THE IMPACT OF DERIVATIVES ON THE VOLATILITY OF TURKISH STOCK MARKET

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Abstract

The interaction among futures and spot markets has been one of the most important issues of the financial markets since the launch of stock index futures by Kansas City Board of Trade in 1982. The main characteristics of derivatives such as having lower transaction costs, higher leverage, higher liquidity and higher flexibility compared to spot markets make them attractive for investors. Besides, derivatives trading are crucial for financial system participants in order to diversify portfolio and minimise risks. The aim of this paper is to emphasize the importance of derivative securities by providing evidence from an emerging stock market, Turkey. In order to emphasize the need for derivatives in the Turkish market, the impact of introduction of index futures and index options trading on the underlying spot market volatility are empirically analysed. Conditional and unconditional volatility of Borsa Istanbul 30 Index is examined using GARCH model starting from its first trade day of January 2, 1997.

Keywords: *Derivatives Trading, Conditional Volatility, Unconditional Volatility*
JEL Codes: *C58, D53, G10*

TÜREV ARAÇLARIN TÜRKİYE BORSASI OYNAKLIĞI ÜZERİNDEKİ ETKİSİ

Öz

Vadeli işlemler ve spot piyasalar arasındaki etkileşim, 1982'de Kansas Ticaret Borsası tarafından stok endeks vadeli işlemlerin başlatılmasından bu yana finansal piyasaların en önemli konularından biri olmuştur. Türevlerin Spot piyasalara kıyasla daha yüksek likidite ve daha yüksek esneklik, daha düşük işlem maliyetleri, daha yüksek kaldıraç gibi temel özellikleri, yatırımcılar için cazip hale getirir. Ayrıca, portföyün çeşitlendirilmesi ve risklerin en aza indirilmesi amacıyla finansal sistem katılımcıları için türev işlemlerin ticareti çok önemlidir. Bu yazının amacı, gelişmekte olan bir hisse senedi piyasasından Türkiye'den kanıt sağlayarak türev menkul kıymetlerin önemini vurgulamaktır. Türkiye piyasasında türev ürünlere duyulan ihtiyacı vurgulamak için, endeks vadeli işlem ve endeks opsiyonu alım satımının spot piyasa volatilitesine etkisi incelenmektedir. Borsa İstanbul 30 Endeksin koşullu ve koşulsuz volatilitesi, 2 Ocak 1997 tarihinden itibaren ilk ticaret gününden itibaren GARCH modeli kullanılarak incelenmiştir.

Anahtar Kelimeler: *Türev Alım-Satımı, Koşullu Volatilite, Koşulsuz Volatilite*
JEL Kodları: *C58, D53, G10*

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1. Introduction

The derivatives market plays an important role in the globally integrated economy. Derivatives are the instruments whose price is derived from the price of another asset. These underlying assets whose price is derived from can be financial products such as interest rate, stock, index or currency as well as the commodities (Hull, 2012). Derivatives are traded at over-the counter markets and exchange traded markets. Main roles of derivatives are hedging, speculation and arbitrage. Hedging is making investments in order to avoid exposure to adverse movements in the asset price while speculation is the act of taking position in the market to bet the price of an asset either it goes up or down. Lastly, arbitrage is the simultaneous buy and sell of an asset to take the advantage of price differences.

The contributions of derivatives to the financial system are profound. Derivatives trading are crucial for financial system participants such as investors, fund managers and regulators. Trade in derivatives market is very attractive for the investors due to the fact that it enables the control of asset with small amounts of money which gives the benefit of leverage. Another advantage of derivatives is its low transaction costs which make it easier for investors to secure their positions as well as portfolio diversification. By taking long and short positions based on the forecast of asset prices in the future, derivatives trading give the advantage of risk minimisation. It also strengthens the liquidity by attracting both domestic and foreign investors that result in an increase of efficiency of market price mechanism. Since the uncertainties that may arise in the future are priced continuously, derivatives provide the spread of transparent information to market participants. Prices of derivatives are predetermined which makes them as a mean of insurance for investors. In terms of fund managers, risk management is the main point of focus which is one of the most important outcomes of derivatives trading. The more information fund managers have about the interaction between derivatives market and spot market, the better decisions they make regarding the control and minimisation of risks. One of the most important participants of the financial system is regulators. Regulators observe the current situation and decide whether further regulations are needed to decrease lack of transparency especially in the over-the-counter market transactions.

Owing to these advantages, financial markets need derivative securities in order to diminish and eliminate financial risks that arise in the spot markets. After the global financial crisis in 2008, derivative instruments are criticised considering the lack of transparency especially in the transactions at over-the-counter markets. Since the the positive impact and importance of derivatives market in the financial system is sound, ISDA (International Swap and Derivative Association) and other regulatory bodies set new regulations to enable liquidity and more transparency in the derivatives markets after the crisis.

2. Literature Review

The world`s first stock index futures contract was launched by Kansas City Board of Trade in 1982. Since the introduction of index futures, researchers have questioned the interaction and volatility transmission among futures and spot markets. The effect of introduction of futures trading on spot market volatility is still a debatable issue because of the mixed empirical results. The findings of empirical analysis varies among the launch of derivatives stabilise or destabilise the volatility of the spot markets. The main point of this dilemma is the impact of speculators, known as uninformed traders, on the spot markets with the launch of futures trading. The reason behind this dilemma is lower transaction costs in derivatives trading compared to spot trading, which makes it attractive for speculators to trade in futures market.

The main reason of these different results is based on the fact that the impact of derivatives trading on spot market volatility is an empirical issue. Time period, indices and countries selected, methodology and model specification are the main factors of the variety in findings.

Some researchers have found that there is an increase in the spot market volatility following the onset of futures trading. They argue that uninformed traders find futures markets attractive due to leverage opportunities. In addition, derivatives markets are alternative routes for the transmission of information, so, greater and faster transmission of information causes the boost in spot market volatility. For instance, Harris (1989) examines S&P 500 stock return volatilities by cross sectional analysis and finds that there is a rise in volatility after the start of derivatives trading. Antoniou and Holmes (1995) study the response of FTSE 100 Stock Index futures on the spot markets volatility by GARCH methodology. The findings show that there is an upward move in volatility in post-futures period based on the rise in the rate of flow of information to the market which is consistent with Ross (1989) as well as the view that flow of information to the spot market increases by futures trading. Maberly, et al., (1989), Brorsen (1991), Lee and Ohk (1992) find an increase in the spot market volatility after the introduction of derivatives trading in developed markets. The results are based on the fact that futures market attract uninformed traders because of their leverage opportunities. Butterworth (2000) investigates the effect of futures trading in FTSE Mid250 Index using GARCH models and finds a raise in the underlying spot market volatility.

On the contrary, some findings emphasize that volatility of underlying markets reduces after the inception of futures trading. The reason behind this is explained by the increase in the market depth after the onset of futures trading which results in a rise in efficiency. Due to hedging opportunities, derivatives trading decreases the volatility associated with risk in spot markets. For instance, Edwards (1988a, 1988b) finds a decline in stock market volatility of S&P 500 after the onset of futures trading. Bologna and Cavallos (2002) search opening of stock index futures in Italy and find that spot market volatility decreases in post-futures period. Pillar and Rafael (2002) analyse the impact of futures and options trading on Ibex 35 Index of Spanish market. The introduction of derivatives contracts is found to reduce the volatility of the spot market as well as an increase in liquidity and market efficiency.

Several empirical studies neither find a significant posive nor a negative impact of derivatives trading on the volatility of underlying spot market. Darrat and Rahman (1995) analyse S&P 500 Index and find no significant relation between futures trading and the spot market volatility. Kan (1999) studies the effect of index futures on Hong Kong market and reaches that the impact of introduction of index futures was not significant on HIS index volatility.

Papers analysing different countries also provide evidence that the results are mixed. For instance, Becchetti and Caggese (2000) research the impact of introduction of index options trading on six European market by using nine different volatility models. Volatility of German market increases as a consequence of index options trading on contrary to the decrease in the Dutch market. No significant effect is found on Austrian, French, Swiss and the UK market. Gulen and Stewart (2000) analyse whether the introduction of index has an impact on market volatility of twenty five countries. Volatility increases in the United States and Japan whereas volatility diminishes in seven countries and no significant effect is found in seven markets. Yu (2001) searches the impact of futures trading on stock market volatility in the USA, Japan, France, Australia, the UK and Hong Kong. The findings indicate that volatility increases in the USA, Japan, France, Australia wheras do not change in the UK and Hong Kong.

Emerging markets are different from developed markets in terms of transparency, transaction costs, liquidity, regulation and governance. For this reason, it is still unclear how suitable to use the findings of developed and liquid markets to emerging markets. The impact of derivatives trading can either support stabilising hypothesis which means that introduction of derivatives trading reduce spot market volatility or destabilising hypothesis which shows derivatives trading increase spot market volatility. The evidence of this phenomenon is contradictory and controversial regardless of the development level of the markets.

Papers that support stabilising hypothesis are as follows. Alexakis (2007) evaluates the effect of onset of stock index futures on underlying spot market volatility by GJR-GARCH model on Athens

Stock Exchange. The results of the empirical analysis show that introduction of stock index futures stabilises the spot market by decreasing volatility, enhancing speed and quality of the flow of information. Bae, et al. (2004) analyse the impact of launch of futures index on spot market volatility and market efficiency on Korean market. The underlying KOSPI 200 stocks as well as the non-KOSPI 200 stocks are examined from January 1990 to December 1998 and greater market efficiency with greater spot market volatility are found following the onset of futures trading. KOSPI 200 stocks are found to have higher efficiency and lower spot market volatility compared to non-KOSPI 200 stocks. After the start of options trading, difference between efficiency of two groups is disappeared.

Some papers find no significant relationship between the price volatility in spot market and onset of the derivatives trading which leads to neither an increase in underlying index nor a rising impact on underlying index volatility. Debasish (2009) researches the effect of onset of Nifty index futures on the underlying Indian spot price volatility by GARCH models. Six different volatility measures are used for the empirical analysis. The findings of regression illustrate that onset of futures trading does not affect spot price volatility. In addition, no evidence of volatility spillover is found in NSE Nifty index from futures market to the spot market. Spyrou (2005) questions the reaction of futures trading on spot market volatility on Greek market. Closing prices of Athens Stock Exchange from September 1997 to September 2003 are analysed with GARCH models. It is found that spot market volatility is not affected by the start of futures trading. Chiang and Wang (2002) explores the effect of futures trading on spot market volatility on Taiwan Stock Exchange by using daily volatility measure of Garman and Klass. Taiwan Index Futures (TAIEX) and MSCI Taiwan futures are take into account for the empirical analysis. The results provide evidence that trades in TAIEX futures has effect on spot market volatility, whereas MSCI Taiwan futures does not have impact on spot pice volatility. Vipul (2006) finds an insignificant effect of derivatives trading on the volatility in the Indian stock market. Xie and Huang (2014) explores the effect of futures trading on the spot market volatility in China by using various GARCH models on China Securities Index (CSI) 300 from 2005 to 2012 daily data. The results show that inception of index futures does not have a significant impact on the volatility of spot markets, sensitivity to historical information rises after the launch of CSI 300 index futures whereas there is a reduction in sensitivity to new information, leverage is not found both pre and post CSI 300 index futures periods. Bohl, et al. (2011) analyse the effect of index futures trading on spot market volatility on Polish market with Markow-switching GARCH model. In addition to Warsaw Stock Exchange closing prices, S&P 500 closing prices are also used to control the interdependence with the international markets. Based on the results obtained, no influence of futures trading is found on Polish spot market volatility.

Some of the researchers provide evidence that there is an increase in spot market volatility after the introduction of derivatives trading. For instance, Poshakwale and Pok (2004) investigate the effect of futures contracts on spot market volatility at Kuala Lumpur Stock Exchange. The results indicate that presence of futures contracts increase spot market volatility. It is also obtained that underlying stocks react to more current news whereas the non-underlying stocks react higher to the older news. KLSE CI and Second Board Index daily closing prices are examined from 25 October 1993 to 31 July 2001 by GARCH and ARCH process. The results provide evidence that the effect of previous day`s futures trading activity on the conditional volatility is positive but short. Ryoo and Smith (2004) analyse the impact of KOSPI 200 futures on the spot market volatility of the Korean market. The findings demonstrate that futures trading results in an rise in volatility caused by reduction in persistence of information with an increase in speed of information transmission. Zhong, et al. (2004) inspect the volatility transmission and price discovery function of Mexican stock index futures market after the launch of futures trading. EC-EGARCH model is applied to the daily data. Empirical evidence show that futures market of Mexico is an effective method for price discovery however spot market volatility becomes instable after futures trading.

Few researchers have conducted empirical analysis on the effect of introduction of futures trading on emerging markets, especially on Turkey. The main reason of limited studies in Turkish market is its small size, scarce liquidity and ten years of history in derivatives trading. Most of the researchers focus on Istanbul Stock Exchange 30 Index because it has the highest trading volume at derivatives market in Turkey. For 2014, 92 % of the trade volume is made up of index futures, while 7 % of trade is based on currency futures. Remaining 1 % consists of trades in precious metals futures, index options, single stock options, single stock futures and currency options (www.borsaistanbul.com).

The first study about the derivatives market of Turkey is done by Baklaci and Tutek (2006). They investigate the impact of futures trading on Turkish spot market volatility for the first time by using ISE 30 futures. The results show that, although data set covers one year period after the introduction of futures trading, volatility in the spot market decrease as well as the increase in efficiency.

Some papers focus on index futures as well as the currency futures. Kayalidere, et al. (2012) examines the interaction between derivatives and spot markets using Istanbul Stock Exchange 30 Index spot and futures closing prices as well as the TRY/US Dollar spot and futures prices. Vector Autoregressive Regression (VAR) model is used to analyse both short and long term dynamics between markets. Stock index futures and currency futures are chosen for the analysis due to their high trading volume. The results provide evidence that for Euro/Turkish Lira futures there is solid volatility transmission from futures to spot market. For US Dollar/Turkish Lira, futures market is directly impacted by shocks and news from spot and futures markets. For ISE 30 Index, volatility transmission occurs from spot markets to futures market.

Several papers have analysed spot market volatility with the exponential GARCH model (EGARCH) since asymmetric relation with historical data of the conditional volatility is measured with EGARCH model. Kasman and Kasman (2008) analyse the effect of inception of stock index futures on the Istanbul Stock Exchange volatility between July 2002 and October 2007. The outcomes obtained from EGARCH shows that conditional volatility of ISE 30 Index decreases by the introduction of futures trading. The results also show that the direction of causality in both short and long run is from spot prices to futures prices which indicates that news firstly spread in spot markets, then in futures markets. Doganay, et al. (2013) examines the volatility of spot market at pre-futures and post-futures period. EGARCH model is used to analyse the volatility between 1997 and 2012. ISE 30 Index spot price, ISE 30 Index futures prices and S&P 500 volatility index are taken for the empirical analysis. The findings indicate that volatility of spot market decrease in the post-futures period. Besides, unidirectional causality is found from from futures market to spot market on contrary to the findings of Kasman and Kasman (2008).

Caglayan (2011) investigates the impact of futures trading on Istanbul Stock Exchange 30 Index. For the empirical analysis, symmetric volatility is measured by GARCH model. The findings indicate that volatility of spot market has reduced following the onset of stock index futures. Another finding of the study is that either good or bad news has the same effect on volatility before futures trading, whereas bad news raises the volatility higher than good news of the same degree.

3. Dataset and Methodology

Borsa Istanbul 30 Index (XU030) is the underlying asset for the index-futures and index-options traded at Borsa Istanbul Futures and Options Market (VIOP). Borsa Istanbul 30 Index (XU030) is made up of thirty actively traded stocks with large market capitalization. For this reason, in order to analyse the impact of these derivatives on spot market volatility, daily closing price of Borsa Istanbul 30 Index (XU030) from its first trade day of January 2, 1997 to June 30, 2015 are downloaded from Datastream. To further find out the direction among spot and futures prices, futures prices of Borsa Istanbul 30 Index are also downloaded from Datastream. Daily continuously compounded returns for market indices are calculated as follows:

$$R_t = 100 * \log(P_t/P_{t-1}) \qquad (1)$$

where R_t and P_t are daily returns and prices respectively.

Dataset consists of 4584 daily logarithmic returns from January 2, 1997 to June 30, 2015. Borsa Istanbul 30 Index futures started trading in February 4, 2005. Hence, dataset is divided into two sub-sections: pre-index futures period and post-index futures period. Pre-index futures period is between January 2, 1997 and February 3, 2005 with 1986 observations whereas post-index futures period is made up of 2598 observations from February 4, 2005 to June 30, 2015.

Borsa Istanbul 30 Index options launched to Turkish Derivatives Exchange in April 5, 2013. In order to understand the effect of options trading on stock market volatility, dataset is split into two sub-sections: pre-index options period and post-index options period. 4030 observations form pre-index options period from January 2, 1997 to April 4, 2013 while the post-index options period is between April 5, 2013and June 30, 2015 with 554 daily returns.

In the context of the Turkish stock market, the research study analyses the following hypothesis regarding the impact of futures on underlying market volatility.

Null Hypothesis (H_0): The introduction of futures has not reduced the overall volatility of the Borsa Istanbul 30 Index (XU030).

Alternate Hypothesis (H_1): The introduction of futures has reduced the overall volatility of the Borsa Istanbul 30 Index (XU030).

In order to examine the onset of options trading, the following hypothesis is used.

Null Hypothesis (H_0): The introduction of options has not reduced the overall volatility of the Borsa Istanbul 30 Index (XU030).

Alternate Hypothesis (H_1): The introduction of options has reduced the overall volatility of the Borsa Istanbul 30 Index (XU030).

R, F_{pre}, F_{post}, O_{pre}, O_{post}, D_f, D_o variables are used for the empirical analysis.

R= Daily log return of Borsa Istanbul 30 Index (XU030).

F_{pre}= Daily log return of Borsa Istanbul 30 Index (XU030) during the period of pre index futures introduction.

F_{post}=Daily log return of Borsa Istanbul 30 Index (XU030) during the period of post index futures introduction.

O_{pre}=Daily log return of Borsa Istanbul 30 Index (XU030) during the period of pre option futures introduction.

O_{post}=Daily log return of Borsa Istanbul 30 Index (XU030) during the period of pre option futures introduction

4. Results

Table 1 indicates the descriptive statistics of Borsa Istanbul 30 Index (XU030) daily continuously compounded returns for the entire period from January 2, 1997 to June 30, 2015. The overall period is divided into pre-index futures period, post-index futures period, pre-index options period and post-index options period by splitting the entire period into two for each derivative instrument.

According to Table 1, average daily returns of Borsa Istanbul 30 Index decrease by the introduction of index futures from 0.078 % at pre-index futures period to 0.018 % at post-index futures period. In accordance with the decline in return, the standard deviation also dropped from 1.468 % at pre-index futures period to 0.820 % at post-index futures period. The impact of index options trading is same with the introduction of futures trading. Average return and standard deviation is higher in pre-index options period than the post-index options period. However, it is impossible to say that the decrease in risk is exactly a consequence of derivatives trading. It might be a result of exogenous variables such as macroeconomic factors and systematic risks.

Overall return, pre-index futures return and pre-index options returns are positively skewed which indicates that return distributions have a long right tail. On the contrary, returns of post-index futures period and post-index options periods are negatively skewed. Moreover, large value of kurtosis shows that returns are leptokurtic or fat-tailed. Jarque-Bera statistics also show that returns are non-normal for all sub-periods and overall.

GARCH analysis is conducted with four different models considering the introduction of both index-futures trading and index-options trading on Borsa Istanbul 30 Index (XU030) volatility. First two models research the impact of onset of futures trading. Model 3 and 4 analyse the effect of launch of index options on underlying spot market volatility.

Table 1: **Descriptive Statistics of Borsa Istanbul 30 Index (XU030) Results**

Descriptive Statistics	***Entire Period Returns***	***Pre-index Futures Returns***	***Post-index Futures Returns***	***Pre-index Options Returns***	***Post-index Options Returns***
Mean (%)	0.044	0.078	0.018	0.050	-0.001
Median (%)	0.040	0.055	0.033	0.042	0.019
Minimum (%)	-8.715	-8.715	-4.735	-8.715	-4.735
Maximum (%)	7.664	7.664	5.527	7.664	3.001
Standard Deviation (%)	1.147	1.468	0.820	1.191	0.744
Kurtosis	8.466	6.471	6.298	8.116	6.937
Skewness	0.047	0.033	-0.129	0.054	-0.489
Jarque-Bera	5708.515	997.073	1184.363	4397.579	379.968
Number of observations	4584	1986	2598	4030	554

4.1. Model 1: Conditional Volatility of Borsa Istanbul 30 Index (XU030) Returns at Pre-Index Futures Period

Model 1 examines the conditional volatility of Borsa Istanbul 30 Index (XU030) for pre-index futures period from January 02, 1997 to February 03, 2005. In order to compare the impact of index futures trading, Borsa Istanbul 30 Index (XU030) returns are divided into pre-index futures period and post-index futures period. Empirical analysis results are found at Table 2. Equation 2.1 and 2.2 show the conditional mean and conditional variance of underlying spot market respectively during the pre onset of index futures.

Conditional Mean Equation: $F_{pre;\,t} = \alpha_0 + \beta_0 F_{pre;\,t-1} + u_t$ (2)

Conditional Variance Equation: $\sigma_t^2 = \alpha_1 + \beta_1 u_{t-1}^2 + \beta_2 \sigma_{t-1}^2$ (3)

4.2. Model 2: Conditional Volatility of Borsa Istanbul 30 Index (XU030) Returns at Post- Index Futures Period

Model 2 analyses the conditional volatility of Borsa Istanbul 30 Index (XU030) for post-index futures period between February 04, 2005 and June 30, 2015. Equation 3.1 and 3.2 illustrate the conditional mean and conditional variance of spot market respectively at pre-index futures period.

Conditional Mean Equation: $F_{post;\,t} = \alpha_0 + \beta_0 F_{post;\,t-1} + u_t$ (4)

Conditional Variance Equation: $\sigma_t^2 = \alpha_1 + \beta_1 u_{t-1}^2 + \beta_2 \sigma_{t-1}^2$ (5)

Table 2: **Comparison of Model 1 and Model 2 GARCH (1, 1) Results**

Pre-Index Futures				Post-Index Futures			
Variable	**Coefficient**	**z-Statistic**	**Prob.**	**Variable**	**Coefficient**	**z-Statistic**	**Prob.**
	Mean Equation				**Mean Equation**		
α_0	0.003	0.099	0.921	α_0	0.013	0.828	0.407
β_0	-0.506	-23.227	0.000	β_0	-0.502	-26.846	0.000
	Variance Equation				**Variance Equation**		
α_1	0.072	4.773	0.000	α_1	0.032	5.179	0.000
β_1	0.133	12.256	0.000	β_1	0.117	9.729	0.000
β_2	0.855	84.684	0.000	β_2	0.853	63.462	0.000

According to Table 2, the coefficients of β_1 and β_2, which are proxies the for new and old news respectively, are statistically significant at 5 % significance level during pre-index futures period with a value of 0.133 and 0.855 respectively. Significance of these proxies shows the existence of current and old news in the spot market volatility. These values are also statistically significant with the coefficients of 0.117 and 0.853 in the post-futures period. In both of the periods, coefficients of β_1 and β_2 indicate the positive impact of new and old news on spot market volatility. Lower value in the lagged error-term, β_1, in the post-index futures period indicates that information is being impounded in prices less quickly following the introduction of futures trading. This illustrates that recent news have a lower impact on market volatility. The coefficient of the lagged variance term β_2, is a proxy of old news. A reduction in the β_2 shows that old news has less effect on current price volatility. From Table 2, it is seen that old news coefficient is slightly lower in the post-index futures period. Borsa Istanbul 30 Index (XU030) returns are more affected by the old news than the recent news regarding the coefficient of β_2 is higher than coefficient of β_1. The results above show that volatility of logarithmic returns is quite less after the introduction of index futures since the sum of β_1 and β_2 equals to 0.988 in pre-index futures period whereas it equals to 0.97 in post-futures period. Comparing the conditional volatility of entire period which is 0.998 with both of the sub-periods, it is certain that old and recent news have less effect on volatility since the sum of β_1 and β_2 is lower in post-index futures period. The sum of β_1 and β_2 is significantly less than one in both periods implementing that the volatility process returns to its means even if takes a long time. The unconditional volatility measured (α_1 /1- β_1- β_2) for pre-index futures period equals to 6 % of market volatility while unconditional volatility at post-index futures period equals to 1.06 % of the market volatility. This confirms that spot market is less volatile in the post-index futures period due to the reduction in the effect of recent and old news on volatility as well as decreased level of information flow to the market. The decline in the spot market volatility is a proxy for increase in efficiency of the underlying stock market. The reduced level of conditional and unconditional volatility after the introduction of futures trading provides evidence of need for derivative securities in the Turkish investment market.

4.3. Model 3: Conditional Volatility of Borsa Istanbul 30 Index (XU030) Returns at Pre-Index Options Period

Model 3 examines the conditional volatility of Borsa Istanbul 30 Index (XU030) for pre-index options period from January 02, 1997 to April 04, 2013. So as to compare the effect of index-options trading on spot market volatility, entire period is divided into two sub-periods: pre-index options period and post-index options period. Conditional mean and conditional variance equations are presented below.

Conditional Mean Equation: $O_{pre;\,t} = \alpha_0 + \beta_0\, O_{pre;\,t-1} + u_t$ (6)

Conditional Variance Equation: $\sigma_t^2 = \alpha_1 + \beta_1\, u_{t-1}^2 + \beta_2\, \sigma_{t-1}^2$ (7)

4.4. Model 4: Conditional Volatility of Borsa Istanbul 30 Index (XU030) Returns at Post-Index Options Period

Model 4 examines the conditional volatility of Borsa Istanbul 30 Index (XU030) for post-index options period from April 05, 2013 to June 30, 2015. Equation 6.1 and 6.2 show the conditional mean and conditional variance for the post-index options period.

Conditional Mean Equation: $O_{post;\,t} = \alpha_0 + \beta_0\, O_{post;\,t-1} + u_t$ (8)

Conditional Variance Equation: $\sigma_t^2 = \alpha_1 + \beta_1\, u_{t-1}^2 + \beta_2\, \sigma_{t-1}^2$ (9)

Table 3**: Comparison of Model 3 and Model 4 GARCH (1,1) Results**

Pre-Index Options				**Post-Index Options**			
Variable	**Coefficient**	**z-Statistic**	**Prob.**	**Variable**	**Coefficient**	**z-Statistic**	**Prob.**
	Mean Equation				**Mean Equation**		
α_0	0.013	0.912	0.362	α_0	-0.016	-0.483	0.629
β_0	-0.501	-33.805	0.000	β_0	-0.528	-13.074	0.000
	Variance Equation				**Variance Equation**		
α_1	0.017	4.649	0.000	α_1	0.052	2.101	0.036
β_1	0.118	17.256	0.000	β_1	0.136	3.372	0.001
β_2	0.881	142.488	0.000	β_2	0.803	13.881	0.000

Table 3 demonstrates that the coefficients of β_1 and β_2, which are proxies for new and old news respectively, are statistically significant at 5 % significance level during pre-index options period with a value of 0.118 and 0.881. Significance of these proxies shows the persistence of current and old news in the spot market volatility for the underlying asset. The coefficients of β_1 and β_2 are also statistically significant with the coefficients of 0.136 and 0.803 after the introduction of options trading. Regarding both of the periods, coefficients of β_1 and β_2 show the positive impact of new and old news on spot market volatility depending on the positive sign of the coefficients. Higher the value in the lagged error-term, β_1, in the post-index options period presents that information is being impounded in prices more quickly which means that news are reflected in prices more rapidly following the introduction of options trading. Increase in β_1 shows that recent news has a higher impact on market volatility. The coefficient of the lagged variance term β_2, known as GARCH coefficient is an indicator of old news. A decrease in the β_2 shows that the effect of old news on current price volatility is less than the pre-index options period. According to Table 3, it appears that old news coefficient, β_2, is lower in the post-index options period. Borsa Istanbul 30 Index (XU030) returns are more affected by the old news than the recent news comparing the coefficients of β_2 and β_1. The outcomes of the empirical analysis above show that volatility of logarithmic returns is lower after the onset of index options considering the sum of β_1 and β_2 equals to 0.999 in pre-index options period whereas it equals to 0.939 in post-index options period. The sum of β_1 and β_2 is significantly less than one in both periods showing that the volatility process returns to its means although it takes a long time. The unconditional variance measured (α_1 /1- β_1- β_2) for pre-index options period is 17 % of market volatility while unconditional volatility at post-index options period equals to 0.85 % of the market volatility. This proves that spot market is less volatile in the post-index options period due to the decrease in the effect of old news on volatility. In addition, a decrease in unconditional variance is an indicator that less information is being transmitted to the market following the introduction of options trading. The reduction in conditional and unconditional volatility at post-options period provides evidence of need for derivative securities in the emerging Turkish market.

5. Conclusion

The interaction and volatility transmission among derivatives markets and the underlying spot markets are analysed by examining the impact of introduction of derivatives trading on spot market volatility. Findings of the empirical analysis regardless of the development level of the markets can be grouped into three. First group of papers provide evidence that spot market volatility increases after the onset of derivatives trading, which supports destabilising hypothesis. These papers suggest that speculators, known as uninformed traders, find futures markets advantageous due to leverage opportunities. Besides, derivatives platforms are attractive markets for information transmission with lower transaction costs that allow investors hedge the risk that might arise in the future. Second group of researchers support the stabilising hypothesis, which is defined as the reduction of underling spot market volatility after the introduction of derivatives trading. In the post-derivatives period, higher efficiency as a result of increase in quality and speed of information is found. Third group of findings neither support a significant positive impact of derivatives on spot market volatility nor a reduction in the market volatility.

This study provides empirical evidence to the argument whether the introduction of futures and options stabilise or destabilise the volatility of emerging Turkish market. GARCH model is applied to dataset to compare the conditional volatility before and after derivatives trading for both futures and options. The findings of the GARCH analysis support the stabilising hypothesis which is defined as the decline in the spot market volatility after the introduction of derivative securities. The results of this paper are in line with Baklaci and Tutek (2006), Kasman and Kasman (2008), Caglayan (2011), which are the previous papers analysed the impact of introduction of futures trading. Besides, this is the first paper that examines the impact of index options on spot market volatility as well as the index options.

The reduced level of conditional and unconditional volatility after the introduction of futures and options trading provides evidence of impact of derivatives in the Turkish investment markets. The reduction in unconditional volatility shows that spot market is less volatile after derivatives trading due to the decreased level of information flow to the market. In addition to futures and options trading, trade of other derivative securities might also decrease volatility of the spot market. As a conclusion, the effect of both futures and options trading increase market efficiency of Turkish market by decreasing the spot market volatility.

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