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Impact of Macro-economic Variables on Share Price Behavior of Karachi Stock Exchange

Muhammad Arshad Haroon (Corresponding Author)
Assistant Professor of Commerce, Government Sindh College of Commerce Hyderabad and Adjunct Assistant Professor
Isra University, Hala Nakka, Hyderabad, Pakistan
E-mail: Arshad31000@yahoo.com

Hummera Jabeen
Teaching Assistant & Ph.D Research Scholar
Isra University, Hala Nakka, Hyderabad, Pakistan
E-mail: hummaira.jabeen@isra.edu.pk

Abstract

This study has been conducted with a view to find out the relationship and impact of macroeconomic variables i.e. 3-Months, 6-Month and 12 Month Treasury Bill Rate (Proxy of Interest Rate), Consumer Price Index, Wholesale Price Index and Sensitive Price Index (Proxy for Inflation) with Karachi Stock Exchange—KSE 100 Share index. Monthly data has been collected from the period of July 2001 to June 2010. Coefficient of correlation and regression analysis have been used to test the hypothesis. The study examined the impact of inflation indices, interest rate (treasury bills), on KSE movement. The results showed that there was significant relationship between macroeconomic variables and KSE-100 Share index. The study further revealed significant impact of treasury bills on KSE-100 index.

Keywords: Macro-economic variables; consumer price index (CPI); whole price index (WPI); sensitive price index (SPI), Karachi Stock Exchange (KSE); share price behavior.

1. Introduction

Stock market reacts in response of various factors ranging from economic, political and Socio-cultural behavior of any country. Like any other stock market the KSE also reacts either positively or negatively by a number of factors occurring within or without the economic system. A stock exchange is an organized institution where the securities of joint stock companies are traded freely and the prices are determined by the forces of supply and demand. In simple, it is a place where buyers and sellers come together to exchange their holdings (shares, bonds, derivatives etc.) during on business hours.

It provides trading facilities to individual and institutional investors to exchange their holdings such as stocks, bonds and debt securities of listed companies. It is a place where investors seek reward in form of income means Dividend or Capital gain means the appreciation in the market value of the securities.

It mobilizes the nation's savings and business activates in the form of enhancing investment projects which promote economic activities in a country. The key function of stock market is to act as mediator between savers and borrowers. It is an ample source of mobilizing nation's savings from a large pool of small savers and channelizes these funds into fruitful investments. The preferences of the lenders and borrowers are harmonized through stock market operation. The stock market also supports reallocation of funds among corporations and sectors. It also provides liquidity for domestic expansion and credit growth. The leading stock markets of the world observed negative growth ranging from 50.7 percent (Pakistan) to 2.9 percent (China) during the fiscal year 2008-09 (Economic Survey of Pakistan 2008-09).

The stock market of Pakistan remained highly volatile during the last decade. Three intense financial crises were observed during that period. First, stock markets were crashed in March 2005. Second collapse was observed in the second quarter of the year 2006. Third and the most serious crashes were observed from May 2008 to January 2009. In this period, KSE-100 index dropped more than ten thousand points. During this period, the Board of Directors of Karachi stock exchange placed a floor in August 2008 due to sharp fall in share prices (KSE–100 Index), later on removed in December 2008.

In view of the above discussion, it is, therefore, paramount need to analyze the impact of macroeconomic variables such as money supply, exchange rate, inflation rate and interest rate on the movement of KSE 100-share index.

1.1 Objectives of Study

- To measure the impact of Inflation on KSE-100 Index
- To measure the impact of Interest Rate on KSE-100 Index
- To full fill above objectives; CPI, WPI and SPI are taken as proxies for inflation and Treasury Bill 3 Months, 6Months and 12 Months are taken proxies for interest rate.

1.2 Hypothesis

KSE-100 Index and Interest rate

H_o: If the Interest rate (T-bill rate) increases then the share market movement will decrease.

H_1: if the Interest rate (T-bill rate) increases then there will not be any impact on the movement of market movement.

KSE-100 Index and Inflation

H_o: If the Inflation increases then the share market movement will also increase.

H_1: if the Inflation increases then there will not be any impact on the movement of stock market.

2. Review of Related Literature

There are vast amount of research literature available on the subject and extensive research have been conducted in both developed and developing countries that has focused on identifying the impact of macro-economic variables on equity share prices. In short the most relevant and current studies in this context are outlined as follows

Mashayekh et al. (2011) in their research studied the relationship of Macroeconomic variables like inflation rate, interest rate of one-year investing deposits in state banks, interest rate of bonds and the growth rate of gold price with Tehran Stock Exchange (TSE). The study was conducted using monthly data from the period of April 1998 to March 2008. For carrying out necessary tests and analyzes they used VAR Model and JOHANSEN co- integration test. The results of the study showed that there was long term positive and meaningful relationship between inflation rate and TSE indicators i.e. stock returns and volume of transaction. Researcher further investigated that increase in bank interest rates were causing decrease in stock exchange activity. They argued that increase in bond interest rate has no negative effect on TSE because bonds are not competitive investment opportunity for stocks. With the help of VECM, researchers investigated the relationship b/w gold market and stock market and found the short run relationship b/w them and identified that in short run gold market can be used as a substitute for stock market as well as gold returns are play an important role in defining the stock market trend but in long run.

Harasheh and Libdeh (2011) investigated the co relational and causality relationships of stock prices in Palestine with variables like Gross Domestic Product (GDP), Inflation Rate, Exchange Rate, LIBOR, and Balance of Trade (BOT) and collected quarterly data from the 1st Quarter of 2000 (March 2000) to the 2nd Quarter of 2010 (June 2010). They conducted research by using for ten years of quarterly data collected and then performed unit root test on the variables in order to perform a Granger causality test. Regression analysis depicted a significant relationship between all macroeconomic variables concerned with stock prices of PEX (Palestine Exchange) while the causality analysis rejected any type of causal relationships between all macroeconomic variable under study and stock prices of PEX.

Sharma and Mahendru (2010) studied long term relationship of Bombay Stock Exchange (BSE) with macroeconomic variables i.e., gold price, foreign exchange reserve, inflation rate and change in exchange rate. They collected weekly data from the period of January 2008 to January 2009 and applied multiple regression equation model to determine the relationship among BSE stock prices and macroeconomic variables. The researchers found that there was a high correlation of exchange rate (88.9%) and gold prices (90.2%) with BSE Stock Prices whereas there was a limited influence of foreign exchange reserves and inflation rate on the stock prices of BSE.

Asaolu and Ogunmuyiwa (2011) investigated the impact of macroeconomic variables on Average Share Price (ASP) of Nigerian Stock Market. For this purpose they collected the yearly data from the period of 1986 to 2007 on External Debt, Inflation Rate, Fiscal Deficit, Exchange Rate, Foreign Capital Inflow, Investment, Industrial Output, Inflation Rate and ASP of Nigerian Stock Market and used analysis techniques like ADF test, Granger Causality test, Co-integration and Error Correction Method (ECM) and revealed that a weak relationship exist between ASP and macroeconomic variables of Nigeria and found that ASP was not a leading indicator of macroeconomic indicator of Nigerian economy but a long run relationship exist between ASP and macroeconomic variables for the period under study.

Oskooe (2010) did a systematic research to find out the relationship b/w stock market of Iran and economic growth of the country. To achieve that objective the researcher collected quarterly data on Iran Stock Market Index (BPI) and Real Gross Domestic

Product (RGDP) from the period of 1997:3 to 2008:3. For conducting the necessary tests researcher used analytical techniques like unit root ADF test, Akaike Information Criterion, Vector Autoregressive (VAR) Model, Vector Error Correction Model (VECM) and Granger Causality Test. The results revealed that in long run real GDP had a positive impact on stock prices and therefore is necessary tool for predicting future stock prices movement while the Granger Causality test confirmed the linkage between economic growth and Stock Price short run.

Olukayode and Akinwande (2009) examined the long and short run shocks exerted by macroeconomic indicators on Nigerian Capital Market. For this purpose, they collected annual data from the period of 1984 to 2007 on following variables: Consumer Price Index, Broad Money Supply (M2), Treasury Bill Rate, Real Output Growth (RGDP), Exchange Rate and Nigerian Stock Exchange (NSE) All-Share Index and used techniques i.e. ADF test and Augmented Engle-Granger Co integration test and Error Correction Model. Augmented Engle-Granger Co integration test revealed that macroeconomic variables had a long-run impact on Nigerian stock market, whereas, Error Correction Model (ECM) revealed that macroeconomic variables had a short-run impact on stock prices. Further they analyzed that exchange rate, inflation rate, money supply and real output were more influencing the NSE-All Share Index during the period under review.

Daferighe and Aje (2009) in their study analyzed the impact of Real Gross Domestic Product, Interest Rate and Inflation Rate on stock prices of Nigeria. They collected yearly data from the period of 1997 to 2006. They used regression analysis and built-up a model to represent stock prices by Stock Market Value Index ($SMVI = \alpha 0 + \alpha 1\ INT + \alpha 2\ INF + \alpha 3\ RGDP + u$). The results showed that variables were causing for 95.6% of variation in stock prices of Nigeria. They further determined that reduction in interest and inflation were causing increase in stock prices while increased RDGP had a positive impact on stock prices of Nigeria during period under review.

Shah (2008) studied the limitations of KSE and tried to explain which factors were creating barriers for KSE to reach the level of world developed stock exchanges and also determined importance and functions of stock exchange. For this purpose, they used qualitative approach and did comparison of KSE with OMX Nordic Exchange Stockholm and London Stock Exchange (LSE). They concluded that first priority of KSE must be to achieve incorporation and demutualization and recommended that KSE should attract regional and international firms for cross – border listings and KSE also must organize separate markets for different capital companies.

Saryal (2007) analyzed the impact of Inflation stock market volatility of Turkey and Canada. She collected monthly data of Turkish economy from the period of January 1986 to September 2005 on CPI and Turkish Stock Market (ISE-100 Index) and collected monthly data of Canadian economy starting from January 1961 to December 2005 on CPI and Canadian Stock Market (TSE-300 Index) and used statistical techniques like Descriptive Statistics, Standard Linear Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model and Quadratic GARCH (QGARCH) Model. It was found that the rate of inflation had a higher forecasting power for stock market volatility in Turkey but it was weaker but also significant for Canada. She concluded that increase in inflation causes stock market to become more volatile which were coincident with high stock market risk.

Menike (2006) researched the effects on stock prices of Sri Lankan stock market caused by macroeconomic variables. For this purpose, he collected monthly time series of data from the period of September 1991 to December 2002 on variables like Exchange Rate, Money Supply, Interest Rate, Inflation Rate and Stock Prices of Colombo Stock Exchange (CSE). The results of the study revealed that most of the firms reported high explanatory power pf macroeconomic variables in determining stock prices. Inflation rate and Exchange rate were negatively affecting the stock prices in CSE. Researcher further found out that increasing interest rate on T-Bills were causing fall in stock prices because investors switching towards treasury securities. Researcher argued that Money Supply was not appeared to had an strong prediction for identifying stock price movement as well as stocks in CSE were not providing effective hedge against inflation. Finally exchange rate was found to be the main source for influencing stock prices and appeared to have a negative impact on stock prices.

Erdogan and Ozlale (2005) studied the impact of macroeconomic variables on the Turkish Stock Exchange Market. They collected the weekly data from the period of June 1991 to march 2000 on currency in circulation, Foreign Exchange Rate, Interbank Rates, Secondary Rates and Industrial production and used a time varying parameter model with GARCH specification. The results of the study revealed that depreciation of local currency led to decrease in stock market returns before and during the financial crisis in 1994 but not after that. They further analyzed that currency in circulation did not seem to have a significant impact on stock market returns, whereas, the industrial production index was found to have an positive impact on stock market returns. Secondary rates did affect the stock returns positively till 1994 crisis but the impact was finished after that. Finally interbank interest rates were found to have a negative relationship with stock returns.

Al-Sharkas (2004) researched the relationship between the Jordanian Stock Market and macroeconomic factors. For this purpose researcher collected the quarterly data from the period of March 1980 to December 2003. The data was collected on Real Economic Activity, Money Supply, Inflation, and Interest Rate and on Jordanian Stock Prices. The analytical techniques used were ADF test, Phillips and Perron unit root test, Descriptive Statistics and Johansen's Vector Error Correction Model. The tests and analysis of the study revealed that Amman Stock Market prices formed a long term relationship with all concerned macroeconomic variables within the specified period of study years.

Omran and Pointon (2001) studied and analyzed the influence of inflation rate on Egyptian stock market by seeing its impact on Activity and Liquidity of the market. for carrying out necessary test and analysis, they collected annual data from the period of 1980/1981 to 1997/1998 on Inflation Rate, Market Activity and Market Liquidity and used statistical tools like ADF test, co-integration analysis and Static Long-Run Regression via Ordinary Least Squares (OLS). The results of the study revealed that there was a negative relationship between inflation rate and both stock market activity and liquidity and finally concluded inflation rate was found to be inversely correlated with stock market returns and stock market prices.

Nishat and Shaheen (2005) in their research studied the impact of multiple factors on share prices of KSE. For this purpose they collected the data from the period of 1981 to 2000. the data was further subdivided into two broad decades. First decade was related to pre-reform period (1981 – 1990) and second decade was related to post-reform period

(1991 – 2000). This was done to analyze the impact on both periods separately. The data was collected on variables like dividend yield, payout ratio, size, asset growth, leverage and earning volatility. The results of the study revealed that in pre-reform period (1981-1990) only payout ratio, size and dividend yield were the factors which explained half variation in share prices of KSE, while, in post-reform period (1991-2000) same factors were causing the one third variation in share prices of KSE. Overall, they found four factors out of six which were exerting multiple effect/impact on share prices and those were size, payout ratio, leverage and dividend yield.

3. Research Methodology

3.1 Data

Data has been collected on Treasury bill rates of 3 months, 6 months and 12 months and on consumer price index, wholesale price index and sensitive price index from the period July 2001 to June 2010.

3.2 Data Collection Methodology

Data has been collected on monthly basis for the period fiscal year 2001-2002 to fiscal year 2009-2010 on 3, 6 and 12 Months Treasury bill rates, Consumer, Wholesale and Sensitive Price Indices and KSE-100 Index from Handbook of Statistics of Pakistan 2010, various issues of Macroeconomic surveys and KSE Annual Reports.

3.3 Data Analysis Methodology

Data has been analyzed by computer generated results using SPSS (computer software for statistics) and to carry out necessary objectives test that are used are correlation and regression analysis.

3.4 Correlation

When two variables are frequently related or associated in some way or to some such type relationships between two or more variables can be studied by means of correlation.

Correlation measure the relationship or interdependence or association between two variables, in which with the changes in the values of one variable, the values of the other variable also changed. Correlation may be positive or negative.

In this study we use co-efficient of correlation to find out the correlation between macroeconomic variables and KSE-100 Index by using following formula.

3.5 Co-efficient of Correlation

The co-efficient of correlation is a measure of the degree of interdependence between two variables. The co-efficient of correlation is denoted by r. it is a pure number and varies between -1 and +1 with the central value of zero. When r = 0, it means that there is no correlation between two variables. For determining the exact degree and trend (direction) of correlation Karal Pearson's method is the most satisfactory method, which is given below:

$$r = \frac{\sum (X-\bar{X})(Y-\bar{Y})}{n\sigma_x\sigma_y}$$

Where,

dx = the deviation of individual X values from their mean

dy = the deviations of individual Y values from their mean

n = the number of pairs of values

σ_x = the standard deviation of x values

σ_y = the standard deviation of y values

The above formula is also known as Pearson product momentum correlation co-efficient.

3.6 Regression

In this study we also use regression analysis to find out the impact / effect of one variable to another variable.

The regression was originated by Frances Galton in 1885. The regression is defined as the dependence of one variable upon another variable. Examples of regression problem are:

1. Yield of crop grown with different amount of fertilizers.
2. Link of life of certain animals exposed to different amount of radiation.
3. Hardness of plastic which are heated for different periods of time.

In all the examples the variation in one measurement is studied for particular levels of the other variable selected by experimenter. Hence regression is a statistical tool with the help of which are in a position to estimate the unknown values of one variable from known values of other variable.

3.7 Regression Co-efficient

Regression co-efficient is the rate of change in the expected values of the dependent variable for a given observe variable. There are two regression coefficients: regression coefficient of X on Y and regression coefficient of Y on X. Regression coefficient are denoted by b_{xy} and b_{yx}.

3.8 Regression Coefficient of X on Y

Regression coefficient of X on Y gives the values by which X variable changes for a unit in the value of Y variable. The co-efficient regression of X on Y is given as:

$$b_{xy} = r.\frac{\sigma_x}{\sigma_y}$$

3.9 Regression Coefficient of Y on X

Regression coefficient of Y on X gives the values by which Y variable changes for a unit in the value of X variable. The co-efficient regression of Y on X is given as:

$$b_{xy} = r.\frac{\sigma_y}{\sigma_x}$$

3.10 Regression Equation

Regression equations are algebraic expressions of the regression lines. There are two regression equations, because there are two regression lines.

3.11 Regression equation of X on Y

This equation shows the effect of variation of X on Y variable.

$$(X - \bar{X}) = r.\frac{\sigma_x}{\sigma_y}(Y - \bar{Y})$$

3.12 Regression equation of Y on X

This equation shows the effect of change of Y on X variable.

$$(Y - \bar{Y}) = r.\frac{\sigma_x}{\sigma_y}(X - \bar{X})$$

Regression equations are used for two purposes. Firstly they provide the values for regression lines and secondly they provide a numerical method of finding out the most suitable value of X for a given value of Y and most suitable value of Y for a given value of X.

4. Results

4.1 Correlation Results

Each time correlation is performed separately of KSE-100 Index with Consumer Price Index, Wholesale Price Index, Sensitive Price Index, Treasury Bills 3 Months Rate, Treasury Bill 6 Months Rate and Treasury Bill 12 Months Rate.

4.1.1 Correlation of KSE-100 Index with CPI, WPI and SPI

Table 1: Correlation of KSE-Index with Inflation Indices

CPI	Pearson Correlation	-0.11
	Sig. (2-tailed)	0.24
	N	107
WPI	Pearson Correlation	-0.09
	Sig. (2-tailed)	0.37
	N	107
SPI	Pearson Correlation	-0.09
	Sig. (2-tailed)	0.38
	N	107

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 1 shows the SPSS generated results of correlations of KSE-100 Index with Consumer Price Index, Wholesale Price Index and Sensitive Price Index. The results of the correlation test revealed that consumer price index has shown high negative correlation of 0.11 with KSE–100 Index from the fiscal year 2001-2001 to 2009-2010, whereas, wholesale price index and sensitive price index has shown moderate negative correlation of 0.09 with KSE – 100 Index in the same period.

4.1.2 Correlation of KSE-100 Index with T.Bill-3 Months, T.Bill-6 Months and T.Bill-12 Months

Table 2: Correlation of KSE-Index with 3, 6 &12 Months T-Bills

T. Bill - 03 Month	Pearson Correlation	-0.28
	Sig. (2-tailed)	0
	N	107
T. Bill - 06 Month	Pearson Correlation	-0.19
	Sig. (2-tailed)	0.05
	N	107
T. Bill - 12 Month	Pearson Correlation	-0.27
	Sig. (2-tailed)	0.01
	N	107
**. Correlation is significant at the 0.01 level (2-tailed).		
*. Correlation is significant at the 0.05 level (2-tailed).		

Table 2 shows the SPSS generated results of correlations of KSE-100 Index T. Bill – 03 Month, T. Bill – 06 Month and T. Bill – 12 Month. The results of the correlation test revealed T. Bill – 03 Month and T. Bill – 12 Month has shown a high negative correlation of 0.28 and 0.27 with KSE – 100 Index while T. Bill – 06 Month has shown negative correlation of 0.19 with KSE – 100 Index.

4.2 Regression Results

Regression analysis has been performed each time separately between KSE-100 Index with Consumer Price Index, Wholesale Price Index, Sensitive Price Index, Treasury Bills – 3Months Rate, Treasury Bills – 6Months Rate and Treasury Bills – 12Months. KSE-100 Index performed as a dependent variable while all other variables used as independent variables.

Table 3: Regression Analysis of KSE-100 Index with Consumer Price Index—CPI

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.113483 [a]	0.012878	0.003477	0.091234
a. Predictors: (Constant), Consumer Price Index				
b. Dependent Variable: KSE				

In model 1 R Square is 0.0128 which means that CPI explains 1.28% of variation in KSE–100 Index movements.

Table 4: Regression Analysis of KSE-100 Index with Wholesale Price Index—WPI

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.088390 [a]	0.007812	-0.001636	0.091467
a. Predictors: (Constant), Whole Sale Price Index				
b. Dependent Variable: KSE				

In model 2 R Square is 0.0078 which states that WPI explains 0.78% of variation in KSE – 100 Index.

Table 5 : Regression Analysis of KSE-100 Index with Sensitive Price Index

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.085067 [a]	0.007236	-0.002218	0.091494
a. Predictors: (Constant), SPI				
b. Dependent Variable: KSE				

In model 3 R Square is 0.0072 which states that SPI is held 0.72% responsible for causing variation in KSE – 100 Index movements.

Table 6 : Regression Analysis of KSE-100 Index with T. Bill – 03 Months

Table 6 Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.277794 [a]	0.077169	0.068381	0.088213
a. Predictors: (Constant), TB Three				
b. Dependent Variable: KSE				

In model 4 R Square is 0.0771 which means that Treasury Bill (3 Months) are held responsible for causing 7.71% of variation in KSE – 100 Index movements.

Table 7 : Regression Analysis of KSE-100 Index with T. Bill – 06 Months

Table 7 Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.191452 [a]	0.036654	0.027479	0.090129
a. Predictors: (Constant), TB Six				
b. Dependent Variable: KSE				

In model 5 R Square is 0.0366 which can be defined as Treasury Bill(6 Months) are held 3.66% responsible or explains 3.66% of variation in KSE – 100 Index movements.

Regression Analysis of KSE-100 Index with T. Bill – 12 Months

Table 8	Model Summary [b]			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.266718 [a]	0.071139	0.062292	0.088501
a. Predictors: (Constant), TB Twelve				
b. Dependent Variable: KSE				

In model 6 R Square is 0.0711 can be explained as Treasury Bill(12 Months) explains 7.11% of variation in KSE – 100 Index movements.

5. Conclusion

Investment in Stock market is an interesting business activity. Practitioners and analysts always try to predict future directions of stock market to spot and outperform the market. Besides this they also try to measure the risk associated with their investment. They try to find out the relationship between macroeconomic indicators and stock market movement which help them to take an appropriate investment decision. Investigators might forecast how financial market changes if macro-economic variables like interest rates, different T-bills rates and inflation, consumer price index, whole sale price index and sensitive price index fluctuate on any particular direction. On the other hand, policymakers may seek linearity of these variables to formulate monetary policies in order to sufficiently and timely adjust KSE.

In this study the investigator examined the impact of macroeconomic indicators on KSE-100 share index prices. The study revealed that CPI has a negative correlation of 0.11 with KSE at 0.05 significance level, WPI revealed negative correlation of 0.09 with KSE at 0.05 significance levels where as SPI also showed negative correlation of 0.07 with KSE at 0.05 significance levels. Treasury bills of 3-months, 6-months and 12-months also showed high negative correlation of 0.28, 0.19 and 0.27 with KSE-100 share index at significance level of 0.05.

The study has further examined the results of regression of each macroeconomic variable with KSE-100 share index. In regression between CPI and KSE, CPI as an independent variable was found to be causing 1.28% of variation of in KSE-100 share index. Similarly, WPI and SPI are found to be explaining variation in KSE-100 share index of 0.78% and 0.72%. In regression between treasury bills and KSE-100 share index, 3-Month T. Bill is found to be explaining 7.71% variation in KSE. Similarly, 6-Month T. Bill and 12-Month T. Bill is found to be explaining 3.66% and 7.11% of variation in KSE-100 share index.

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