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Q-statistic and Bear market phenomenon of the Indian stock market

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Abstract
A decade after Samuelson's (1965) landmark paper, many others extended his framework to allow for risk-averse investors, yielding a neoclassical" version of the EMH where price changes, properly weighted by aggregate marginal utilities, must be unforecastable (Le Roy, 1973; Rubinstein, 1976; and Lucas, 1978). In markets where, according to Lucas (1978), all investors have rational expectations", prices do fully reflect all the available information and marginal-utility-weighted prices follow martingales. The EMH has been extended in many other directions, including the incorporation of non-traded assets such as human capital, state-dependent preferences, heterogeneous investors, asymmetric information, and transaction costs. But the general thrust is the same: individual investors form expectations rationally, markets aggregate information efficiently, and equilibrium prices incorporate all the available information.

Keywords: Aggregate marginal utilities, non-traded assets, equilibrium prices, efficiency, India

1. Introduction
More generally, the current EMH paradigm can be summarized in the three P's of Total Investment Management prices, probabilities and preferences. The three P's have their origins in one of the most basic and central ideas of modern economics, the principle of supply and demand. This principle states that the price of any commodity and the quantity traded are determined by the intersection of supply and demand curves, where the demand curve represents the schedule of quantities desired by consumers at various prices and the supply curve represents the schedule of quantities producers are willing to supply at various prices. The intersection of these two curves determines equilibrium, a price-quantity pair that satisfies both consumers and producers simultaneously. Any other price-quantity pair may serve one group's interests, but not the other's. Even in this simple description of a market, all the elements of modern finance are present. The demand curve is the aggregation of many individual consumers' desires, each derived from optimizing an individual's preferences subject to a budget constraint that depends on prices and other factors (e.g. income, savings requirements, and borrowing costs). Similarly, the supply curve again is the aggregation of many individual producers' outputs, each derived from optimizing an entrepreneur's preferences subject to a resource constraint that also depends on prices and other factors (e.g. costs of materials, wages, and trade credit). And probabilities aspect both consumers and producers as they formulate their consumption and production plans through time and in the face of uncertainties uncertain income, uncertain costs, and uncertain business conditions. It is the interactions among prices, preferences, and probabilities that give modern financial economics its richness and depth. Formal models of financial asset prices such as Lucas (1978) [12], and Usha, Arora, and Bansal Monika (2008) [8] show precisely how the three P's simultaneously determine a general "equilibrium" in which demand equals supply across all markets in an uncertain world where individuals and corporations act rationally to optimize their own welfare. The three P's enter into any economic decision under uncertainty and it may be argued that they are fundamental to all forms of decision making.

2. Review of Literature
Fama and Blume (1966) [2] conducted the study on filter rule and stock market trading, 24 different filters ranging from 0.5 per cent to 50 per cent were used.

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It examined when transaction cost and dividend income were taken into account whether filter rules give large returns in comparison to a buy-and-hold strategy. It was further observed that the floor trader could not use filter rule to increase his expected returns highly and concluded that there appeared to be both positive and negative dependence in price changes. The order of magnitude of dependence was so small, however, that results add further to the evidence that for practical purpose random walk model was an adequate description of price behaviour. Granger and Morgenstern (1970) [3] studied the random behaviour of stock prices for more than fifty stock market price series over several time periods with differing sampling intervals. The study showed that the spectra of long price differences were flat for all the series over a frequently range of 0.5 cycles per year up to 0.5 cycles per day. This gives notice that short term prices behave randomly. Though, it noticed some differences from the random walk model in both the high and low frequency regions of the spectrum. Bansal Monica (2010) [7] recommended that that movements within the very short period i.e. transaction to transaction data and movements within a very long period were not adequately described by the model. The results of this study confirm the random walk hypothesis a broad description of the normal behaviour of price series over a wide range of frequencies. Yong (1989) [4] examined the weekly closing prices of 30 stocks of random selection over the period January 1977 to June 1988 with the help of serial correlation and runs tests. Another significant contribution to the literature was made by having sample stocks that are representative of the market; he used weekly closing prices of all 170 stocks traded on the KLSE from January 1977 to May 1985 inclusive. Results from various statistical tests, especially those from the runs test reinforced earlier findings of departure from weak form market efficiency. The low trading volumes in most stocks and the possible price manipulations by those investors who own majority of the stocks might help to explain the findings of the runs test.

3. Objective of the Study
The main objective of this research paper is to study the Q-statistic and Bull Market Phenomenon of the Indian Stock Market

4. Analysis and Interpretation
Findings of Q Statistic
The Q statistic is often used as a test of whether a time series is indepent. Independentness of stock returns as documented through auto correlation matrices is revalidated for significance through a statistical test Box-Pierce Q-statistics (1970) in order to comment of status of market efficiency in its weak form. The Q-statistics is developed to test joint hypothesis as to the significance of all auto correlation matrices at a given lag. It is used to derive more generalized conclusions and evaluate the validity of overall autocorrelation matrices. In case computed Q exceeds its critical value on chi-square distribution at given significance level (0.01, 0.05), null hypothesis is rejected.

4.1 Empirical Results of the April 1996-March 2000
The results reported for the (April 1996-March 2000) for Q-statistics reveals that 13.70 (26.3 per cent) Q-statistics coefficients were significant at 5 per cent level, while the same has been reduced to 5.48 (32.0 per cent) at 10 per cent level of significance. Therefore, it can be conclusively constructed that the Indian stock market is weak form efficient market on the basis of majority of stocks.

4.2 Q-statistic and Bear Market Phenomenon
During the bear market phenomenon (from April 2000-March 2003), the Q-statistics, 10.21 (26.3 per cent) stocks showed significant value at 5 per cent level. Further, same number of stocks i.e. 10.21 (32.0 per cent) were found significant at 10 per cent level. The overall results of the bear market showed that the Indian stock market is efficient in weak form.

Table 1: Box-Ljung Q-Statistic based on Autocorrelation Matrices (1996-2000)

Code	Name of Company Stock	Q-Statistics	Code	Name of Company Stock	Q-Statistics
1	A B B Ltd.	21.690	38	I D B I Bank Ltd.	19.564
2	A C C Ltd.	39.03*	39	I F C I Ltd.	28.083**
3	Aban Offshore Ltd.	16.980	40	I T C Ltd.	28.074**
4	Aditya Birla Nuvo Ltd.	19.373	41	Indian Hotels Co. Ltd.	18.284
5	Ambuja Cements Ltd.	22.381	42	Infosys Ltd.	10.614
6	Apollo Tyres Ltd.	30.624**	43	J S W Ispat Ltd.	13.610
7	Areva T & D India Ltd.	15.537	44	J S W Steel Ltd.	18.284
8	Ashok Leyland Ltd.	28.151**	45	Jain Irrigation Systems Ltd.	10.614
9	Asian Paints Ltd.	15.369	46	Jindal Saw Ltd.	13.610
10	Bajaj Holdings & Invst. Ltd.	25.016	47	Kotak Mahindra Bank Ltd.	27.228**
11	Bharat Forge Ltd.	24.453	48	L I C Housing Finance Ltd.	12.073
12	Bharat Heavy Electricals Ltd.	21.007	49	Larsen & Toubro Ltd.	28.337**
13	Bharat Petroleum Corpn. Ltd.	18.940	50	Lupin Ltd.	15.033
14	Bosch Ltd.	6.655	51	Mahindra & Mahindra Ltd.	6.998
15	Castrol India Ltd.	15.462	52	Nestle India Ltd.	14.774
16	Century Textiles & Inds. Ltd.	14.831	53	Oil & Natural Gas Corpn. Ltd.	16.302
17	Chambal Fertilisers & Chemicals Ltd.	13.300	54	Oriental Bank Of Commerce	19.444
18	Cipla Ltd.	31.235**	55	Piramal Healthcare Ltd.	14.402
19	Colgate-Palmolive (India) Ltd.	10.420	56	Ranbaxy Laboratories Ltd.	16.707
20	Crompton Greaves Ltd.	22.945	57	Reliance Capital Ltd.	19.501
21	Cummins India Ltd.	8.380	58	Reliance Industries Ltd.	8.413
22	Dabur India Ltd.	30.963**	59	Reliance Infrastructure Ltd.	17.333

23	Dr. Reddy'S Laboratories Ltd.	11.688	60	Siemens Ltd.	8.613
24	Essar Oil Ltd.	13.773	61	State Bank Of India	26.982**
25	Exide Industries Ltd.	9.239	62	Steel Authority Of India Ltd.	5.232
26	Federal Bank Ltd.	6.678	63	Sterlite Industries (India) Ltd.	24.799
27	Glaxosmithkline Consumer Healthcare Ltd.	16.913	64	Sun Pharmaceutical Inds. Ltd.	10.055
28	Glaxosmithkline Pharmaceuticals Ltd.	8.136	65	Tata Chemicals Ltd.	10.217
29	Godrej Industries Ltd.	12.132	66	Tata Global Beverages Ltd.	15.704
30	Grasim Industries Ltd.	45.196*	67	Tata Motors Ltd.	23.872
31	H D F C Bank Ltd.	32.802*	68	Tata Power Co. Ltd.	7.483
32	Hero Honda Motors Ltd.	31.371**	69	Tata Steel Ltd.	8.655
33	Hindalco Industries Ltd.	16.052	70	Thermax Ltd.	23.914
34	Hindustan Petroleum Corpn. Ltd.	12.777	71	Titan Industries Ltd.	12.748
35	Hindustan Unilever Ltd.	17.353	72	Voltas Ltd.	24.103
36	Hindustan Zinc Ltd.	13.647	73	Zee Entertainment Enterprises Ltd.	23.314
37	Housing Development Finance Corpn. Ltd.	33.460*	74		

Source: Data Complied from CMIE – Prowess database.

** Significant at 5 per cent level of significance. * Significant at 10 per cent level of significance.

Table 2: Box-Ljung Q-Statistic based on Autocorrelation Matrices (2000-2003)

Code	Name of Company Stock	Q-Statistics	Code	Name of Company Stock	Q-Statistics
1	A B B Ltd.	19.180	38	Hero Honda Motors Ltd.	15.423
2	Aban Offshore Ltd.	12.360	39	Hindalco Industries Ltd.	16.806
3	A C C Ltd.	13.616	40	Hindustan Petroleum Corpn. Ltd.	13.778
4	Adani Enterprises Ltd.	41.940*	41	Hindustan Unilever Ltd.	11.032
5	Aditya Birla Nuvo Ltd.	30.915**	42	Hindustan Zinc Ltd.	13.867
6	Ambuja Cements Ltd.	13.203	43	Housing Development Finance Corpn. Ltd.	11.011
7	Apollo Hospitals Enterprise Ltd.	16.562	44	I D B I Bank Ltd.	13.104
8	Apollo Tyres Ltd.	12.108	45	I F C I Ltd.	29.104**
9	Areva T & D India Ltd.	7.902	46	I T C Ltd.	25.209
10	Ashok Leyland Ltd.	27.806**	47	Indian Hotels Co. Ltd.	13.724
11	Asian Paints Ltd.	21.120	48	Indian Oil Corpn. Ltd.	6.495
12	Aurobindo Pharma Ltd.	22.468	49	Infosys Ltd.	27.211**
13	Bajaj Holdings & Invst. Ltd.	24.180	50	J S W Ispat Ltd.	7.945
14	Bank Of Baroda	17.681	51	J S W Steel Ltd.	11.073
15	Bharat Electronics Ltd.	10.710	52	Jindal Saw Ltd.	42.542*
16	Bharat Forge Ltd.	17.950	53	Kotak Mahindra Bank Ltd.	15.854
17	Bharat Heavy Electricals Ltd.	39.282*	54	L I C Housing Finance Ltd.	15.490
18	Bharat Petroleum Corpn. Ltd.	4.618	55	Larsen & Toubro Ltd.	39.726*
19	Bhushan Steel Ltd.	11.793	56	Mahindra & Mahindra Ltd.	18.874
20	Castrol India Ltd.	28.416**	57	Marico Ltd.	15.892
21	Century Textiles & Inds. Ltd.	24.154	58	N C C Ltd.	10.738
22	Chambal Fertilisers & Chemicals Ltd.	14.617	59	National Aluminium Co. Ltd.	16.484
23	Cipla Ltd.	14.455	60	Nestle India Ltd.	26.399**
24	Colgate-Palmolive (India) Ltd.	14.694	61	Neyveli Lignite Corpn. Ltd.	10.427
25	Crompton Greaves Ltd.	13.460	62	Oil & Natural Gas Corpn. Ltd.	15.145
26	Dabur India Ltd.	21.295	63	Oriental Bank Of Commerce	19.817
27	Dr. Reddy'S Laboratories Ltd.	12.127	64	Pantaloon Retail (India) Ltd.	17.929
28	Exide Industries Ltd.	15.607	65	Piramal Healthcare Ltd.	20.003
29	Federal Bank Ltd.	7.647	66	Ranbaxy Laboratories Ltd.	24.507
30	Financial Technologies (India) Ltd.	16.008	67	Rashtriya Chemicals & Fertilizers Ltd.	19.109
31	G A I L (India) Ltd.	22.497	68	Reliance Capital Ltd.	32.267*
32	Glaxosmithkline Consumer Healthcare Ltd.	10.010	69	Reliance Industries Ltd.	17.392
33	Glaxosmithkline Pharmaceuticals Ltd.	18.690	70	Reliance Infrastructure Ltd.	41.062*
34	Grasim Industries Ltd.	19.769	71	Sesa Goa Ltd.	24.781
35	Great Eastern Shipping Co. Ltd.	16.941	72	Shipping Corpn. Of India Ltd.	21.734
36	H D F C Bank Ltd.	12.769	73	Shree Cement Ltd.	36.555*
37	H M T Ltd.	19.261	74	Siemens Ltd.	7.814
75	State Bank Of India	29.384**	82	Tata Steel Ltd.	14.720
76	Steel Authority Of India Ltd.	23.857	83	Thermax Ltd.	17.564
77	Sun Pharmaceutical Inds. Ltd.	49.725*	84	Titan Industries Ltd.	9.715
78	Tata Chemicals Ltd.	12.020	85	United Phosphorus Ltd.	12.860
79	Tata Communications Ltd.	9.487	86	Voltas Ltd.	23.072
80	Tata Global Beverages Ltd.	14.462	87	Wipro Ltd.	26.597**
81	Tata Power Co. Ltd.	28.133**	88	Zee Entertainment Enterprises Ltd.	39.587*

Source: Data Complied from CMIE – Prowess database.

** Significant at 5 per cent level of significance. * Significant at 10 per cent level of significance.

5. Empirical Results of the Overall Study period

During the overall study period, the results reported for Q-statistics in table-2 reveals that 11.76 (26.3 per cent) Q-statistics coefficients were significant at 5 per cent, while the same has increased as during the fourth sub-period 44.12 (32.0 per cent) at 10 per cent level of confidence. Majority of the stocks showed non-random behaviour during this phase.

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