

© Journal of Contemporary Issues in Business Research
ISSN 2305-8277 (Online), 2014, Vol. 3, No. 2, 88-99.
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CAUSAL RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES: EVIDENCE FROM DEVELOPING ECONOMY *

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ABSTRACT

Importance of stock market in the economic development of a country cannot be denied, and macroeconomic variables are important indicators that affect stock market of a country. Present study provides a great contribution to understand the association of these variables with stock market. This paper deals with the causal relationship among KSE 100 index and interest rate, exchange rate, consumer price index, imports and exports. For this purpose data of nineteen years has been collected from 1992 to 2010. Techniques of Augmented Dickey-Fuller test, regression analysis and Granger Causality test have been applied to examine the causal relationship of selected macroeconomic variables with KSE 100 index. Results of regression analysis indicate the presence of strong positive relation between IMP and KSEI. Furthermore, interest rate, exchange rate, consumer price index and exports have no relationship with KSE 100 index. Results of Granger Causality test demonstrate that bi-directional relationship exists between interest rate and KSE 100 index. Exchange rate and imports have uni-directional relationship with KSE 100 index and no causal relationship exists between consumer price index, exports and KSE 100 index. Present study provides valuable contribution in knowledge. It is important and attractive not only for investors but also for policy makers.

Keywords: Inflation; KSE 100 index; Interest Rate; Exchange Rate; Consumer Price Index; Imports; Exports.

INTRODUCTION

Efficient market is characterized as that market in which security prices give very quick response to new information. In this way current prices of security provide complete information about security. In efficient market every investor has complete knowledge of market. He is well aware of all the new information arriving in the market. No investor can earn extra profit unless he or she has inside information. According to economic theory stock prices should give an idea about future performance of a corporation. Corporate profits normally represent the stage of economic activity. If the stock prices cover all the basic essentials then stock prices can be considered as important sign of upcoming economic

* The views or opinions expressed in this manuscript are those of the author(s) and do not necessarily reflect the position, views or opinions of the editor(s), the editorial board or the publisher.

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activity (Chong & Goh, 2003; Maysami, Howe, & Hamzah, 2004). Present study is based on the association of macroeconomic variables with stock market with reference to Pakistan.

Importance of stock exchanges is greatly increasing day by day as an indicator of economic growth. It is an important debatable issue in economics that whether economic growth is result of financial development or whether it is an outcome of improved economic activity. Deep study of all these factors indicates that they are all interrelated in a sense that technological improvement is the main cause of long-term economic growth and these technological improvements are due to easy availability of credit to entrepreneurs. It is an important area of research to study the relationship between all these factors. In order to design macroeconomic policies, role of association of macroeconomic indicators with stock market is very important. Present study can be very helpful for policy makers keeping in view influence of macroeconomic changes on stock market in a developing economy. Domestic and foreign investors can also get benefit from present literature in investment decisions.

Many reforms have been introduced in the financial sector of Pakistan. These reforms have resulted in improvement in efficiency of financial sector of Pakistan. Capital market of Pakistan is composed of three stock exchanges. First and the largest is Karachi Stock Exchange (KSE) 100-index established in 1949. Second largest and important stock exchange of Pakistan is Lahore Stock Exchange (LSE) 25-index. Third important stock exchange is Islamabad Stock Exchange (ISE) 10-index. Role of KSE is very important in capital market growth. It has become the most important indicator of capital market condition. There are four categories of companies in KSE which represent all sectors of Pakistani economy. In order to create a balanced growth between capital markets and financial sector many reforms have been introduced in Pakistan. These reforms are helpful to control the crisis of bank-dominated financial markets.

There are many macroeconomic factors which influence stability and growth of stock market. Present study is based on those important macroeconomic factors which play important role in the development of stock market in an economy. Macro economic variables discussed in present study include Interest Rate (IR), Exchange Rate (EXR), Consumer Price index (CPI) as proxy of inflation rate, Imports (IMP) and Exports (EXPT).

Objective of Study

Purpose of this literature is to determine the casual association between selected macroeconomic variables and KSE 100 index using important tests and techniques.

1. To determine causal relationship between macroeconomic variables and KSE 100 index
2. To assess the strength of association between macroeconomic variables and KSE 100 index
3. To find out the dependence of KSE 100 index on macroeconomic variables

Present study is ordered as follows. Section I represents the introduction of topic under discussion. Section II represents the study that has already been done by different economists, analysts and etc. Section III describes the theoretical framework. Section IV discusses research methodology, data and variables, data description, sources of data and hypothesis. Section V includes results of study, findings. Last section includes conclusion and recommendations.

LITERATURE REVIEW

Relationship between macroeconomic variables and stock market is an important area of research addressed by many researchers nationally and internationally. Previous studies reveal that affiliation between the both is strong in developed countries as compared to

undeveloped and under developing countries. This section has designed to provide valuable information regarding this relationship on the basis of previous studies.

Study of literature reveals that a lot of research has been done to study the effect of macroeconomic variable and stock market with reference to Indian Stock market.(Tripathy, 2011) examined the causal relationship between interest rate, international market, exchange rate, inflation rate and stock market. He took weekly data of five years from 2005 to 2011. He applied the techniques of Granger causality test, Ljung-Box Q statistics and Unit Root test. He found that autocorrelation exists between all these selected variables and Indian Stock market. All these selected variables are helpful to predict future changes in stock prices.

(Oseni & Nwosa, 2011) found the effects of changes in real GDP, inflation rate and interest rates on stock market volatility. They implemented AR (k)-EGARCH (p, q) and LA-VAR Granger Causality test. These researchers used secondary data. Their studies demonstrated bi-causal relationship of changes in stock market with changes in real GDP and no causal relationship with changes in inflation rate.

(Samadi, Bayani, & Ghalandari, 2012) studied the relationship between macroeconomic variables like inflation rate, gold price, liquidity, foreign exchange rate and oil prices on stock return with reference to Tehran Stock Exchange. They took monthly data from 2001 to 2010 and applied GARCH approach. Results of study revealed that stock returns have relationship with rate of inflation, foreign exchange rate and prices of gold and no relationship with oil prices and liquidity.

(Pilinkus, 2009) conducted an important research to check the influence of 40 macroeconomic indicators on stock market index with reference to Lithuania. He used monthly data from 1999 to 2008 and implemented Granger causality test to check the relationship. Results of study confirm that stock market returns and macroeconomic indicators are interrelated and influence each other.

(Gay, 2008) focused on emerging economies like China, Russia, India and Brazil to examine the connection of macroeconomic indicators with stock market index prices. He found that macroeconomic indicators like rate of foreign exchange and oil prices have no significant relationship with stock price with respect to all these countries. He said that there are many national and international factors which may affect this association of macroeconomic variables with stock prices.

(Herve, Chanmalai, & Shen, 2011) examined the relationship of five important macroeconomic indicators with stock prices. Results of their study indicated that stock prices are influenced by mainly domestic rate of interest and consumer price index. (Dr., 2011) done very detailed study to observe the causal association of exchange rate with stock indices. In his study stock indices included financial, national, technological, service and industrial indices. Findings of his study revealed that exchange rate has bi-directional causal relationship with stock market indices. He concluded that industrial, national, financial and service indices have negative relationship and technology indices have positive relationship with exchange rate whereas exchange rate has negative relationship with all stock indices.

(M. B. Ali, 2011) studied the effect of fluctuation in micro and macroeconomic indicators on stock returns. His study was focused on Dhaka Stock Exchange. They implemented model of multivariate regression to study the association. They found that foreign remittance and inflation rate have negative relationship with stock prices whereas stock prices are positively related with rate of capitalization, market price per earnings and industrial production index.

(Maysami et al., 2004) focused on sector indices instead of composite indices of stock market. Their study was based on three sector indices of Singapore Stock Exchange like finance, hotel, and property indices along with overall stock index of Singapore Stock Exchange. Results of study determined that Singapore Stock Market index and Property

index have bi-directional significant relationship with all identified variables as compared to finance index and hotel index. Finance index has no relationship with money supply and real economic activity whereas hotel index has no relationship with interest rate and money supply.

(GENÇTÜRK, ÇELİK, & B N C , 2012) examined the effect of important macroeconomic variables on stock prices with respect to Istanbul Stock Exchange. They found that stock prices have uni-directional relationship with industrial production. (Hussain, Aamir, Rasool, Fayyaz, & Mumtaz, 2012) analyzed affiliation of macroeconomic variables and Karachi Stock Exchange. Results of their study demonstrated that money supply, wholesale price index, foreign exchange reserves, interest rate, and imports are positively and considerably related with stock prices, exports and exchange rate are negatively and insignificantly related with stock prices and industrial production index has considerable negative association with stock prices.

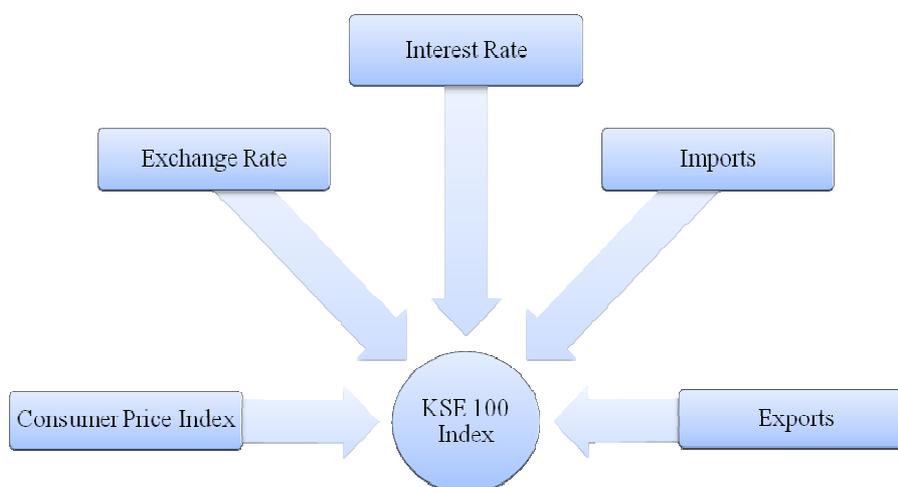
(Singh, 2010) observed the underlying connection of Bombay Stock Exchange with important macroeconomic variables. He found that stock index has strong bilateral relationship with index of industrial production, significant unilateral relationship with wholesale index but no relationship with exchange rate. (I. Ali, Rehman, Yilmaz, Khan, & Afzal, 2010) provided their great contribution by examining the causal association of important macroeconomic variables with stock prices on the basis of Karachi Stock Exchange in Pakistan. Results of their studies demonstrated bi-causal association of stock prices with index of industrial production. They found no causal association of stock prices with macroeconomic variables in Pakistan.

Above literature provide a sound base for importance of present study. In order to provide great contribution in knowledge present study combines those important variables which have studied by different researchers in different economies. Importance of developing economies is increasing day by day for investors as compared to developed economies. Developing economies provide attractive opportunities of investment not only for domestic investors but also for foreign investors.

THEORETICAL FRAMEWORK

FIGURE 1

Possible “Systematic Diagram” based on Conceptual Framework



RESEARCH METHODOLOGY

This study examines the causal relationship of CPI, exchange rate, interest rate of three months treasury bills, imports and exports with KSE 100 index. This relationship has been determined using different techniques. Augmented Dickey-Fuller test has been applied to test stationarity of variables. Regression Analysis has been done to determine the relationship between dependent and independent variables. Granger Causality test is applied to test the causality of relationship among the variables.

Data Collection

Annual data has been used for the period of 1992 to 2010. Data has been collected from different sources. Data related to CPI, imports and exports has been gathered from Economic Survey of Pakistan. Exchange rate data has been collected from State Bank of Pakistan's website. Interest rate of three months treasury bills has been collected from www.federalreserve.gov. Data of KSE 100 index has been collected from website of KSE.

Sample. Sample of nineteen year data for KSE 100 index and selected macroeconomic variables has taken. Annual data of nineteen years from 1992 to 2010 has taken for KSE 100 index and all selected macroeconomic variables which include CPI, IR, EXR, IMP and EXPT.

Description of Variable

This literature considers five independent variables and evaluates their relationship with one dependent variable. KSE 100 index has been considered as dependent variable, and remaining variables as independent such as consumer price index, exchange rate, interest rate, imports and exports.

Where;

- CPI refers to Consumer price index
- IR refers to Interest rate of treasury bills
- EXR refers to Exchange rate
- IMP refers to Imports
- EXPT refers to Exports

Present study considers the CPI as proxy of inflation rate. Present study considers the IR of three months treasury bills to observe the association of macroeconomic variables with KSEI. Imports include those goods and services which are purchased by domestic country from foreign country. Exchange rate can be defined as that rate which is used to change currency of one country into currency of another country. Exports include all those goods which are produced in one country and then sold to another country. Exports are important source to increase foreign exchange reserves of a country. Every country focuses to increase its exports in order to increase its foreign reserves which help a country to make economic progress.

Hypothesis

The main hypothesis of present study is as follow:

H0: There exists no causal relationship between CPI, IR, EXR, IMP, EXPT and KSE 100 index

H1: There exists causal relationship between CPI, IR, EXR, IMP, EXPT and KSE 100 index

RESULTS AND DISCUSSION

Descriptive Statistics

Descriptive statistics of all the selected macroeconomic variables and KSE 100 index can be explained with the help of following table. Following table provides information about mean, median, standard deviation, minimum value, maximum value, skewness and kurtosis of selected macroeconomic variables and KSE 100 index.

TABLE 1
Descriptive Statistics of Variables under Consideration

	KSEI	CPI	IR	EXR	IMP	EXPT
Mean	4711.7605	7.7432	3.3037	50.8827	1.0091E6	640003.3684
Median	2164.0000	7.5000	3.4300	57.5745	627000.0000	539070.0000
Minimum	945.24	2.00	.14	24.84	229889.00	171728.00
Maximum	14077.16	17.60	5.82	83.80	2910975.00	1617458.00
Std. Dev.	4254.56299	3.94065	1.83821	16.91193	8.87459E5	4.29467E5
Skewness	.999	.603	-.471	.070	1.212	.916
Kurtosis	-.370	.532	-1.140	-.613	.096	-.057

Results of Table 1 indicate that mean and median for CPI and IR are equal so these both macroeconomic variables have symmetrical data distribution. Mean and median for KSEI, EXR, IMP and EXPT are not equal which an indication is of asymmetrical data. For regression analysis symmetrical data is required. Asymmetrical data has converted into symmetrical by taking logarithm of KSEI, EXR, IMP and EXPT. Following table represents the results of symmetrical data.

TABLE 2
Descriptive Statistics of transformed Variables under Consideration

	logKSEI	CPI	IR	logEXR	log IMP	logEXPT
Mean	8.0618	7.7432	3.3037	3.8714	13.4870	13.1488
Median	7.6797	7.5000	3.4300	4.0531	13.3487	13.1976
Minimum	6.85	2.00	.14	3.21	12.35	12.05
Maximum	9.55	17.60	5.82	4.43	14.88	14.30
Std. Dev.	.91509	3.94065	1.83821	.36163	.83063	.69729
Skewness	.381	.603	-0.471	-0.500	.432	-0.017
Kurtosis	-1.528	.532	-1.140	-.808	-1.060	-1.094

On the analysis of above Table 2 it can be concluded that values of mean and median are equal for KSEI, CPI, IR, EXR, IMP and EXPT so data of all these selected variables and KSE 100 index has become symmetrical. Values of skewness for all selected variables and KSE 100 index are between +1 and -1 which is another indication of symmetrical data. Now this symmetrical data can be used for regression analysis.

Regression Analysis

Regression analysis technique has been used to check the dependence of KSEI on selected macroeconomic variables. In order to observe the dependence of KSEI on CPI, IR, EXR, IMP and EXPT following regression model has been developed. This model is helpful to examine the relationship of selected variables with KSE 100 index.

$$\text{KSEI} = a + b_1\text{CPI} + b_2\text{IR} + b_3\text{EXR} + b_4\text{IMP} + b_5\text{EXPT} + e$$

Here,

a = Constant

e = Error term

As logarithm of KSEI, EXR, IMP and EXPT have taken in order to make them symmetrical so this model can be revised as:

$$\text{LogKSEI} = a + b_1\text{CPI} + b_2\text{IR} + b_3\text{logEXR} + b_4\text{logIMP} + b_5\text{logEXPT} + e$$

Above model is consistent with model developed by (M. B. Ali, 2011) who also first transformed data into symmetrical and then applied regression analysis technique. Results of regression can be explained with the help of following tables:

TABLE 3
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.911 ^a	.829	.763	.44518

In case of multiple regression our major concern is with the value of Adjusted R Square instead of value of R and R square. On the basis of Model summary results of Adjusted R Square indicate that 76.3% variation in KSE 100 index is explained through IR, EXR, CPI, IMP and EXPT and the rest is not explained through this model of regression.

Statistical significance is checked through ANOVA. Table 4, ANOVA helps to examine the overall validity of the model with respect to statistical procedures. According to the following table value of significance (0.000) which shows that model is statistically significant and variation explained through this model is real not due to chance variation.

TABLE 4
ANOVA

Model	Sum of Squares	Mean Square	F	Sig.
Regression	12.497	2.499	12.611	.000 ^a
Residual	2.576	.198		
Total	15.073			

TABLE 5
Coefficients

Model	Unstandardized Coefficients				Collinearity Statistics	
	B	Std. Error	t	Sig.	Tolerance	VIF
Constant	-13.308	7.467	-1.782	.098		
CPI	-.029	.038	-.762	.459	.482	2.073
IR	-.083	.071	-1.166	.265	.648	1.543
Log EXR	-3.508	1.784	-1.966	.071	.026	37.817
Log IMP	.054	1.405	.038	.970	.008	123.643
Log EXPT	2.641	2.386	1.107	.288	.004	251.424

On the basis of above Table 5 it can be concluded that those variables whose value of significance is not less than 0.1 are not contributing in this model of regression. As value of

Tolerance is near to zero for most of the variables and value of VIF is greater than 2 for most of the variables so there exists the issue of multicollinearity.

TABLE 6
Collinearity Diagnostics

Eigen value	Condition Index	Variance Proportions					
		Constant	CPI	IR	LogEXR	LogIMP	LogEXPT
5.607	1.000	.00	.00	.00	.00	.00	.00
.235	4.884	.00	.10	.46	.00	.00	.00
.155	6.008	.00	.37	.11	.00	.00	.00
.002	49.666	.05	.05	.42	.03	.00	.00
.000	131.377	.07	.27	.00	.22	.04	.00
7.375E-6	871.954	.88	.22	.00	.75	.96	1.00

Table 6 of Collinearity Diagnostics shows that as Eigen value is near to zero and value of condition index is greater than 15 for most of the variables so there exists issue of multicollinearity. On the basis of above results of multiple regression models it can be concluded that when I observe the relationship of CPI, IR, EXR, IMP and EXPT with KSEI there exist issue of multicollinearity. In order to resolve the issue of multicollinearity, present study rerun the regression through stepwise method of regression.

TABLE 7
Model Summary in case of Stepwise Method of Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864 ^a	.747	.732	.47394

According to the above Table 7 value of Adjusted R Square indicates that 73.2% variation is explained through this model when regression is rerun. Table of ANOVA shows that value of significance is less than 0.05 so model is statistically significant and variation explained through this model is real not due to chance variation.

TABLE 8
ANOVA

Model	Sum of Squares	Mean Square	F	Sig.
Regression	11.255	11.255	50.105	.000 ^a
Residual	3.819	.225		
Total	15.073			

TABLE 9
Coefficients

Model	Unstandardized Coefficients				Collinearity Statistics	
	B	Std. Error	t	Sig.	Tolerance	VIF
Constant	8.062	.109	74.145	.000		
CPI	.791	.112	7.078	.000	1.000	1.000

Results of above Table 9 indicate that Imports have positive relationship with KSEI. 8.062 is the value of constant, 0.791 is the value of beta and value of significance is .000

0.5. So there is strong positive relationship of IMP with KSEI. This result is consistent with (Hussain et al., 2012). It can be explained as:

$KSEI = 8.062 + 0.791\text{LogIMP}$ Following Table 10 represents those variables which have excluded and have no relationship with KSEI. These variables include CPI, IR, EXR and EXPT. These results are consistent with the results obtained by (GENÇTÜRK et al., 2012; Ali et al., 2010).

TABLE 10
Coefficients

Model					Collinearity Statistics		
	Beta In	t	Sig.	Partial Correlation	Tolerance	VIF	Minimum Tolerance
Zscore: CPI	-.011 ^a	-.085	.933	-.021	.985	1.015	.985
Zscore: IR	-.108 ^a	-.719	.483	-.177	.681	1.468	.681
Zscore:Log IMP	-.363 ^a	-1.376	.188	-.325	.203	4.930	.203
Zscore:Log EXPT	-.447 ^a	-.694	.498	-.171	.037	26.995	.037

a. Predictors in the Model: (Constant), Zscore(LogIMP)

b. Dependent Variable: LogKSEI

Augmented Dickey-Fuller Test

Augmented Dickey-Fuller test is very useful and important to check stationary of data. Before applying Granger Causality test it is necessary to observe stationary of data. If data is not stationary it can be converted into stationary using different test and techniques and Dickey-Fuller test is one of those tests. Following table represents the results of Dickey-Fuller test.

On the basis of results of following Table 11 it can be concluded that all dependent and independent variables are stationary at first difference. It can be observed from the following table that value of ADF test statistics is less than 0.5 for all variables and value of probability is also less than 0.5 for all variables so data is stationary at first difference.

TABLE 11
Investigation of Unit Root within series at level & 1st difference

Variables	At Level			At First Difference				
	ADF test	Critical Values		Prob.	ADF test	Critical Values		Prob.
KSEI	-0.6732	At 1%	-3.857	0.829	-4.8848	At 1%	-3.8867	0.0014
		At 5%	-3.040			At 5%	-3.0521	
		At 10%	-2.660			At 10%	-2.6665	
CPI	-1.4804	At 1%	-3.857	0.520	-3.7464	At 1%	-3.8867	0.0132
		At 5%	-3.040			At 5%	-3.0521	
		At 10%	-2.660			At 10%	-2.6665	
IR	-2.3556	At 1%	-3.886	0.167	-3.4919	At 1%	-3.9203	0.0227
		At 5%	-3.052			At 5%	-3.0655	
		At 10%	-2.666			At 10%	-2.6734	
EXR	-1.0880	At 1%	-3.857	0.696	-3.1673	At 1%	-3.8861	0.0403
		At 5%	-3.040			At 5%	-3.0521	
		At 10%	-2.660			At 10%	-2.6665	
IMP	0.6479	At 1%	-3.857	0.986	-3.3032	At 1%	-3.8867	0.0312
		At 5%	-3.040			At 5%	-3.0521	

Variables	At Level			At First Difference				
	ADF test	Critical Values		Prob.	ADF test	Critical Values		Prob.
		At 10%	-2.660			At 10%	-2.6665	
EXPT	0.2395	At 1%	-3.857	0.967	-5.5727	At 1%	-3.8867	0.0004
		At 5%	-3.040			At 5%	-3.0521	
		At 10%	-2.660			At 10%	-2.6665	

Granger Causality Test

Granger Causality test is very useful and important technique to observe the causal relation between variables. Results are examined on the basis of probability at 1%, 5% and 10% level of significance. If value of probability is observed less than level of significance then we can reject null hypothesis which means variables cause and affect each other.

TABLE 12
Results of Granger Causality Test

Variables	Alternate Hypothesis	Probability	Results
CPI	CPI → KSEI	0.1220	Independent
	CPI ← KSEI	0.2848	
IR	IR → KSEI	0.0252**	Bi-directional
	IR ← KSEI	0.0768***	
EXP	EXR → KSEI	0.0763***	Uni-directional
	EXR ← KSEI	0.1172	
IMP	IMP → KSEI	0.2407	Uni-directional
	IMP ← KSEI	0.0962***	
EXPT	EXPT → KSEI	0.1057	Independent
	EXPT ← KSEI	0.4231	

1% Significance Level = *Significant

5% Significance Level = **Significant

10% Significance Level = ***Significant

Results of above Table 12 indicate that there exists no causal relationship between CPI, EXPT and KSEI this result is supported by the results observed by (Oseni & Nwosa, 2011), (I. Ali et al., 2010) and (Khalid, Altaf, Mehmood, Bagram, & Hussain). Bi-directional relationship exists between IR and KSEI this result is consistent with study done by (Herve et al., 2011). EXR and IMP have uni-directional relationship with KSEI this result is supported by the results obtained by (Hussain et al., 2012) and (Tripathy, 2011). This result is not supported by the results examined by Gay (2008) and Ali et al. (2010).

CONCLUSION AND RECOMMENDATIONS

Present literature can be summarized in a way that it has been designed particularly to study the causal association of CPI, IR, EXR, IMP and EXPT with KSE 100 index. Annual data of nineteen years has been taken from 1992 to 2010. Different tests and techniques have been applied. Results of multiple regression models indicate that only IMP has significant positive relationship with KSEI. IR, CPI, EXR and EXPT have no relationship with KSEI. Results of Granger Causality test represent that there exists bi-directional causal relationship between IR and KSEI. Uni-directional causality exists between EXR, IMP and KSEI. No causal relationship exists between CPI, EXPT and KSEI.

On the basis of this study it can be recommended that further research should be done in this area of study because stock market plays very important role in the economic progress of a country and it is affected by various macroeconomic variables. This study is limited to

five variables so there is scope for further research to study their relationship with stock market.

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