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ANALYSIS OF BEHAVIOUR OF WEEKLY PRICES IN BOMBAY STOCK MARKET

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Abstract. The paper examines the behaviour of weekly prices in Bombay Stock Market. Dickey-Fuller and Engel-Granger tests of unit root are used to validate RWM and chosen regression.. Prices and volume both depict stationarity. Volume, showing effective demand, decisively affects equity prices. Behaviour of weekly prices conforms to flex price based distributed lag model.

Keywords: flex-price, Random Walk Model, expectation model

1. Introduction

Explanation and forecasting of equity prices embody knowledge gap. Explanation of volatility needs theoretical base. Stock market mobilizes capital, including foreign capital, facilitates induction of new technology/ products, and promotes growth. Share of Equity in total capital in developed countries exceeds its share in developing countries. Most of the risk averters with low or modest income, including small and medium enterprises, invest in fixed-return instruments. Uncertainty and risk associated with investment in equities make the explanation and forecasting of equity prices difficult. Equity prices change hourly. Price changes inflict loss on some and bestow gain on others. So, returns also fluctuate. Some studies focused on day of the week, week of the month and month of the year effect. EMH, RWM, ARCH and GARCH models are used extensively in research. The findings are inconclusive or contradictory.

First order difference equation model of weekly, monthly and quarterly equity prices of 7 companies of 8 years shows volatility to be occasional as changes in prices are contained in narrow range (Prakash-Subramanian). Such studies overlook the influence of expectation on prices.

Effect of adaptive expectation on weekly equity prices in flex price framework, embodied in distributed lag model, is examined. Stationarity of time series of volume and prices is examined as a preliminary step. Validity of flex-price theory, embodied in econometric model, is also evaluated.

2. Hypotheses

(i) Equity prices are not explained by RWM. (ii) As equity prices are not sticky, preceding period's price does not affect current price. (iii)Equity prices are affected both by random and systematic factors. Though random factors move price temporarily away from equilibrium price, yet systematic factors pull the price back to equilibrium level.

3. Methods and Models

3.1. Random walk models with and without drift, and with drift and trend, are used in the study

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$$\Delta Y_t=\beta_1+\quad Y_{t-1}+U_t$$
$$\Delta Y_t=\quad Yt\text{-}1+U_t$$
$$\Delta Y_t=\beta_1+\beta_2 T+\quad Y_{t-1}+U_t$$

3.2. Adaptive Expectation Model

Cagan's distributed lag model of Adaptive expectation analyzes the preceding value of Y on its current value. Despite day on day volatile movement, different prices of the day may converge to average. Intra-day volatility may be assessed either by trade volume, or by spread/range of opening-closing, and maximum-minimum prices of the day. Inter-day or intra-week volatility may similarly be assessed by the within the week range of above paired differences of prices. Kendal (1992) opined that average monthly prices eliminate volatility, so weekly prices are analyzed here. Preceding week's price exercises some influence on current week's price. Adaptative expectation model takes expectation and its modification in the light of experience into account explicitly.

Current equity price is postulated to depend on the expected state of the market represented by the volume of trade, X_t^*

$$Yt= \alpha_0+ \alpha_1 X_t^*+U_t \qquad (1)$$

Expected state of the market, depicted by X_t^*,is an unobserved variable. It is eliminated as follows:

$$X_t^* - X_{t-1}^* = \lambda(X_t - X_{t-1}^*)$$

Difference between current and preceding period's expectation is proportional to the divergence between currently observed and preceding period's expected value of X_t., λ is the factor of correction of observation.

$$X_t^*= \lambda X_t-(1- \lambda) X_{t-1}^* \qquad (2)$$

Current expected state of the market is a weighted average of currently observed state and the expected state in the preceding period. Substitution of (2) in (1) will give

$$Y_t= \alpha_o+\alpha_1\lambda X_t+\alpha_1((1- \lambda) X_{t-1}^*+ U_t$$

Algebraic manipulation, leads to the following

$$Y_t=\lambda\alpha_o+\lambda\alpha 1Xt+ (1-\lambda) Y_{t-1}+v_t \qquad (3)$$
$$Y_t= \pi_o+\pi_1 X_t+\pi_2 Y_{t-1}+ V_t$$

Where $\pi_o=\lambda\alpha_o$, $\pi_1=\lambda\ \alpha_1$, $\pi_2=1-\lambda$

3.3. Flex-Market Behaviour of Equity Prices

Generally, price is determined by demand and supply. If supply exceeds demand at the given price, price falls. Demand comprises flow and stock components. Flow component represents investment of current income in stock market with long term perspective. But traders invest for short term gains. They accumulate stock of shares at low and sell at high prices. They accumulate shares prices of which are expected to rise. Demand of shares for stocking further fuels price rise. Rising price thus becomes self propelling in boom phase till the bubble of expectation is burst in bear phase. If traders expect the price to fall, they deaccumulate stock of such shares. This represents stock components of supply. The flow of supply is represented by initial offer of shares for sale by companies. Traders have shares of many companies as stock component of supply, while inflow of new shares depicts flow component of supply. Thus, normal laws of demand and supply do not hold true in share market. There is a Ratchet like effect of expectations on price movements.

4. Literature Review

Efficient Market Hypothesis played pivotal role in analysis of equity prices. If market is efficient, observed price will be an unbiased estimate of intrinsic value of shares. Unbiased errors in market price and its deviation from intrinsic value are random; and hence, these are uncorrelated with any systematic variable. Random price movements are caused by shocks. This induced some scholars to examine volatility.

Li-Weibaum (2000) used intra-day high frequency data to measure volatility; they found evidence to support extreme values. In Gregory Kutmos and Reza Saidi worked on leverage effect in individual stock. Forecasting also uses stochastic analysis. Deju Zhana empirically explored Markov Chain model, he derived good results. R. Sundarajan, Aswath Kumar, P.N Bandrikrishna, K.N, Dinesh R , Karthikeyan S, Sridhar,

formulated Stochastic Markov Chain model which is useful for short time analysis. G. Sarvanan and Malabika Deo found that risky returns are not distributed randomly across the data, since, there exists autocorrelation in risky returns. But informed traders do not wait for future expiration for final settlement in the market. Ricky Chee-Jiwn Chia and Venus Khim Sen hiew examine the existence of day- of the week effect and asymmetrical behaviour in Bombay stock exchange (BSE) during 9/11/2001 sub periods. EGARCH and EGARCH-M models revealed asymmetrical market reaction to positive and negative news in BSE.

Shri Prakash and A Ramasubramanian, (2006) Finance India. This concludes that except occasional crash and boom in the stock market, their alternative models can explain and predict share price movements. But GLS has provided better results than OLS.

5. Empirical Results

First we examine results furnished by RWM model.

Company wise OLS Estimates of RWM Models are reported below**:**

- GAIL (India) Limited (price) [GAIL]

ΔY_t =-0.01700Y_{t-1},R^2=0.26390, F=3.52000,t: 1.876000

ΔY_t=9.75000-0.04000Y_{t-1}, R^2 =0.01900, F=0.93000, t (0.57670) (-0.96699)

ΔY_t=51.02000+T-0.11700Y_{t-1}, R^2=0.05200,F=1.37400, t: (1.45500),(-1.34000)(-1.65600)

- Hindustan Unilever Limited (Price) [HUL]

ΔY_t=0.00826Yt-1, R^2 =0.09500, F=21109.50000, t: (145.29000)

ΔY_t=-59.10700+0.25500Y_{t-1},R^2 =0.35000,F=6.45000, t: (-2.54000)(2.54000)

ΔY_t=-71.80000+T+0.32700$Y_{t-1,}$ R^2= 0.40900, F=4.42600, t: (-2.93000)(2.97000)(-1.49000)

- ITC Limited (Price) [ITC]

ΔY_t=-0.00700Y_{t-1}, R^2 =0.02400,F=1.17600,t:(-1.08400)

ΔY_t=27.53000 -0.14000Y_{t-1}, R^2=0.13800,F=3.52800,t: (2.00500) (-2.10100)

ΔY_t=53.83000+T-0.25900Y_{t-1}, R^2=0.13800,F=3.52000,t: (2.51000)(-1.57800)(-2.62000)

- SUZLON Energy Limited (Price) [SUZLON]

ΔY_t=-0.33200Yt-1, R^2=0.45000, F=38.53000, t: (-6.20700)

ΔY_t=87.10200 -0.44000Yt-1,R^2=0.51400,F=48.81300,t: (2.81600)(-6.98600)

ΔY_t=169.28000+T-0.49200Yt-1,R^2=0.53300,F= 25.70970,t: (2.45900)(-6.71530)(-1.33900)

- Reliance Communications Limited (Price) [RCOM]

ΔYt=-0.03080Yt-1, R^2=0.14400, F=7.74200, t: (-2.78000)

ΔYt =19.54000 -0.06000Yt-1, R^2 =0.07490, F=3.64400, t: (1.11200) (-1.90800)

ΔYt=190.22000+T-0.30000Yt-1, R^2=0.19870, F=5.45000, t: (2.81800)(-3.16390)(-2.60000)

- NTPC Limited (Price) [NTPC]

ΔYt=-0.01600Yt-1, R^2=0.66300, F=3.18900, t: (-1.78500)

ΔYt= 38.68000 -0.22500Yt-1 , R^2=0.25200,F=3.18900, t: (3.69200)(-3.94000)

ΔYt =74.72900+T-0.37000Y t-1, R^2=0.31900, F=10.56000, t: (3.76000)(-4.16000)(-2.10800)

Above functions reveal that the roots of weekly prices of equity of GAIL, ITC, NTPC, SUZLON, and RELCOM are less than unit for all three models. Root of prices of HUL is more than 1only for RWM with Drift and Trend. Therefore, equity prices of all companies are stationary, according to Dickey Fuller unit root test.

Same test is applied to evaluate stationarity of volume of trade. OLS estimates of RWM are reported below.

- GAIL (India) Limited (volume of trade) [GAIL]

ΔSt=-0.10300 Yt-1, R^2=0.23000,F=2.66000,t: 0.1.63000

ΔSt= 228015.29000-0.63600Yt-1, R^2=0.56300,F=21.43000,t: (4.22000)(-4.62920)

ΔSt= 196714.40000+T -0.68220Yt-1, R^2=0.34000, F=11.59700, t: (3.31090)(-4.81600)(0.00000)

- Hindustan Unilever Limited (volume of trade) [HUL]

ΔSt =-0.11550 Yt-1, R^2=0.25000,F= 3.08000,t: (0.00000)

ΔSt =277811.07000-0.52700Yt-1, R^2=0.26000, t: (3.47000)(-0.39100)

$\Delta St=221552.06000+T-0.59000$, $R^2= 0.29000$, t: (2.50000)(1.41000)(-4.26000)

- ITC Limited (volume of trade) [ITC]

$\Delta St=-1.00000Y_{t-1}$, $R^2=1$, F=0, t:65535.

$\Delta St=6.985E-10 -1.00000Y_{t-1}$, $R^2=1$, F=3.66E+32, t: (10.58000)(-1.9E+16)

$\Delta St=6.98500+T -1.00000Y_{t-1}$, $R^2=1$,F=1.799E+32, t: (6.44000)(0.48400)(-1.8E+10)

- SUZLON Energy Limited (volume of trade) [SUZLON]

$\Delta St=-0.03300Y_{t-1}$, $R^2 =0.00600$,F=0.28900,t: (-0.53800)

$\Delta St=727948.00000-0.10060Y_{t-1}$, $R^2 =0.03460$, F= 1.65220,t: (1.40800)(-1.28500)

$\Delta St=-507173.00000+T -0.20900Y_{t-1}$,$R^2 =0.10400$,F=2.63220, t: (-0.61200)(1.87660 (-2.18600)

- Reliance Communications Limited (volume of shares traded) [RCOM]

$\Delta St=$ -0.02700Yt-1, $R^2 =0.07700$,F=0.27000,t: (-0.52800)

$\Delta St=667434.00000 -0.02440Y_{t-1}$, $R^2= 0.93300$,F=4.63000,t: (2.11480)(-2.15200)

$\Delta St=411073.32000+T-0.42000Y_{t-1}$,$R^2 =0.23300$, F=6.70600 ,t: (1.33800)(-3.44000)(2.83800)

- NTPC Limited (volume of trade) [NTPC]

$\Delta St=-0.08300Yt-1$, $R^2=0.06160$, F=3.08000,t: (-1.75700)

$\Delta St=833882.00000-0.35800Y_{t-1}$,$R^2=0.20600$,F= 11.93000,t: (2.92800)(-3.45500)

$\Delta St= 1298373.00000+T -0.42800Y_{t-1}$, $R^2=0.23060$, F=6.74400, t: (2.70440)(-3.61390)(-1.19800)

All above models of volume of all companies, including HUL show lower than unit roots. Therefore, trade volume, like prices, constitute stationary time series.

These results highlight that both prices and trade volume are influenced largely by systematic factors, though random factors may also exercise some influence. Above results pave the way to apply adaptive expectation model. OLS estimates of the price functions of these companies are reported below.The estimated errors of these models will be subjected to Engle-Granger test.

Adaptive Expectation Distributed Lag Model

RCOM: $Y_t=40.5100+0.4262X_t+0.9080Y_{t-1}$, $\lambda=0.09200$, $R^2=0.93600$, F=324.60000,
t (1.247) (19.60) (0.77)
$\Delta Ut=-0.994U_{t-1}$
t: (-1.77)

SUZLON: $Y_t=115.99000+0.5075X_t+0.53500Y_{t-1}$,$\lambda=0.46500$, $R^2=0.63800$,F=39.79000,
t (2.836), (8.030) (1.07)
$\Delta Ut=-1.47U_{t-1}$
t: (-15.91)

HUL: $Y_t=60.64000+7.78800X_t+0.72170Y_{t-1}$,$\lambda=0.28000$, $R^2=0.78$, F=48.6,t:
t:(2.632) ,(7.1843), (1.385)
$\Delta Ut=-1.081U_{t-1}$)
t: (-7.34)

ITC: $Y_t=28.19500+1359X_t+0.8540Y_{t-1}$,$\lambda=0.14600$,$R^2=0.76000$,F=71.07000,
t: (-7.349 (11.909), (-0.56)
$\Delta U_t=-1.076U_{t-1}$
t : (-7.25)

NTPC: $Y_t=32.48500+0.303X_t+0.84900Y_{t-1}$,$\lambda=0.15100$,$R^2=0.81000$,F=98.55000,
t : (3.0) (12.43) (1.889)
$\Delta U_t= -1.1542U_{t-1}$
t : (-8.1238)

GAIL: $Y_t=26.90700-2.45E-05X_t+0.93400Y_{t-1}$,$\lambda=0.06600$,$R^2=0.91100$,F=230.60000,
t: (1.059) (8.322), (0.90)
$\Delta U_t= -0.0174\ U_{t-1}$
t: (-1.765)

All coefficients of Ut-1 in the regression of first differences of errors of above models are negative and statistically significant. Engle-Granger test of residuals of distributed lag models show the residuals of all companies to be stationary. It means that the main models are genuine regression functions.

The distributed lag models fit the data of all companies well; coefficients of determination range from 64 to 94 % The coefficient attached to volume of trade is statistically significant in all cases even at .01 probability level. However, the coefficients of lagged price are not statistically significant. This may be explained as follows: (1) non significance of coefficient of lagged value of price arises from multicollinearity between explanatory variables. This is logical also since the preceding period's price may carry some influence on volume of next period's trade also; (2) Lead –lag period involved in the may be extremely small, since changes in prices tend to change even within a day, which influences the price expectation; (3) Interestingly, positive sign of the coefficients of lagged price suggest that the explosive cobweb model with quick revision of expectation may be valid. Nearer the λ to unity, which is not the case,, adaptation of expectation to observed change is spread over more than one week. So, above results may be taken to lend support to the thesis built in the paper.

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