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Macro-Economic Variables and Their Impact on Stock Exchange: A Study of Pakistan (KSE 100 Index)

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Abstract

This study examines the relationship between the Karachi stock exchange and macro-economic variables. Monthly data for the time period July 2005 to April 2014 has been considered. CPI, FX, GDP, INT, Gold prices and oil prices in Pakistan are chosen as the macroeconomic variables. Unit root tests, Johansen and Juselius 1990 Cointegration, long & Short term granger causality under VECM framework along with the Sims 1980 variance decomposition and Pulse impulse response function has been employed. The analysis suggest that there is the long run cointegration among the variables and KSE and all the variables granger cause the KSE 100 index in the long run whereas in short run only forex granger cause KSE. An interesting finding is the significant explanation of variance in KSE 100 Index by the oil prices in Pakistan and the adverse response of the KSE on the one standard deviation shock to the oil prices.

Keywords: Macro-Economic Variables;Karachi Stock Exchange(KSE100);Consumer Price Index(CPI); Foreign Exchange Rate(FX); Interest Rate(INT).

1. Introduction

Stock market in any economy plays the role of stimulator and the base index represents the flow and stimulus of economic development. It is the ultimate indicator of the growth in the economic sector. Thus, any progress in the said market leads us to infer about the conditions of the economy.

For many years, the relationship between the macro-economic indicators and their impact on the stock market index has been of keen interest to the researchers and financial analysts. Fama (1981, 1990), Chen (1986), Bong Soo Lee(1992), Levine and Zervos (1996) are few notable studies out of many in this regard but one thing common in these† studies is that these studies were done for the developed markets where the relationship between the macro-economic factors and the stock exchange is more visible or clear because of their integrated and somehow efficient markets. Since, all aspects of their economy are functional and more integrated so any impact on one variable with respect to another variable is more vivid than the case of the developing economies where market and economy is struggling to find their feet on the ground.

To measure this sort of relation in the developing and emerging market is difficult to observe due to the high volatility in the stock market and somewhat in the economic indicators. All these factors make the study of relationship between these becomes much more interesting to follow and observe.

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As for as the Pakistan is concerned, it is considered one of the developing Asian economies. There are three stock exchanges in Pakistan. Lahore stock exchange (LSE), Islamabad Stock Exchange (ISE) and the biggest and most prominent stock exchange of Pakistan, Karachi stock exchange (KSE 100 index). It was developed in 1949 and since then it is acting as the pillar of financial activity in Pakistan. It was stated as the *"Best Performing stock market of the world"* in 2002. Though the economy of Pakistan is not well established and the various parts of the economic sectors are not well integrated so it is really quite a task to determine the extent of influence of various macro-economic variables on the KSE 100 index but This research has been done quite a few times in the recent past with different indicators and different time periods. Nishat and Saghir (1991), Hussain and Mahmood (2001), Naeem and Rasheed (2002), Nishat and Shaheen (2004), Abid and Rehana (2012), Arshad Haroon & HummeraJabeen (2013) are few notable mentions in this regard.

My research in this regard is a bit different from the other studies as it is taking into account the more comprehensive set of macro-economic variables and the most recent data set which has not been published yet or came into the knowledge of the author at the time of writing this paper.

1.1. Research Gap

The introduction and back ground has provided an insight to the problem being identified. Pakistan has major trade with the Japan, China, Malaysia and Taiwan. Due to globalization, investors are interested in portfolio diversification and they look for alternative baskets for their portfolio selection. To check if the Karachi Stock Exchange, KSE-100 index (Pakistan) has any dynamic inter linkage with emerging stock markets of Nikkei-225 (Japan), Shanghai Stock Exchange, SSE (China), Kuala Lumpur Stock Exchange, KLSE (Malaysia) and Taiwan Stock Exchange Corporation, TSEC Taiwan, the current study investigates these dynamic linkages between KSE and the selected equity markets, whereby to the best of our knowledge that there is no prior study founded that investigated this specific linkages. The current study will be equally useful for financial inventors, policy makers and regulators in these selected Asian Equity markets.

1.2. Statement of the Problem

Thus Pakistani stock market has become volatile for indigenous investor and investor are seeking new horizons for investments in equity markets of Asia.

1.3. Research Objectives

The objective of this research is

- **i) To explore the short term/long term co-integration between Pakistani Equity Market and selected Asian countries.**
- **ii) To analyze Unidirectional and Bidirectional causality.**
- **iii) To explore diversification opportunities for investors.**

1.4.Research Question

- i) Has Pakistani Stock Market any short term/long term co-integration with selected Asian Markets?
- ii) Is there any diversification opportunity among selective Asian countries?

1.5. Research Significance

From Pakistani investor perspective there is still need to explore the cross boarder securities especially in the Asian countries which are politically, geographically and strategically important as investment portfolio point of view. Hence this study is an effort to explore the long term relationship between Pakistani equity market and Asian equity Markets. These equity markets are being selected as these persisted a significant financial as well as economic growth within stipulated time frame. On these equity markets, a great interest has been shown by the global market players in this stipulated time period. Pakistan is doing major trade with these countries; therefore the selection of these stock markets is quite justified. Furthermore, this study would have a very positive impact for investors and governmental financial agencies management, shareholders, stakeholders, and portfolio managers for minimizing the risk. This study will be also very helpful for students, teachers, and researchers.

2. Objective:

The objective of the paper is to analyse the long run as well as short run relationship between the macro-economic factors and KSE 100 index. We will be mainly interested to see whether the volatility or variation in the KSE 100 index can be explained with these macro-economic indicators and if there exists a short term or long term relationship between any of these factors and stock exchange.

3. Hypothesis

KSE 100 index and Bench mark Interest rate:

- Ho: Movements in interest rate do not have any impact on the fluctuation of KSE 100 index.
- Ha: Movements in interest rate do have an impact on the fluctuation of KSE 100 index.

KSE 100 index and CPI:

- Ho: Movements in Consumer Price Index (Proxy for Inflation) do NOT have any impact on the fluctuation of KSE 100 index.
- Ha: Movements in Consumer Price Index (CPI) do have an impact on the fluctuation of KSE 100 index.

KSE 100 Index and Exchange Rate:

- Ho: Movements in Exchange Rate do NOT have any impact on the fluctuation of KSE 100 index.
- Ha: Movements in Exchange rate do have an impact on the fluctuation of KSE 100 index.

KSE 100 Index and Corporate Tax:

- Ho: Corporate Taxes do NOT influence the KSE 100 index.
- Ha: Corporate Taxes do influence the KSE 100 index.

KSE 100 index and GDP:

- Ho: Changes in GDP do NOT have any impact on the fluctuation of KSE 100 index.
- Ha: Changes in GDP do have any impact on the fluctuation of KSE 100 index.

4. Literature Review

Many studies examined this relationship in the developed and developing market. Few references of the researches done in this regard are mentioned here.

4.1. Literature for Developed Markets:

Fama (1981) examined the relationship between inflation, real activity and interest rate on the stock exchange and found a serious positive correlation among the real activity variables and stock returns. However, he introduced the idea of proxy hypothesis regarding the negative relation between inflation and stock returns. He also documents the negative relation between inflation and Real activity.

Glutekin & Bulent (1983) examined the relation between inflation and stock returns in 26 countries for the period 1947 to 1979. They implied time series regression and their findings did not support the significant positive relation between the inflation and nominal stock returns in most of the countries.

Bong Soo Lee in 1992 investigated the causal relation between stock returns, interest rates, real activity and inflation for the period 1947 to 1987 for the NYSE value weighted index. He used four variable VAR model and concluded that stock returns are negatively correlated with inflation for all leads and lags. Moreover, nominal interest rate and inflation are positively correlated for all leads and lags while real interest rates are negatively associated with the inflation. He also found the positive association between the real activity and stock returns. Overall he found no causal relation between stock returns, money supply and growth in real sector.

Levine &Zevos (1996) studied the relationship between stock market and economic growth and found a strong positive correlation between the stock market development and economic growth. Hence, providing a reference of a theory that more liquid, efficient stock market boosts economic development.

4.2. Literature Review for Pakistan Stock Exchange

Abid, Rehana&Aamir (2012) analysed the relationship between KSE and inflation, Exchange rate & Interest rate considering the monthly data from 2003 to April 2009. They applied the Auto regressive distributed lag technique to analyse the long run co integrated relation between the stock exchange and macro-economic variables and Error Correction Model (ECM) was applied through the OLS to study the short term impact of macro-economic variables on the

KSE. Wald test confirms the long run co integrated relation between the stock exchange and macro-economic variables whereas ECM predicts that the dynamics of KSE can be related to the Interest rates and Exchange rates in the short run.

Imran, Kashif, Yilmaz&Afzal (2009) studied the causal relationship between the KSE and macro-economic variables (Inflation, Exchange rate, Balance of Trade and index of industrial Production) for the period 1990 to 2008. They applied the Augmented Dickey Fuller test, Johansen's Co- integration & Granger's causality test and found that co-integration exists between the IP index and KSE prices. However, there was no causal relationship between macro-economic variables and stock returns in Pakistan. Hence we cannot predict the behaviour of stock prices with the help of these macro-economic variables.

Khalid, Altaf, Mehmood&Hussain took the monthly data of inflation, Exchange rate, T.Bill and stock return for the period 2000 to Dec 2010 and investigated the long run impact of macro-economic variables on the movement of KSE 100 index. Co-integration analysis was used to explore the long run relationship and they concluded that no such relationship exists among these macro-economic variables and KSE 100 index.

Arshad&Humera 2013 conducted a research to determine the impact of 3 month, 6 month and 12 month T. Bill (Proxy for interest rate) and CPI, WPI & SPI (Proxy for inflation) on KSE 100 index. Monthly data was taken for the period July 2001 to June 2010. Regression analysis was used and they found the significant relationship between macro-economic variables and KSE 100 index further revealing the significant impact of Treasury bill on the stock exchange. All three proxies for inflation showed the negative correlation with the share index at 0.05 significance level.

Sajid, Bilal, Shakil&Moeez (2010) researched the post liberalization impact of macro-economic variables on the KSE returns. They used the EGARCH model for the monthly data taken from 1991 to 1998 and found the negative impact of inflation, interest rate & exchange rate on the return and volatility of KSE whereas they also found that increased political competition and democratic condition favour the stock returns.

Farid, Ijaz and AbdurRauf (2014) investigated the impact of inflation, Interest rate & Exchange rate on the dynamics of KSE 100 index. Monthly data from Jan 2008 to Dec 2012 was taken and bound testing approach was applied. They found the negative association of interest rate and exchange rate with KSE in the long and short run while no association was found the stock returns and inflation.

Nishat and Rozina analysed the long run relationship between Industrial production index, M1, CPI & value of an investment earning the money market rate and Stock market index. They employed VECM to explore the relationship for the time period 1973 to 2004. Their result indicated that IP index is the biggest positive determinant of the stock prices while inflation exhibits the reverse of that relationship. Macro-economic variables were found to Granger cause the stock market movement.

4.3. Impact of Exchange Rate on Stock Returns

Maya Sami (2004) suggests the impact of exchange rate mainly depends on the level of international trade and the extent of trade balance. Muhammad &Rasheed (2001) in their study observed that in financial crisis, the stock markets and the currency both are effected so if there is a causal relation between these two then the crisis in stock exchange can be prevented by managing the exchange rate. Fama (1981) finds the double edge effect of the exchange rate. Devaluation of currency makes the exports cheaper and increases the demand. On the other hand devaluation also makes the imports expensive which adversely effects the firms and their cash flows who rely on the imports. However, Liu and Shrestha (2008) found the exchange rate as a non-significant factor in explaining development of stock prices.

4.4. Impact of Interest Rate on Stock Returns

Nishat and Shaheen (2004) suggested a negative relation between the interest rate and stock returns because any increase in the interest rate increases the opportunity cost and substitution rate between stock returns and interest bearing securities.

Mayasami (2004) while studying the Singapore stock exchange found that decrease in interest rate lowers the cost of borrowing for the firm and hence increases the potential for more expansion and growth. Thus having a positive influence on the cash flows of the firms. Any increase in interest rate will make the transactions with the borrowed money more expansive and the return demanded will increase which will reduce the demand for the stocks and depreciate the stock price.

4.5. Impact of Inflation on Stock Returns

Fama (1981) suggested that the negative relation between the inflation and stock returns is basically the proxy of negative relation between inflation and real activity. Glutekin&Bulent in 1983 studied the relation between inflation and stock returns for 26 countries for the post war period 1947 to 1987 and found no significant relation between the inflation and stock returns for most of the countries.

4.6. Impact of Economic Growth on Stock Returns

Fama 1981 found the significant positive relationship between the real activity and stock prices movement. Bong soo lee in 1992 while studying the NYSE value weighted index found the same positive association between the economic growth and movement in stock prices. Chen Roll and Ross also found the positive relation between economic growth/real activity and stock prices.

5. Data

This analysis has been conducted for the time period July 2005 to April 2014.The macro-economic variables used in this study are GDP, KIBOR offer rate, Forex, CPI, M2, International Oil Prices and Gold Prices. Data has been collected from various sources. KSE 100 index monthly data was collected from the Karachi stock exchange website and the data of macro-economic variables was collected mainly from Pakistan Bureau of statistics, State bank of Pakistan and Trading economics.com. All the data collected is of monthly frequency.

6. Methodology

We applied multiple regression to find out the extent of variation in KSE 100 index that is explained by the above mentioned macro-economic variables. We also applied pair wise granger causality test to determine the causal relationship between the KSE and bench mark interest rate, KSE and GDP, KSE and CPI & KSI and Forex. The brief introduction of the variables is given below.

6.1. Stock Market Returns

Change in the monthly KSE 100 Index have been calculated by using following equation

Rt = (Pt / Pt-1)-1

Where Rt is return for month ‘t’; and Pt and Pt-1 are closing values of KSE- 100 Index for month ‘t’ and ‘t-1’ respectively.

I. Change in Interest Rate:

KIBOR offer rate is used as a proxy for the interest rate.

Change in the Interest Rate = (KBt / KBt-1)-1

Here KBt and KBt-1 are closing values of Kibor rate for month ‘t’ and‘t-1’ respectively.

II. Change in Foreign Exchange Rate:

The change in the foreign exchange rate is measured by engaging the end-of-month US $/Rs exchange rate and the change in forex is calculated as bellows.

Change in the Foreign Exchange Rate = (FXt / FXt-1)-1

Where FXt and FXt-1 are closing values of US $/Rs exchange rate for month ‘t’ and‘t-1’ respectively.

III. Change in Inflation Rate:

The consumer price index (CPI) is used as a proxy for inflation. It is a broad-based measure for calculating the average change in prices of goods and services during a particular time period.

Change in the Inflation Rate = (CPIt / CPIt-1)-1

Where CPIt and CPIt-1 are closing values of Inflation rate for month ‘t’ and‘t-1’ respectively.

IV. Change in M2:

Pakistan Money Supply M2 includes M1 plus short-term time deposits in banks whereas M1 measures all physical money, such as coins and currency, as well as demand deposits and checking accounts. In short M1 measures the most liquid components of money while M2 also includes near money. The change in M2 was calculated by **(M2 t / M2 t-1)-1**

V. Change in GDP:

Monthly data for GDP was collected and percentage change in it was calculated by the formula (GDPt /GDPt-1)-1. Here CPIt and CPIt-1 are closing values of Inflation rate for month‘t’ and‘t-1’ respectively.

VI. Change in Gold Prices:

Monthly data for gold price was also collected to study its impact on explaining the variation in KSE 100 index. The data was collected from the various sources and its percentage change in these prices were used in the analysis to determine their effect on the KSE 100 index.

VII. Change in International oil prices:

Among all these local variables, monthly international oil prices of US $/Barrel of oil was also considered. Since many of the commodity prices are linked with the price of the oil in Pakistan and secondly due to heavy import of the refined oil reserves, it has a significant impact on the economy of Pakistan which we tried to capture by including it in the analysis.

6.2. Unit Root Tests

Since, we can't deny the fact the most macro-economic series are non-stationary (Nelson and Plosser 1982). So, the first part of analyzing the macro economic variables is to check their stationarity properties through unit root tests. Also. The required condition for the (Johansen and Juselius 1990) co-integration is that all the series should be of same order of integration because if we get the mixed results then normally instead of applying JJ 1990, we then proceed to apply ARDL approach because ARDL doesn't require the order of integration to be same to determine the co-integration among the series. The order of integration refers to the number of time a series is differenced to portray the characteristics of the stationary series.

So, in order to determine the order of integration, we employed most commonly Augmented Dickey–Fuller (Dickey and Fuller, 1979) and Phillips–Perron (Phillips and Perron, 1988) (PP) tests, a relatively more powerful generalized least squares (GLS)-detrended Dickey–Fuller (DFGLS) unit root test and KPSS (Kwiatkowski, D.; Phillips, P. C. B.; Schmidt, P.; Shin, Y. (1992)) which is used to testing a null hypothesis that an observable time series is stationary around a deterministic trend. It complements the results of other unit root tests.

Table 1: Unit Root Tests Results							
Variables		**ADF Statistics**	**lag**	**DF-GLS Statistics**	**lag**	**PP Statistics**	**KPSS Statistics**
Levels							
Intercept							
KSI		1.749	0	3.307	0	1.725	1.148
CPI		2.662	1	5.467	1	3.073	1.452
GDP		-1.849	0	-1.269	0	-1.873	0.371
FX		0.105	1	-0.669	3	0.362	0.362
INT		-1.456	2	-0.468	0	-1.997	0.670
IOP		-1.994	1	-0.889	1	-1.828	1.246
Gold		-0.445	0	0.829	0	-0.419	1.375
Intercept and Trend							
KSI		0.292	0	-0.391	0	0.210	0.146
CPI		-1.874	1	-0.256	1	-1.818	0.367
GDP		-2.220	0	-1.464	0	-2.228	0.169
FX		-2.659	1	-1.625	3	-2.617	0.298
INT		-1.886	2	-1.155	2	-2.858	0.186
IOP		-3.792	1	-3.817	1	-3.342	0.130
Gold		-1.700	0	-1.286	0	-1.654	0.263
First Difference							
Intercept							
KSI		-11.453	0	-11.427	0	-11.492	0.419
CPI		-16.136	0	-15.851	0	-16.236	1.001
GDP		-12.251	0	-12.290	0	-12.251	0.164
FX		-7.946		-3.126		-8.426	0.338
INT		-6.868	1	-1.092	3	-11.504	0.241
IOP		-8.218	0	-8.224	0	-8.173	0.025
Gold		-11.930	0	-11.953	0	-11.925	0.203
Intercept and Trend							
KSI		-11.668	0	-11.374	0	-11.673	0.221
CPI		-16.938		-16.833		-18.224	0.079
GDP		-12.270	0	-12.317	0	-12.270	0.098
FX		-8.003	0	-2.868	2	-8.486	0.119
INT		-6.822	1	-3.690	1	-11.523	0.215
IOP		-8.191	0	-8.242	0	-8.146	0.022

Gold		-11.891	0	-11.966	0	-11.884	0.187

The results of the unit root tests are reported in levels and in first difference in Table 1 & 2 respectively. From the table 1, we can easily infer that all the macroeconomic series are non-stationary in levels but after taking the first difference they become stationary. So, our order of integration for all the series is I(1).

6.3. Cointegration Tests

Now, since we have all the macro-economic series of same order of integration so, we can proceed to employ the (Johansen and Juselius 1990) co-integration test. It let us know about the existence of long-term equilibrium relationship among the macro-economic variables and the KSE 100 index. We employ the existence of co-integration between the variables if a linear combination of these variables is stationary. Gonzalo (1994) presents Monte Carlo evidence that the full-information maximum likelihood procedure of JJ performs better than others. Before applying the JJ 1990, it is recommended to determine the appropriate lag length because insufficient lag length can lead to rejection of the null of no cointegration.

Table 2: **Lag Selection**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4255.37	NA	5.24E+21	69.87491	70.0358	69.94026
1	-3095.07	2168.439	6.42e+13*	51.65680*	52.94389*	52.17958*
2	-3046.21	85.70064	6.48E+13	51.65914	54.07243	52.63934
3	-3018.77	44.98628	9.41E+13	52.01255	55.55205	53.45019
4	-2971.22	72.48838	1.00E+14	52.03639	56.70209	53.93145
5	-2936.13	49.4714	1.34E+14	52.26442	58.05633	54.61691
6	-2881	71.40294*	1.33E+14	52.16386	59.08198	54.97379
7	-2829.77	60.45998	1.47E+14	52.12742	60.17174	55.39477
8	-2785.78	46.87708	1.93E+14	52.20951	61.38004	55.93429

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

6.4. Lag Selection Criteria

So, next phase is to determine the appropriate lag length. E-Views defines the criteria. We determined the lag length using the sequential modified LR test statistic (LR), Final prediction error(FPE), Akaike information criterion(AIC), Schwarz information criterion(SC), Hannan-Quinn information criterion(HQ) for 8,6,4 and 2 lags respectively. In all the cases, FPE, AIC, SC & HQ suggested 1 lag. The result for the 8 lag is reported in Table 2. So, the choice of lag ends with the one lag.

Table 3: Johansen and JuseliusCointegration Results

H0	λtrace	5%	λmax	5%	Eigenvalues
r =0	188.0025	125.6154	74.30738	46.23142	0.440396
r ≤ 1	113.6951	95.75366	46.61861	40.07757	0.305253
r ≤ 2	67.07653	69.81889	30.86613	33.87687	0.21427

The result for the JJ1990 cointegration is presented in the table 3. Both trace statistics (λtrace) and Eigen values (λ max) are reported here. We can see from the table that we can easily reject the null hypothesis of no cointegration at 5% confidence level. Both the trace statistics and Eigen value suggest the existence of 2 cointegartion vectors. Since, this process of estimation and hypothesis testing is sensitive to the departure from the time trend assumption. So, for the sake of robustness, we jointly tested the cointegration rank and the presence of time trend.

Table 4: Joint Hypothesis for Johansen and JuseliusCointegration

Model	Trace Statistics	5% Critical value	Decision Rule
D0,0	188.0025	125.6154	Rejected
D0,1	210.8829	150.5585	Rejected
D1,0	113.6951	95.75366	Rejected
D1,1	135.7499	117.7082	Rejected
D2,0	67.07653	69.81889	Accepted

We employed Johansen's (1992) decision rule where Dr,m denote the combination of deterministic component and rank where r is the rank and m is the model. We compare the trace test statistic with the corresponding critical value at 5%. While rejecting the model, rank assumption is kept and time trend model is shifted to another and so on. Both r and m are shifted to 0, 1 and 2 respectively until the model is accepted. D0,0 represents the most restricted one.

Table 4 reports the results of this joint hypothesis and we can conclude from the table that the accepted model is D2,0 which complements the earlier finding of two cointegration vectors and no linear trend in the cointegration space.

All this suggest a long run relationship among the macro-economic variables and the KSE 100 index. It means that in an emerging economy like Pakistan, capital markets cannot separate themselves and they do correlate with the financial and economic indicators. It also suggests the Pakistan has also sort of integrated financial market which can be a useful finding for the policy makers and the international investors & researchers where they can have a better idea about the capital market of Pakistan by looking at their financial and economic indicators.

6.5. Granger Causality under VECM Framework

In simple words we say that x granger cause y if y can be predicted with the help of the lagged values of x and y. Stock and Watson (1989) argue that Granger causality tests are very sensitive to the stationarity of the series. More importantly, if there exists a cointegration between the macroeconomic variables and KSE 100 Index, then there exists a granger causality but the direction of this causality is unknown. For this we set a basic VECM model in the differenced data and check for both the long and short run causality. Granger (1988) argues that VECM should be established in case of existence of JJ Cointegration. VAR is more suitable to specify or estimate when there is no cointegration among the variables.

The VECM equation estimated is referred below

D(KSE) = C(1)*(KSE(-1) - 420.958214651*FX(-1) - 90.3299137281*GDP(-1) + 843.150282749*INT(-1) + 0.173519799374*GOLD(-1) - 342.095033745*IOP(-1) + 23780.702171) + C(2)*(CPI(-1) - 2.25193866473*FX(-1) - 2.36469448005*GDP(-1) - 1.35911579543*INT(-1) + 0.000107934539737*GOLD(-1) - 0.531824971243*IOP(-1) + 108.193173182) + C(3)*D(KSE(-1)) + C(4)*D(CPI(-1)) + C(5)*D(FX(-1)) + C(6)*D(GDP(-1)) + C(7)*D(INT(-1)) + C(8)*D(GOLD(-1)) + C(9)*D(IOP(-1)) + C(10)

Table5: Wald Coefficient Diagnostic Test for Long Term Granger Causality

Variables:	Test Statistic	df	Probability
	F-statistic		
CPI	4.781742	(3,118)	0.0035
FX	4.736209	(3,118)	0.0037
GDP	4.265123	(3,118)	0.0067
INT	4.53868	(3,118)	0.0048
GOLD	4.614632	(3,118)	0.0043

IOP	4.19356	(3,118)	0.0074

So the main difference between the short and long term granger causality is the inclusion of coefficient of error correction along with the coefficient of independent variable term while employing Wald coefficient diagnostic test. For example, while checking how KSE 100 index responds to the deviation of the CPI from the long run equilibrium, we will set the null hypothesis of C1=C2=C4=0,

Where C1 & C2 are the coefficients of ECT 1 & ECT 2 and C4 is the coefficient of CPI. Remember, since we have two cointegrating vectors suggested by the JJ cointegration so, we have two error correction terms.

The result of this joint hypothesis Wald coefficient diagnostic test for all the macroeconomic variables is reported in the table 5 and from there we can see that all the independent variables we can reject the null hypothesis of no granger causality in the long run. It shows that KSE 100 index adjusts itself to the long run shocks in the macro economic variables.

Interestingly, we are also able to reject the null hypothesis of no granger causality for gold and Oil prices in Pakistan which means they granger cause the KSE 100 index in the long run. It can be understood with the fact that amount of gold hoarded in Pakistan for cultural and other purposes and the growing need and dependence on oil also have a critical impact on our local financial and capital markets. In light of the severe energy shortfalls this result carry important implications for the policy makers.

Table 6: Wald Coefficient Diagnostic Test for Short Term Granger Causality

Variables:	Test Statistic	df	Probability
	t-statistic		
CPI	-1.513526	118	0.1328
FX	2.291033	118	0.0237
GDP	-0.440014	118	0.6607
INT	0.552983	118	0.5813
GOLD	-1.018768	118	0.3104
IOP	0.493445	118	0.6226

6.6. Short Run Granger Causality

Short run granger causality normally referred as weak granger causality. It basically refers to adjustment of dependent variable to the short term shocks in the stochastic environment. Here the null hypothesis of no granger causality is tested by using the Wald coefficient diagnostic test but instead of including the coefficient of error correction term, here just the coefficients of independent variables is tested. As specified in the above VECM equation, C4, C5, C6, C7, C8 & C9 are tested for CPI, FX, GDP, INT, Gold, IOP respectively. The null hypothesis for CPI is C4=0.

The results for the short term causality in VECM framework are presented in Table 6. From the table, we can see that only the coefficient of FX is significant enough to deduce that the KSE 100 index is prone only to the deviation of FX in the short term dynamics. This give us the clear indication that in the short term still KSE 100 index is independent enough to be defined or predicted by the macroeconomic financial indicators. This indicates that there is still a long way till we can claim that Pakistani economy and the financial and capital markets are integrated and efficient.

To determine the validity of the model, we applied series of diagnostic checks (Jarque-Bera normality test, serial correlogram Q-statistics, Chow test, Ramsey RESET, etc.) to determine whether there is any significant departure from the standard assumptions. No such serious violation was found.

6.7. Variance Decomposition and Impulse Response Analysis

In this phase, we will discuss about the variance decomposition and impulse response. Any individual shock in the independent variables can not only effect itself but also the other variables collectively. Variance Decomposition reports the relevant effect of these shocks or innovations. Now, since there are two techniques where Variance Decomposition can be employed. First one is the orthogonalzed methodology suggested by the Sims (1980) and the other one is relatively new technique developed by the Pesaran and Shin (1998). The results of the orthogonalized methodology of Sims (1980) are sensitive to the order in which the variables are entered in the VAR. However, the generalized methodology is robust regardless of the order but if the changing of order in the Sims (1980) methodology doesn't change the results significantly, we can always take the results reported by them. I employed Sims (1980) and the results of my analysis are

reported in the table 7.

Table 7: Variance Decomposition of KSE							
Period	**KSE**	**CPI**	**FX**	**GDP**	**INT**	**GOLD**	**IOP**
1	100	0	0	0	0	0	0
2	97.46269	0.217491	1.2665	0.39992	0.032137	0.260755	0.36051
3	95.44179	0.25431	1.236987	1.027266	0.052602	0.176303	1.810739
4	92.74444	0.485859	1.00212	1.715136	0.143488	0.131606	3.77735
5	89.79811	0.679767	0.816797	2.173819	0.217965	0.102896	6.210649
6	86.57009	0.814256	0.675178	2.434428	0.27013	0.101836	9.134084
7	83.18801	0.898662	0.571166	2.55973	0.308487	0.138844	12.3351
8	79.9052	0.940946	0.499519	2.593657	0.337366	0.208094	15.51522
9	76.92133	0.953373	0.454181	2.572076	0.359107	0.297108	18.44282
10	74.34198	0.947171	0.429245	2.521967	0.37547	0.392456	20.99171
11	72.19265	0.930866	0.419242	2.460953	0.387841	0.48399	23.12446
12	70.44785	0.910241	0.419343	2.399399	0.397305	0.565741	24.86013
13	69.05671	0.888842	0.425605	2.34273	0.404673	0.635128	26.24631
14	67.96014	0.868628	0.435046	2.29328	0.410528	0.691889	27.34049
15	67.10046	0.850542	0.445574	2.251594	0.415281	0.737104	28.19945
16	66.42624	0.83491	0.455852	2.217262	0.41922	0.77248	28.87404
17	65.89409	0.821709	0.46512	2.189423	0.42255	0.799881	29.40723
18	65.4688	0.810735	0.47304	2.167052	0.425413	0.821065	29.83389
19	65.1227	0.801694	0.479548	2.149122	0.427913	0.837554	30.18146
20	64.83461	0.794272	0.484744	2.134693	0.430123	0.850597	30.47096
21	64.58871	0.78816	0.488812	2.122947	0.432098	0.861171	30.7181
22	64.37354	0.783081	0.491967	2.113209	0.433878	0.870012	30.93431
23	64.181	0.778796	0.494415	2.104942	0.435492	0.877659	31.1277
24	64.00552	0.77511	0.496342	2.097736	0.436964	0.884487	31.30384

Since my data is of monthly frequency, so, I selected the 24 period frequency and from the table 7, we can easily figure it out that junk of the variation in KSE 100 Index is explained by itself. Only other serious candidate is Oil prices in Pakistan which explain about the 31% of the variation in Kse 100 index. This is an interesting finding which we were not expecting while employing variance decomposition. Even when the order is changed, Oil prices remain the significant contributor. So, this is another important implication for the energy economists.

Figur1. Pulse Impulse Response function

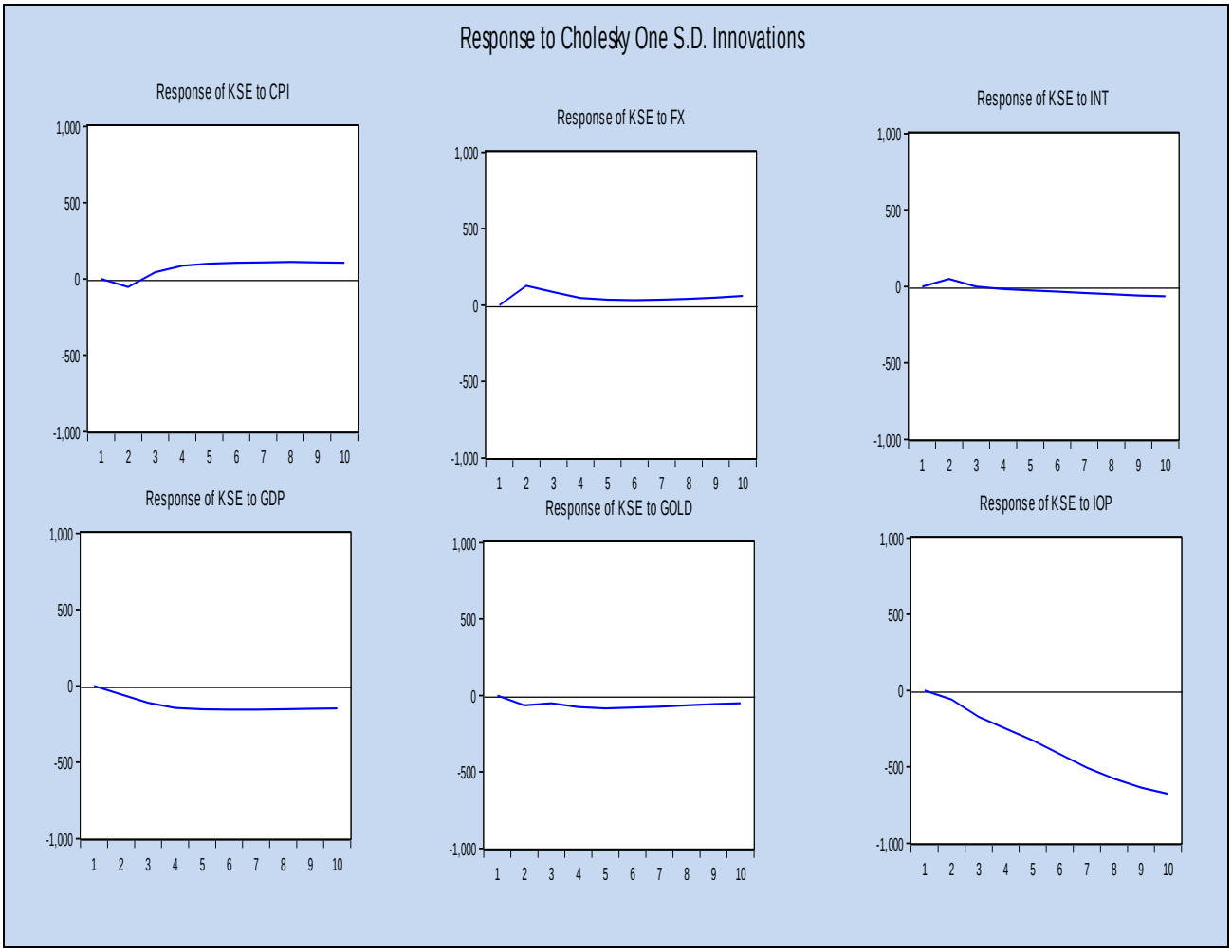

Figure 1 presents the result of the response of KSE 100 index to the one standard deviation shock to the independent variable. From the responses of KSE, we can mainly infer that KSE remains unmoved or doesn't show any significant response to the shocks or innovation in macroeconomic variables except for the oil prices. We can see that KSE 100 index is adversely effected by the shock in Oil prices.

7. Conclusion

In this study we tried to examine the impact of leading macro-economic variables on the KSE 100 index. Regression analysis and pair wise Granger Causality test was used to study their relationship. From the regression analysis we found that only Foreign exchange, international oil prices and gold prices are significant enough to explain the 25 percent variation in the KSE 100 index and further more we found no causal relationship between the macro-economic variables and the KSE index in either direction.

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