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Gulin Vardar (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)

Gokce Tunc (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)

Berna Aydogan (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)

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Author (s)

Gulin Vardar (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)

E-mail: gulin.karasulu@ieu.edu.tr

Gokce Tunc (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)

E-mail: gokce.aksoy@ieu.edu.tr

Berna Aydogan (Department of International Trade and Finance, Izmir University of Economics, Balcova, Izmir, Turkey)
E-mail: berna.okan@ieu.edu.tr

Abstract

This paper investigates the short-run and long-run dynamics among the major sectoral stock indices of the Istanbul Stock Exchange over the period 1997-2011. Long-run relationship among these indices is analyzed by using both conventional Engle and Granger (1987) and Johansen-Juselius (1990) cointegration tests, causal relationship through Vector Error Correction Model (VECM). Likewise, variance decomposition analysis is employed to partition the variance of the forecast error of one sector index into proportions attributable to shocks in each sector index in the system including its own. The findings suggest that all sectors show consistent and strong evidence of a long-run relationship, the short-term causal relationships between the sector indices are considerably limited and, where they exist, especially unidirectional. The variance decomposition analysis confirms that even though a high percentage of error variance is accounted for by the innovations in the same index, innovations in the variance of returns in the Banking sector are able to explain, on average, 63% innovations in the variance of the Chemistry, Petrol and Plastic, 57% of the Basic Metal and 79% of the Holding and Investment sector returns. These results indicate that the Banking sector is the most influential sector in the ISE.

Keywords: Stock market indices, cointegration, Granger-causality, VECM, variance decomposition
JEL Classification: G11, G12, G14, G15

Introduction

There has been an increasing interest among investors in emerging markets which has led to examine the understanding of the risk and return characteristics of stock prices in these markets. Mainly, investors have gained higher asset returns in emerging markets compared to the developed markets since there is a potential of identifying any signals of informational inefficiency and substantial increase of capital flows from developed markets to emerging markets. Stock indices are frequently used to test the market efficiency and performance of emerging markets particularly in cases where there is a high market concentration. Also, stock indices of different countries are subject to different monetary and fiscal policy shocks from their governments, as well as the specific structural problems each country may face. Therefore, research on individual emerging markets is appropriate to eliminate the effects of different policy and structural shocks on stock indices.

Also, the analysis of relationship among different stock market indices in one country becomes important for researchers to examine the financial environment in the country and investors to get benefit from their investments. Among the emerging markets, Turkey is the largest economy in Eastern Europe and Middle East. The US Department of Commerce (DOC) has identified Turkey as one of the ten most promising emerging economies, and a recent World Bank study also declared Turkey one of the ten countries most likely to enter the top tier of the world economy. These characteristics make the Turkish stock market a good representative of many emerging stock markets.

The Istanbul Stock Exchange (ISE hereafter) is a dynamic and growing emerging stock market with an increasing number of publicly traded companies and strong foreign participations. Since 1989, there have been no restrictions on foreign portfolio investors trading in the Turkish securities markets. Hence, the Turkish stock market provides a transparent and fair trading environment for both domestic and foreign investors without any restrictions on the repatriation of capital and profits. The market capitalization in the ISE has increased from $7 billion in 1989 to $18.74 billion in 1990 and reached $307.55 billion in 2010. Another noticeable growth is observed in the trading value, which has sharply increased from only $ 13 million in 1986, to over $ 428 billion in 2010. With the respect of Turkish economy's strong growth, low indebtedness and robust budget performance, the ISE has become the second-best-yielding stock exchange with % 25.6 return, according to a report by a Turkish stock market association, KoteDer.

Until the end of 1996, ISE used to compute only the ISE-100 index. As of 1997, sector and sub-sector indices began to be calculated within ISE aiming to measure performance of a stock market for different sectors. In this respect, for portfolio diversification and risk avoidance purposes, it is essential to examine the short-run and long-run comovements of different indices of a stock market.

The main purpose of this paper is to empirically examine the short-run and long-run dynamics among the sector indices of the ISE. By focusing on the relationship between different indices belonging to ISE, we will attempt to analyze the performance of different sectors of an economy with respect to price and return performance as well as the financial depthnesses of these sectors. The investigation of the contemporaneous behaviors of sector indices is crucial since they include important information about the efficiency of stock market. The contribution of this paper to the related literature is three-fold. First, to the authors' best knowledge, this is the first study that examines the short-term and long-term linkages among the six different sub-sector indices of the ISE. Since Turkey is an attractive emerging market for investors, we believe that such an analysis will be valuable for investors. Second, it utilizes a single country data set to eliminate the effects of different monetary and fiscal policy and structural shocks on stock market indices.

The rest of the paper is organized as follows. First of all, a brief literature review about the dynamic interactions among sector indices is given which is followed by data set. Then, the econometric methodology is provided. Empirical results are presented in the following section. Finally, concluding remarks are offered.

Literature Review

Many studies in the literature have been devoted to investigation of short-term and long-term interrelationships among worldwide stock markets. These studies mainly concentrated on the relationship of international stock market indices (see, e.g., Kasa 1992; Beckers et al., 1996; Griffin and Karolyi 1998; Beca et al. 2000; Ferreira and Ferreira 2006; Hargis and Mei, 2006; Meric et al. 2008). A major contribution of these studies was the information they provided for financial market participants about the diversification potential among international stock markets.

Although there exists a vast literature regarding how different stock markets interact over time, limited number of studies is undertaken to examine the dynamic interactions among sector indices within the same stock market. An important study in this line of research is that of Arbeláez et al. (2001) in which they analyzed the short-term and long-term linkages among the several stock indices of the Colombian stock market applying tests of cointegration, causality, impulse response and variance decomposition. The results indicated that the Colombian market indices are highly correlated with each other and exhibit long-term linkages that could explain the rejection of weak form market efficiency. Amongst others, Ratner (1996) investigated the efficiency and characteristics of the nine major indices of the Madrid Stock Exchange and the findings did not support weak form efficiency. Ewing (2002) analyzed the interrelationships among five major S&P stock indices in order to determine their interrelationships and how shocks to one index are transmitted to the others. By and large, he found strong interrelationships amongst the five S&P's stock indices. In other study, Wang et al. (2005) examined the patterns of information flows within and across sectors of the two Chinese stock exchanges in Shanghai and Shenzhen and suggested a high degree of interdependence, indicating that the sectors are highly integrated and sector prices reflect information from other sectors. Berument et al. (2005) examined the long-run relationship properties of the sector indices of ISE and could not find any significant correlation among these indices. Under a similar spirit, Mohamad et al. (2006) investigated the opportunity for diversification across different economic sectors for long-term investment using sectoral indices of the Malaysian Stock Exchange. The results pointed out that although the returns of different industry sectors tend to be highly correlated, this correlation relationship is not stable. Hassan and Malik (2007) used a multivariate GARCH model to simultaneously estimate the mean and conditional variance among different US sector indices and found significant transmission of shocks and volatility among different sectors.

More recently, Patra and Poshakwale (2008) provided empirical evidence on the short-term and long-term relationships among the major stock indices of the Athens stock exchange (ASE hereafter). They found that although the sector indices do not show a consistent and strong long-term relationship, the banking sector seems to have a strong influence on returns and volatility of other sectors at least in the short-run. Al-Fayoumi et al. (2009) investigated the dynamic interactions across four stock market indices in the Amman Stock Exchange. Similar to Wang et al.'s (2005) study, their findings indicated that investors who diversify their portfolios across sectors in ASE should expect portfolio advantages in the light of significant causality linkages and high correlations among sector returns. In this context, the service sector gives the best diversification opportunities since it is the least integrated with other sectors while the financial is the most influential sector in the ASE. Ahmed (2011) analyzed the long-run equilibrium relationships as well as the short-run dynamic linkages amongst the various sectors of the Egyptian stock market. These results are consistent with the economic intuition that the capital market sectors have a tendency to move towards the same direction, at least in the long run.

Data

There are 20 sub-sector indices in the ISE. The sample data consists of daily closing price indices for the six sub-sectors of ISE; Chemistry, Petrol and Plastic (XKMYA), Basic Metal (XMANA), Trade (XTCRT), Telecommunication (XILTM), Banks (XBANK), Holding and Investment (XHOLD). The data set covers the period from January 2, 1997 through February 2, 2011, thereby providing a sample size of 3409 observations. All data were retrieved from the ISE database and transformed to natural logarithms for use in the analysis. The indices are weighted by market capitalization, containing the largest firms in each market. The main rationale behind including these six sub-sectors is that they account for approximately 83% of the total market capitalization in the ISE. Therefore, they dominate the market capitalization in the ISE. The remaining 14 sub-sectors had just 17% market capitalization. Table 1 indicates the weights of each sub-sector in the ISE-100 Index and their market capitalization.

The Banking sector leads all other sectors with the highest percentage (40.97%) of the total market capitalization. It is followed by Holding and Investment, Chemistry, Communication, Commerce and Basic Metal sectors respectively in terms of market capitalization.

The summary statistics of the daily stock index returns are presented in Table 2. The Basic Metal and Commerce sector outperform the other sectors in terms of daily index returns (0.0008) over the sample period, whereas Communication sector performs the worst with return averages of 0.0003. The Communication sector seems to be the most volatile amongst all six sectors with the highest standard deviation of 0.0326. All index returns are positively skewed except Basic Metal and Commerce sectors. The relatively large value of kurtosis suggests that the underlying data are leptokurtic or fat-tailed and sharply peaked about the mean when compared with the normal distribution. This finding is supported by the relevant Jarque-Bera test providing clear evidence to reject the null hypothesis of normality at 1% significance level.

Methodology

The modeling strategy adopted in this study involves three steps. Prior to modeling time series data, firstly we determine the order of integration of the variables and ensure that it is equal for all series. The unit root tests, namely Augmented Dickey and Fuller (Dickey and Fuller, 1979) (ADF test) and Philips Perron (Phillips and Perron, 1988) (PP test), are used to check the nonstationarity of the series. For the series that are integrated of the same order, the next step is to perform conventional cointegration tests for long-run relationship. The existence of any bivariate and multivariate cointegration is tested by employing Engle and Granger (1987) and Johansen and Juselius (1990) methods, respectively.

Johansen's method based on vector autoregressive (VAR) analysis utilizes the maximum likelihood estimates and allows testing and estimation of more than one cointegrating vector in the multivariate system.

$$\boldsymbol{y}_t = \boldsymbol{A}_1 \boldsymbol{y}_{t-1} + \boldsymbol{A}_2 \boldsymbol{y}_{t-2} + \ldots + \boldsymbol{A}_p \boldsymbol{y}_{t-p} + \boldsymbol{B}\boldsymbol{x}_t + \varepsilon_t \quad (1)$$

where $\boldsymbol{Y}_t$ is a k vector of nonstationary I(1) variables, $\boldsymbol{X}_t$ is a vector of deterministic variables and ε_t is a vector of innovations. The VAR representation is also written as follows;

$$\Delta \boldsymbol{y}_t = \Pi \boldsymbol{y}_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta \boldsymbol{y}_{t-i} + \boldsymbol{B}\boldsymbol{x}_t + \varepsilon_t \quad (2)$$

where

$$\Pi = \sum_{i=1}^{p} \boldsymbol{A}_i - \boldsymbol{I}, \quad \Gamma_i = -\sum_{j=i+1}^{p} \boldsymbol{A}_j \quad (3)$$

If the coefficient matrix Π has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. The elements of α are known as the adjustment parameters in the vector error correction model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

In determining the rank of matrix Π (number of cointegrating vectors), the characteristic roots or eigenvalues, $\hat{\lambda}_i$ of Π are calculated. The hypothesis of the existence of r cointegrating vectors can be tested by using the maximum likelihood-based trace (λ_{trace}) and maximum eigenvalue (λ_{max}). λ_{trace} is based on the null hypothesis that the number of cointegrating vectors is less than or equal to r against a general alternative, while λ_{max} is based on the null hypothesis that the number of cointegrating vectors is r against the alternative $r+1$ cointegrating vectors. If the computed values of $\lambda_{trace}$and λ_{max} are less than critical values provided by Osterwald-Lenum (1992), then the null hypothesis cannot be rejected. The optimal system lag length is determined by employing the Schwarz Bayesian Criterion.

Apart from the examination of the long-term relationships between the sector indices of the ISE, the direction of the short and long-term relationship between the same set of variables is investigated using the Granger's causality tests. Granger's causality approach (Granger, 1969) stated a testable definition of causality in terms of predictability in a set of non-cointegrated variables. Then, Granger (1988) extended the definition of causality to a set of cointegrated variables. In the presence of cointegration among the variables, the causal relationships should be examined within the framework of the vector error correction model (VECM). VECM approach permits the distinction between causality based on short-run dynamics of VAR and on the disequilibrium adjustment of ECT. In this case, the Granger causality between the endogenous variables can be written as:

$$\Delta \boldsymbol{y}_t = \alpha_y + \sum_{i=1}^{n} \beta_{y,i} \Delta \boldsymbol{y}_{t-i} + \sum_{i=1}^{n} \gamma_{y,i} \Delta \boldsymbol{x}_{t-i} + \varphi_y \boldsymbol{ECT}_{y,t-i} + \varepsilon_{y,t} \quad (4)$$

$$\Delta \boldsymbol{x}_t = \alpha_x + \sum_{i=1}^{n} \beta_{x,i} \Delta \boldsymbol{x}_{t-i} + \sum_{i=1}^{n} \gamma_{x,i} \Delta \boldsymbol{y}_{t-i} + \varphi_x \boldsymbol{ECT}_{x,t-i} + \varepsilon_{x,t} \quad (5)$$

where $\boldsymbol{ECT}$ represents the vector of error correction terms which represents the deviation from the long-run relationships at time t and φ_x and φ_y are the parameters of the ECT, estimating the response of the dependent variable to departures from equilibrium[1]. From Models 4 and 5, the short-run dynamics is provided by the lagged values of the difference terms.

The variance decomposition analysis is employed to investigate the short-run dynamics by determining the amount of information each variable contributes to the other variables in VAR models. Especially, the forecast error variances give information about the percentage of the movements caused by own shocks vis-a-vis shocks in other variables.

Empirical Results

To investigate long-run and short-run dynamics across sub-sector indices, the order of integration in each series is tested, using Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests. The unit root test statistics reported in Table 3 reveal that each series is nonstationary in log levels but stationary in log first differences. Therefore, it is noted that all sub-sector index price series are integrated of order one, I(1).

As the condition of the same order of integration is met, the existence of long-run relationship between the sector indices is examined using the Engle-Granger two-step procedure and the Johansen and Juselius cointegration tests. The findings of the Engle-Granger test are reported in Table 4. According to the results, the null hypothesis of no cointegration is rejected at the 1% level of significance for all combinations of the ISE sector index pairs. This points out that the sector index prices are related in the long-run. Results of the Johansen and Juselius (1990) multivariate cointegration tests among six sector indices are given in Table 5.

Trace and maximum eigenvalue statistics show that there are six cointegrating relationships among sector indices. The statistical evidence supports the results obtained through the bivariate Engle and Granger (1987) cointegration analysis. The results are also in line with the findings reported by Arbeláez et al. (2001), Wang et al. (2005) and Patra and Poshakwale (2008) for various stock exchanges where sector indices have a tendency to move toward same direction at least in the long-run. This confirms that most of the sectors are more or less influenced by both the macroeconomic indicators and political events in the long-run. This statistically significant long-run relationship between six sector indices supports that there are no benefits from portfolio diversification in terms reduction in risk. In the presence of cointegrated variables, the Granger causality test requires VECM to capture both the short-run dynamics between time-series and their long-run equilibrium relationship. The results of the causality tests through ECM for sectoral indices are reported in Table 6. The lagged error correction terms are statistically

[1] Since the results of the Granger causality test is very sensitive with respect to the selected lag length, Schwarz Bayesian Criterion is used in determining the appropriate lag length because it is considered theoretically to be superior to the Akaike Information Criterion and penalizes for inclusion of higher number of lags in the regression.

significant, suggesting bidirectional causality in the long-run for all sectoral indices except Banking-Holding and Holding-Commerce pairs.

For the short-run dynamics, there is unidirectional causality running from Banking to Chemistry, Holding and Communication. This reveals that the Banking sector seems to be the most dominant and leading sector in the ISE. This strong influence can be explained by banking sector's market capitalization value of 44 billion TL and its approximately 41% share of the total market capitalization of the ISE-100 index as of January 31, 2011. The Banking sector index includes 17 banks and they represent 30% of the total trading volume in the ISE in 2010[2]. There is also bidirectional causality between Holding and Commerce whereas unidirectional causality from Chemistry to Commerce. Having a better knowledge of the nature of the sub-sector relationships is crucial for considerable number of market participants to make optimal portfolio allocation decisions across sectors. The noticeable correlation among sub-sector indices shows that the benefits of portfolio diversification diminish or may even completely disappear in ISE.

While Granger causality results show qualitative relationship between the variables, variance decomposition analysis provides quantitative measure to these causal relationships representing how much the movement in a sector index can be explained by other indices in terms of the percentage of the forecast error variance of that sector index. Results for variance decomposition analysis for periods ranging from 1 day, 5 days, 10 days and 15 days ahead of forecast for all indices are summarized in Table 7. The findings indicate that for all sector indices, high percentage of forecast variance is influenced by the innovations in the past variance of the same sector. The analysis concentrates on 15-day ahead forecast result in order to see the contribution of each index in explaining the percentage of forecast error variance. For instance, after 15 days 99.36% of the variation in Banking sector is explained by its own innovations whereas changes in Telecommunication; Chemistry, Petrol and Plastic; Trade; Basic Metal; Holding and Investment only explain 0.07%, 0.14%, 0.10%, 0.05% and 0.25% of the variance in the Banking sector, respectively. On the other hand, Banking sector explains approximately 63% of the variation in Chemistry, Petrol and Plastic sector, 79% of the variation in Holding and Investment sector, 45% of the variation in Telecommunication sector which is consistent with causality results. The dominant role of the Banking sector entails that changes in the Banking sector index may potentially be used in forecasting movements in other sector indices corroborating a radical departure from the weak form efficiency.

[2] ISE Annual Factbook, 2010.

Conclusion

This paper analyzes short and long-run relationships among the major sector indices of ISE, using daily data. The empirical results from Engle and Granger two-step cointegration tests indicate that there is long-run relationship between all sector index pairs. On the basis of cointegrated variables, the Granger causality test through VECM is used to check the direction of the short and long-run relationship. The significant lagged error correction terms suggest the bidirectional causality in the long-run for all sector indices except Banking-Holding and Holding-Commerce index pairs. For the short-run causality channels, Banking granger causes Chemistry, Holding and Communication. Moreover, the empirical results suggest the existence of short-run bidirectional causality between Holding and Commerce whereas unidirectional causality from Chemistry to Commerce. The leading and dominant role of the Banking sector, confirmed by the results of variance decomposition test, can be explained by 41% share of the total market capitalization of the ISE-100 index.

The findings of this paper provide important information particularly for investors and portfolio managers in optimal portfolio allocation decision across sectors. The findings show that there are no potential portfolio diversification benefits through investing in the sub-sector indices in Turkish stock market.

Table-1: ISE Sector Indices (as of January 31, 2011)

Index	**Market Capitalization (million TL)**	**Weight in ISE-100 Index (%)**
XKMYA	9,350.8	8.68
XMANA	3,464.6	3.21
XTCRT	6,961.7	6.46
XILTM	8,698.8	8.08
XBANK	44,118.9	40.97
XHOLD	17,677.1	16.41

Source: www.ise.org

Table-2: Descriptive Statistics

	XBANK	**XHOLD**	**XILTM**	**XKMYA**	**XMANA**	**XTCRT**
Mean	0.0007	0.0004	0.0003	0.0006	0.0008	0.0008
Median	0.0009	0.0005	0.0000	0.0005	0.0007	0.0005
Maximum	0.1726	0.1795	0.1796	0.1871	0.1982	0.1781
Minimum	-0.2117	-0.2017	-0.1961	-0.1856	-0.2075	-0.2037
Std. Dev.	0.0293	0.0268	0.0326	0.0243	0.0288	0.0235
Skewness	0.0706	-0.0310	0.0179	0.0610	-0.0728	-0.1377
Kurtosis	7.5316	8.4303	7.7351	10.0891	8.2931	12.6015
Jarque-Bera	2167.6	3110.2	2364.6	5301.4	2956.8	9730.0
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table-3: The Results of Unit Root Tests

		ADF		**Philips-Perron**	
	Level/First Difference	**No Trend**	**Trend**	**No Trend**	**Trend**
XHOLD	*Level*	-1.135	-2.379	-1.078	-2.361
	First Difference	-20.967*	20.969*	-48.811*	-48.806*
XMANA	*Level*	-0.554	-2.401	-0.562	-2.415
	First Difference	-50.016*	-50.009*	-50.018*	-50.011*
XILTM	*Level*	-0.806	-3.897**	-0870	-3.857**
	First Difference	-21.703*	-21.726*	-49.487*	-49.493*
XBANK	*Level*	-0.583	-2.321	-0.619	-2.378
	First Difference	-21.568*	-21.571*	-49.028*	-49.022*
XTCRT	*Level*	0.369	-3.360***	0.396	-3.339***
	First Difference	-22.020*	-22.090*	-49.835*	-49.870*
XKMYA	*Level*	-0.608	-2.779	-0.518	-2.674
	First Difference	-21.959*	-21.973*	-51.714*	-51.718*

Note: XHOLD, XMANA, XILTM, XBANK, XTCRT and XKMYA represent natural logarithm of sector stock price index. ADF: Optimum lag is selected according to the AIC, critical values are based on MacKinnon (1991). *, **, *** imply 1%, 5% and 10% significance level respectively.

Table-4: The Results of Engle and Granger Cointegration Test

Index pairs	**ADF**	**k**
XBANK- XKMYA	-46.994*	0
XBANK - XHOLD	-48.421*	0
XBANK - XMANA	-47.248*	0
XBANK - XTCRT	-21.710*	5
XBANK - XILTM	-29.030*	2
XHOLD - XMANA	-48.767*	0
XHOLD - XKMYA	-33.960*	1
XHOLD - XTCRT	-21.868*	5
XHOLD - XILTM	-33.025*	1
XMANA - XKMYA	-50.569*	0
XMANA - XTCRT	-49.046*	0
XMANA - XILTM	-48.890*	0
XKMYA - XTCRT	-51.126*	0
XKMYA - XILTM	-21.332*	5
XTCRT - XILTM	-21.952*	5

Note: XHOLD, XMANA, XILTM, XBANK, XTCRT and XKMYA represent natural logarithm of sector stock price index. * implies significance of 1%. Critical values are based on MacKinnon (1991).

Table-5: The Results of Johansen-Juselius Maximum Likelihood Cointegration Tests

Maximum eigenvalue test				**Trace test**			
Null	**Alternative**	**Statistic**	**95% critical value**	**Null**	**Alternative**	**Statistic**	**95% critical value**
$r = 0$	$r = 1$	537.15*	43.41	$r = 0$	$r \geq 1$	853.28*	107.34
$r \leq 1$	$r = 2$	509.88*	37.16	$r \leq 1$	$r \geq 2$	816.12*	79.34
$r \leq 2$	$r = 3$	485.85*	30.81	$r \leq 2$	$r \geq 3$	806.24*	55.24
$r \leq 3$	$r = 4$	469.96*	24.25	$r \leq 3$	$r \geq 4$	520.39*	35.01
$r \leq 4$	$r = 5$	434.34*	17.14	$r \leq 4$	$r \geq 5$	850.42*	18.39
$r \leq 5$	$r = 6$	416.08*	3.84	$r \leq 5$	$r \geq 6$	416.08*	3.84

Note: The notation “r” denotes the number of cointegrating vectors. * implies significance of 5%.

Table-6: The results of Granger Causality through ECM

	Index Pairs	F-statistics	Causal Inference	$EC_{(t-1)}$
1	XBANK - XKMYA	2.328***	X causes Y	0.624 (27.047)*
	XKMYA - XBANK	0.007	No causality	0.253 (8.268)*
2	XBANK - XHOLD	2.861***	X causes Y	0.042 (0.639)
	XHOLD - XBANK	1.236	No causality	-0.934 (-13.258)*
3	XBANK - XMANA	1.622	No causality	0.496 (31.020)*
	XMANA - XBANK	0.013	No causality	0.231 (12.550)*
4	XBANK - XTCRT	0.009	No causality	0.297 (5.073)*
	XTCRT - XBANK	2.023	No causality	-0.702 (-9.727)*
5	XBANK - XILTM	2.854***	X causes Y	-0.287 (-24.833)*
	XILTM - XBANK	0.916	No causality	-0.198 (-18.259)*
6	XHOLD - XMANA	0.372	No causality	0.825 (26.227)*
	XMANA - XHOLD	0.147	No causality	0.254 (7.855)*
7	XHOLD - XKMYA	1.549	No causality	0.833 (14.240)*
	XKMYA - XHOLD	1.136	No causality	0.153 (2.297)**
8	XHOLD - XTCRT	3.025**	Bidirectional	0.723 (12.886)*
	XTCRT - XHOLD	2.716***	Bidirectional	-0.099 (-1.505)
9	XHOLD - XILTM	0.893	No causality	0.176 (29.901)*
	XILTM - XHOLD	0.152	No causality	0.082 (15.395)*
10	XMANA - XKMYA	1.213	No causality	0.586 (28.927)*
	XKMYA - XMANA	0.603	No causality	0.247 (9.151)*
11	XMANA - XTCRT	0.312	No causality	-0.232 (-6.961)*
	XTCRT - XMANA	1.671	No causality	-1.096 (-30.881)*
12	XMANA - XILTM	0.912	No causality	-0.189 (-35.890)*
	XILTM - XMANA	0.783	No causality	-0.116 (-22.478)*
13	XKMYA - XTCRT	2.693***	X causes Y	-0.260 (-4.889)*
	XTCRT - XKMYA	1.264	No causality	-1.214 (-24.092)*
14	XKMYA - XILTM	0.976	No causality	-0.536 (-33.982)*
	XILTM - XKMYA	0.389	No causality	-0.347 (-28.088)*
15	XTCRT - XILTM	1.109	No causality	0.447 (28.264)*
	XILTM - XTCRT	0.799	No causality	0.090 (7.048)*

Note: Numbers in parenthesis denote t values. The lag length for the models is determined according to the Schwarz Bayesian Criterion. *, **, *** imply 1%, 5% and 10% significance level respectively.

Table-7: The results of the Generalized Variance Decomposition Analysis

		Explained by		
	Period	**XBANK**	**XILTM**	**XKMYA**
XBANK	1	100	0.00	0.00
	5	99.36	0.07	0.14
	10	99.36	0.07	0.14
	15	99.36	0.07	0.14
XILTM	1	45.07	54.92	0.00
	5	44.99	54.71	0.00
	10	44.99	54.71	0.00
	15	44.99	54.71	0.00
XKMYA	1	63.05	1.24	35.70
	5	62.71	1.27	35.51
	10	62.71	1.27	35.51
	15	62.71	1.27	35.51
XTCRT	1	49.49	1.53	4.71
	5	49.15	1.60	4.97
	10	49.15	1.60	4.97
	15	49.15	1.60	4.97
XMANA	1	56.80	1.78	5.63
	5	56.67	1.78	5.63
	10	56.67	1.78	5.63
	15	56.67	1.78	5.63
XHOLD	1	79.09	1.29	3.79
	5	78.75	1.28	3.78
	10	78.75	1.28	3.78
	15	78.75	1.28	3.78
		XTCRT	**XMANA**	**XHOLD**
XBANK	1	0.00	0.00	0.00
	5	0.10	0.05	0.25
	10	0.10	0.05	0.25
	15	0.10	0.05	0.25
XILTM	1	0.00	0.00	0.00
	5	0.01	0.06	0.20
	10	0.01	0.06	0.20
	15	0.01	0.06	0.20
XKMYA	1	0.00	0.00	0.00
	5	0.10	0.13	0.26
	10	0.10	0.13	0.26
	15	0.10	0.13	0.26
XTCRT	1	44.26	0.00	0.00
	5	43.90	0.01	0.35
	10	43.90	0.01	0.35
	15	43.90	0.01	0.35
XMANA	1	0.12	35.65	0.00
	5	0.16	35.63	0.10
	10	0.16	35.63	0.10
	15	0.16	35.63	0.10
XHOLD	1	0.57	1.04	14.20
	5	0.65	1.16	14.35
	10	0.65	1.16	14.35
	15	0.65	1.16	14.35

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