The Study of Inflation and Stock Market Returns in Japan

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Abstract:
This study examines the impact of inflation on stock returns for the period of 10 years. Nikkei stock 300 index month closing value has been used in the study to represent the monthly stock market returns and the Consumer price index as a measure of inflation. The study examines the monthly data of Nikkei stock 300 index from January 2005 to November 2014. The study tries to analyze the relationship between the dependent and independent variables using the simple regression model. We have taken CPI monthly values as independent variable and stock index value as dependent variable and used one lag percentage differentials value by converting both the time series to analyze the nature of stationary. These tests examine both long-run and short-run dynamic relationships between the stock market index and the inflation. This paper established that there is positive but not significant relationship between stock market returns and inflation in Japan.

Keywords: *CPI, Index, Inflation, Stock market return*

1 Introduction

The relationship between stock returns and stock values has its wide importance for any economy as inflation is inevitable and if we are able to establish a strong positive relationship between both these variables, we can use stock as good hedge against inflation and preserve our real returns in the economy. The relationship between inflation and stock market returns has been investigated number of times by numbers of researchers but it has still been a difficult task to clearly express the said relationship in general. Number of researchers argued that there is a positive relationship between inflation and stock market returns and some of the researchers proved using cross sectional and time series data that it varies country to country specially with respect to their particular structural changes during time series data procured. It is quite obvious with respect to cross sectional data that stocks available in the market are good hedge against inflation. Some researchers have also showed with their research that there is negative relationship between stock market returns and inflation considering various ups and downs in the economies and neglecting the stock as good hedge against inflation. Many of them found positive and negative relationship between these two variables but considered as neutral as their studies did not show the significant results. The present study has been conducted in order to truly understand the relationship between the two major variables, i.e. inflation and stock market returns.

2 Review of Literature

Pierrel and Kwoks (1992) They concluded that there is a negative relationship between inflation and returns on stock. They used VAR model to test the various hypotheses that explain the relationship

between inflation and returns on stock. They have also used the distributed lags to study the dynamic structure of inflation.

Lee at al (2000) examine the impact of hyperinflation in 1920's on stock returns in Germany and concluded that there is significant and positive relationship between inflation and stock returns irrespective of the realized or expected inflation . ARIMA model is used in this study to test the various hypotheses to show the relationship between inflation and stock market returns.

Choudhary (2001) did study the relationship between stock returns and inflation in some selected Latin and Central American countries for the period of 1981 to1996 and this study shows that there is positive relationship between these two variables. This study shows that stock can be taken as good hedge against inflation. This study also used ARIMA model and did not show much difference between expected and realized inflation with respect to stock returns.

Crosby (2001) did study the relationship between the inflation and stock returns in Australia for the period of 1875 to 1996 and found a short run negative relationship between these two variables.

Spyros (2001) did study the relationship between the inflation and stock returns in Greece for the period 1990 to 2000. This study concluded that there is negative but not significant relationship between these two variables. They used VAR model to test the hypotheses.

Floros (2002) did study the relationship between the stock returns and inflation in Greece and the results of this study were neutral. This study also argued to treat these two variables as independent and concluded that there is no relationship between inflation and stock returns in Greece. This study based on standard causality test.

Ugur (2005) also examine the relationship between stock returns and inflation in Turkey for the period of 1986 to 2000. This study shows negative relationship between inflation and stock returns, which could be the reason of unexpected inflation on stock returns, this study argued.

Alagidede and Panagiotidis (2006) They also studies the relationship between stock returns and inflation in Greece for the period of 1990 to 1999. This study shows macro variables like money supply, volume of trade and exchange rate have their impact on inflation and the relationship between these two variables is positive for short run as well as long run.

Yeh and Chi (2009) examine the relationship between stock returns and inflation by testing various hypotheses. This study conducted upon 12 OECD countries and concluded that there is short run negative relationship between these two variables and suggested that an increase in inflation reduces the real returns on stock. They used ARDL model to test the hypotheses.

3 Objectives of the Study

1. To examine the relationship between inflation and stock market returns in Japan.
2. To analyze the impact of inflation on stock market returns in Japan.

4 The Methodology and Econometric Model

In order to examine the relationship between nominal stock returns and inflation, we have used monthly data regarding CPI for the period from January 2005 to November 2014. Data were collected from **http://data.worldbank.org**. Stock market returns are proxies by Nikkei 300 returns and data has procured from **http://www.tradingeconomics.com/japan/stock-market**.

We started our study with the regression, by regressing index values over CPI and taking basic linear regression model as mentioned below. We intentionally kept the regression model as simple as possible because it's generally accepted phenomenon in econometrics that if we can explain the behavior of dependent variables substantially with less number of independent variables and if theory

is not strong enough to suggest what other variables might be included, we prefer not to include more variables. This can also make the experiment easy to deal with autocorrelation, heteroscedasticity and multicollinearity, etc. The following model has been used in the study:

4.1 Econometric Model

Regression equation: $\underline{R_t = \alpha + \beta\pi_t + e_t}$

Where $\mathbf{R_t}$ is index value at time **t**, $\boldsymbol{\pi_t}$ is given **CPI** for corresponding time period **t**. **α** as intercept i.e. the value of **Index**, when the slope coefficient becomes 0. **β** as slope coefficient of the given value of **CPI** as explanatory variable and **Index** value as explained variable. $\mathbf{e_t}$ as the stochastic disturbance variable that has not been captured by **β** as explanatory variable but it do effect the $\mathbf{R_t}$ as per past experiences and past studies and general belief.

5 Data Analysis

In this study, we find the value of α as intercept (1858.452) and β as slope coefficient 20.84 and T statistics values are also supporting the relationship with "P-Value" as 0 (refer appendix, Table 5). This shows that there is positive and significant relationship between R_t and $\pi t_{\text{ i.e.}}$ series of absolute index values and CPI. Further analysis required as this result cannot be accepted unless we check for the nature of stationary, because both series are time series and contain absolute values. It is advisable here not to conclude now and go for the test of nature of stationary in time series data which could be a big problem and make our efforts useless though we have good value of R^2 but still we need to check the non-stationary. We have used DF Unit Root Test to know the nature of stationary in both the time series.

5.1 DF Unit Root Test

$$\Delta Y_t = \delta Y_{t-1} + u_t$$

$$H_o: \delta = 0 \text{ (Unit Root)}$$

$$H_1: \delta \neq 0$$

- Let Index Value = Y_t , **the DF Unit Root Test** are based on the following regression form:
- Without Constant and Trend
- The hypothesis is: H
- Decision rule:
- If t* > ADF critical value ==> not reject null hypothesis, i.e., unit root exists and we can say that time series is non-stationary or it has a stochastic trend.
- If t* < ADF critical value ==> reject null hypothesis, i.e., unit root does not exist and we can say that time series is stationary possibly around a deterministic trend.
- We run this test for both time series one by one.

The following table represents the result of the DF Unit Root Test:

Table 1: DF Unit Root Test (INDEX VALUE Time Series)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		**1.203496**	**0.6714**
Test critical values:	**1% level**	**-3.487046**	
	5% level	**-2.886290**	
	10% level	**-2.580046**	

Table 2: DF Unit Root Test (CPI Time Series)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		**0.959680**	**0.7657**
Test critical values:	**1% level**	**-3.487046**	
	5% level	**-2.886290**	
	10% level	**-2.580046**	

The above table (1& 2) gives the result of the DF Unit Root Test to examine nature of stationary in both the time series data. The augmented Dickey-Fuller test statistic in Table 1 above shows the t* value is greater than the ADF critical values at all three levels of significance with respect to INDEX VALUE time series, associated with "P-Value" as 0.6714, so we can conclude that do not reject null hypothesis, i.e., unit root exists and we can say that time series is non-stationary or it has a stochastic trend.

Similarly, the augmented Dickey-Fuller test statistic in Table 2 shows the t* value is greater than the ADF critical values at all three levels of significance with respect to CPI time series, associated with "P-Value" as 0.7657, so we can conclude that do not reject null hypothesis, i.e., unit root exists and we can say that time series is non-stationary or it has a stochastic trend.

In order to have a proper understanding of the data, we provide below the graphical representation of the INDEX VALUE series and CPI series of data analyzed:

Fig. 1 Graphical representation: Index value series

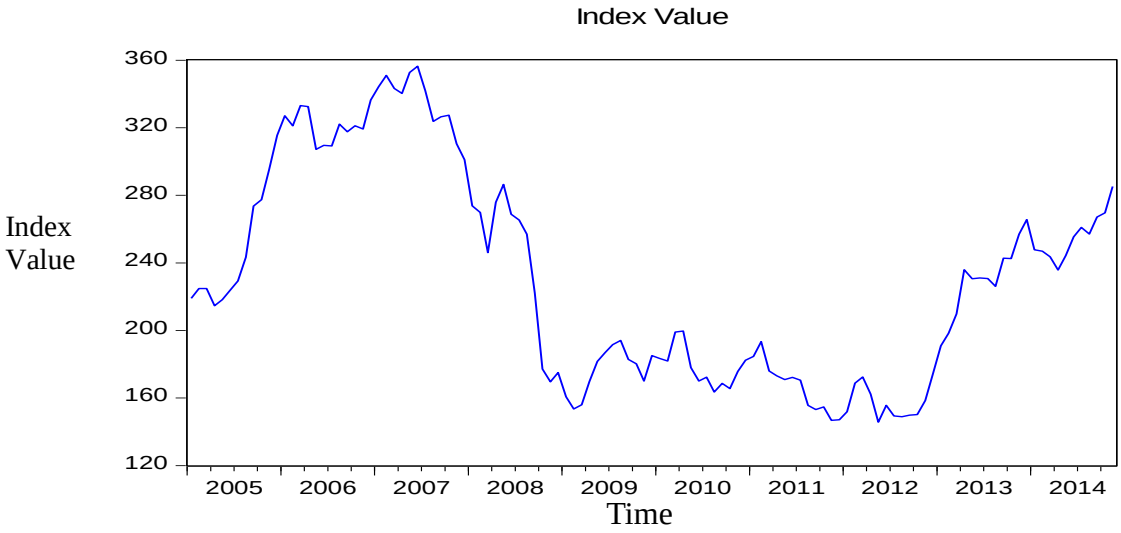
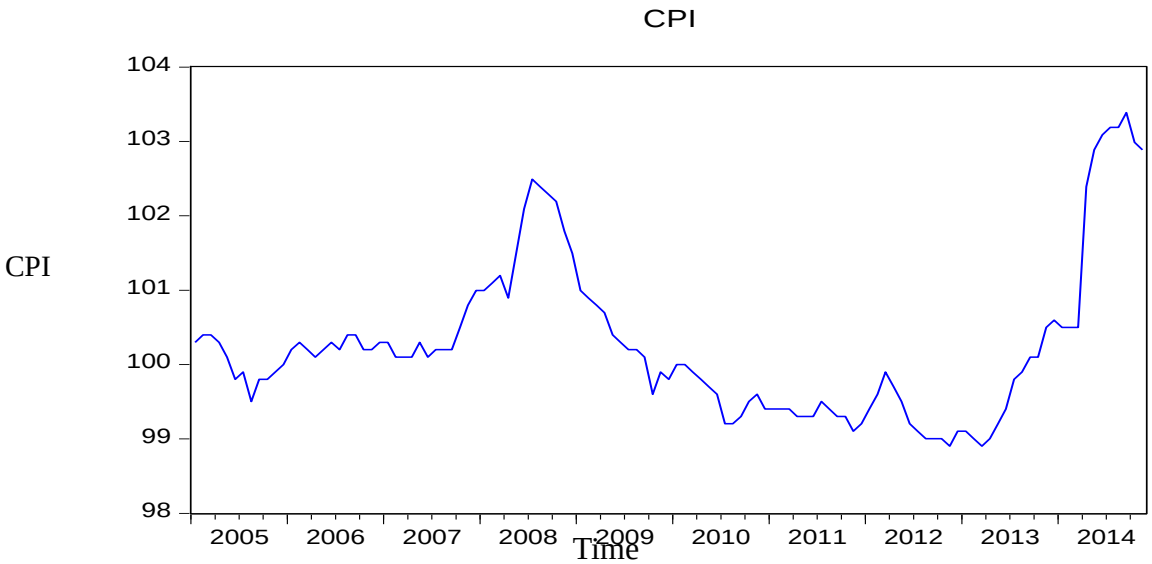


Fig. 2 Graphical representation: CPI series



To convert these time series absolute values into percentage terms, we have used Dlog function of E-views and then run the test of unit root on converted time series i.e stock returns from index values and rate of inflation from CPI values to test the nature of stationary characteristic of these converted time series to conclude about the relationship in general and the results are as follows:

Table 3: DF Unit Root Test (Index value one period lagged time Series)

Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-8.119237	0.0000
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

Table 4: DF Unit Root Test (CPI one period lagged time Series)

Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-8.306492	0.0000
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

The above table (3 & 4) gives the result of the DF Unit Root Test to examine nature of stationary in both the time series data. The augmented Dickey-Fuller test statistic in Table 3 above shows the t* value is smaller than the ADF critical values at all three levels of significance with respect to **Index value one period lagged time Series** or Stock Returns time series, associated with "P-Value" as 0, so we can conclude that reject the null hypothesis, i.e., unit root does not exist and we can say that time series is stationary possibly around a deterministic trend.

Similarly, the augmented Dickey-Fuller test statistic in Table 4 shows the t* value is smaller than the ADF critical values at all three levels of significance with respect to **CPI one period lagged time Series** or Inflation Rate, associated with "P-Value" as 0, so we can conclude that reject null hypothesis, i.e., unit root does not exist and we can say that time series is stationary possibly around a deterministic trend.

In order to have a proper understanding of the data, we provide below the graphical representation of the **Index value one period lagged time Series** and **CPI one period lagged time Series** of data analyzed:

Fig. 3 Graphical representation: Stock returns

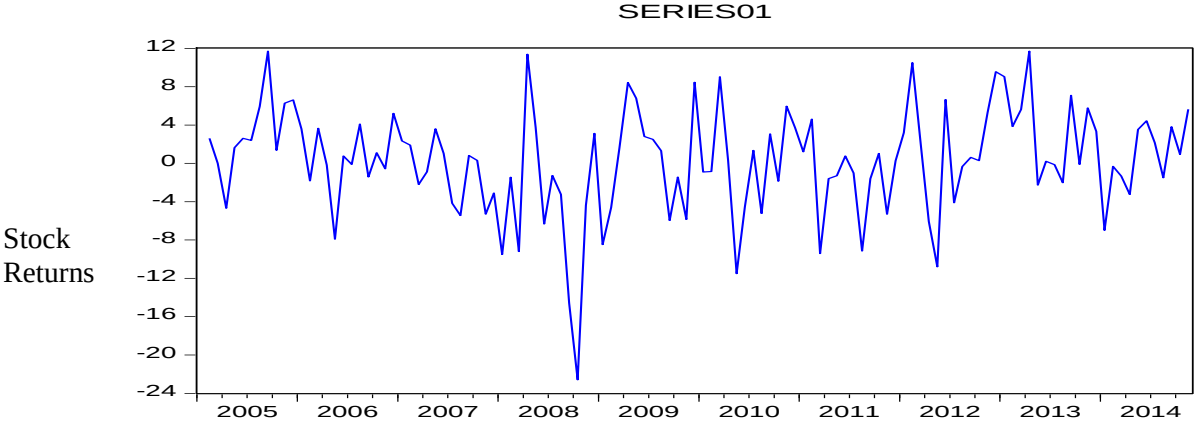
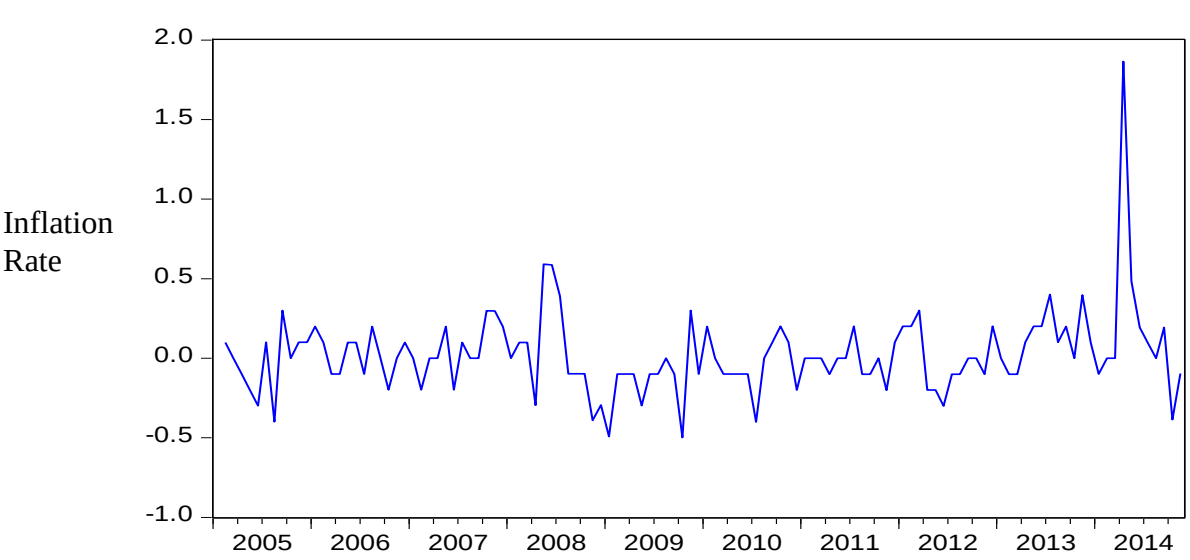


Fig. 4 Graphical representation: Inflation rate



6. Interpretation of the Results

- Given the negligible values of intercept, slope, t-statistic and probability accompanied by 0.0018 value of R^2, (refer appendix, Table 6) we can conclude here that there is no significant relationship between stock returns and inflation rate.
- When we regressed the absolute values of index value series over absolute value of CPI series they resulted as significant positive relationship. However as we know these absolute value time series of index value and CPI has non-stationary characteristic, so we can make valid the first regressed results only for this particular period taken into consideration and the results may not be generalized.
- As the finding suggests that the converted series i.e. stock returns and inflation rate time series has characteristic of stationary. So we can conclude in general irrespective of the time lag and time period taken into consideration that there is positive but not significant relationship between stock market returns and inflation rate.

7. Summary and Conclusion

A number of tests and a simple regression model have been applied in the study in order to arrive at a rational and logical finding of the study. The objective of the study was primarily to examine the relationship between inflation and stock market returns in Japan and to analyze the impact of inflation on stock market returns in Japan. We have accentuated the importance of both the variables, i.e. inflation and stock market returns in our study and run a number of tests to find the relationship between stock returns and inflation during the last decade (January 2005 to November 2014) in Japan with the help of index values of Nikkei 300 as approximate for stock returns and CPI values as approximate for inflation. Initially we directly run the regression for the absolute values of index and CPI and found that there is significant and positive relationship between index value and CPI and one can follow that the stock returns are good hedge against inflation.

Secondly we have run the unit root test to know the nature of stationary in the time series available with us and we found that the index value and CPI time series are non-stationary but when we converted these time series into percentage terms by using one lag value with the help of Dlog function in E-views they gave us just opposite results for both the converted series i.e. stock returns series and inflation rate series. Finally we regressed this converted series of stock returns over series of inflation rate and found that there is positive but not significant relationship between stock returns and inflation rate and hence can say that it is difficult to answer, are nominal stock returns good hedge

against inflation? The answer to this question still remains a paradox. Hence, it provides the basis for academicians and researchers to investigate on this issue at greater depth and find a reasonable solution to the above problem.

Appendix

Table 5 : Regression Results of both the time series.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1858.452	520.8882	-3.567853	0.0005
CPI	20.83565	5.195027	4.010692	0.0001
R-squared	0.120867	Mean dependent var		230.5542
Adjusted R-squared	0.113353	S.D. dependent var		63.48689

Table 6 : Regression Results of both the one period lagged series.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.204357	0.512862	0.398464	0.6910
DLOG(CPI)	0.895740	1.940161	0.461683	0.6452
R-squared	0.001834	Mean dependent var		0.223707
Adjusted R-squared	-0.006771	S.D. dependent var		5.533768

References

1. Ajayi, S. I., & Ojo, O. (2006). “Money and Banking”, second edition, Ibadan, Nigeria: Daily Graphic Ltd.
2. Alagidede, P. and Panagiotidis, T. (2006). “Can Common Stocks Provide a Hedge against Inflation? Evidence from African Countries”, The Rimini Center for Economic Analysis, Italy (2006), WP 10-06.
3. Bakshi, G., & Chen, Z. (1996). “Inflation, Asset Prices, and the Term Structure of Interest Rates in monetary economics”, The review of financial studies, Vol. 9, No. 1, 241-275.
4. Balduzzi, P. (1994), “Stock returns, Inflation and the" proxy hypothesis"; a New looks at the data Retrieved on August 10, 2010, from SSRN: http://ssrn.com/abstract=1298811.
5. Berument, H., & Jelassi, “M. M. (2002). “The Fisher hypothesis: a multi-country analysis”. Applied Economics, Vol. 34, 1645-1655.
6. Bodie, Z. (1976). “Common stocks as a hedge against inflation”, Journal of Finance, Vol. 31, 459-470.
7. Bruno A. Oudet (1973). "The Variation of the Returns on Stocks in Periods of Inflation", Journal of Financial and Quantitative Analysis, 247-58
8. Caporale, T., & Jung, C. (1997). “Inflation and real stock prices”, Applied financial economics, Vol.7, 265-266.
9. Charles R. N. (1976). "Inflation and Rates of Return on Common Stocks", Journal of Finance, 471-83.
10. Choudhry, T. (2001). “Inflation and Rates of Return on Stocks: Evidence from High Inflation Countries”, Journal of International Financial Markets, Institutions and Money, 11:75-96.
11. Crosby, M. (2001), “Stock returns and inflation”, Australia economics papers, 156-165.
12. Fama, E. F. (1981). “Stock Returns, Real Activity, Inflation, and Money”, The American Economic Review, Vol. 71 no. 4, 545-565.
13. Feldstein, M (1980). “Inflation and the Stock Market. American Economic Review”, 70(5): 839-947.
14. Floros, C. (2004). “Stock returns and inflation in Greece”. Applied Econometrics and international Development, Vol. 4-2, 55-68.
15. Geske, R., & Roll, R. (1983). “The Fiscal and Monetary Linkage between Stock Returns and Inflation”, The Journal of Finance, Vol. 38, No. 1, 1-33.

16. Gultekin, B. (1983). "Stock Market Returns and Inflation: Evidence from Other Countries", The Journal of Finance, Vol. 38, No. 1, 49-65.
17. Hasan, S. (2008). "Stock returns, inflation and interest rates in the United Kingdom", The European Journal of Finance, 14, 687-699.
18. http://www.ukessays.com/dissertation/literature-review/literature-review-on-inflation-and-stock-returns.php
19. Irving F. (1930). "The Theory of Interest", New York, NY: Macmillan.
20. Jefferey F. J. and Gershon M. (1977), "The 'Fisher Effect' for Risky Assets: An Empirical Investigation." Journal of Finance, 447-58.
21. John L. (1973). "Inflation and Common Stock Prices in a Cyclical Context". National Bureau of Economic Research Annual Report.
22. Jones, C., & Wilson, J. (2006). "The impact of inflation measure on the real returns and Risk of U.S stocks". The financial review (2006) Vol. 41, 77-94.
23. Kwok, B. and Siklos, P. L. (1992). "Stock Returns and Inflation: A New Test of Competing Hypotheses".
24. Lee, B.S, (1992). "Causal Relationships among Stock Returns, Interest Rates, Real Activity, and Inflation", Journal of Finance, 47, 1591-1603.
25. Modigliani, F. and Cohn, R. A. (1979). "Inflation, Rational Valuation, and the Market", Financial Analysts Journal, 35: 24-44.
26. Rapach, D. E. (2002). "The long-run relationship between inflation and real stock prices", Journal of Macroeconomics, 24?311-351
27. Schwertand G. W. S. (1977). "Asset Returns and Inflation", Journal of Financial Economics, 115-46.
28. Spyrou, S.I. (2001). "Stock returns and inflation: evidence from an emerging market", Applied Economic Letters, 8:447-50.
29. Ugur, S., & Ramazan, S. (2005). "Inflation, Stock Returns, and Real Activity in Turkey", The Empirical Economics Letters, Vol., 4 (3), 181-192.
30. Yeh, C. C and C. F. Chi. (2009). "The Co-Movement and Long-Run Relationship between Inflation and Stock Returns: Evidence from 12 OECD Countries", Journal of Economics and Management, 5(2): 17-186.
31. Zvie B. (1976). "Common Stocks as a Hedge against Inflation", Journal of Finance, 459-70.