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STABILITY OF BETA IN VARIOUS SECTORS IN DIFFERENT PHASES OF STOCK MARKET

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Abstract *Identifying and measuring risk has been a constant endeavor for identifying assets related to investment. Various theories have been propounded for pricing of assets considering the risk element. The most common and widely accepted method has been the capital asset pricing model (CAPM) model, which takes into consideration the systematic risk of the asset. It linearly measures returns based on beta which in turn measures this risk. However, one of the major point of contention has been the stability of beta over long period of time and change of systematic risk over different phases of market. Besides, there exists dual-beta, which is upside beta and downside beta, depending upon the market movement in the respective direction. It has been observed that there has been a significant difference in upward and downward beta. Furthermore, even dual-beta are not constant over different phases of the market. It is in this context that the current paper explores the stability and duality of beta in 11 Sectors in Indian market, namely auto, banking, capital goods, consumer durable, FMCG, health, IT, metal, oil, power and realty. They were represented by their respective indices of Bombay Stock Exchange in different phases of the market. The study observes that there is a change in systematic risk of most of the sectors over different phases and there also exists a difference in upside and downside beta.*

Keywords: *Dual Beta, Dummy Variable, Sectoral Indices, Downside Risk, Capital Asset Pricing Model*

INTRODUCTION

Investors have always been concerned about downside risk in their investment and this downside volatility has been the part of financial literature. Roy (1952) advocated about safety first for investors and minimizing the probability of negative returns. Markowitz (1959) also advocated that semi variance is a better measurement of risk than variance itself. Kahneman and Tversky (1979), in one of their significant studies on behavioral finance, came up with the prospect theory. This suggested that investors, while making a decision for investment, give more weightage to downside loss rather than gain. Ang, Chen and Xing (2006) extended premises of prospect theory and stated that the basic premise drives investors and assets which are more volatile to negative markets than upward market should not be part of the portfolio for loss-averse investors. The motivation of the current study is to also contemplate whether valuing security conservatively using the capital asset pricing model (CAPM), it is better to have downside beta in the model.

Chong and Pleffeir (2011) have studied duality in beta as a strategy of proper asset allocation and for rebalancing of portfolio. Baker, Bradley and Wurgler's (2011) research showed that low-beta portfolios tend to provide higher returns with relatively lesser volatility as compared to portfolios with higher beta. It is important in this context to also study the duality of beta in various sectors is explored in this study.

Return expected in any security has been related to risk associated with it and it is on this premises which the CAPM is based. Markowitz's mean-variance (MV) approach (1952) stated that when the markets are in equilibrium, expected return of asset is in linear relationship with the risk associated in the respective asset and the relationship of the same is portrayed by capital market line (CML), which is denoted by:

$$E\left(R_p\right) = R_f + \sigma_p \left(\frac{E\left(R_p\right) - R_f}{\sigma_m} \right)$$

$E(R_p)$ is expected return of portfolio Rf is risk-free rate of return.

The CML equation is a sum of risk-free rate of return and risk premium, which the investor expects and is measured by total risk σ_p. The CAPM is also expressed by SML (security market line), which measures expected return of security. It is based on risk-free rate and systematic risk denoted by beta

$$E\left(R_i\right) = R_f + \beta_i \left(E\left(R_m\right) - R_f\right)$$

The beta of security is estimated by regressing the security return (r_i) with the market return (r_m) and can be estimated

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by:

$$\beta_i = \frac{Cov(r_i, r_m)}{Var(r_m)}$$

One of the anomaly for which CAPM model has been criticized is the stability of beta over different phases of economy and its behaviour in the upward and downward market condition. For making better valuation models, it is imperative that more accurate beta needs to be estimated for investors to make better investment decisions.

Many developing markets are undergoing dynamic changes in political and economic environments and financial markets are facing impacts because of these changes. India, too, has fast-growing financial markets and has been one of the prime attractions for foreign investors and institutions across the globe. It is, therefore, very important to identify risks in various industries while making investments.

The Sharp-Linter CAPM, which was developed for an economy, assumed that investors will have identical holding period and beta remains constant over time. However, in reality, this is not the case as the expectations of investors are changing and so is the risk in various sectors are undergoing fast changes with changes in business cycles. This questions the stability of beta over a long period.

The rationale for this study thus is to explore whether the assumption laid down by Sharp-Linter Model of beta being constant over time is justified or not. It is also pertinent to evaluate the behavior of beta in different market conditions.

The existing paper discusses the stability of beta over different phases of the market and the difference between upward and downward beta, also referred to as dual beta in different phases for various sectors. The study evaluates whether there is a difference in upside and downside beta in various sectoral indices and whether there is difference in sector betas in different phases of economy.

The paper is divided in four sections. While the second section provides review of literature on existing thoughts, the third section focuses on the methodology incorporated to conduct the study. The fourth section presents the result of analysis. Finally, the conclusion, scope and implications of the study are discussed in the last section.

REVIEW OF LITERATURE

In this section, review of existing studies has been done related to risk involved, measured by beta, which provides the basis for pricing theories and guidance for investments.

The CAPM has been the dominant model in financial economics as an important estimator for expected return with the condition that the markets are in equilibrium. However, if there are abnormal phases in markets, credibility of the CAPM and beta has been questioned in various studies.

There have been studies indicating existence of stability of beta over different phases of market. Fabozzi and Francis (1977), after estimating beta, tested its stability in different phases of the market and their results concluded of not having a substantial difference in beta over different phases. Atilgan (2015), through his research on 170 million daily return observations, concluded that downside beta does not substantiate any importance and there was no difference in returns from ordinary beta. Braun et al. (1995) and Chou and Engle (1999) studied the good and bad news as measured by positive and negative returns on beta.

Nevertheless, there have been contrarian studies indicating instability of beta over different times. Kon and Jen (1978 and 1979) observed that stock market reacts differently during different phases and this would result in having different betas. Chen (1982) tested for stationarity of beta in up and down markets and concluded that investors do get premium for downside risk, as having higher downside beta. Galagedera and Faff (2003) discussed the validity of a conditional three-beta model in three different phases of volatility and concluded that there was no significant difference in the betas of these three phases. Javed and Ahmad (2011) measured the dual-beta CAPM and dual-beta Fama French 3 factor model on 50 stocks traded over the Karachi Stock Exchange from 1993 to 2007. Their test result supports the evidence that betas increase in rising market and decrease in falling market.

Other studies which were primarily focused on specific countries, on identifying evidences that betas are time varying, include Bos and Newbold (1984), Jagannathan and Wang (1996), and Groenewold and Fraser (1999) for the United States; Cheng (1997) for Hong Kong; Brooks et al. (1998) for Australia; Wells (1996) for Sweden; Bucland and Fraser (2001) for the United Kingdom.

Ye, Y. (2017) has discussed that in China, beta has depicted lower stability for cyclical industries and it has shown higher stability for small companies.

Teh (2017) in his study on Malaysian Market observed that most stocks have depicted an increasing (decreasing) beta in the downtrend (uptrend) period. It was thus observed that investors are rewarded with a positive risk premium for holding an asset in the down market, while the upside beta carries a negative premium.

Guo (2017) has also studied nonlinear dependence of alpha on corporate decision and concluded that the conditional CAPM based on conditional beta performs better than the CAPM.

Valeyre (2019) has also explored reactive beta model that accounts for the leverage effect and beta elasticity and how change in beta values help in developing portfolio strategies.

For Indian markets, Dubey (2014) observed that many stocks showed large degrees of instability in their beta based on investment horizons because of high degree of heterogeneity with different time horizons in investments. He also argued that in emerging countries, the conditions are very dynamic because of which this instability of beta exists.

Das (2015) explored the existence of dynamic beta in the Indian market. The results indicate the presence of systematic risk or beta of Indian industries is affected by the global economy. Vipul (1999) studied the relationship between beta and size of the company, liquidity and nature of industry from 1986 to 1993 and used 114 securities in the Bombay Stock Exchange. He concluded that beta is influenced by the size of the company and observed that securities, liquidity and nature of industry do not influence the beta stability.

It is thus observed from these studies that beta, as a subject, has been widely explored in various literatures and various studies are covering different periods, markets and various assets. There has been no conclusive evidence on the stability of beta and on the difference between upside and downside beta.

In the Indian context, there have been few studies and the results have been widely different. This study will add to existing literature in understanding the behavior of various sectors and their sensitivity in different market conditions. The study also aids understanding the behavior of various sectors in terms of risk in various phases of economy.

DATA & METHODOLOGY

The study is conducted on 11 sectors, namely auto, banking, capital goods, consumer durable, FMCG, health, IT, metal, oil, power and realty. These were represented by their respective indices of the Bombay Stock Exchange. S&P Sensex represented the market.

Daily data of 2,997 days was taken from the Bombay Stock Exchange from a period January 2006 to January 2018. Daily returns were calculated for all these days.

Even though there has been a definition of bull and bear market, long-term trends show excessive abnormal positive and negative returns. These can be referred to as bull and bear phases and markets showing normal returns can be referred to as stable periods.

Ibbotson and Jaffe (1975) identified bull markets as long and continued periods of higher than usual returns and bear markets as sustained periods containing lower than normal returns, with bull and bear market turning points being detected when the stock index return series switches from one state to the other. Dębski (2016) identified the basic period from the bottom (lowest value of the index) to the peak (highest value of the index) is a bull market, and the period from the peak to the bottom is a bear market.

In this paper, a similar approach has been used to identify different phases of bull and bear, and switching points have been identified, where bull phase has given abnormally high returns and in bear phase, abnormally low returns were offered in the market. The data was analyzed using E-views-8 and Excel, which helped in identifying switches in the market. To understand the relationship in upside and downside market, dummy variables were created; thus, different phases of markets are also represented by different dummy variables.

For comparing the performance of sectors in different phases of the market, data is split in four phases. As shown in Fig. 1, four phases for study have been identified as:

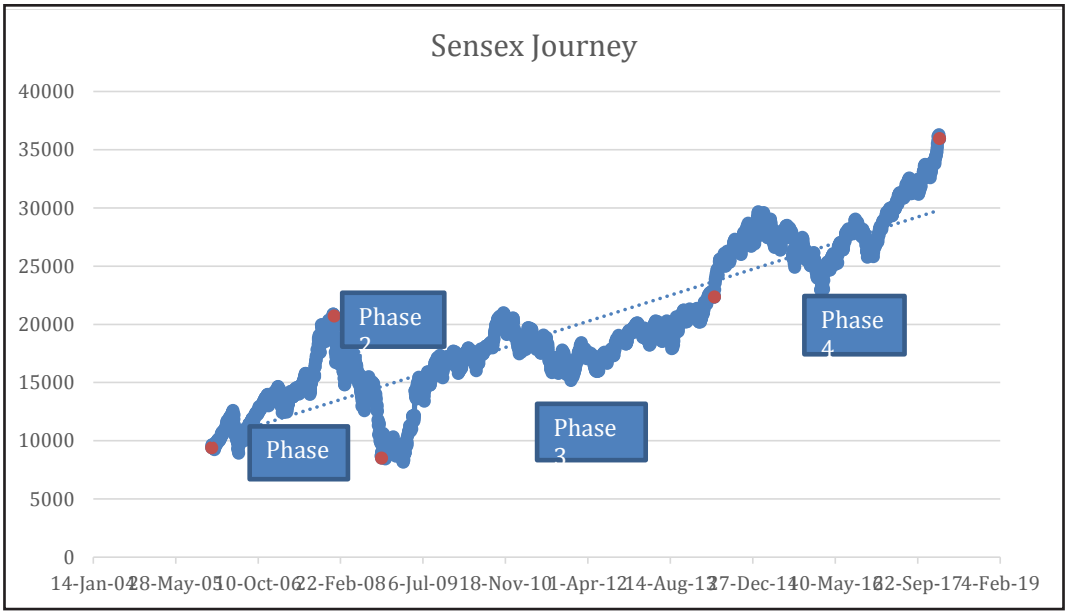
Phase-I: Data from 2nd January 2006 to 14th January 2008, when the Sensex peaked at a level of 20728 and in this phase from 9390 at the start of January 2006 generating a Compounded Annual Growth Rate (CAGR) return of 48.55%.

Phase-II: Data ranges from 15th January 2008 to 27th October 2008, when the Sensex bottomed to the level of 8509 and witnessed a sharp fall of -67.77%.

Phase-III: Data is depicted from 28th October 2008 to 8th May 2014. This is a recovery phase when the Sensex recovered to 22344 generating a CAGR return of 19.06%.

Phase-IV: Data has been taken from 9th May 2014 to January 2018 since the formation of new Government in India and Sensex has scaled to 35965 generating an annual return of 13.58%.

It is observed that Phase-I and Phase-II are characterized by abnormally high and low returns, respectively. Phase-III is a reflection of recovery and Phase-IV depicts the normal markets. Thus, these four phases represent four different behaviors of the market and the paper explores to study the downside risks of various sectors in these different phases.



Source: Author's Contribution

Fig. 1: Sensex Journey

Beta is the measurement of systematic risk of the security and measures the sensitivities of security and is calculated by studying the relationship between security return and market return.

$$r_i = \alpha + \beta_i r_m + e_i$$

r_i = Security Return r_m = Market Return

To test whether the beta coefficient is symmetric over bull and bear market, the model suggested by Fabozzi and Francis (1977) has been used. The regression model incorporates both bull and bear market in the same model and testing the symmetry of beta over bull and bear market is given in the equation 1 below.

Downside beta has gained relevance as the investor always tends to protect his/her downside risk by anticipating the potential loss in investment. Thus, it measures the sensitivity of security when the markets are negative. To identify the impact of upside and downside market, a dummy variable is created and the model is framed as:

$$r_i = \alpha + \beta_{1i} r_m + \beta_{2i} D_0 r_m + e_i$$

$D_0 = 1$ when $r_m > 0$ and $D_0 = 0$ when $r_m < 0$ (Equation 1)

In the upside market, $D_0 = 1$ and coefficient of r_m will be $\beta_{1i} + \beta_{2i}$ whereas in the downside market, coefficient of r_m will be only β_{1i}. The significance of β_{2i} will indicate whether a differences exists between upside and downside beta. Furthermore, if the value of β_{2_i} is positive, it indicates that upside beta is more than downside beta, and if its value is negative, it indicates that upside beta is less than downside beta. To capture the stability of beta over different phases, as mentioned, and to study the impact of the economic condition on the beta of sectors, dummy variables are defined for different phases as follows:

$D_1 = 1$ for phase 2 else 0

$D_2 = 1$ for phase 3 else 0

$D_3 = 1$ for phase 4 else 0

As indicated by definition, if all are zero, that phase is indicated by the first phase.

The model, which includes the impact of different scenario, is framed as:

$$r_i = \alpha + \beta_{1i} r_m + \beta_{2i} Dr_m + \beta_{3i} D_1 r_m + \beta_{4i} D_2 r_m + \beta_{5i} D_3 r_m + e_i \quad \text{(Equation 2)}$$

Thus, these models test the following hypothesis:

- There is no difference between upside and downside beta in sectoral indices return.
- There is no difference in beta in different phases of the economy in sectoral indices return.

FINDINGS & ANALYSIS

As observed from Table 1, in terms of risk reward ratio measured by the coefficient of variation (CV), the FMCG Sector is the best-performing sector with CV = 0.055. Its VaR (5%) is -2% which is the highest after Health

Sector which has VaR (5%) at -1.8%. Downside return as measured by VaR (5%) is the worst for Realty Sector at -4.4%. This primarily can be because both these sectors are conservative in nature and are not highly dependent upon the macro condition of economy. Gupta (2017) has explored that FMCG and Health Sectors are the best sectors in terms of risk-return reward ratio and it also explores causality between different sectors.

Table 1: Descriptive Analysis of All Sectoral Indices for Entire Period of Study (Jan 2006 - Jan 2018)

	SE NSEX	AUTO	BANKEX	CAP GOODS	CONS DUR	FMCG	HEALTH	IT	METAL	OIL	POWER	REALTY
Sensex		0.882	1.165	1.088	0.944	0.647	0.664	0.766	1.342	1.051	1.068	1.561
SE		0.019	0.019	0.021	0.029	0.021	0.018	0.026	0.027	0.019	0.019	0.040
T –value		47.550	60.709	50.875	32.919	31.528	35.940	29.870	49.653	54.631	55.890	38.667
D Sense		-0.125	-0.001	-0.008	-0.307	-0.102	-0.222	0.035	-0.252	-0.076	-0.123	-0.410
SE		0.029	0.030	0.034	0.045	0.032	0.029	0.040	0.043	0.030	0.030	0.064
T-value		-4.281	-0.022	-0.245	-6.785	-3.162	-7.623	0.871	-5.911	-2.509	-4.098	-6.448
P-Value		0.000	0.982	0.806	0.000	0.002	0.000	0.384	0.000	0.012	0.000	0.000
Count	2997	2997	2997	2997	2997	2997	2997	2997	2997	2997	2997	2997
Mean	0.06%	0.07%	0.08%	0.06%	0.08%	0.07%	0.06%	0.05%	0.05%	0.06%	0.03%	0.06%
Median	0.08%	0.11%	0.08%	0.07%	0.13%	0.08%	0.09%	0.03%	0.08%	0.05%	0.10%	0.12%
SD	1.46%	1.48%	1.92%	1.87%	1.77%	1.29%	1.18%	1.66%	2.18%	1.73%	1.72%	2.73%
CV	0.038	0.049	0.041	0.032	0.045	0.055	0.049	0.033	0.024	0.034	0.018	0.022
Skewnes	0.347	-0.210	0.320	0.562	-0.173	-0.132	-0.524	0.063	-0.100	-0.008	0.182	-0.118
Kurtosis	10.833	4.298	6.542	8.865	5.538	3.345	4.867	5.075	4.234	10.378	9.097	6.231
VaR (5%)	-2.2%	-2.3%	-3.0%	-2.9%	-2.6%	-2.0%	-1.8%	-2.5%	-3.5%	-2.6%	-2.7%	-4.4%
Max	17.3%	11.2%	19.2%	21.9%	13.3%	7.2%	8.1%	11.4%	16.1%	19.1%	18.3%	23.4%
Min	-11.0%	-10.4%	-12.6%	-9.2%	-11.0%	-8.0%	-8.3%	-11.1%	-13.3%	-15.0%	-11.4%	-24.4%

Source: Author's finding- Using Excel 2017 and Eviews 8

In addition to this, all sectors other than Banking, Capital Goods & IT, show a significant difference in upside & downside beta. (Table 2). It is only in the IT sector where upside beta (0.802) is more than downside beta (0.766). However, that difference is not found to be significant. In sectors such as auto, consumer durable, FMCG, health, metal, oil, power and realty, downside beta has been more than upside beta. This further indicates that fall in return is more in a falling market than an increase in return in the rising market. Realty sector has shown the highest upside (1.15) & downside beta (1.561) and FMCG, as expected to be a defensive sector, has shown low upside (0.545) and downside (0.647) beta. The results are in line with the nature of industry as Realty sector, which includes infrastructure, shows high growth when the economy is rising and promises good return whereas in the slowdown the sector is highly regressive.

Table 2: Dual Beta Analysis of All Sectoral Indices for Entire Period of Study (Jan 2006 - Jan 2018)

	AUTO	BANKEX	CAP GOODS	CONS DUR	FMCG	HEALTH	IT	METAL	OIL	POWER	REALTY
Sensex	0.882	1.165	1.088	0.944	0.647	0.664	0.766	1.342	1.051	1.068	1.561
SE	0.019	0.019	0.021	0.029	0.021	0.018	0.026	0.027	0.019	0.019	0.040
T-value	47.550	60.709	50.875	32.919	31.528	35.940	29.870	49.653	54.631	55.890	38.667
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D Sensex	-0.125	-0.001	-0.008	-0.307	-0.102	-0.222	0.035	-0.252	-0.076	-0.123	-0.410
SE	0.029	0.030	0.034	0.045	0.032	0.029	0.040	0.043	0.030	0.030	0.064
T-value	-4.281	-0.022	-0.245	-6.785	-3.162	-7.623	0.871	-5.911	-2.509	-4.098	-6.448

	AUTO	BANKEX	CAP GOODS	CONS DUR	FMCG	HEALTH	IT	METAL	OIL	POWER	REALTY
P-Value	0.000	0.982	0.806	0.000	0.002	0.000	0.384	0.000	0.012	0.000	0.000
Up Beta	0.757	1.165	1.079	0.638	0.545	0.442	0.802	1.090	0.975	0.944	1.150
Down Beta	0.882	1.165	1.088	0.944	0.647	0.664	0.766	1.342	1.051	1.068	1.561
Beta Overall	0.818	1.165	1.083	0.786	0.594	0.549	0.785	1.212	1.012	1.004	1.349

Source: Author's finding- Using Excel 2017 and Eviews 8

To understand how beta changes in different phases of the market as seen from Table 3 in the bull market, in phase-I there has been a significant difference between upside and downside beta in all sector other than banking, capital goods & IT. In this phase, the downside beta is more than upside beta for all other sectors which include auto, consumer durable, FMCG, health, metal, oil, power and realty.

Table 3: Dual Beta Analysis of All Sectoral Indices for Different Phases of Economy in (Jan 2006- Jan 2018)

		AUTO	BANKEX	CAP GOODS	CONS DUR	FMCG	HEALTH	IT	METAL	OIL	POWER	REALTY
Phase I	Upside	0.790	1.030	1.069	0.620	0.736	0.578	0.866	1.119	0.965	0.965	0.717
	Downside	0.929	1.029	1.086	0.895	0.817	0.775	0.818	1.411	1.035	1.057	1.129
Phase II	Ddown	-0.168	0.174	-0.049	0.141	-0.218	-0.144	0.004	-0.201	0.035	0.073	0.551
	SE	0.033	0.034	0.038	0.051	0.036	0.033	0.046	0.048	0.034	0.034	0.071
	T-value	-5.137	5.113	-1.291	2.761	-6.017	-4.413	0.077	-4.184	1.012	2.136	7.747
	p-Value	0.000	0.000	0.197	0.006	0.000	0.000	0.939	0.000	0.311	0.033	0.000
	Upside	0.622	1.204	1.020	0.761	0.519	0.434	0.870	0.918	1.000	1.038	1.268
	Downside	0.761	1.203	1.036	1.036	0.599	0.632	0.822	1.210	1.070	1.129	1.681
Phase III	Dreco	-0.048	0.160	0.011	-0.012	-0.270	-0.209	-0.080	0.002	0.007	-0.065	0.528
	SE	0.029	0.030	0.034	0.045	0.032	0.029	0.040	0.042	0.030	0.030	0.063
	T-Value	-1.667	5.344	0.329	-0.270	-8.486	-7.304	-1.984	0.038	0.217	-2.182	8.449
	p-Value	0.096	0.000	0.742	0.787	0.000	0.000	0.047	0.970	0.828	0.029	0.000
	Upside	0.742	1.190	1.080	0.608	0.467	0.369	0.786	1.121	0.972	0.900	1.245
	Downside	0.881	1.189	1.097	0.883	0.547	0.566	0.738	1.413	1.042	0.991	1.657
Phase IV	Dstab	0.214	0.197	0.122	0.050	-0.053	0.057	-0.214	-0.020	0.016	0.071	0.564
	SE	0.041	0.042	0.047	0.064	0.045	0.041	0.057	0.060	0.043	0.042	0.089
	T-Value	5.257	4.631	2.572	0.778	-1.168	1.403	-3.762	-0.332	0.384	1.674	6.370
	p-Value	0.000	0.000	0.010	0.437	0.243	0.161	0.000	0.740	0.701	0.094	0.000
	Upside	1.003	1.226	1.191	0.670	0.684	0.635	0.652	1.099	0.981	1.036	1.280
	Downside	1.142	1.226	1.208	0.944	0.765	0.832	0.604	1.391	1.052	1.127	1.693

Source: Author's finding- Using Excel 2017 and Eviews 8

When the markets were showing a downward trend in phase-II, banking was the only sector where the upside beta (1.204) was slightly higher than the downside beta (1.203). IT, capital goods & oil show no difference in upward and downward beta than phase-I. However, other sectors such as auto, consumer durable, FMCG, health, metal, power and realty indicate a significant difference in beta value than phase-I. Auto, FMCG, health & metal sectors have become less sensitive than phase-I, whereas banking, consumer durable, power and realty indicate that systematic risk has increased in this period. During this phase, banking & realty showed high systematic risk whereas health and FMCG sectors depicted their defensive behavior.

In phase-III of the market, auto, Auto, FMCG, Health, IT & Power Sector the value of Beta has fallen significantly from Phase-1 of the market, whereas in the banking and realty sector both upside and downside beta values have shown

upward trend. Similar to phase-II, in this phase also, banking & realty were risky sectors and FMCG & health continued in defensive space.

In phase-IV, auto, banking, capital goods and realty have shown a significant positive difference in their upward and downward beta values, whereas IT has shown fall in beta values. In this phase, auto, banking, capital goods and realty were aggressive sectors having beta values more than 1, whereas FMCG and health were defensive sectors and their beta values were almost the same as in phase-I.

As observed, the downside beta has been more for most of the sectors in all phases of the market, which is an indicator that most sectors are more sensitive in falling markets.

The study thus confirms the dual nature of beta, which is that, that there is a difference between upside and downside beta. This behavior has been depicted by many sectors. Besides, the behavior of beta is different across different market conditions. This also indicates that beta is not stable across period and its application to relevant asset pricing model such as the CAPM also has to be evaluated for that period only.

Managerial Implications

The findings in the paper confirm the existence of a difference in upward and downward beta in most of the sectors in India. It is also indicative of the instability of beta in different phases of the market which is in contrary to me CAPM model, which preassumes the stability for predicting expected return of security. The study is important as it guides the portfolio manager while picking sectors in different phases of the market. As observed in the study, certain sectors such as realty are highly aggressive in almost all phases, and there also exists a difference in upward and downward beta. Whereas, in defensive sectors such as FMCG & health, there exists a difference in upward and downward beta. The oil and gas sectors have shown stability of beta across all phases and there was no significant difference in their upside and downside beta. Banking sector, generally referred to as the leading indicator of the economy, has also depicted instability of beta, even though the existence of dual-beta in this is not very significant.

Scope for Future Work

The current study advocates replacing risk by downside risk in asset pricing model, which will help investors in cautiously pricing security. Since investors, as discussed in various studies, are more wary of downside risk, incorporating behavioral approach in asset pricing through downside beta can also be looked into. The study was primarily conducted in the Indian context on different sectors. However, it can be further elaborated and tested in industries of other emerging and developed markets for insights corroborating the existence of duality in beta.

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