APPLICABILITY OF FISHER HYPOTHESIS ON PRE & POST REFORMS ERA OF INDIAN CAPITAL MARKET

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Abstract

This study empirically assesses the applicability of Fisher Hypothesis between closing price of sensex, a leading stock index of India and whole sale price index of India. The study has used cointegration test to check the relationship. The study has covered data from both pre and post reforms period of Indian economy and it has decomposed the whole sale price index into expected and unexpected parts. The study has proved that neither whole sale price index nor any of its form can influence the sensex price in any of the periods

Keywords: *Sensex, whole sale price index, expected and unexpected whole sale price index, integration test.*

1. Introduction:

Investors at share market should be saved from inflation. Fisher (1930) hypothesis, in its most familiar version, states that "the expected nominal rate of return on stock is equal to expected inflation plus the real rate of return", where the expected real rate of return is independent of expected inflation. Fisher hypothesis, therefore, predicts a positive homogenous relationship between stock returns and inflation. In other words, Fisher hypothesis implies that stocks offer a hedge against inflation. All researchers did not support Fischer hypothesis.

Reforms at Indian capital market were introduced in 1991. Before reforms the capital market of India was closely supervised by Controller of Capital Issue(CCI). CCI supervised and controlled the timing, composition, interest rates, pricing, allotment and floatation costs of new issues. These strict regulations demotivated many companies going public for almost four and a half decades. After reforms security markets in India have made enormous progress by developing sophisticated instruments and modern market mechanisms. The key strengths of the present Indian capital market include a fully integrated and automated trading system on all stock exchanges, a wide range of products, a nationwide network of trading and strong regulation system. Around five thousand companies command a total market capitalization of USD 1.06 trillion as of May 15, 2012 at Bombay Stock Exchange and became world's number one exchange in terms of listed members and fifth most active exchange in terms of number of transactions handled through its electronic trading system. National Stock Exchange (NSE) of India is the 16th largest stock exchange in the world in terms of market capitalization and largest in India for daily turnover and number of trades. But this growth story was stayed along with high inflation.

India after independence has had a more stable record of inflation, than most of other developing countries. Since 1950, the inflation in Indian economy had been in single digits for most of the years (two percent in1950-1960, Seven point two percent in 1960-1970, and eight point five percent in 1970-1980). Since July 2010, inflation in India remained stubbornly high at around 9-10 percent and was fairly broad-based. The rise in inflation started with food and later got generalized. Food inflation which has remained persistently high has become a major cause of concern. With the inflation remaining beyond the comfort level of Reserve Bank of India (RBI), the RBI continued to tighten its monetary policy through the year to arrest inflation, even in the face of a slowdown in economic growth. Hence this has motivated the author to study whether Fisher hypothesis is fully applicable on both pre and post reforms period of Indian economy.

Therefore this study has been organized as follows. Section II reviews the published literature pertinent to the topic. Section III mentioned the required data and their sources, Section IV outlines

the methodology used, section V provides the empirical results and analysis and finally concluding remarks are given in section VI.

2. Review of Literature:

Adam and Frimpong (2010) studied the relationship of stock price and inflation for Ghana for the sample period 1991:1-2007:12. Cointegration analysis was employed and the findings showed strong support for Fisher hypothesis. Spyrou (2001) and Floros (2004) examined stock returns-inflation relation in Greece, using the Johansen cointegration test and they found that there is no significant long-run relationship between inflation and stock returns in Greece. Al-Khazali and Pyun (2004) investigated the statistical relationship between stock prices and inflation in nine countries in the Asia Pacific Basin. Using Johansen cointegration test and they concluded that stock prices in Asia reflect a time-varying memory associated with inflation shocks that make stock portfolios a reasonably good hedge against inflation in the long run. Spyrou (2004) examined the Fisher hypothesis for 10 emerging countries, namely, Chile, Mexico, Brazil, Argentina, Thailand, South Korea, Malaysia, Hong Kong, Philippines and Turkey. They found little evidence to support this hypothesis in these countries. Kim and Francis (2005) studied the Fisher hypothesis based on a wavelet multi-scaling method for US, for the period from 1926:1 to 2000:12. Their findings revealed that there is a positive relationship between stock returns and inflation in the shorter period, while a negative relationship is found in longer period. Ahmad and Mustafa (2005) studied the relationship for Pakistan, for the period from 1972 to 2002. Full Information Maximum Likelihood (FIML) method was employed. They divided the inflation into two parts – expected and unexpected. Results revealed that relationship between real returns and unexpected growth and unexpected inflation are negative and significant. Kim (2003) employed quarterly data of Germany for the period from 1971:1 to 1994:4. Symmetric and asymmetric Granger causality test was performed and results demonstrated the negative correlation between stock returns and inflation. Using the monthly data, Nelson (1976) studied the relationship for the US in the postwar period, (from 1953:1 to 1972:12). Box and Jenkins' ARIMA method was used to divide the inflation into expected and unexpected part. They found the stock returns were negatively related with both expected and unexpected inflation. Samarokoon (1996) and Jaffe and Mandelker (1976) used the same method on Sri Lanka and US data respectively and got the same result. Some of the studies had divided the study period into various zones and got various results. Kolluri and Wahab (2008) studied the relationship between stock returns and inflation through asymmetric test specification, which is capable to distinguish stock returns into high and low inflation period. The study period was from 1960:1 to

2004:12 and Findings of the study revealed that there was inverse relationship between stock returns and inflation during low inflation periods. On the contrary, positive relation is observed through high inflation periods. Lee (2008) analyzed the causal relationship in the UK, the sample period ranged from 1830 to 2000. The sample period was further divided into two sub-periods, 1830-1969 and 1970- 2000. The empirical findings of the study reported that there is a significant negative correlation between unpredictable stock returns and inflation for the subperiod 1970-2000. However, unpredictable stock returns were hardly correlated to unpredictable inflation during the same subperiod. Employing the wavelet methodology Durai and Bhaduri (2009) examined the relationship between stock returns, inflation for the post-liberalization period in India. The study employed monthly data from 1995:1 to 2006:7. The wavelet analysis helped to decompose the inflation into expected and unexpected components. In short run, the expected component of inflation was insignificant, while in the medium and long run, the expected component was found to be negatively significant with the real stock returns. Therefore Fisher hypothesis is not unanimously applicable on all stock markets. Hence this study will investigate whether closing price of sensex is related to whole sale price index of India in both short and long period.

3. Data:

Some studies used Consumer Price Index (CPI) as inflation measure (Kumari 2011, Schwert 1989 and Alagidede 2009). Shanmugam and Mishra (2008) mentioned that there is not a single indicator of CPI in India. Four different variants of CPI are complied on monthly basis that are designed for specific group of population with specific objectives. Therefore this study has taken Wholesale Price Index (WPI) as inflation measure. Monthly data covering period from April 1982 to March 2011 of WPI, and Sensex has been taken for analysis. This time period comprises of pre and post reforms phase of Indian Economy. Sensex data has been collected form Bomaby Stock Exchange of India. The Ministry of Industry, Government of India is the sources for the WPI.

4. Methodology:

Auto-Regressive Integrated Moving Average (ARIMA) is not applicable on the WPI data because auto-correlation is not dying exponentially (Gujarati 1995). Hence Hodrick-Prescott (HP) filter is used to derive the expected and unexpected components of the inflation. This filter decomposes the inflation into its trend and unexpected deviations from the trend. As suggested in Hodrick and Prescott (1980) for monthly data, (ϕ=14400) have been used as the value of the smoothing pharameter. Cointegration method has been used to check the hypothesis.

4.1.Equation:

$SP_t = \beta_1 + \beta_2 WPI_t + \varepsilon_t$ ----------(1)

Wherein SP_t and WPI_t are the closing price Sensex price wholesale price index at t th period respectively. ε_t is the error term.

$\varepsilon_t = SP_t - \beta_1 - \beta_2 WPI_t$ ----------(2)

Here both SP_t and WPI_t are nonstationary but to satisfy the cointegration ε_t needs to be stationary.

Relationship between Stock price and expected inflation

$SP_t = \delta_1 + \delta_2 WPI_{Expectedt} + \phi_t$ ---------- (3)

Wherein $WPI_{expectedt}$ is the expected inflation at t th period and ϕ_t is the error term

$\phi_t = SP_t - \delta_1 - \delta_2 WPI_{expectedt}$ ---------- (4)

Relationship between stock price and unexpected inflation

$SP_t = \rho_1 + \rho_2 WPI_{unexpectedt} + \nu_t$ ----------(5)

$\nu_t = SP_t - \rho_1 - \rho_2 WPI_{unexpectedt}$ ---------- (6)

Wherein $WPI_{unexpectedt}$ is the unexpected inflation at t th period and ν_t is the error term.

Data from April 1982 to March 2012, pre-reforms period (April 1982-Dec 1991) and post-reforms period (January 1991- March 2012) will be used in the above equations.

5. Empirical Results:

As noted earlier, the HP filter is employed to derive the expected and unexpected inflation. Then data has been separated between pre-reform and post-reform period.

5.1.The Test Of Nonstationarity Of Data:

Data needs to be nonstationary before using for co-integration process (Gujarati 1995). Table 1 shows the Dickey Fuller test result for wholesale price index, daily closing price of sensex, expected and unexpected whole sale price index.

Total Data				
	Level		1st difference	
Variable	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Whole sale price Index	-1.992	-1.686	-8.168*	-8.247*
Sensex	-0.039	-1.944	-7.821*	-7.391*
Expected Whole shale price index	-1.904	-1.341	-2.339	-2.815
Unexpected Whole sale price index	-5.707*	-5.691*		
Pre Reforms Period				
Whole sale price Index	-2.815***	-0.007	-5.507*	-5.888*
Sensex	0.428	-1.806	-4.682*	-4.878*
Expected Whole shale price index	2.241	-0.526	-0.313	-0.724
Unexpected Whole sale price index	-3.261**	-3.497**		
Post Reforms Period				
Whole sale price Index	-1.839	-2.323	-6.802*	-6.856
Sensex	-0.446	-2.033	-6.068*	-6.125*
Expected Whole shale price index	-1.449	-2.958	-2.167	-2.421
Unexpected Whole sale price index	-4.733*	-4.713*		
*,**,*** Represents significance at 1%, 5% and 10% level respectively.				

Table 1: Dickey Fuller Test result

Whole sale price index, monthly closing price of sensex and expected wholesale price index are nonstationary at all stages i.e. in whole period (April 1982-March 2011), pre-reforms period (April 1982 – December 1991) and Post-reforms period (January 1992 – March 2011). ADF test value of whole sale price index is significant at ten percent significance level at pre-reforms period. Unexpected wholesale price index is significant at all stages. Hence it is not possible to use unexpected WPI data for cointegration process.

Whole d ata					
Constant	Whole sale price index	Expected Wholesale Price index	Unexpected Whole sale price index	R^2	d
1354.325 (1.6251)	16.734 (4.391)			0.528	0.0113
656.3575 (0.7314)		20.11236 (4.858)		0.0638	0.0093
4811.953 (17.158)			-1.1408 (-0.0911)	0.00002	0.0086
Pre reforms period					
-848.98 (-12.883)	9.907 (20.8126)			0.808	0.234
-834.399 (-13.553)		9.783 (22.0503)		0.825	0.274
489.4468 (21.1869)			-59.05370 (-4.516)	0.1653	0.1006
Post reforms period					
1059.73 (8.279)	-16.276 (-3.14)			0.039	0.015
11994.47 (8.084)		-22.468 (-3.677)		0.053	0.0131
6673.894 (19.774)			-1.908 (-0.1514)	0.000	0.0122

Table 2: Estimation of result of equation 1, 3, and 5 for three periods

Validity of the above table or cointegration between closing price of sensex and whole sale price index, expected whole sale price index and unexpected whole sale price index will be proved if Augmented Dickey-Fuller (ADF) test result of the error term in equation in 1, 3 and 5 i.e. ε, ϕ, and ν, is significant.

	Whole period	Pre-reforms Period	Post-reforms Period
ε_t	1.045	-2.357	-0.291
ϕ_t	1.222	-2.438	-1.038
ν_t	0.896	-1.049	0.267

Table 3: ADF test result

Table 3 shows that none of the ADF result is significant at even ten percent level. As it is cointegration test therefore in place of ADF test augmented Engle-Granger (AEG) test will be used. At the time of ADF test in case of ε in equation one (when whole period's data was considered) the following equation was obtained-

$$\Delta\varepsilon_t = 0.0059\varepsilon_{t-1} \qquad R^2 = -0.005641 \qquad d = 1.499$$
$$t = 1.0278$$

This t is the τ in AEG test (Gujarati 1985). The critical τ value at one percent level in -2.5899. As the calculated τ value is positive hence the residuals received from regression between whole sale price index and closing price of sensex during April 1982 – March 2011 is not $I(0)$.

	Whole period	Pre-reforms Period	Post-reforms Period
ε_t	1.0278	-2.37	-0.3045
ϕ_t	1.2026	-1.074	-0.1538
ν_t	0.8763	-2.438	0.2477

Table 4: AEG test result of residuals

None of the τ values are more negative than -2.5899. Hence it can be concluded that whole sale price index is not integrated with closing price of sensex in any period.

An alternative and quicker way to findout the cointegration between wholesale price index and closing price of sensex is Cointegrating Regression Durbin-Watson (CRDW) test (Gujarati 1985).

Here the CRDW is the d value in table 1. The critical value of CRDW at one percent significance level is 0.511. Here all the d values are less than its critical value.

6. Conclusion:

By using co-integration test the study has critically assessed Fisher Hypothesis between closing price of sensex and whole sale price index. Using Hodrick-Prescott (HP) filter the whole sale price index has been decomposed into expected and unexpected part. To be more affirm about the result the study has considered the whole data period i.e. April 1982 to March 2012 for analysis along with pre and post periods. The result shows that closing price of sensex and whole sale price index in any times (both divided and undivided periods) were not cointegrated. Even expected part of whole sale price index also cannot explain the movement of sensex. Therefore Fisher Hypothesis is not valid on Indian Economy in any period. This implies that stock price does not have any positive relationship with inflation. Structural reforms at Indian capital market on 1991 onwards also can not save the investors from inflation.

Some more advanced econometric methods can be used to check this relationship. These are out of the scope of this research work. Some more available Indian indices along with consumer price index may be analysed before generalising the result. Still the study can provide a clear idea about this.

References:

1. Adam A M and Frimpong S (2010), "Can Stocks Hedge Against Inflation in the Long Run? Evidence from Ghana Stock Market", *International Journal of Business and Management*, Vol. 5, pp. 188-194.
2. Ahmad R and Mustafa K (2005), "Real Stock Returns and Inflation in Pakistan", *21st Australasian Finance and Banking Conference 2008 Paper.*
3. Al-Khazali O and Pyun C (2004), "Stock Prices and Inflation: New Evidence from the Pacific-Basin Countries", *Review of Quantitative Finance and Accounting*, Vol. 22, pp. 123-140.
4. Alagidede P (2009), "Relationship Between Stock Returns and Inflation", *Applied Economic Letters*, Vol. 16, pp. 1403-1408.
5. Durai S R S and Bhaduri S N (2009), "Stock Prices, Inflation and Output: Evidence from Wavelet Analysis", *Economic Modelling*, Vol. 26, pp. 1089-1092.
6. Fisher, I. (1930), "Theory of Interest", *MacMillan*, New York.
7. Floros C (2004), "Stock Returns and Inflation in Greece", *Applied Econometrics and International Development*, Vol. 4, pp. 12-25.
8. Gujarati D N (1995), *Basic Econometrics*, 3rd Edition, McGraw-Hill, Inc, New York.
9. Hodrick, R. and Prescott, E.C. (1980), "Post-War U.S. Business Cycles: An Empirical Investigation", mimeo, Carnegie-Mellon University, Pittsburgh, P.A.
10. Jaffe F and Mandelker G (1976), "The 'Fisher Effect' for Risky Assets: An Empirical Investigation", *Journal of Finance*, Vol. 31, pp. 447-458.
11. Kim S and Francis I (2005), "The Relationship Between Stock Returns and Inflation: New Evidence from Wavelet Analysis", *Journal of Empirical Finance*, Vol. 12, pp. 435-444.
12. Kim Jeong-Ryeol (2003), "Stock Returns Inflation Puzzle and the Asymmetric Causality in Stock Returns, Inflation and Real Activity", *Economic Letters*, Vol. 80, pp. 155-160.
13. Kolluri B and Wahab M (2008), "Stock Returns and Expected Inflation: Evidence from an Asymmetric Test Specification", *Review of Quantitative Finance Accounting*, Vol. 30, pp. 371-395.
14. Kumari Jyoti (2011), "Stock Returns and Inflation in India An Empirical Analysis", *The IPU Journal of Monetary Economics*, Vol. IX, No. 2, pp. 39-75.
15. Lee Keun Yeong (2008), "Causal Relationship Between Stock Returns and Inflation", *Applied Economic Letters*, Vol. 15, pp. 125-129.

16. Nelson C (1976), "Inflation and Rate of Returns on Common Stocks", *Journal of Finance*, Vol. 31, pp. 471-483.
17. Samarakoon P L (1996), "Stock Market Returns and Inflation: Sri Lankan Evidence", *Sri Lankan Journal of Management*, Vol. 1, pp. 292-311.
18. Schwert G W (1989), "Why Does Stock Market Volatility Changes Over Time?", *Journal of Finance*, Vol. 44, pp. 1115-1153.
19. Shanmugam K R and Misra S B (2008), "Stock Returns Inflation Relations in India", Working Paper, Madras School of Economics, Chennai.
20. Spyrou S I (2001), "Stock Returns and Inflation: Evidence from an Emerging Market", *Applied Economics Letters*, Vol. 8, pp. 447-450.
21. Spyrou S I (2004), "Are Stocks a Good Hedge Against Inflation?", *Applied Economics Letters*, Vol. 36, pp. 41-48.
22. Wahlroos B and Berglund T (1986), "Stock Returns, Inflationary Expectations and Real Activity: New Evidence", *Journal of Banking and Finance*, Vol. 10, No. 3, pp. 377-389.