

Inflation and Stock Price Behaviour in Selected Asian Economies: An Econometric Snapshot

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Abstract: The empirical nexus between stock prices and inflation in an economy has been subjected to the intensive research, predominantly for the developed countries as well as in emerging economies of the world. The objective of this study is to examine the relationship between inflation and the stock prices and to assess the impact of inflation on stock prices of five Asian economies-India, Hongkong, Singapore, Japan and Korea over the period, 2002-2010. The result suggests that in countries like Hongkong and Singapore, long run relationship exists between inflation rate and stock prices but short run causality disappears whereas in case of India and Korea, short run unidirectional granger causality running from inflation to stock prices is found to exist but long run cointegrating relationship disappears. Results of correlation analysis show that except in case of Korea, correlations between inflation and stock prices are positive in most of the cases under our investigation. Stocks are a perfect hedge to the degree in case of Hongkong, India, Japan, Singapore that corporate cash flows are positively related to inflation following conventional Fisherian wisdom. But, in case of Korea only, stock prices are negatively related to inflation indicating that stock prices are not good hedge against inflation.

Keywords: Inflation; Stock Prices; causality; PP test; cointegration analysis; Granger Causality Test.

1. Introduction

The empirical nexus between stock prices and inflation in an economy has been subjected to the intensive research, predominantly for the developed countries. Nevertheless, the study in the emerging Asian markets also has been gaining popularity among the researchers especially after the occurrence of the Asian turbulent time of Financial Crisis in 1997. In financial theory, inflation rate replicated by consumer price index (CPI) represents an overall upward price movement of goods and services. Inflation happens either when prices go up or when it takes more money to buy the same substance. Researchers suppose that the rates of inflation will persuade the stock market volatility and risk. According to the generalized Fisher hypothesis, equity stocks, which represent claims against the real assets of a business, may serve as a hedge against inflation. Accordingly, investors would put on the market the financial assets in exchange for real assets when expected inflation is evident. In such a case, stock prices in nominal terms should fully reflect expected inflation and the relationship between these two variables should be found positively correlated *ex ante*. Consequently, equities are a hedge against the increase of the price level due to the fact that they represent a claim to real assets and, hence, the real change on the price of the equities should not be affected. But, different empirical evidences do not represent such truth. Therefore, the present study is a humble attempt to enquire into the impact of inflation on stock prices vis-à-

vis searching causal nexus between stock prices and inflation in selected Asian economies.

The objective of this study is to examine the relationship between inflation and the stock prices and to assess the impact of inflation on stock prices of five Asian economies-India, Hongkong, Singapore, Japan and Korea over the period, 2002-2010.

2. Theoretical underpinning on the relation between inflation and stock prices

Irving Fisher was the first economist to probe into impact of inflation on share prices. He concluded that shares should be a good hedge against inflation. Fisher observed that nominal interest rates consist of two components: a required real return on monies lent and an expected loss in value of money because of inflation. He argued that the required real return is determined by real factors and is unrelated to expected inflation. In other words, the real rate of return required by the investors does not change with expected inflation. During inflation the cash flows from shares go up (because of rise in selling prices). The increased cash flows, discounted with the same old required rate of real returns, would give a higher value and thus share value should go up during inflation, making them a good hedge. But, actually, this has not been observed.

Fama & Schwert (1997) found evidence that the lowering of share prices (due to inflation) can be explained by two correlations: first between inflation and expected level of economic activities, which are negatively correlated (higher

inflation bodes lower economic activities) and second between expected economic activities and share prices, which are positively correlated (higher level of economic activities imply higher stock prices). Taking them together would suggest that inflation should lower the stock prices. Inflation here acts as a proxy for lower economic activities in near future and this line of reasoning is called the *proxy effect* or the *proxy hypothesis*. They also distinguished between expected inflation and unexpected inflation. The negative relationship between real stock return and inflation puzzled many as it contradicts conventional Fisherian wisdom.

However, inflation has enormous shock on stock valuations. Stock prices depend principally on the present value of future streams of cash flows thrown off by the investments. In other words, investors buy a stock today for tomorrow's cash flows. If inflation is going to augment, it reduces their value. If the future value of cash flows is reduced, that means those cash flows are worth less in today's monetary term which means that a company's stock is worth less. A stock's price/earnings ratio is a barometer for how much investors are willing to pay for a company's growth prospects. If a company is going to grow quickly in the future, investors are willing to pay up for that growth. Paying up for growth means buying stock with high price/earnings ratios. But, if inflation is going to erode the value of that growth, investors won't be willing to pay as much for the growth because it will be worth less in a high inflation environment. That means price/earnings ratios fall. Therefore, lower inflation means higher price/earnings ratios and higher stock prices and higher inflation means lower price/earnings ratios and lower stock prices. If inflation were to take off, that would have a dramatic impact on price/earnings ratios of stocks.

The relationship between stock prices, rates of return and inflation is perhaps best understood in view of the dividend-discount model (DDM). Investors will set the price of a stock at time t , S_t , to a point where the expected return on the stock is equal to the required rate of return.

If it is assumed that there does not exist any inflation and a company is expected to generate a real cash flow of C per period in perpetuity. Assume that the firm pays out all free cash flow as a dividend.

The current price of a stock (S_t) is calculated by dividing the dividend (D) by the required rate of return (k_s). The formula expressed mathematically is as follows:

$$S_t = D / k_s \text{-----(1)}$$

Suppose now that expected inflation increases. This brings about two fundamental changes. First, the cash flows of the company may change as general Inflation acts on both revenues and expenses. Second, the discount rate will change to a nominal rate (k_n) defined by:

$$k_n = (1 + kr) (1 + I) \text{----- (2)}$$

where: k is the real required rate of return given that expected inflation (I) is at some positive value. The Fisher Effect expresses the nominal rate of interest (r) as the sum of the real rate of interest plus the inflation rate. as follows: $1 + r = (1 + R)(1 + I)$

$$r = R + I \text{-----(3)}$$

Where: r is the nominal rate of interest.

R is the real rate of interest.

I is the real rate of inflation.

3. Literature review

Financial economists, policymakers and investors have long attempted to understand the dynamic interactions between inflation and stock prices. Empirical work has provided evidence for the effect of inflation on stock prices as well as on stock returns.

Richard A. Cohn and Donald R. Lessard (1981) examined the impact of inflation on stock prices in international perspective. Having collected data on Stock price, earnings, dividend, and depreciation from Capital International Perspective for the time period of 1969-1979, it has been found that there exists negative relationship between the stock prices and inflation.

Charles R. Nelson (1976) examined the inflation and rate of return on common stocks. The monthly return of diversified portfolio of common stock and monthly inflation rate measured by the consumer price index has been taken into investigation. Monthly stock returns consist of the Scholes Index of value-weighted returns (1953-1972) and returns on the Standard and Poor's 500 Index (1973-1974). Running the regression, the results reported that there is negative relationship between stock returns and inflation.

Chao Wei, (2010) used VAR results to advocate in inflation illusion as the explanation for the positive association between inflation and the dividend yield. The model results support a proxy hypothesis, according to which, a third factor, which represents technology shocks, moves both inflation and the dividend yield in the same direction, resulting in a positive correlation between the two. The VAR structure of the model solutions makes it possible to decompose the dividend yield into the long-run expected dividend growth rate and the discount rate components, so that their relative importance can be studied.

Al-Rjoub, S(2005) extends the empirical evidence by analyzing the reaction of monthly stock returns to the unexpected portion of CPI inflation rate and by capturing the asymmetric shocks to volatility of unexpected inflation in five MENA countries. Both Threshold GARCH and Exponential GARCH are used to catch the news affect that unexpected inflation may have on stock returns. The results suggest a negative and strongly significant relationship between unexpected inflation and stock returns in MENA countries and also indicate that the stock markets of the listed MENA countries does not feel the high up's and down's movements in the markets and as such the volatilities and the asymmetric news effect is absent.

K V S S Narayana Rao L M Bhole (1990) examined the impact of inflation on rate of return on equity for India. For examining this, they estimated nominal return on equity by using reserve Bank of India for share prices and equity

yield and real rate of return is calculated by whole sale index as well as consumer price index for the time period of 1953-1987. They run the simple regression and concluded that for short run, there is negative relationship between inflation and equity returns and positive return for long run.

Malathy Prabhakaran (1989) examined whether equities act as a hedge against inflation. To examine this, he took the annual average of index of wholesale prices and prices index of equity shares of all industries from Reserve Bank of India and confirmed that equities securities have failed to provide inflation hedge.

Boucher, (2004) considers a new perspective on the relationship between stock prices and inflation, by estimating the common long-term trend in real stock prices, as reflected in the earning-price ratio, and both expected and realized inflation. The article studied the role of the transitory deviations from the common trend in the earning-price ratio and realized inflation for predicting stock market fluctuations. In particular, the result suggests that these deviations exhibit substantial in sample and out-of-sample forecasting abilities for both real stock returns and excess returns and found that this variable provides information about future stock returns at short and intermediate horizons that is not captured by other popular forecasting variables.

Glenn L. Johnson, Frank K. Reilly, and Ralph E. Smith (1971) examined whether the individual stock acts as an inflation hedge. To check this, they selected the thirty stocks in the Dow-Jones Industrial Average as common stock sample and calculated the inflation by Consumer Price Index and concluded that individual common stocks in the Dow-Jones Industrial Average are not consist as inflation hedges.

Theodore E. Day (1984) examined the relationship between real stock returns and inflation and concluded that there is negative relationship between real stock returns and inflation.

N. Bulent Gultekin (1983) examined the relationship between stock market returns and inflation. To investigate this he collected the stock returns and inflation for 26 different countries. He collected monthly inflation rates for the period of 1947-1979 by using Consumer Price indices from International Financial Statistics (IFS) and Stock returns for the same period from capital international Perspective(CPI).It has been concluded that there is negative relationship between unexpected inflation and expected inflation with stock returns.

Mark Crosby Glenn Otto (2000) examined the relationship between inflation and capital stock for different countries. They run the regression model and reported that there is negative relationship between capital stock and inflation.

Frank K. Reilly, Glenn L. Johnson and Ralph E. Smith (1970) examined inflation and inflation hedges and common stocks and concluded that stock returns are not hedge of inflation.

Patrick J. Hess Bong-Soo Lee (1999) examined the Stock Returns and Inflation with Supply and Demand Disturbances. To examine this they took USA data for the

period of (1947-1994). By running the Vector auto regression model and concluded that there is negative relationship between the stock returns and inflation.

Geske and Roll (1983) documented a negative relationship between inflation and stock return. An increase in inflation has been expected to increase the nominal risk-free rate, which in turn will raise the discount rate used in valuating stocks. If cash flows increase at the same rate, the effect of a higher discount rate will be neutralized. On the other hand, if contracts are nominal and cannot adjust immediately, the effect will be negative. Also, the empirical evidence suggests that high and variable inflation rates increase inflation uncertainty and thus lower share value. Further research also supports the hypothesis that stock returns are negatively related to both expected and unexpected inflation rate. However, the study conducted by Caporale and Jung (1997) rejected the hypothesis that stock returns and inflation are negatively correlated. While other studies such as (Chatrath et al., 1997) and (Adrangi et al., 1999) show only partially support to this hypothesis in the developing stock markets of India, Peru and Chile respectively. Another study by Salameh (1997) documented that there is no relationship between stock prices and inflation for period of December 1993 to June 1996 in Jordan. Furthermore, Joo (2000) examined whether monetary policy accounts for the negative relationship between real stock returns and inflation. His evidence suggests that about 30% of the observed negative relationship is attributed to monetary innovations. Also, Patra and Poshakwale (2006) found that short-run and long-run equilibrium relationship exists between inflation and stock prices for stocks listed at Athens stock exchange. On the other hand, Zoicas and Fat (2008) found that inflation rate has led to the estimation of significant relationships to the variations of stock market. The study by Suliaman et al., (2009) also found that whole sale price index is significantly and positively related to stock prices. Similarly, Antonio and Francisco (2009) examined the short-run response of daily stock prices on the Spanish market to the announcements of inflation news at the industrial level. They observed a positive and significant response of stock returns in the case of "bad news" (total inflation rate higher than expected one) in recession, and also in the case of negative inflation surprises ("good news") in non-economic recession. The study conducted by Durai and Bhaduri (2009) tested the relationship between stock returns, inflation and output for the post-liberalized period in India using the wavelet methodology. The findings showed that there is a strong negative relationship between inflation and real stock return in the short and medium term.

4. Methodology

4.1. Database:

The data comprises the monthly closing prices of stock exchanges and inflation rates for five Asian countries-

Hongkong, India, Japan, Korea and Singapore. Data Sources include International Financial Statistics, Handbook of Statistics on Indian Securities Market, 2010, World Economic Outlook, October, 2010 released by IMF. Two variables used in this study are nominal stock price and inflation. The CPI is the standard choice for inflation in the literature due to its availability and consistency.

4.2. Econometric model

In this study, the methodology used to test the relation between inflation and stock prices are ADF Test, the PP Test to examine the stationarity. Johansen Co integration test is applied for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). Then, granger causality test is adopted to verify the existence of short run causal nexus between inflation and stock price behaviour.

4.2.1. Unit Root Tests

a) Augmented Dickey Fuller (ADF)

The Augmented Dickey Fuller (ADF) test is the modification of the DF test, allowing higher order of autoregressive process. The tests for unit root identify whether an individual series (Y_t) is stationary by running an ordinal least square (OLS) regression equation. The ADF test makes a parametric correction for higher-order correlation by assuming that the y series follow an AR (p) process and adjusting the test methodology where p is the number of lagged changes in Y_t necessary to make μ_t serially uncorrelated. Two types of Augmented Dickey Fuller regressions covered the non-linear trend and linear trend element respectively as shown in equation (4) and (5)

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \gamma_1 \sum_{i=2}^k \Delta y_{t-i+1} + \epsilon_t \dots\dots\dots (4)$$

$$\Delta Y_t = \beta_0 + \beta_{it} + \gamma Y_{t-1} + \sum_{i=1}^k \alpha_i \Delta Y_{t-1} + \epsilon_t \dots\dots\dots (5)$$

where t is the time or trend variable, Δ is the first-difference operator, Y_t is the logarithm of the variable in period t, Δ Y_t = Y_t - Y_{t-1}, α and β are the constant parameters, μ is intercept, ε_t is the disturbance term which was assumed to be white noise and p is the number of the lagged terms. The optimal lag length of p may be selected by using Akaike Information Criteria (AIC) suggested by Akaike (1977). In each case, the hypothesis involved in identifying the unit root problem or non-stationarity which can be represented as below:

- H0: α = 0 (non-stationary for equation 4)
- HA: α < 0 (non-stationary for equation 5)
- H0: β = 0 (non-stationary for equation 4)
- HA: β < 0 (non-stationary for equation 5)

The null hypothesis that α and β = 0, the conventionally computed t-statistic is known as the τ (tau) statistic, whereby the critical values of this statistic have been tabulated by Dickey and Fuller on the basis of Monte Carlo simulation. If the computed absolute values of τ-statistic exceed the ADF critical τ values, then the above null hypothesis can be rejected, meaning that the Y_t is stationary. A large negative τ value is generally an indication of stationarity.

b) Phillips-Perron (PP)

More weight was given to the Phillips-Perron unit root as this test has been shown to be more reliable than Dickey-Fuller test in presence of large amounts of heteroscedasticity. The PP unit root test proposed by Phillips and Perron (1988) has an advantage as it propose a nonparametric method of controlling for higher-order serial correlation in a series.

The PP unit root test is performed by conducting the following regressions:

$$Y_t = \alpha_0 + \beta Y_{t-1} + \eta t \dots\dots\dots (6)$$

$$Y_t = \alpha_0 + \alpha_{1t} + \beta Y_{t-1} + \eta t \dots\dots\dots (7)$$

where α₀ is the intercept, β and α₁ is the estimator of the equilibrium parameters, and t is the trend term and ηt is white noise error term.

The first step in this procedure is to assume that the number of lag terms in the regression functions is equal to zero. The PP unit root test is similar to ADF unit root test from the regression equation in (6) and (7) with lag p = 0. Next, the statistic will be transformed to remove any effects of series correlation on the asymptotic distribution of the test statistics. Thus, the test transformed the t-statistic into the Phillips-Perron Z-statistic as a simple modification of t-statistic which allows the lagged level term to be incorporated in the ADF test. The PP test accounts for non-independent and identically distributed (n.i.i.d) process using non-parametric adjustment to the standard ADF test. The critical values of PP test are the same as those used for ADF test since both tests have the same asymptotic distribution. The null and alternative hypothesis applied in the unit root is:-

- Ho : Y_t is non-stationary, Y_t does exhibit a unit root
 - Ho : Y_t is stationary, Y_t does not exhibit a unit root
- If all series are integrated as of order one, denotes I (1), consists of unit root at first difference. Further diagnosis of common trend within the prices, as the long-run relationship will be conducted. The cointegration test requires at least two variables to exhibit the same order of non-stationary or integrated in the same order.

4.2.3. Johansen Co integration test

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or

equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non – stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non – stationary series is cointegrated or not.

Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be co-integrated, they must be integrated of order one (non-stationary) and the linear combination of them is stationary I(0).

The crucial approach which is used in this study to test cointegration is called the Johansen cointegration approach. The Johansen approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

If the hypothesis of nonstationarity is established for the underlying variables, it is desirable and important that the time series data are examined for cointegration. Toda and Philips (1993) have shown that ignoring cointegration when it exists, can lead to serious model misspecification. We use the maximum likelihood procedure of Johansen (1991, 1995) because it is based on well-established maximum Likelihood procedure.

If two data series are integrated of the same order, it is useful to test for cointegrating relationship between the integrated variables. The Johansen method applies maximum likelihood procedure to determine the presence of cointegrating vectors in non-stationary time series as a vector autoregressive (VAR):

$$\Delta Y_t = C + \sum_{i=1}^k \psi_i \Delta Y_{t-1} + \varphi Y_{t-1} + \eta_i \dots \dots \dots (8)$$

where Y_t is a vector of non-stationary variables and C is the constant term.

4.2.4.Granger Causality test

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger. 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of Y_t add no information to explanation of

movements of X_t beyond that provided by lagged values of X_t itself (Green, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H_0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X. In summary, one variable (X_t) is said to granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice-versa.

The spirit of Engle and Granger (1987) lies in the idea that if the two variables are integrated as order one, I(1), and both residuals are I(0), this indicates that the two variables are cointegrated. The Granger theorem states that if this is the case, the two variables could be generated by a dynamic relationship from SP to EXR and, vice versa.

Therefore, a time series X is said to Granger-cause Y if it can be shown through a series of F-tests on lagged values of X (and with lagged values of Y also known) that those X values predict statistically significant information about future values of Y. In the context of this analysis, the Granger method involves the estimation of the following equations:

If causality (or causation) runs from INFLA to SP, we have:

$$\Delta SP_{it} = \eta_i + \sum \alpha_{11} \Delta SP_{i,t-1} + \sum \beta_{11} \Delta INFLA_{i,t-1} + \epsilon_{i,t} \dots \dots \dots (9)$$

If causality (or causation) runs from SP to INFLA, it takes the form:

$$\Delta INFLA_{i,t} = \eta_i + \sum \alpha_{12} \Delta INFLA_{i,t-1} + \sum \beta_{12} \Delta SP_{i,t-1} + \lambda ECM_{it} + \epsilon_{2t} \dots \dots \dots (10)$$

where, SP_t and $INFLA_t$ represent stock prices and exchange rate respectively, ϵ_{it} is uncorrelated stationary random process, and subscript t denotes the time period.

The decision rule:

From equation (9), $\Delta INFLA_{i,t-1}$ Granger causes ΔSP_{it} if the coefficient of the lagged values of INFLA as a group (β_{11}) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (10), $\Delta SP_{i,t-1}$ Granger causes $\Delta INFLA_{it}$ if β_{12} is statistically significant.

5. Empirical results

Table: 1 present the summary of descriptive statistics for the selected dependent and independent variable-namely stock prices (SP) and inflation rate(INFLA) under study. We have examined 108 monthly observations of both the

variables to estimate the following statistics. As mean describes the average value in the series and Std. Dev. measures the dispersion or spread of the series, then stock prices (SP) for all the five Asian countries taken into our study are highly volatile data series as compared to inflation rates. The skewness measures whether the distribution of the data is symmetrical or asymmetrical. All positive skewness value of the all variables (except Hongkong and India) indicates that distribution of most of the data series

has a long right tail. On the other hand, kurtosis measures the peakedness and flatness of the distribution of the series. Kurtosis estimates in this table indicate that only exchange rates for Korea and Singapore are relatively peaked compared to normal (leptokurtic) and all other variables have platykurtic distribution. Jarque-Bera test statistics is used for testing whether the data series is normally distributed.

Table 1: Descriptive Statistics (2002:1 to 2010:12)

Panel A: Stock Prices	Hongkong	India	Japan	Korea	Singapore
Mean	17563.89	10791.33	13225.00	1322.55	2394.33
Median	14876.00	12277.00	11489.00	1379.00	2281.00
Std. Dev.	5921.98	5604.365	3668.68	496.44	750.92
Skewness	0.36	-0.033	0.29	0.076	0.031
Kurtosis	2.04	1.56	1.55	1.72	1.62
Jarque-Bera	0.54	0.77	0.91	0.62	0.72
Probability	0.76	0.68	0.63	0.73	0.70
Panel B: Inflation Rate	Hongkong	India	Japan	Korea	Singapore
Mean	0.711	6.79	-0.244	3.11	1.71
Median	0.09	6.2	-0.30	2.8	1
Std. Dev.	2.40	3.38	0.826	0.742	2.07
Skewness	-0.29	0.86	0.56	1.008	1.54
Kurtosis	2.10	2.39	2.93	3.38	4.56
Jarque-Bera	0.43	1.24	0.47	1.58	4.48
Probability	0.807	0.538	0.79	0.45	0.107

Source: Own estimate

The Jarque-Bera test, a type of Lagrange multiplier test, was developed to test normality of regression residuals. The Jarque-Bera statistic is computed from skewness and kurtosis and asymptotically follows the chi-squared distribution with two degrees of freedom. Jarque-Bera test statistics is used for testing whether the data series is normally distributed. The high probability value estimated above accepts null hypothesis that the data series is

normally distributed. The outcome were supported by the small figure of JB test (Jarque-Bera probability test), where the null hypothesis (that the data are normally distributed) can not be rejected.

Table 2: Correlations between inflation and stock prices for the selected Asian economies

Name of the country	Correlation
Hongkong	0.572431
India	0.84661
Japan	0.821223
Korea	-0.37216
Singapore	0.040892

Shares represent residual claims on real assets; i.e. claims on assets after creditors' claims are met; (Equity = Assets – Liabilities). Inflation increases the prices of real assets but

does not increase the creditors' claims. Thus inflation should increase the nominal value of equity. The problem with this simplistic reasoning is that it assumes the value of

firm to be the same as the value of the real assets owned by the firm.

It can be argued that if “other things remain the same” (*ceteris paribus*) and if it is assumed that inflation is uniform i.e. if prices and costs increase uniformly across the board then a firm will be able to pass on all increased costs (raw material, wages etc) to its buyers and its real earnings should remain unaffected. The problem with this argument is that *cetera* rarely remain at par, i.e. other things do change and inflation is rarely uniform. Some firms manage to pass on increased costs to their customers while some others fail to do so and go bust. Inflation increases earning volatility and hence should reduce value. Thus the value of firms may become lower on onset of inflation even

though the prices of its real assets go up in response to the rising prices.

However, results of correlation analysis show that except in case of Korea, correlations between inflation and stock prices are positive in most of the cases under our investigation. Stocks are a perfect hedge to the degree in case of Hongkong, India, Japan, Singapore that corporate cash flows are positively related to inflation following conventional Fisherian wisdom. But, In case of Korea only, stock prices are negatively related to inflation indicating that stock prices are not good hedge against inflation.

Table:3: Augmented Dickey-Fuller (ADF) Test

ADF-Inflation												
Countries	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
Hongkong	-1.71	-2.33	-1.71	-2.05	0.717	0.844	-3.97	-0.009	0.464	-6.78	-1.66	-1.94
India	2.25	1.41	1.28	-0.976	-0.51	-0.132	-1.58	-0.831	-0.341	-3.74	-2.68	-2.97
Japan	-2.72	-1.72	-1.23	-2.40	-0.308	-0.579	-4.14	-0.205	-0.259	-5.05	-0.592	-0.874
Korea	-2.92	-2.48	-4.99	-2.65	-2.23	-5.12	-3.42	-2.39	-4.52	-3.02	-2.37	-2.69
Singapore	-2.70	-1.65	-0.418	-3.20	-2.81	-29.93	-4.21	-2.32	-30.2	-3.94	-1.82	-2.07
ADF-stock prices												
Countries	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
Hongkong	-13.36	-2.95	0.737	0.269	-11.44	-5.80	-2.21	-7.49	-5.44	-2.21	0.11	1.06
India	-0.62	-0.629	-0.935	-2.29	-2.04	-3.44	-3.01	-2.31	-2.76	-2.69	-2.27	-2.61
Japan	-1.86	-1.47	-1.32	-1.18	0.651	0.873	-2.86	-0.135	0.543	-4.71	-2.32	-2.89
Korea	-1.28	-0.868	-1.36	-2.81	-1.79	-4.14	-3.96	-1.85	-3.64	-3.53	-1.90	-2.16
Singapore	-2.04	-1.56	-1.52	-2.64	-1.92	-0.131	-3.61	-2.34	-0.165	-3.26	-3.09	-3.28
Critical Values												
1%	-4.64			-5.75			-4.89			-6.13		
5%	-3.34			-4.20			-3.42			-4.35		
10%	-2.82			-3.55			-2.86			-3.63		

Ho: series has unit root; **H1:** series is trend stationary

Table-3 presents the results of the unit root test by ADF for the two variables for their levels. The results indicate that the null hypothesis of a unit root can not be rejected for the given variable and, hence, one can conclude that the variables are not stationary at their levels. On the other hand, to determine the stationarity property of the variable, the same test above was applied to the first differences.

Results from table- 3 revealed that all the ADF values are not smaller than the critical t-value at 1%, 5% and 10% level of significance for all variables. Based on these results, the null hypothesis that the series have unit roots in their differences can not be rejected. Therefore, the augmented Dickey Fuller Test fails to provide result of stationarity both at levels and first differences at all lag differences.

Table:4: Phillips-Perron (PP)Test

INFLA-Inflation rate												
Countries	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
Hongkong	-1.71	-1.76	-1.77	-2.05	-1.99	-1.98	-3.97	-3.92	-3.86	-6.78	-8.23	-9.42
India	2.25	2.76	3.22	-0.976	-0.868	-0.839	-1.59	-1.50	-1.48	-3.74	-4.17	-6.12
Japan	-2.72	-2.71	-2.719	-2.39	-2.37	-2.36	-4.14	-4.21	-4.28	-5.05	-5.12	-5.56
Korea	-2.92	-2.94	-3.02	-2.65	-2.64	-2.69	-3.42	-3.54	-4.06	-4.02	-4.10	-4.49
Singapore	-2.70	-2.71	-2.71	-3.20	-3.26	-3.63	-4.21	-4.43	-5.15	-3.94	-4.08	-4.64
SP-Stock Prices												
Countries	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
Hongkong	-13.36	-12.11	-12.98	0.269	0.230	-5.80	-0.041	-0.105	-0.092	-3.21	-3.69	-4.06
India	-0.62	-0.51	-0.30	-2.29	-2.39	-2.23	-2.99	-3.04	-3.36	-3.67	-3.71	-4.45
Japan	-1.86	-1.85	-1.83	-1.18	-0.852	-0.849	-2.86	-2.84	-2.83	-4.71	-5.41	-5.97
Korea	-1.28	-1.08	-0.968	-2.81	-2.80	-2.87	-3.96	-4.11	-4.60	-3.53	-3.65	-4.07
Singapore	-2.04	-2.01	-2.00	-2.64	-2.64	-2.70	-3.61	-3.76	-4.29	-3.26	-3.39	-4.14
Critical Values												
1%	-4.64			-5.75			-5.24			-6.13		
5%	-3.34			-4.20			-3.55			-4.35		
10%	-2.82			-3.55			-2.82			-3.63		

PP tests specify the existence of a unit root to be the null hypothesis.

H₀: series has unit root; H₁: series is trend stationary

* ADF, PP stand for unit root tests developed by Dickey and Fuller (1979, 1981), Phillips and Perron (1988) respectively.

** ADF and PP tests specify the existence of a unit root to be the null hypothesis.

Conversely, PP test provides better results than ADF test and it attempts to satisfy the stationarity conditions for all the variables for all five Asian countries under our study. The results of unit root test in table-4 show that both variables of our interest, namely stock price (SP) and inflation rate (INFLA) for all the countries under our consideration attained stationarity after first differencing,

$I(1)$, using Phillips-Perron (PP) Test as PP values with and without trend at first differences for all two variables-SP and INFLA for all countries are less than critical values at 5% and 10 % respectively. Therefore, the series are $I(1)$ processes and they are integrated of the same order.

Table 5: Results of Johansen Cointegration Test (Stock Price vs. Inflation rate)

Hongkong				
Hypothesized No. of CE(s)	Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None *	0.89381	20.44747	18.17	23.46
At most 1	0.269046	2.507238	3.74	6.4
L.R. test indicates 1 cointegrating equation(s) at 5% significance level.				
India				
Hypothesized No. of CE(s)	Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None	0.595898	9.316372	15.41	20.04
At most 1	0.22776	2.067677	3.76	6.65

L.R. rejects any cointegration at 5% significance level.				
Japan				
Hypothesized No. of CE(s)	Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None	0.64233	11.36618	15.41	20.04
At most 1	0.32472	3.141017	3.76	6.65
L.R. rejects any cointegration at 5% significance level.				
Korea				
Hypothesized No. of CE(s)	Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None	0.672915	10.21855	15.41	20.04
At most 1	0.147672	1.278267	3.76	6.65
L.R. rejects any cointegration at 5% significance level.				
Singapore				
Hypothesized No. of CE(s)	Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
None **	0.952563	27.36016	15.41	20.04
At most 1	0.310411	2.973274	3.76	6.65
L.R. test indicates 1 cointegrating equation(s) at 5% significance level.				

Ho: has no co-integration; H₁: has co-integration

*(**) denotes rejection of the hypothesis at 5%(1%) significance level.

After ensuring that all series are I(1), we step forward to cointegration test to find the presence of any cointegrating relationship between stock prices and exchange rates. The cointegration test is performed to the series of stock prices and inflation rate for all the countries under our consideration. Table 5 depicts the results of the Johansen test. One cointegration relationship is found for Hongkong and Singapore as reported by reported by LR test statistic.

On the other hand, this cointegration approach fails to discover any cointegration relationship in the case of India, Japan and Korea. Based upon the results of the empirical tests for co-integration, there is no long-run significant correlation between stock prices and inflation rate in case of India, Japan and Korea but significant relations exist for countries like Hongkong and Singapore.

Table:6: Granger Causality Test

Hongkong		
Null Hypothesis:	F-statistics	probability
HSTOK does not Granger Cause HINFLA	4.93571	0.16847
HINFLA does not Granger Cause HSTOK	6.39069	0.13531
India		
ISTOK does not Granger Cause IINFLA	0.48014	0.67561
IINFLA does not Granger Cause ISTOK	13.7462 *	0.04781
Japan		
JSTOK does not Granger Cause JINFLA	0.38519	0.72192
JINFLA does not Granger Cause JSTOK	0.21918	0.82022
Korea		
KSTOK does not Granger Cause KINFLA	1.56600	0.38971
KINFLA does not Granger Cause KSTOK	3790.10*	0.00026
Singapore		
SSTOK does not Granger Cause SINFLA	3.12888	0.24220
SINFLA does not Granger Cause SSTOK	0.55095	0.64477
HSTOK stands for stock price of Hongkong, HINFLA for inflation rate of Hongkong.		

ISTOK stands for stock price of India, IINFLA for inflation rate of India.
 JSTOK stands for stock price of Japan, JINFLA for inflation rate of Japan.
 KSTOK stands for stock price of Korea, KINFLA for inflation rate of Korea.
 SSTOK stands for stock price of Singapore, SINFLA for inflation rate of Singapore.

* Indicates significant causal relationship at 5% significance level.

The results of Pairwise Granger Causality between stock price and (SP) and inflation rate (INFLA) are contained in Table 6. We have found that both for the Ho of "IINFLA does not Granger Cause ISTOK" and Ho of "KINFLA does not Granger Cause KSTOK", we reject the Ho at 5% level since the F-statistics are rather larger and most of the probability values are less than 0.05 at the lag length of 2. Therefore, we reject the Ho and conclude that IINFLA Granger Causes ISTOK and KINFLA Granger Causes KSTOK. The above results generally show that causality is unidirectional in case of India and Korea and it runs from inflation to stock prices. So we can say that inflation rate influences stock prices of Korea and India and inflation rate can be used to improve the forecast of stock prices of the two said economies. But there is no causal relationship between stock prices and inflation of Japan, Hongkong and Singapore. The test results in table 6 suggest that we fail to reject the null hypothesis of Granger non-causality from stock price to exchange rate and vice versa in countries like Japan, Hongkong and Singapore at 5% level of significance. This implies that the inflation cannot be used as a leading indicator for future growth in stock prices in countries like Japan, Hongkong and Singapore and vice versa.

6. Conclusion

The study tries to examine the relationship between inflation rate and stock prices of selected Asian countries-India, Hongkong, Japan, Korea and Singapore over the period, 2002-2010. The result of unit root test suggests that all the data series of the variables are stationary at first differences and integrated of order one, using Phillips-Perron test. Johansen cointegration test suggests that there is no long run cointegrating relationship between stock prices and inflation rates in India, Japan and Korea but significant relations exist for countries like Hongkong and Singapore.

In order to find out any short run causal relationship between stock prices and inflation rates, standard Granger causality test generally shows that causality is unidirectional in case of in case of India and Korea and it runs from inflation to stock prices. So we can say that inflation rates influence stock prices in short run in case of India and Korea. The Granger causality test results shows that stock prices does not Granger cause inflation rates and inflation rate does not Granger cause stock prices in countries like Japan, Hongkong and Singapore implying no causal relationship between stock prices and inflation rates.

Results of correlation analysis show that except in case of Korea, correlations between inflation and stock prices are positive in most of the cases under our investigation. Stocks are a perfect hedge to the degree in case of Hongkong, India, Japan, Singapore that corporate cash flows are positively related to inflation following conventional Fisherian wisdom. But, In case of Korea only, stock prices are negatively related to inflation indicating that stock prices are not good hedge against inflation.

In conclusion, in countries like Hongkong and Singapore, long run relationship exists between inflation rate and stock prices but short run causality disappears whereas in case of India and Korea, short run unidirectional granger causality running from inflation to stock prices is found to exist but long run cointegrating relationship disappears.

References

- [1] Adrangi, B., Chatrath, A. and Shank, T. M. (1999). "Inflation, output and stock prices: evidence from Latin America". *Managerial and Decision Economics*, vol.20, pp63-74.
- [2] Al-rjoub Samer (2005), "The Adjustments of Stock Prices to Information about Inflation: Evidence Form MENA Countries", *Applied Economic Letters*, vol.12, issue.14, pp871-879.
- [3] Antonio Diaz, Francisco Jare'no (2009), "Explanatory factors of the inflation news impact on stock returns by sector: The Spanish case", *Research in International Business and Finance*, vol.23, pp349-368.
- [4] Boucher C (2004). Stock prices, inflation and stock returns predictability, CEPN University of Paris-Nord Version 16.
- [5] Caporale, T., Jung, C.(1997), Inflation and real stock prices, *Applied Financial Economics*, vol.7 (3), vol.265-266.
- Charles R. N.,(1976), Inflation and Rates of Return on Common Stocks, "The Journal of Finance", Vol. 31, No. 2, pp. 471-483.
- [6] Chatrath, A., Ramchander, S. and Song, F. (1997), "Stock prices, inflation and output: evidence from India". *Applied Financial Economics*, vol.7, pp439-445.
- [7] Dickey, D.A and W.A.Fuller (1979), Distribution of estimators of Autoregressive Time series with a Unit Root, *Journal of the American Statistical Association*, vol.74, pp427-31.
- [8] Dickey, D.A and W.A.Fuller (1981), Likelihood Ratio Test for Autoregressive Time Series with a Unit Root, *Econometrica*, vol.49, pp1057-72.
- [9] Durai S. Raja Sethu and Bhaduri Saumitra N. (2009), "Stock prices, inflation and Output: Evidence from wavelet analysis", *Economic Modeling*, vol.26, pp1089-1092.
- [10] Engle, R..F., & Granger, C. W., (1987), Co-integration and error correction: representation, estimation, and testing, *Econometrica*, vol.55, pp251-276.
- [11] Glenn L Johnson, Frank K. Reilly, and Ralph E. Smith (Jun.,1971), Individual Common Stocks as Inflation Hedges, "The Journal of Financial and Quantitative Analysis", Vol. 6, No. 3 , pp. 1015 -1024.
- [12] Fama, E.F. & Schwert. G. W(1997), Asset return and inflation, *Journal of Financial Economics*, vol 5, pp115-46.
- [13] Fisher, R. A. (1932), *Statistical Methods for Research Workers* (4th Ed.). Edinburgh: Oliver & Boyd.

- [14] Granger C.W.J. (1969), Investigating causal relations by econometric models and cross spectral methods, *Econometrica* 37.
- [15] Granger, C. W. J. and Newbold, P. (1974), "Spurious regressions in econometrics", *Journal of Econometrics* vol.2 (2): pp111-120.
- [16] Geske, Z. and R. Roll (1983), "The Fiscal and Monetary Linkage Between Stock Returns and Inflation", *Journal of Finance* 38 (March), 1-33.
- [17] Glenn L Johnson, Frank K. Reilly, and Ralph E. Smith (Jun., 1971), Individual Common Stocks as Inflation Hedges, "The Journal of Financial and Quantitative Analysis", Vol. 6, No. 3 , pp. 1015 -1024.
- [18] Joo, S. (2000), "Stock returns and inflation: covariance decomposition". *Applied Economic Letters*, vol.7, pp.233-237.
- [19] Johansen, S. (1996) Likelihood-Based Inference in Cointegrated Vector Autoregressive Models, 2nd edition, Oxford University Press.
- [20] Johansen, S(1988), "Statistical Analysis of Cointegrating Vectors." *Journal of Economic Dynamics and Control*, 12, 231-54.
- [21] Johansen, S., Juselius, K.(1992), Structural hypotheses in a multivariate cointegration analysis of the PPP and UIP for UK. *J. Economics*. 53, pp 211-44.
- [22] K. V. S. S. Narayana Rao and L. M. Bhole(1990), Inflation and Equity Returns *Economic and Political Weekly*, Vol. 25, No. 21 (May 26, 1990), pp. M91-M96.
- [23] N. Bulent Gultekin (Mar.,1983), Stock Market Returns and Inflation: Evidence from Other Countries, "The Journal of Finance", Vol. 38, No. 1 pp. 49-65.
- [24] Mark Crosby Glenn Otto (2000), Inflation and the Capital Stock, *Journal of Money, Credit and Banking*, vol. 32, issue 2, pages 236-53.
- [25] Patrick J. Hess Bong-Soo Lee (1999), Stock returns and inflation with supply and demand disturbances, *Review of Financial Studies*, vol.12, pp1203-1218.
- [26] Phillips, Peter and Pierre Perron (1998), "Testing for a Unit Root in Time Series Regression." *Biometrika*, Vol. 75 (June). pp. 335-346.
- [27] Patra Theophano and Poshakwale Sunil (2006), "Economic variables and stock market returns: evidence from the Athens stock exchange". *Journal of Applied Financial Economics*, vol.16(13),pp993-1005.
- [28] Prabhakaran Malathy (1989), "Do Equities Act as a Hedge against Inflation?", *Economic & Political Weekly*, Vol. 24, No. 8, Feb 25, p. 24-26.
- [29] Richard A. Cohn and Donald R. Lessard (1981), Effect of inflation on stock prices: International evidence, *Journal of Finance*, vol.36,no.2,pp277-289.
- [30] Sims, C. A. (1972): Money, Income and Causality, *American Economic Review*, vol. 4, pp. 540-542.
- [31] Salameh, Rashed Mohammad (1997), "Forecasting share prices traded at Amman financial market", *Al-Basaer*, 1, no.1.
- [32] Sulieman D. Mohammad, Adnan Hussain, and Adnan Ali (2009), "Impact of macroeconomic variables on stock prices: Empirical evidence in case of KSE (Karachi Stock Exchange)". *European Journal of Scientific Research*, vol.38 (1), pp96-103.
- [33] Wei, Ch.(2010), Inflation and Stock Prices: No Illusion , *Journal of Money, Credit and Banking*, Volume 42, issue 2-3 (March 2010), p. 325-345.
- [34] Zoicas Ienciu Adrian and Fat Maria (2008), "The Analysis of the relation between the evolution of the bet index and the main macroeconomic variables in Romania, *Codruta Annals of Faculty of Economics*, vol.3(1), pp632-637.