VOLATILITY TRANSMISSION, ASYMMETRIC LINKAGES, AND SPILLOVER INDEX BETWEEN SINGLE STOCK FUTURES AND UNDERLYING STOCK OF COMMERCIAL BANKS OF PAKISTAN

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Abstract
In financial system derivatives have their important role which can be categorize in three forms like speculation, hedging, and arbitrage. Prices of derivatives are determined for future which provide investors some kind of assurance. In stock market two types of future instruments exist which are index futures and single stock futures. Single Stock Futures (SSF) have several advantages over spot market in terms of transaction cost, volume of futures, and leverage facility. PSX offer only one active product of derivatives which is Deliverable Futures Contract (DFC). DFC were initially introduced in 2005 with strict criteria later on in 2007 trading in DFC were banned which was later on resumed in 2009. Since then trading was continued in DFC. In 2022 stocks of 93 companies were listed in DFC. Objective of this study was to determine volatility transmission between single stock futures and underlying stock of commercial banks listed in Pakistan Stock Exchange. For this purpose BEKK-GARCH and Diebold and Yilmaz (2012) methodology were applied. Results of BEKK-GARCH had shown that in most of banks either no volatility transmission exist or it was exist with flow from stock futures to underlying stock. In one bank (Askari Bank) direction of transmission was from underlying stock to stock futures and in two banks Bank Al Habib and Habib Bank bi directional volatility transmission was found. Spillover index has shown that magnitude of spillover of underlying stock to stock future was more as compared to stock futures to underlying stock. Findings of the study helpful for traders in pulling out their hedging and arbitrage stratigies

Key Words: *Deliverable Futures Contract, BEKK-GARCH, Spillover Index, Single Stock Futures, Volatility Spillover, Asymmetric Linkages*

INTRODUCTION

In financial system derivatives have their important role which can be categorize in three forms like speculation, hedging, and arbitrage. Hedging keep investment safe from adverse price fluctuations of an asset or security. Speculation is all about estimation of market participant for future prices of an asset and adopting appropriate position, long or short, according to his estimation. Arbitrage is a simultaneous prices of buying an asset from one market and sells in another market because of different prices of an asset in different markets. As prices of derivatives are determined for future which provide investors some kind of assurance(Cimen, 2018).

In financial crises of 2007-2009 many countries like USA and UK banned short selling of stocks to cure the effect of crises. In that particular situation single stock futures found to be an effective alternative of short selling and put options lead to improve market quality of underlying stock (Jiang et al., 2020). Single Stock Futures (SSF) have several advantages over spot market in terms of transaction cost, volume of futures, and leverage facility. For this reason in many countries share of futures in total trade of a market is increasing like in India share of futures contracts are 30% and of options contract was 46% which depicts that derivative products process information more quickly and thus create information asymmetry in the market (Dungore et al., 2022). Despite of all this most stock futures found to have very small percentage share in discovering price of spot market(Curran et al., 2020; Woo & Kim, 2021).

Relationship between spot and future is not same in different regions. In emerging economies like Hong-Kong, China, Russia, and Brazil for of transmission was from futures to spot. Among

developed countries results are not same for US futures have impact on spot market, in Germany volatility transmission is exist from both sides and in France spot market was found to have significant volatility transmission to its underlying spot market(Aloui et al., 2018; Rastogi & Athaley, 2019a).Another advantage that SSF has over on spot market is information and price discovery process as in case of India futures were found to have 55% contribution towards price discovery and this percentage get increase to 61% for bad news(Aggarwal & Thomas, 2018).

Spillover index methodology was introduced by Diebold and Yilmaz (2009) to capture variation in one series due to variation of other series using Vector Auto Regressive approach. One of the limitation of that approach was sensitivity of analysis to ordering of variables which was later on removed. Diebold and Yilmaz (2012) made update to their previous methodology in which they removed the requirement of sequence of variables. By doing this methodology became enable to determine directional spillover of all variables of interest.

In Pakistan two derivative markets exist financial and commodity. Financial derivatives are offer from the platform of Pakistan Stock Exchange and commodity derivatives are offer from Pakistan Mercantile Exchange (PMEX). PSX offer only one active product of derivatives which is Deliverable Futures Contract (DFC). DFC were initially introduced in 2005 with strict criteria later on in 2007 trading in DFC were banned which was later on resumed in 2009. Since then trading was continued in DFC. In 2022 stocks of 93 companies were listed in DFC (PSX, 2022). Two factors are considered to allow trading in futures of a particular company which are average trading volume and free float market capitalization. Sixty percent weightage is of trading volume and forty percent weightage is for free float market capitalization. Minimum average daily trading volume of any company should be greater than 0.1% percent of total trading volume. Free float shares of the company should be more than 25% of shares issued or total number of free float shares should be at least 40 million shares. Any company to be listed in futures contract must be registered on PSX at least for six months and trading days of stock of any company should be 90 percent of days of review period (PSX, 2021a). Standard size of one DFC is 500 shares and period of each contract is 90 days. Contract is initiated on first trading day following the last Friday of calendar month and expiry of the contract is held on last Friday of month in which contract going to be expired(PSX, 2021b)[13](PSX, 2021b).

Pakistan stock exchange market always use to face ups and down in prices which make market renowned for high level of volatility. In recent report by World Bank volatility was reported at level of 17.28% in 2021(Economics, 2021). In the year of 2022 same problem was persisted and market had experienced high amount of fluctuations (Finance, 2022). This situation pose problem for investors as it leads to both abnormal losses and profits. This situation require fund managers and individual investors to device hedging strategies to protect their investment from fluctuation of the market (Ali & Shah, 2019).

In market like Pakistan where high level of volatility is a regular feature role of future is important for investors to device hedging strategy or speculative activities. Whatever intention investor has direction of volatility transmission between stock futures and its underlying stock is important factor. Direction of volatility transmission enable investors to implement effective risk management stratigies (Ali & Shah, 2019; Sifat et al., 2021). For this purpose investors are more interested in knowing relationship of individual stock with its futures. Relationship between these two instruments also 0contribute towards overall stability of the market(Kara et al., 2022; Roy & Chakraborty, 2020)

OBJECTIVES OF THE STUDY

1. To determine volatility transmission between deliverable stock futures and underlying stock.
2. To determine asymmetric linkages between deliverable stock futures and underlying stock.
3. To determine directional spillover index between deliverable stock futures and underlying stock.

Literature Review

In the literature most studies have been done on index futures as compared to single stock futures. Whereas single stock futures provide more precise information of behavior of market(Curran et al., 2020). In Vietnam where VN 30 stock index future was introduced in 2018 and found to be source of stability in spot market and contribute significantly to variation in spot market. However, role of index futures reduced in discovery of price when spot index follows upward trend (Nhung et al., 2019). In Germany liquidity related measure of DAX futures also have significant impact on changes in underlying equity index (Sorokina & Booth, 2022). For US market is was observed that both spot and futures market variations cause each other. However, nature of relationship was different at different scales like a higher scale it was found that sign of volatility transmission is negative and flow of transmission was from spot to futures(Siddiqui & Roy, 2020)

Mostly it is believed that introduction of futures bring instability in the market but Liu and Zhong (2018) found that futures reduces the chances of crash in spot market. Reason for this was mainly due to the participation of institutional investors in futures. However, involvement of shareholders with large holding and state ownership reverse the impact of futures on spot price crash. Qiao et al. (2019) found that liquidity of index has significant negative impact on volatility of futures both in pre and post crises period whereas liquidity of futures have positive impact on index volatility although the impact was not strong. Hou and Li (2020) also found that direction of volatility transmission was from futures to spot but during the period of crises it was found that relation was turned from unidirectional to bidirectional. Some studies revealed that predictive power of futures in China was more as compared to spot and futures were less risky and more efficient then spot index (Bamrungsap, 2018; Huo & Ahmed, 2018). In another study it was found that future index had bi direction relationship with its underlying index but impact of futures to spot index was negative in nature and positive when volatility flow from spot to futures(Siddiqui & Roy, 2020)

Wang et al. (2019) found for CSI 300 stock index that leverage effect exist in market where bad news has more effect on market as compared to positive news. However, study found that this leverage effect is not as stronger in terms of magnitude.

In market of India stock futures and spot market have bidirectional volatility spillover whereas spot found to have strong impact on futures (K. A. Ganai, 2019; Rastogi & Agarwal, 2020; Rastogi & Athaley, 2019b). Siddiqui and Roy (2020) also found bi direction relationship for futures and spot in Indian market but nature and direction of transmission was varied at different time scale. Like at high time scale transmission is bi directional but signs were different. Past volatility of spot market had negative impact on volatility of futures and volatility transmission of futures to spot market exist with positive sign. In the same study it was found that on lower scale direction of volatility was one sided and that was from future to spot.

Most studies on Pakistan stock futures market has been done to test stabilize and destabilize hypothesis and results was not conclusive. Shah and Khan (2019) used data of 18 companies whose futures are listed and confirm that introduction of futures have brought stability in prices of underlying stock. Ali and Shah (2019)found for Pakistan market that relationship between spot and future prices is not bidirectional. Spot prices found to be more capable of predicting prices of futures.

Theoretical Framework

Theoretically two point of view exist that explain relationship between stock futures and underlying stock. One point of view which is named as stabilize hypothesis describes that introduction of stock futures reduces volatility of spot market. The argument build by this hypothesis is that speculators use futures platform for their speculative activities rather than spot market and result in smooth functionality of spot market (Anthony, 1988; Cox, 1976; Tomek, 1980).

Second opinion which is named as destabilize hypothesis which take other view of introduction of futures and explain that futures increase volatility of underlying stock because of leverage effect and low transaction cost uninformed investors participation get increased and result in increase in volatility of underlying stock (Danthine, 1978; Stein, 1987).

Both these point of views explain that flow of volatility transmission is from futures to underlying stock. However, later studies have proved that direction of relationship can be from underlying stock

to futures (Jain et al., 2020; Roy & Chakraborty, 2020). Similarly in some studies bi direction relationship were also found between stock futures and underlying stock (D. K. A. Ganai, 2019; Rastogi & Athaley, 2019a; Siddiqui & Roy, 2020)

RESEARCH METHODOLOGY

The nature of this study is time series and daily data of different companies were obtained from official website of Pakistan Stock Exchange. Selecting frequency of data has effect on findings of any study. Selecting low frequency data may result in loss of information which can be captured only through high frequency data. However, high frequency data contain too much micro information which pose problem of noise in the data (Wang et al., 2019). In this study we have taken daily data of 13 commercial banks whose stock futures were listed on October, 2022. Daily prices of spot market and futures of each company have been taken. Data of futures are available from 2013. However, number of observations of stock futures are different for each company. reason for this trading of futures of any company is started when it meet eligibility criteria.

BEKK GARCH

The purpose of this study is to investigate volatility transmission between spot price and single stock futures prices of all companies whose stock futures are listed on Pakistan Stock Exchange (PSX). To measure volatility transmission full BEKK-GARCH was developed by Engle and Kroner (1995). The model was capable of calculating variations occur due to time and also make sure that covariance matrix has property of positive definite. Equation of bivariate BEKK GARCH term is given below

$$H_t = CC' + A'^{\varepsilon_{t-1}\varepsilon'_{t-1}}A + B'^{H_{t-1}} \qquad (1)$$

Later on this model got extension of asymmetric term to capture the effect of bad and good news (Grier et al., 2004; Kroner & Ng, 1998). Equation of full BEKK-GARCH with asymmetric term is given below

$$H_t = C\acute{C} + \acute{A}\varepsilon_{t-1}\acute{\varepsilon}_{t-1}A + \acute{B}H_{t-1}B + \acute{D}\varepsilon_{t-1}\acute{\varepsilon}_{t-1}D \qquad (2)$$

In equation (2) H is matrix of time-varying variance and co variance matrix. Error term in the equation is matrix of residual term derived from mean equation. Matrices A, B,C, and D are mean coefficient parameters. All these matrices are 2 x 2 where diagonal elements capturing the effect within the market whereas off-diagonal elements measuring the effect across the market. In matrix A off diagonal elements show the effect of shocks in one market to variance of another market. In matrix B off-diaonal elements describing impact of variance in one market on variance of another market. Matrix D in equation (2) containing parameters of asymmetric term. Significance of off-diagonal elements in matrix D confirming the existence of leverage between relationship of stocks and futures. Which mean that bad news in one market have more impact on variance of other market as compared to good news. In matrix D diagonal elements show impact of bad news within the market. In this study volatility transmission between stock futures (DFC) and underlying stock of individual companies is determined while also capturing asymmetric effect within and across the market using equation (2). Variance equation of individual stock (s) and stock futures (f) are given below

$$\sigma_f^2 = C(1,1)^2 + A(1,1)^2\varepsilon_{1,t-1}^2 + 2A(1,1)A(2,1)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + A(2,1)^2\varepsilon_{2,t-1}^2 + B(1,1)^2\sigma_{1,t-1}^2 + 2B(1,1)(2,1)\sigma_{12,t-1} + B(2,1)^2\sigma_{2,t-1}^2 + D(1,1)^2\varepsilon_{1,t-1}^2 + 2D(1,1)(2,1)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + D(2,1)^2\varepsilon_{2,t-1}^2 \qquad (3)$$

$$\sigma_s^2 = C(2,1)^2 + C(2,2)^2 + A(1,2)^2\varepsilon_{1,t-1}^2 + 2A(1,2)A(2,2)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + A(2,2)^2\varepsilon_{2,t-1}^2 + B(1,2)^2\sigma_{1,t-1}^2 + 2B(1,2)(2,2)\sigma_{12,t-1} + B(2,2)^2\sigma_{2,t-1}^2 + D(1,2)^2\varepsilon_{1,t-1}^2 + 2D(1,2)(2,2)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + D(2,2)^2\varepsilon_{2,t-1}^2 \qquad (4)$$

Equation (3) and (4) are variance equation of individual stock future and underlying stock respectively. In both variance equations squared co efficient means that these parameters always have positive impact on variance of next period. In equation (3) positive value of coefficient B(1,1)B(2,1) means that increase in covariance of underlying stock and futures result in increase of variance of futures in next period. Similarly in equation (4) positive value of coefficient B(1,2)B(2,2)

means that positive change in covariance of stock and futures leads to increase in variance of underlying stock in next period. For interpretation of both these coefficient it is assumed that covariance of stock and futures is positive. Coefficient D(1,1)D(2,1) in equation (3) and D(1,2)D(2,2) measures the impact of bad news or negative shocks in futures and underlying stock series on their respective variances. Positive values of these coefficient depicts if bad news or negative shocks occur in both time series will result in increase in variance of respective time series. Covariance equation of futures and stock is given below

$$\sigma_{fs,t} = C(1,1)C(2,1) + A(1,1)A(1,2)\epsilon_{1,t-1}^2 + \big(A(1,2)A(2,1) + A(1,1)A(2,2)\big)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + A(2,1)A(2,2)\varepsilon_{2,t-1}^2 + B(1,1)B(1,2)\sigma_{1,t-1}^2 + (B(1,2)B(2,1) + B(1,1)B(2,2)\sigma_{12,t-1} + B(2,1)B(2,2)\sigma_{2,t-1}^2 + D(1,1)D(1,2)\varepsilon_{1,t-1}^2 + \big(D(1,2)D(2,1) + D(1,1)D(2,2)\big)\varepsilon_{1,t-1}\varepsilon_{2,t-1} + D(2,1)D(2,2)\varepsilon_{2,t-1}^2 \quad (5)$$

In equation (5) coefficient A(1,1)A(1,2) and A(2,1)A(2,2) measure the impact of shocks in one series on covariance of two series in next period. Like in our case value of A(1,1)A(1,2) describe the effect of socks in return of futures on covariance of futures and stock. Similarly coefficient A(2,1)A(2,2) shows impact of shocks in individual stocks on covariance of futures and stock. Terms B(1,1)B(1,2) and B(2,1)B(2,2) describe the impact of variance of each series on covariance of two series. Like B(1,1)B(1,2) shows impact of variance of futures on covariance of futures and stock and coefficient B(2,1)B(2,2) reveals impact of variance of stocks on covariance of futures and stock. With regard to asymmetric term coefficient D(1,1)D(1,2) shows the impact of negative shocks or bad news in futures on covariance of futures and stock whereas coefficient D(2,1)D(2,2) describe impact of negative shocks in stocks on covariance of both time series.

Spillover Index

Spillover index methodology was used to measure connectedness between each stock futures and underlying stock that helped us to further explain results obtained from BEKK-GARCH. By using this approach directional and total spillover index was calculated. Equation for measuring spillover from futures to underlying stock is given below

$$S^g_{f\rightarrow s(H)} = \frac{\sum_{s=1, s\neq f}^{n}(H)\theta_{fs}^g}{N} \quad (6)$$

Equation of spillover from underlying stock to futures is as follows

$$S^g_{f\leftarrow s(H)} = \frac{\sum_{s=1, s\neq f}^{n}(H)\theta_{sf}^g}{N} \quad (7)$$

Equation for total spillover between two instruments is given below

$$\theta_{fs}^{\sim g} = \frac{\sum_{f,s=1}^{N}{}_{f\neq s}\ \theta_{fs}^{\sim g}(H)}{N} \quad (8)$$

Results and Discussion

In Table 1, 2, and 3 results obtained from BEKK-GARCH for 13 commercial banks are given below

Table 1

Commercial Banks

	Bank Alfalah Ltd.		Bank Al Habib Ltd.		Bank of Punjab		Faysal Bank Ltd.		AskariBank Ltd.	
coef	Value	Tvalue	Value	Tvalue	Value	Tvalue	Value	Tvalue	Value	Tvalue
C11	0.01354	26.88119	0.00414	9.714166	0.006408	1.513178	0.008189	9.496045	0.005285	13.692
C12	0	0	0	0	0	0	0	0	0	0
C21	0.016119	1.551095	0.003415	8.04204	0.013079	3.58349	0.079692	130267 51	0.00440	16.6934

C22	0.012051	50.69569	0.002921	16.57914	9.09E-05	0.000174	0.001765	2.20554	0.00220	10.4010
A11	0.273487	24.77193	0.461425	17.05117	0.457931	5.00201	0.323739	4.190761	0.34552	19.8947
A12	-0.03269	-8.56453	-0.02183	-0.89367	-0.02547	-0.40815	-0.00914	-0.13929	-0.00230	-0.18833
A21	0.032263	1.912222	0.27123	10.3124	0.16296	1.38543	0.028655	0.350733	0.03132	-1.5873
A22	0.26819	21.68997	0.172759	7.061456	0.396362	4.642242	0.260822	3.869959	0.26867	20.4564
B11	-0.039044	-0.124654	-1E-05	-0.001682	-0.414385	-1.53802	-2.78E-06	-1.36E-05	-0.000107	-0.00009510
B12	-0.00264	-0.01164	-0.092106	-4.923495	-0.362637	-1.605207	-0.188906	-1.005991	-0.009753	-0.22977
B21	0.042388	0.126222	0.025458	4.543304	0.17535	0.672365	0.028195	1.391783	0.19739	1.8654
B22	0.179341	1.031945	0.230272	7.868849	0.171505	0.732053	0.426593	2.238612	0.23523	4.6565
G11	0.915158	46.31063	0.860923	86.33936	0.626766	10.92877	0.906017	8.43115	0.91217	159.3957
G12	-0.018237	-2.943661	-0.04239	-6.07388	-0.15461	-2.74071	-0.05321	-4.63988	-0.03812	-12.2763
G21	0.00916	0.86743	0.068692	5.337416	0.33792	3.619368	0.022702	0.954696	0.010435	-1.0589
G22	0.905629	358.2317	0.941845	93.45622	0.949301	12.28171	0.927366	47.94995	0.92483	151.1962

Table 2

Commercial Banks (Continued)

	Habib Bank Ltd.		MCB Bank Ltd.		Meezan Bank Ltd.		National Bank of Pakistan	
coef	Value	Tvalue	Value	Tvalue	Value	Tvalue	Value	Tvalue
C11	0.015345	18.55408	0.005065	15.90914	0.001663	1.048076	0.006124	14.47224
C12	0	0						
C21	0.016079	21.41237	0.004075	4.249994	0.004876	1.631868	0.004681	16.89887
C22	1.89E-06	2.73E-06	0.002379	19.76549	2E-05	2.87E-05	0.002149	9.521177
A11	0.266294	1.607111	0.359025	10.42087	0.196404	5.48547	0.30289	11.8510605

A12	-0.02109	-0.12423	0.08172	2.200308	-0.02218	-0.53359	-0.0837	-3.870202
A21	-0.04872	-0.28764	-0.10068	-2.60535	0.046738	1.039045	-0.01279	-0.3833984
A22	0.330569	1.907199	0.214949	5.299886	0.296359	6.457333	0.330363	12.849528
B11	1.521211	8.491321	0.450976	5.649158	0.080086	0.643831	0.046786	0.3118672
B12	1.030285	4.763221	-0.07099	-1.16601	-0.12	-1.63498	-0.0102	-0.2342072
B21	-1.11282	-6.05935	-0.11364	-1.44434	-0.08781	-0.77208	0.239008	1.8461122
B22	-0.63642	-2.73627	0.459312	7.10297	0.198022	2.263506	0.277543	6.3942843
G11	0.357151	2.521771	0.823813	61.00879	0.93023	63.71174	0.9061	105.479814
G12	-0.49909	-2.88993	-0.09242	-8.05479	-0.03567	-2.77947	-0.04973	-5.368416
G21	0.214989	1.477377	0.072779	4.926386	0.075397	2.360024	-0.00964	-1.115585
G22	0.96243	5.452499	0.939387	74.48553	0.938311	42.86317	0.91506	83.742764

Table 3

Commercial Banks (Continued)

	Silk Bank Ltd.		Summit Bank Ltd.		Soneri Bank Ltd.		United Bank Ltd.	
coef	Value	Tvalue	Value	Tvalue	Value	Tvalue	Value	Tvalue
C11	0.006197	0.442905	0.007693	2.199927	0.004397	3.19069	0.005166	9.521214
C12								
C21	-0.01134	-0.30017	0.008014	4.823051	0.005068	4.289111	0.005298	15.65861
C22	0.000671	0.001036	0.00057	0.056108	8.35E-05	0.0062	0.00133	3.49597
A11	0.298678	3.818615	0.184715	1.004445	0.068961	0.241859	0.169032	2.859254
A12	-0.08799	-2.57299	-0.09036	-1.1541	-0.07307	0.3134	-0.09911	-2.10129
A21	-0.04075	-0.25787	0.0974	0.495593	0.189386	0.693763	0.068184	1.178422
A22	0.379473	3.23	0.333542	3.8529	0.312651	1.307815	0.323261	7.001673
B11	0.151228	0.1803	6.99E-06	6.53E-06	7.46E-06	2.02E-05	4.62E-07	4.11E-06
B12	-0.14994	-0.68562	-0.18606	-0.25453	-0.425	-1.09282	-0.16463	-1.362

B21	0.072191	0.04695	0.315914	0.305554	0.214017	0.62813	0.286033	1.650268
B22	0.152387	0.308291	0.449865	0.618301	0.64064	1.719271	0.4129	3.656352
G11	0.796326	21.09819	0.910375	16.60384	0.903415	13.66856	0.911355	85.34769
G12	0.015701	0.668103	-0.04989	-0.96149	-0.0748	-0.98776	-0.05087	-5.07661
G21	0.311025	1.632271	0.030475	0.409828	-0.0098	-0.12333	0.020964	0.95545
G22	0.889686	18.60982	0.932171	16.8963	0.917782	10.68521	0.926281	74.84842

In Table 1, 2, and 3 results of BEKK-GARCH for commercial banks are presented. Results presented above have revealed that in commercial banks direction of volatility transmission between stock futures and underlying stock was uni-direction. In most of commercial banks it was found that flow of transmission was from futures to stock. Major banks like Al Falah Bank, Bank of Punjab, National Bank of Pakistan, and United Bank had shown the superiority of futures in transmitting of volatility to underlying stocks. This means that past shocks and volatility of futures had capability of determining volatility of underlying stock. However, in all these banks where futures had significant impact on volatility of underlying stock nature of transmission was found to be symmetric except for Bank Al Falah where asymmetric linkages was found between its futures and stock. This shows that although past shocks or volatility of stock futures effect future volatility of underlying stock but this transmission does not have leverage effect. So any bad or good news of stock futures have same effect on volatility of stocks. Askari Bank was the only bank where direction of volatility transmission was one way and it was from underlying stock to stock futures. However inverse relationship was exist between its underlying stock and stock futures and nature of transmission was symmetric.

In three banks two way volatility or shocks transmission was found between their stock futures and underlying stock. These banks were Bank of Al-Habib, Habib Bank, MCB Bank. In all these banks sign of transmission was positive except for Habib Bank where transmission of underlying stock to stock future was negative. In all these three banks volatility transmission from stock futures to underlying stock was symmetric whereas in asymmetric linkages were found for volatility transmission from underlying stock to stock futures.

In case of five banks no significant volatility transmission exist between their stock futures and underlying stock. These banks were Faysal Bank, Meezan Bank, Silk Bank. Samba Bank, and Soneri Bank. In case of all banks it was found that both instruments, underlying stock and stock futures, had been significant impacted by their own past volatility and shocks. For both instruments nature of their own past volatility was asymmetric which means that they response differently to their own bad or good news.

SPILLOVER INDEX RESULT

In this part results of Diebold and Yilmaz (2012) methodology was applied to know direction of spillover between stock and stock future of selected companies. Sector wise results are given below

Table 4

Commercial Banks

Bank Alfalah Ltd.			Bank Al Habib Ltd.			Bank of Punjab			Faysal Bank Ltd.		
Futures	Stock	From	Futures	Stock	From	Futures	Stock	From	Futures	Stock	From

Futures	99.76	0.24	0.12	Futures	87.72	12.28	6.14	Futures	93.01	6.99	3.50	Futures	95.38	4.62	2.31
Stock	0.51	99.49	0.26	Stock	1.00	99.00	0.50	Stock	0.07	99.93	0.04	Stock	1.75	98.25	0.88
To	0.26	0.12	0.35	To	0.50	6.14	6.64	To	0.04	3.50	3.53	To	0.88	2.31	3.18

Table 5

Commercial Banks (Continued)

Habib Bank Ltd.				MCB Bank Ltd.				Meezan Bank Ltd.				National Bank of Pakistan			
	Futures	Stock	From		Futures	Stock	From		Futures	Stock	From		Futures	Stock	From
Futures	81.16	18.84	9.42	Futures	87.85	12.15	6.07	Futures	82.53	17.47	8.74	Futures	80.62	19.38	9.69
Stock	0.38	99.62	0.19	Stock	0.59	99.41	0.30	Stock	0.39	99.61	0.20	Stock	1.09	98.91	0.54
To	0.19	9.42	9.61	To	0.30	6.07		To	0.20	8.74	8.93	To	0.54	9.69	10.23

Table 6

Commercial Banks (Continued)

Silk Bank Ltd.				Summit Bank Ltd.				Soneri Bank Ltd.				Askari Bank Ltd.			
	Futures	Stock	From		Futures	Stock	From		Futures	Stock	From		Futures	Stock	From
Futures	87.09	12.91	6.45	Futures	81.25	18.75	9.38	Futures	84.51	15.49	7.74	Futures	76.74	23.26	11.13
Stock	0.23	99.77	0.12	Stock	3.80	96.20	1.90	Stock	18.81	81.19	9.40	Stock	0.08	99.92	0.04
To	0.12	6.45	6.57	To	1.90	9.38	11.28	To	9.40	7.74	17.15	To	0.04	11.63	11.67

Diebold and Yilmaz (2012) was applied to have further insight into relationship of single stock futures and underlying stock. In Table 4,5, and 6 results of spillover index were presented for commercial banks of Pakistan. Results of this methodology had shown that both stock futures and underlying stock transfer volatility to each other however magnitude of spillover of underlying stocks was more as compared to stock future for all banks except for two banks which were Bank Al Falah and Soneri Bank. These results had clearly indicated that underlying stocks had more influence on their stock futures as compared to stock futures.

CONCLUSION

In this study relationship between single stock futures and underlying stock was examined through BEKK-GARCH and further directional spillover index was measured through Diebold and Yilmaz (2012) methodology. Results of BEKK-GARCH have shown that stock futures of commercial banks are suitable for hedging purposes as most of banks had either no significant volatility transmission or nature of relationship was inverse. In few banks two way volatility transmission was found. This means that we may conclude that traders of market are using stock futures for hedging purposes in case of commercial banks Findings from Diebold and Yilmaz (2012) also confirmed it and showed that stocks had lead of transmitting volatility over stock futures. Findings of this study will be helpful for investors who are planning to hedge their investment made in the sector of commercial

banks. Policy maker also have take away from this study in a way that results of this study confirmed stock futures have been using for vary purpose they were introduced in the market. In future studies other sectors needs to be explore to know behavior of stock futures in overall market.

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