribute to the occurance of fair values of assets traded in spot markets. Two contrary viewpoints have emerged in the literature related with the impact of futures markets to the underlying spot market volatility. The basis for the view which asserts that futures markets increase the spot price volatility is the speculative transactions. Since speculative trading will increase with futures contracts, spot market volatility will highly increase. Speculators will try to make profits by taking futures positions as per their expectations. The contrary view supports the fact that futures markets diminish the spot market volatility as futures contracts will provide new information flow to the markets and thus, enable the fair price formation in the spot market.

Futures markets guide manufacturers, exporters and importers, portfolio managers, bankers and investors for their risk and inventory management by giving an estimate for the future course of prices. Investors have the opportunity to transact with relatively less funds as compared to the spot markets. The whole transaction amount is paid in spot markets, while transactions in futures markets can be done only by paying the margin as the deposit value. Futures markets provide transactions so that risks emerging in the spot markets can be lowered or managed and hedging can be done against any possible price fluctuations by buying or selling today for future price changes. Moreover, futures markets contribute in a more efficient mechanism for price formation. Futures markets constitute alternative investment opportunity, thus with the addition of these markets to the present spot markets both the circulation of capital in the markets increases and new information reach the prices more rapidly. The commissions in futures markets are lower as compared to that of spot markets, thus diminish the costs of investors. These markets generally ensure a higher liquidity in the spot markets. Investors' interest to the commodities or assets traded in spot markets naturally increase since there are opportunities to hedge against adverse price movements in futures markets. Futures markets provide opportunity for investors who have necessary market knowledge but not enough capital to take positions or have to buy and sell on credit in spot market. Those investors may take high futures positions with lower amounts of capital and get high porofits with the leverage effect in futures markets. These markets also provide various options to portfolio managers for portfolio diversification and thus, for risk minimization. Synthetic positions may be formed by using contracts traded in futures markets with return graphs similar to that of transactions traded in spot markets. Due to all above-mentioned characteristics, futures markets contribute in increasing efficiency in financial markets and decreasing price volatility in underlying spot markets [1].

This research is one of the pioneer studies examining the interaction between spot and futures markets in Turkey and alternates to other studies by injecting a dummy variable in the variance regressor. The study is constituted of five sections. The impact of futures on the spot markets is described in Section 2 and a brief literature survey is given in Section 3. Section 4 presents the research and the statistical modelling. Finally, Section 5 concludes the empirical findings.

2. Effects Of Futures Contracts on The Underlying Spot Market

Futures markets have two fundamental functions being risk management and price determination for future dates. Risk management gives the opportunity to investors for hedging against any adverse price changes which may be observed in the future. Speculators basically do not hedge against risk and look for making profits due to price changes by taking future positions as per their expectations.

Prices in the spot market constitute a reference for calculating prices for future times. Spot price is one of the variables for determining the fair values of futures contracts and 'Carrying Cost' model is used for pricing of futures. Accordingly, futures price is calculated as follows in Equation (1):

Futures Price = Spot Price + Carrying Cost (1)

Carrying cost in financial futures contracts is constituted of financial cost only, while it also includes storage and insurance expences for commodity futures contracts. Accordingly, for a financial futures contract the price will be expressed as in Equation (2):

Futures Price = Spot Price (1+ interest rate * days to maturity/365) (2)

The above expression determines the futures price with the simple interest rate calculation whereas futures prices are generally calculated with continously compounded interest rate. The price calculation in Equation (2) is expressed as follows in Equation (3) with continous compounding: [2]

$$F_0 = S_0 * e^{Ti} \quad (3)$$

F_0: futures price, S_0: spot price, T: days to maturity, i: carrying cost

Equation (3) shows that the main determiner of the futures prices are spot prices and the futures price calculated as per the equation is the theoretical or intrinsic price. In case that there is a difference between the calculated theoretical price and the prevailing price in the futures market, an arbitrage opportunity arises in the markets. As a result of investors buying in markets with lower prices and selling in other markets with higher prices, prices reach their equilibrium levels both in spot and futures markets. Thus, spot and futures prices mutually affect each other.

Although it is possible to express that futures contracts affect spot prices, there has been no common evidence in the literature regarding the direction of this relation. While it is thought that futures markets diminish the fluctuations or volatility in spot markets by bringing spot prices to equibrium levels with providing information, empirical studies have indicated contrary results. This situation is being explained that highly speculative transactions in futures markets have increased the price fluctuations in spot markets. Even, in many researches it is observed that no interaction exists between the markets.

3. Literature Survey

It is observed that recent studies investigating the effects of futures markets on spot markets within the literature have focused on the interaction between spot and futures markets and price formation. Besides, there are studies conducted for the speculative effects of futures markets on spot markets and the interaction of the two markets' volatilities.

Many studies such as Edwards [3], Harris [4], Antoniou & Holmes [5], Dennis & Sim [6] have found evidence that the start of index futures contracts have important effects on the price volatility of the reference asset and supported that this evidence forms an important information content for fund managers and traders.

Two dominating but different views have been put forward related with the effects of futures contracts on spot markets. One of these viewpoints asserts that the speculative transactions in futures markets stabilize the reference spot market and diminish its volatility (Baldauf & Santoni [7], Antonio & Foster [8], Galloway & Miller [9], Dennis & Sim [6], Rahman [10]). The other view concludes that futures contracts increase the volatility in the spot market due to large number of speculative transactions in futures markets (Antoniou, A. and Holmes P [5]).

Evidence has also been found that results may change whether markets are efficient or not. It is revealed that in efficient and fully competing markets futures contracts have no effect on spot markets since futures are synthetic products and they are inadequate as compared to spot markets. However, Ross [11] and Hakansson [12], claimed that in inefficient markets futures contracts result in mixed results since expected return and risk in reference asset markets (spot markets) decrease as investors have a broader investment opportunity set. Danthine [13] found evidence that derivative products with their information content increase the debth and liquidity and decrease the volatility of markets (Jeff Fleming and Barbara Ostdiek[14]).

Edwards [3] utilizes the highest and lowest intra-day and closing-day values of S&P 500 Index and interest rate futures and finds out that futures contracts have a volatility effect on the spot market for a very short period of time and do not cause any unstability in spot markets.

Pericli and Koutmos [15]uses S&P 500 Indeks and its Futures Index and find evidence that S&P 500 Futures Index causes no change on the spot index volatility.

Min and Naj [16] use the interactions of futures and spot markets' volatilities to investigate the flow of information process between these markets and put forward that price formation based on information rate appears earlier in futures markets.

Butterworth [17] uses Nid-250 Index and asserts that futures contracts considerably affect the spot index volatility, and using GARCH modelling finds out that the rate of information flow diminishes with increasing volume of futures transactions.

Darrat, et. al., [18] tests the effects of index futures contracts on spot market volatility by using S&P 500 index data and considering macroeconomic variables in EGARCH modelling. Results show that index futures contracts have no effect on the spot market volatility. Evidence is found that the volatility of the spot market is rather stemmed from the turbulances within the market. Macroeconomic variables used in the research to have any effect on the spot market volatility are inflation rate, political activities, and level of economic activity.

Yu [19] utilizes the stock index and index futures data from different countries and finds out that the volatility of stock returns increased with futures contracts being included in the markets in USA, Australia, France, and Japan; while no changes occur in England and Hong Kong. GARCH modelling is conducted in the analysis with dummy variables for testing the effects of index futures contracts on spot markets.

Pilar and Rafael [20] investigate any possible changes in the volatility and volume of the reference index with the inclusion of futures and option contracts to the Spanish markets. Conditional volatility models are thought of to be appropriate for testing the effects of these derivative markets on volatility and the GJR (Glosten, Jaganathan, Runkle) Model has been chosen. This model is an asymmetric model being less sensetive to extreme values as compared to EGARCH Model. Results of the GJR Model show that the conditional volatility of the reference index decreases and trade volume of Ibex-35 index increases significantly with the trading of derivative products in the Spanish markets.

Gupta and Kumar [21] and Thenmoshi [22] find evidence that futures contracts on S&P Nifty Index have dimished the volatility of the spot S&P Nifty Index.

For the Korean markets, Ryoo and Smith [23] find that futures markets increase the volatility, and thus the rate of information flow of the underlying spot market. In other words, authors assert that information is reflected to prices more rapidly in spot markets with the start of transactions in futures markets, and therefore price formation occurs more rapidly.

Some researches consider the effects of futures trading volume rather than the effects of the start of futures trading to the underlying spot market and studies of Figlewski [24] Bessembinder and Seguin [25], Darrat and Rahman [26], Chen, Cuny, and Haugen [27], Chatrath, Ramchander, and Song [28], Adrangi and Chatrath [29], and Gulen and Mayhew [30] are of this type. Yang, Balyeat, and Leatham [31] also investigate the effects of the futures trading volume. The authors study the effects of futures markets considering the basic agricultural products rather than the financial products. Both with the Granger Causality Tests and estimated error variance correcter method, the study shows that "unexpected futures trading volume" causes volatility of the underlying spot prices.

As it is summarized above, evidences of the studies do not gather at a specific result. The volatility increasing or decreasing effect of futures contracts change according to the markets. Even in some markets, the evidence proving that futures contracts have no effect to the underlying spot market is found out. In cases that there is a relation between futures and spot markets, the common result for the direction of relation is frequently from the futures market to the underlying spot market. The bidirectional relation of the two markets as asserted by the theory is mostly observed with a specific direction from the futures markets to the spot markets in practice.

4. Analysis

4.1. Data

Although it has been only three years that the Turkish Derivatives Exchange was established, it attracts attention that the derivatives market has shown a rapid development and the trade volume has grown to considerably high amounts. While transaction volumes show an increasing trend in the derivatives market, the fact that contracts are still traded at lower volumes as compared to the underlying spot markets is an indication of the unsufficient interests of investors to these markets. It is observed that 87.5 % of the recent transactions are index futures contracts (especially ISE-30 index futures contracts) and 11.3 % are currency futures contracts mainly on US Dollar.

As the trade volumes of currency and commodity futures contracts have been very small as compared to their spot transactions, these instruments are not included into the analyses and only index futures contracts are examined in the scope of this research. The ISE-30 and the ISE-100 Index futures contracts have been traded in the Turkish Derivatives Exchange since February 2005. In terms of trade volumes, it is seen that the ISE-30 Index futures are more frequently traded than the ISE-100 Index futures contracts. Therefore, the impact of index futures contracts to the spot market is examined only for ISE-30 contracts.

The initial future contracts written on ISE-30 Index futures were traded on February 1st, 2005. The daily data for ISE-30 Index return and volume series span the period of 12 March 2001 to 5 December 2008 and the related descriptive statistics for the data sets are given in the appendix at Graphs 1 and 2 and Tables 1 and 2.

The data set has been obtained by using the logarithmic differences of the ISE-30 Index value and volume series with 1942 daily observations using Equation (4) and (5).

$$ise30_t = \ln(P_t / P_{t-1}) \quad (4)$$

$$Volume_t = \ln(V_t / V_{t-1}) \quad (5)$$

Graph 1 and 2 show that the ISE-30 Index return and volume series are leptokurtic with the kurtosis value greater than 3 and are skewed to the right with a positive skewness value though it is too small. The Jarque-Bera statistic indicates that ISE-30 Index return and volume series do not distribute normally at 5% significance level.

Table 1 shows the descriptive statistics of ISE-30 Index returns for different periods which are two equal subperiods before and after the ISE-30 Index futures are traded in the Turkish Derivatives Exchange and the whole period. It is observed that the average of the ISE-30 Index returns decline in the period when ISE-30 Index futures are traded in the derivatives market. Besides, the standard deviation decreases and the maximum value shows a small decline in this period.

Table 2 shows a similar pattern such as the average of the ISE-30 Index spot trade volume and the standard deviation of the percentage change in trade volume have declined in the same period.

When the statistics are roughly examined and as compared to the initial subperiod, it is observed that the volatility and the percentage change of the trade volume in the spot stock market have relatively diminished with the ISE-30 contracts being introduced to the derivatives market. These observations have to be tested with more advanced econometric models to determine whether they are statistically significant or not.

4.2. Methodology

The conditional variance in the Auto Regressive Conditional Heteroskedasticity (ARCH) Model being one of the main methods for modelling varying variances in financial time series, is modelled with the squares of ex-post values of errror terms in the regression equation.

The ARCH processes have zero mean, they are unrelated in series, and their unconditional variance (if any) is constant whereas their conditional variance changes with time. Bollerslev [32] identifies the ARCH model as the moving average of the squares of the error terms instead of the autoregressive process of the conditional variance and puts forward that the conditional variance may be enlarged by adding lags of the conditional variance to the ARCH method and modelled as the ARMA (Auto Regressive Moving Average) process (Engle, [33]).

The literature survey related with the properties and empirical applications of the ARCH type models designate that these models are developed beyond the initial ARCH model of Engle [32] and the simple property of Bollerslev's [32] GARCH model. For modelling volatility in finance and econometry literature, AutoRegressive Conditional Heteroskedasticity (ARCH) Model initially designed by Engle [33] and Generallized AutoRegressive Conditional Heteroskedasticity (GARCH) Model developed by Bollerslev [32] have been utilized.

When a regression equation with k variables is considered;

$$Y_t = \beta_1 + \beta_2 X_{2t} + \ldots\ldots + \beta_k X_{kt} + \varepsilon_t \quad (6)$$

In Equation (6) with an assumption that conditional information can be obtained in (t-1) time point, the error term; $\varepsilon_t \sim N[0, (\alpha_0 + \alpha_1 + \varepsilon^2_{t-1})]$ distributes normally with zero mean variance. $(\alpha_0 + \alpha_1 + \varepsilon^2_{t-1})$.

The illustration of basic ARCH (1) Model may be shown as the following [34]

$$\sigma^2_t = \alpha_0 + \alpha_1 + \varepsilon^2_{t-1} \qquad (7)$$

By utilizing the conditional variance equation, the standard GARCH(1,1) process may be defined as the following:

$$\sigma^2_t = \omega + \alpha\, \varepsilon^2_{t-1} + \beta\, \sigma^2_{t-1} \qquad (8)$$

Equation (8) indicating the conditional variance, is a function of the mean (ω), the ARCH term (ε^2_{t-1}) and the GARCH term (σ^2_{t-1}). Generally, in the GARCH(p,q) modelling (p) indicates the ARCH term and (q) indicates the GARCH term. In the ARCH(p) process, the conditional variance is only a function of the ex-post sample variances, whereas the GARCH(p,q) process also allows the lagged conditional variances to be included in the modelling.

4.2.1. Pre-Tests for Analysis

Prior to the analyses of time series, the stationary condition of the series should be accomplished. In cases where unstable regressors are used in the regression equation, unrealistic relations may be observed. In general, financial time series show unstable patterns. In other words, the means, variances and covariances of the series change with time. The stationary condition of the time series in this analysis are tested with the Augmented Dickey-Fuller (ADF) (1979) Test. The results are given in the appendix at Table 3 and 4. All series are stable at %1, %5 and %10 significance levels.

In the second stage of the pre-tests, it has been examined whether the series have heteroscedasticity or not with the ARCH-LM Test. The return and volume series should be correctly modelled before the ARCH-LM Test. One lagged values of each series have been added to the equations and AR(1) model has been tried as the mean equation for each model. The mean equations for each series are given below:

$$ise30 = \phi ise30_{t-1} + c \qquad (9)$$

$$volume = \phi volume_{t-1} + c \qquad (10)$$

The results of the AR(1) models for each series are presented in the appendix at Table 5 and 6.

Since the coefficient of ISE-30 Index return series in AR(1) model given at Table 5 is statistically insignificant, AR (2), AR(3), MA(1), MA(2), MA(3) and all other ARMA models up to lag 10 have been tried. The mean equations are statistically insignificant except for AR(6) and Equation (10) has been formed as the mean equation of return series with lag 6. The results of the mean equation with lag 6 are given at Table 7.

$$ise30 = \theta ise30_{t-6} + c \qquad (11)$$

$$volume = \theta volume_{t-1} + c \qquad (12)$$

Table 7. Mean Equation Results of ISE-30 Index Return Series

Dependent variable: IMKB30				
Method: Least squares				
Sample (adjusted): 7 1942				
Variables	Coefficent	Std. Dev.	t-statistics	Prob.
C	0.000535	0.000530	1.009012	0.3131
AR(6)	-0.067619	0.022600	-2.991992	0.0028
R-squared	0.004607	Mean dependent var		0.000537
Adjusted R-squared	0.004093	S.D. dependent var		0.024965
S.E. of regression	0.024914	Akaike info criterion		-4.545739
Sum squared resid	1.200451	Schwarz criterion		-4.539986
Log likelihood	4402.275	Hannan-Quinn criter.		-4.543623
F-statistic	8.952016	Durbin-Watson stat		1.961806
Prob(F-statistic)	0.002897			

Similarly, all AR-MA models up to lag 10 have been examined for the ISE-30 volume series and AR(1) has been accepted as the best fitting mean equation for the modelling of series. The results of the 1 lagged mean equation are given in Table 8 below:

Table 8. Mean Equation Results of ISE-30 Index Volume Series

Dependent Variable: Volume				
Method: Least Squares				
Sample(adjusted): 2 1942				
Variables	Coefficient	Std. Var.	t-statistics	prob.
C	0.000752	0.006783	0.110918	0.9117
AR(1)	-0.26894	0.021876	-12.2938	0.0000
R-squared	0.072309	Mean dependent var		0.000742
Adjusted R-squared	0.071831	S.D. dependent var		0.393593
S.E. of regression	0.379194	Akaike info criterion		0.899491
Sum squared resid	278.8048	Schwarz criterion		0.905232
Log likelihood	-870.956	Hannan-Quinn criter.		0.901602
F-statistic	151.1364	Durbin-Watson stat		2.111428
Prob(F-statistic)	0			

The presence of the ARCH effect in Equations 11 and 12 has been investigated after deciding the mean equations for each series[4].

[4] Two important tests proposed in the literature for testing the presence of the ARCH effect are the ARCH-LM test of Engle (1982) and the Q test of McLeod and Li (1983). As ARCH-LM test is generally preferred in practice, this test in this research has been utilized for testing the presence of the ARCH effect.

In ARCH-LM test;

The rejection of the null hypothesis; H_0: $\beta_1=\beta_2=\ldots\ldots=\beta n=0$ indicates the presence of the ARCH effect [32].

The results of ARCH-LM test are given in Table 9 and 10.

Table 9. ARCH-LM Test Results for ISE-30 Return Series Mean Equation

Heteroscedasticity Test: ARCH

F-statistic	22.66493	Prob. F(1,1934)	0.0000
Obs*R-squared	22.42556	Prob. Chi-Square(1)	0.0000

Table 10. ARCH-LM Test Results for ISE-30 Volume Series Mean Equation

Heteroscedasticity Test: ARCH

F-statistic	25.40199	Prob. F(1,1939)	0.0000
Obs*R-squared	25.09937	Prob. Chi-Square(1)	0.0000

The results from Table 9 and 10 indicate that the null hypothesis H_0 showing the homoscedasticity is rejected. That is, there is an ARCH effect in the residuals of the mean equations for both return and volume series and it should be eliminated.

Consequently, the best fitting ARCH type models have been tried and GARCH (1,1) for the ISE-30 Index return series and ARCH(1) for the trade volume have been determined as the best models according to the AIC (Akaike Information Criteria). The data for these models are given in Table 11 and 12.

Table 11. GARCH (1,1) Results of ISE-30 Index Return Equation

Dependent Variable: ise30
Metot: ML - ARCH (Marquardt) -

Variable	Coef.	Std. Dev.	Z-statistics	Prob.
C	0.001081	0.000437	2.473122	0.0134
AR(6)	-0.059771	0.023409	-2.553312	0.0107
	Variance Equation			
C	9.48E-06	4.04E-06	2.348611	0.0188
RESID(-1)^2	0.082144	0.018015	4.559828	0.0000
GARCH(-1)	0.905091	0.021159	42.77620	0.0000

R-squared	0.004009	Mean dependent var	0.000537
Adjusted R-squared	0.001946	S.D. dependent var	0.024965
S.E. of regression	0.024941	Akaike info criterion	-4.718158
Sum squared resid	1.201173	Schwarz criterion	-4.703776
Log likelihood	4572.176	Hannan-Quinn criter.	-4.712868
F-statistic	1.943082	Durbin-Watson stat	1.960414
Prob(F-statistic)	0.100746		

Table 12. ARCH (1) Results of ISE-30 Index Volume Equation

Dependent Variable: Volume Method: ML - ARCH				
Variable	Coeff.	Std. Dev.	z-statistics	Prob.
C	-0.001202	0.006785	-0.177181	0.8594
AR(1)	-0.264175	0.023866	-11.06917	0.0000
	Variance Equation			
C	0.131587	0.005893	22.32979	0.0000
RESID(-1)^2	0.081818	0.030727	2.662749	0.0078
R-squared	0.072247	Mean dependent var		0.000742
Adjusted R-squared	0.070810	S.D. dependent var		0.393593
S.E. of regression	0.379402	Akaike info criterion		0.892766
Sum squared resid	278.8235	Schwarz criterion		0.904247
Log likelihood	-862.4294	Hannan-Quinn criter.		0.896988
F-statistic	50.28024	Durbin-Watson stat		2.118874
Prob(F-statistic)	0.000000			

For testing whether the ARCH effect has been eliminated or not in these models, the ARCH-LM tests have been run again and no ARCH effect has been observed.

4.2.2. The Impact of ISE-30 Index Futures to the Spot Markets

Up to this point, determining the most appropriate models for the logarithmic return and volume series of the ISE-30 Index has been aimed. Now, the volatility in the spot stock market and change in trade volume are investigated after the introduction of the ISE-30 Index futures contracts since February 2005. Dummy variable series have been formed by assigning a dummy variable of (1) for the period before 1 February 2005 and (0) for the period after. Dummy variables for GARCH(1,1) and ARCH(1) have been injected to the model in variance regressors.

The ARCH type models make it possible to inject explanatory variables to the conditional variance equation. Dummy variables have been added to the standard ARCH(p) and GARCH(p,q) variance equations for testing the structural changes in the unconditional variances. The presentation of the equations is given below:

$$h_{treturn} = \gamma_0 + \sum_{i=1}^{p} \delta_i h_{t-i} + \sum_{j=1}^{q} \gamma_j u_{t-j}^2 + \sum_{k=1}^{m} \mu_k X_k \tag{13}$$

$$h_{tvolume} = \alpha_0 + \sum_{j=1}^{q} \gamma_j \varepsilon_{t-j}^2 + \sum_{k=1}^{m} \mu_k X_k \tag{14}$$

In Equations 13 and 14, X_k is the explanatory variable for the variance. Dummy variable being statistically significant (μ_1 being statistically significant) means that the introduction of index futures trading affects the volatility and the trade volume of the ISE-30 spot market. The sign of the coefficient shows how it affects the volatility and volume of the spot market. μ_1 having a positive sign means that index futures contracts increase the volatility and trade volume in the spot market, whereas a negative sign means a decline in the regressors.

The results of the GARCH(1,1) and ARCH(1) models formed with the dummy variables are given in Table 15 and 16. The coefficient of the dummy variable in the return equation is not statistically significant at 5% level. On the other hand, the coefficient of the dummy in the trade volume equation is positive and highly significant. These results indicate that there is no statistically significant change in the volatility of stock market, while trade volume increases with the introduction of the futures contracts.

Table 13. GARCH (1,1) Model with Explanatory Variable in Variance Equation

GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1) + C(6)*DUMMY				
Variable	Coeff.	Std. Dev.	z-statistics	Prob.
C	0.001083	0.000431	2.509366	0.0121
AR(6)	-0.059465	0.023379	-2.543562	0.0110
	Varyans Denklemi			
C	1.03E-05	4.31E-06	2.379550	0.0173
RESID(-1)^2	0.086296	0.018821	4.585142	0.0000
GARCH(-1)	0.895312	0.022445	39.88988	0.0000
DUMMY	5.27E-06	4.12E-06	1.278929	0.2009
R-squared	0.004001	Mean dependent var		0.000537
Adjusted R-squared	0.001420	S.D. dependent var		0.024965
S.E. of regression	0.024947	Akaike info criterion		-4.718503
Sum squared resid	1.201183	Schwarz criterion		-4.701246
Log likelihood	4573.511	Hannan-Quinn criter.		-4.712156
F-statistic	1.550467	Durbin-Watson stat		1.960394
Prob(F-statistic)	0.170991			

Table 14. ARCH (1) Model with Explanatory Variable in Volume Equation

Dependent Variable: HACIM Method: ML - ARCH (Marquardt) - Normal distribution				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000671	0.006683	-0.100423	0.9200
AR(1)	-0.264463	0.023801	-11.11161	0.0000
	Variance Equation			
C	0.109783	0.006867	15.98676	0.0000
RESID(-1)^2	0.066711	0.029599	2.253837	0.0242
DUMMY	0.047916	0.009783	4.897664	0.0000
R-squared	0.072268	Mean dependent var		0.000742
Adjusted R-squared	0.070352	S.D. dependent var		0.393593
S.E. of regression	0.379496	Akaike info criterion		0.879416
Sum squared resid	278.8171	Schwarz criterion		0.893767
Log likelihood	-848.4736	Hannan-Quinn criter.		0.884694
F-statistic	37.70262	Durbin-Watson stat		2.118460
Prob(F-statistic)	0.000000			

5. Conclusion

The rapid developments in finance and other sectors in thirty years have added new types of risks which countries around the world have to face. This has caused to conduct more complex researches for redefining the risk concept and determining the true level of risk. In recent years, increasing risks and their complexity have resulted in the rapid development of derivatives market for managing those risks. However, diminishing volatility as the indicator of risk and price formation should be the tasks of the derivative markets so that the expected benefits from derivatives markets can be obtained. Thus, the impact of futures contracts to the spot market volatility has a vital importance. An efficient futures market will also make the underlying spot market efficient with volatility decreasing and price determining roles. In general, the distruption effect of speculative transactions is more evident in futures markets as compared to spot markets and thus, the efficiency of futures markets is extremely important. Recently, a vast number of studies have been conducted for investigating the impact of futures markets to the underlying spot market.

Operation of the derivatives products and futures markets efficiently may be a solution for the lack of variety in financial instruments and shallow underlying markets as being the main problems in the Turkish financial sector. In Turkey, derivatives products have been traded for around three years with the construction of the Turkish Derivatives Market and index futures contracts constitute the bulk of the transactions in terms of trade volume.

This research investigates any possible impact of index futures to the spot market volatility and it has been found out that ISE-30 Index futures contracts do not affect the volatility of ISE-30 Index. No empirical findings supporting either of the two viewpoints that futures markets increase or decrease the spot markets' volatility could be obtained in the analysis. The findings that futures markets have no impact to the underlying spot markets have also been observed in some researches in the literature.

The unsufficient level of trade volumes in the Turkish Derivatives Exchange operating recently and the market's inefficiency may explain that index futures have no impact to the price formation and thus, the volatility in the spot stock market. It is inevitable that a futures market which does not possess sufficient depthness will not be capable of having price formation function in the underlying spot market.

Besides, empirical findings show that the index trade volumes increase in the spot stock market with the introduction of index futures. This may be explained with the fact that investors can make a better management and hedging of their risks and therefore, their investment appetite to trade in the underlying spot markets increase.

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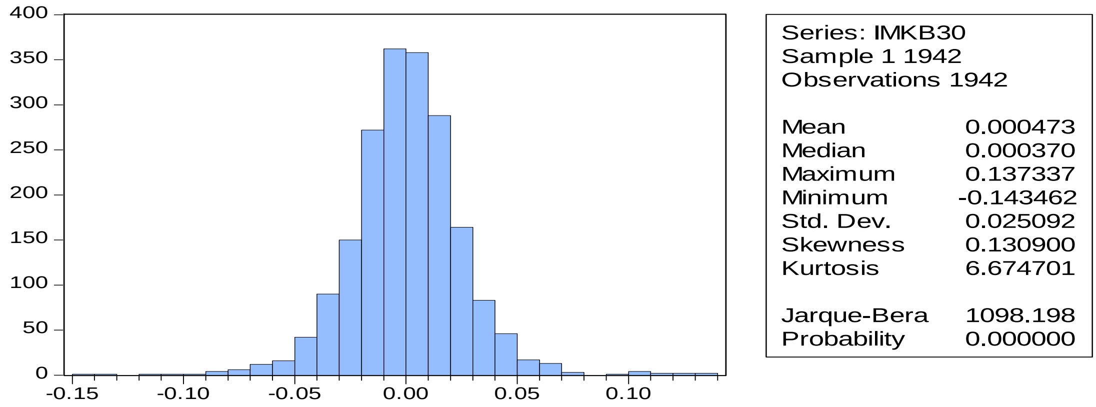
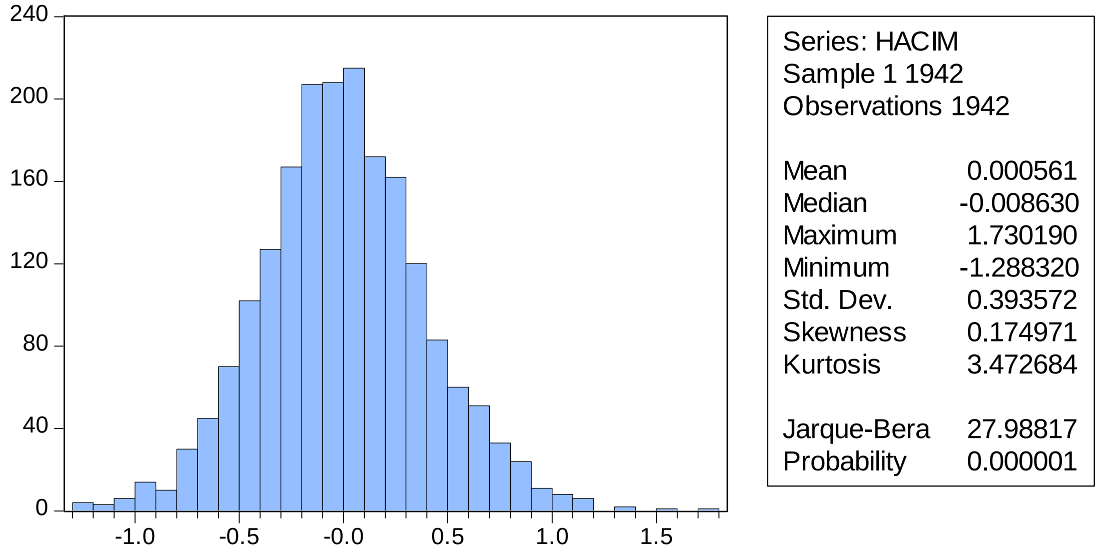
APPENDIX



Graph 1. ISE-30 Index Return Series Distribution Statistics

Table 1. ISE-30 Index Return Series Descriptive Statistics

Date	12 March 2001-5 Dec. 2008	12 March 2001-1 Feb. 2005	1 Feb. 2005-5 Dec. 2008
	Whole Period	ISE-30 Pre Futures	ISE-30 Post Future
Mean	0.000473	0.001094	-0.00015
Median	0.00037	0.001412	-0.00032
Maximum	0.137337	0.137337	0.135407
Minimum	-0.14346	-0.13589	-0.14346
Std. Dev.	0.025092	0.02763	0.022265
Skewness	0.1309	0.175212	-0.00496
Kurtosis	6.674701	5.728614	7.921927
Jarque-Bera	1098.198	306.194	980.122
Probability	0	0	0
Total	0.919475	1.062152	-0.14268
Sum Sq. Dev.	1.222095	0.740493	0.480855
Observation	1942	971	971



Graph 2. ISE-30 Index Volume Series Distribution Statistics

Table 2. ISE-30 Index Volume Series Descriptive Statistics

Date	12 March 2001- 5 Dec. 2008	12 March 2001- 1 Feb. 2005	1 Feb. 2005- 5 Dec. 2008
	Whole Period	ISE-30 Pre Futures	ISE-30 Post Future
Mean	0.000561	0.001174	-0.000052
Median	-0.00863	-0.02334	-0.00207
Maximum	1.73019	1.73019	1.38368
Minimum	-1.28832	-1.28832	-1.23098
Std. Dev.	0.393572	0.426262	0.358131
Skewness	0.174971	0.233973	0.068151
Kurtosis	3.472684	3.243106	3.629754
Jarque-Bera	27.98817	11.25042	16.79702
Probability	0.000001	0.003606	0.000225
Total	1.08947	1.14011	-0.05064
Sum Sq. Dev.	300.6593	176.2482	124.4103
Observation	1942	971	971

Table 3. ADF Test Statistics for ISE-30 Index ReturnSeries at I(0) Level

	none	constant	Constant&Trend
ADF test statistic	-43.3221	-43.3296	-43.3575
Prob.*	0.0001	0.0000	0.0000
1% critical value	-2.56615	-3.43352	-3.96278
5% critical value	-1.94099	-2.86283	-3.41213
10% critical value	-1.61659	-2.5675	-3.12798
* MacKinnon (1996) one-sided p-values.			

Table 4. ADF Test Statistics for ISE-30 Index Volume Series at I(0) Level

	none	constant	Constant&Trend
ADF test statistic	-21.3645	-21.3613	-21.3559
Prob.*	0.0000	0.0000	0.0000
1% critical value	-2.56616	-3.43353	-3.9628
5% critical value	-1.94099	-2.86283	-3.41214
10% critical value	-1.61659	-2.56751	-3.12799
* MacKinnon (1996) one-sided p-values.			

Table 5. AR(1) Mean Equation Results for ISE-30 Return Series

Dependent Variable :ISE -30 Method: Least Squares				
Observation: 1942				
Variable	Coeff.	Std. Dev.	z-statistics	Prob.
C	0.000516	0.000567	0.9086	0.3637
ISE-30(-1)	0.019868	0.02262	0.878324	0.3799

Table 6. AR(1) Mean Equation Results for ISE-30 Volume Series

Dependent Variable :Volume Least Squares Method: Least Squares Sample(adjusted): 2 1942				
Variable	Coeff.	Std. Dev.	z-statistics	Prob.
C	0.000752	0.006783	0.110918	0.9117
Hacim(-1)	-0.26894	0.021876	-12.2938	0.0000