

EMPIRICAL TESTING OF ARBITRAGE PRICING THEORY IN THE INDIAN STOCK MARKET: FACTOR ANALYSIS APPROACH

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ABSTRACT

Investors all over the world have been in search of a model that can help them in estimating the parity between risk and return relationship which paved the way for the models like CAPM, Conditional CAPM, multi factor CAPM model with different firm specific factors, Arbitrage Pricing Theory and various other modified versions of the same. The traditional theories however have been time and again criticised for being too simple and ignoring an important aspect which is very much evident in the emerging stock markets that is the Behavioural factor. The study tested applicability of APT in the Indian context using monthly data for the period January 2000 to December 2018. Factor analysis and Fama-Macbeth regression technique has been used to find out applicability of APT in the Indian context. Results were found to be partially suited towards the applicability of the APT in estimating the risk return parity of the 500 stocks listed on the Bombay Stock Exchange.

Keywords Asset Pricing, Portfolio, Capital Asset Pricing, Arbitrage

INTRODUCTION

The advent of development of an economy is concerned with the rate of savings and investment and how the circular flow of income is generated. Various researchers have tried to find out the linkage between the growth in the financial sector and economic development of a country reinforcing the fact that both of them go hand in

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hand. As the income of the residents of a country increase they try to find out alternative for investments and with a growing and strong capital market more and more investors are attracted towards it. The two important considerations that any investor looks at before making an investment are – Risk and Return. The MPT theory laid foundation for various future researches and modern studies like Sharpe, Lintner and Mossin's CAPM, Zero variance portfolio asset pricing theory developed by Black, Intertemporal CAPM propounded by Merton, International CAPM of Solnik, Multifactor model named Arbitrage Pricing Theory by Ross, Consumption oriented model of Lucas and Breeden, three-factor, four-factor and five-factor model originated by Fama and French, Behavioural CAPM by Shefrin and Statman, Four Factor Model by Carhart, Downside CAPM by Estrada, Housing Consumption CAPM by Piazzesi, Reward CAPM originated by Bornholt, Six factor CAPM by Rahul Roy and Santhakumar Shijin. These models are an attempt to explain the portion of expected returns that cannot be attributed to beta alone thereby laying the foundation for what came to be known as Anomalies to CAPM or modern asset pricing theories. One important study that did away with the unrealistic assumptions of CAPM was provided by Ross (1976) and came to be known as the Arbitrage Pricing theory.

REVIEW OF LITERATURE

George P. Diacogiannis (1986) conducted a study using monthly data of 200 companies listed for the period 1956-1981 to identify if the number of significant factors impacting the expected returns varies with the size of the portfolio and time period or the theory can be generalized for all sample sizes across all time periods. For this all the securities were listed in 5 portfolios of 40 securities each and within the portfolio sub groups were created that consisted of 5, 10, 15, 20, 25, 30 and 35 securities to estimate the relationship between the sample size and APT. Empirical results were found to be dependent on the portfolio size and period for which testing was done Chen et al (1986) the study is one of the seminal works in the area of APT as it deals with the expected impact of innovations in certain macroeconomic

variables on the stock returns. Instead of using the macroeconomic variables as the independent variable impacting the stock returns the study made use of shocks or unexpected changes in the variables which were then used to see the impact on the stock returns. It used four variables namely spread of the interest rate, inflation which had been divided into expected and unexpected component, index of industrial production and spread which is calculated as gap between the high grade and low grade bonds. However to reduce the errors-in-variables problem the testing was done on portfolios formed on size basis rather than testing done on securities. The study used monthly data from 1958-84 and using the two step regression technique propounded by Macbeth provided that the economy wide macro factors had an impact on the portfolio returns when measured as innovations; however market portfolio and consumption were not priced separately. Demos and Parissi (1998) tested the APT model using every fifteen days data of the stocks belonging to nine different sectors and listed on the Athens Stock Market during January 1985 to June 1997. It used Kalman filter technique after which a model similar to conditional CAPM was employed for the estimation purpose. Results were found to be in favour of the GARCH conditional variance and ARCH type model that suggested that a dynamic latent factor was more significant in explaining the asset returns as compared to the simple CAPM. Chung S. Kwon and Tai S. Shin (1999) the study tested the significance of multi factor macro economic model on the Korean stock market making use of pre specified macro economic variables namely interest rates, inflation, industrial production, trade balance, oil price and money supply for the period 1980 to 1992 . It tested the relationship using Johansen cointegration and granger causality which revealed that though there is no cointegration between stock returns and individual macro variables but when macroeconomic variables are combined they produce cointegration result. However the variables that impact stock returns were found to be different from those of developed markets as in Korea variables like exchange rate, money supply, trade balance and index of industrial production were found to have an impact on the stock returns. Cagnetti (2002) compared “CAPM and APT on the Italian stock market using monthly data of 30 companies for the period January 1990 to June 2001”. Study used Principal

Component Analysis before going for regression analysis after which “Davidson Mckinnon equation, posterior odds ratio and residual analysis” have been used for comparing the explanatory power of the models. Results revealed that APT is a better model in explaining the stock and portfolio returns wherein almost 40 percent of the variation in the expected returns was explained by five factors used in APT. The significant factors were found to be fixed return, inflation factor, imports, market portfolio returns and people's expectation. Singh (2008) the study made a comparison between APT and CAPM using daily data of 158 stocks listed on BSE 200 for the period 1991 to 2002. For testing of APT it used ten macroeconomic variables namely “WPI, exchange rate, IIP, gold price, call money rate, 91 day T-bill rate, money supply, foreign exchange forward premium, market and sector specific indices”. The study made use of literature to find out variables that have an impact on the stock returns but inclusion of individual variables and indices had the problem of multi collinearity so on the basis of cross correlation matrix the study excluded sectoral indices and included only BSE 200. Using the above variables a multiple regression was run on industry classified portfolios whose results revealed that none of the macroeconomic variables was found to be significant for all the portfolios and at all times and it was only market portfolio that had significant impact on the portfolio returns thus showing that the superiority of APT over CAPM was negligible as it was present in only few portfolios across few sub periods. Sohail and Hussain (2009) tested the presence of APT using monthly data for the period 2002 to 2008 using macroeconomic variables like consumer price index, exchange rate, interest rates and industrial production on the Lahore stock exchange using the techniques of multiple regression, vector error correction mechanism and cointegration. Using unexpected changes by taking log returns of all the variables study confirmed that there is negative impact of inflation as proxied by CPI on the stock index while the other variables were positively related. Inflation factor was confirmed as the most significant factor having the greatest return predictive capacity. Tripathi and Kumar (2015) the study used autoregressive distributed lag model to test the impact of macro-economic variables on the securities listed on the stock exchange of emerging economies of Brazil, Russia, India, China and South

Africa using quarterly data of the period 1995-2014. The study tested relationship (short and long run) between the explanatory variables that is exchange rate, money supply, price of oil, GDP, Inflation rate, interest-rate and international stock index and stock returns of the above countries. For testing the stability of the results it made use of the CUSUM test and found that interest rate, exchange rate and oil prices had a significant and negative impact on the stock returns while money supply impacted the returns positively and other variables namely GDP and inflation were found to be insignificant in explaining the expected returns. Gupta (2019) the study used monthly data of three macro economic variables CPI, IIP and interest rates for the period 2009 to 2017 to test the relationship between the above variables and NSE nifty index. The study used cointegration, error correction mechanism, impulse response function, granger causality to test the relationships. Results provided that there is no long run relationship that can be estimated between the variables using VECM however the “short run relationship was seen between the three variables and index” which provided bi directional causality between them. Impulse response function also provided that the short run relationship was found to be negative between the three variables and the index.

RESEARCH METHODOLOGY

The study includes the stocks that are listed on the BSE 500 for the period January 2000 to December 2018. As the stocks don't remain fixed in the index and keep on changing so only those stocks have been included in the study that have been there in the index throughout the study period. It leads to selection of two hundred twenty one (221) securities that covers the securities from different industries and different market capitalisation which can be further used for making a comparison across different industries and different capitalisation to be used by the investors for their decision making.

Stock Portfolio Formation

For testing of APT two things have to be specified namely the portfolio computation

basis and number of securities to be included in a portfolio. The study has three bases for portfolio classification - beta sorted, market capitalisation and industry classification while for the second aspect Stattman (1987) has provided that a portfolio including 20-30 stocks provides best diversification. Thus in the study ten portfolios have been constructed with twenty two securities in each and the last one having twenty three securities when portfolios are formulated on the basis of market capitalisation of the individual securities and on the basis of their systematic risk while for industry classification value research and BSE classification has been used that produced 16 different industries/portfolios. The second advantage of combining securities into portfolios instead of using the individual components (securities) is that it reduces Errors-in-variables problem that might arise because of using estimated betas rather than the actual betas.

Macroeconomic Variables in the Model

Eleven factors that have an impact on the economy namely changes in the price level proxied by CPI, Foreign Direct Investment, Foreign Portfolio Investment, rate of exchange between Rupees and Dollars, Gold Prices, Growth rate of an economy proxied by changes in the level of industrial production, Interest Rate spread (10 year bond yield minus Repo rate), Money supply, Oil Prices, BSE 500 Index, MSCI world Index have been selected. The description and source of the variables used in the study are presented in table 1.

Table 1: Description of Variables

Variable Name	Description of Variable	Data Form	Sources	Symbol	Expected Relation with the Portfolio Returns
Consumer Price Index	Base year 2010 =100	Log CPI	OECD	CPI	Negative
Exchange Rate	Rupees per Dollar	Log ER	RBI	ER	Negative/Positive

Foreign Direct Investment	Net FDI in US Million Dollars	Log FDI	RBI	FDI	Positive
Foreign Portfolio Investment	Net FPI in US Million Dollars	Log FPI	RBI	FPI	Positive
Index of Industrial Production	Base Year 2010=100	Log IIP	OECD	IIP	Positive
Money Supply	Billion Rupees	LogM3	RBI	M3	Positive
Oil Price	Price in Rupees per Barrel	Log OP	Index Mundi	OP	Negative
Gold Price	Indian Rupee per Troy Ounce	Log GP	Index Mundi	GP	Negative
Interest Rate Spread	Difference between 10 year Government Bond yield and Repo rate	Spread	RBI	Spread	Negative
BSE 500 Index	Index	LogBSE	Prowess	BSE	Positive
MSCI World Index	Index	Log MSCI	Investing .com	MSCI	Positive

The first step in any quantitative analysis is to present a descriptive analysis of the variables to find out their average values, distribution of the data to provide a presentable form to the raw data which can be easily understood and analyzed further. Descriptive statistics of all the above variables are presented in table 2.

Table 2 Descriptive statistics of the variables used in the study

	CPI	Exchange Rate	FDI	FPI	Gold Prices	Index of Industrial Production	10 year Bond Yield	Money supply	Oil Prices	BSE 500 Index	Repo Rate	US stock Index
Mean	92.24	50.38	1472.9	1045.7	45091.6	84.07	7.82	50612	3185	5332.38	7.52	1369.1
Median	79.30	47.01	1224.0	436.5	37360.1	89.55	7.81	41014	2973	5639.21	7.25	1289.2
Maximum	159.2	68.60	5670.0	28704.0	95194.2	123.5	11.60	12489	6928	11878.8	15	2173.6
Minimum	53.00	39.20	58.00	-19811.0	12100.2	46.80	5.10	10943	887	850.56	4.75	735.09
Std. Dev.	33.60	8.13	1330.8	3616.6	28282.8	23.84	1.30	34169	1675	3227.10	1.49	356.07
Skewness	0.58	0.93	1.05	1.44	0.32	-0.16	0.48	0.60	0.51	0.23	1.37	0.76
Kurtosis	1.90	2.51	3.48	24.34	1.49	1.54	4.08	2.03	2.13	1.97	7.91	2.72
Jarque-Bera	21.60	31.04	39.38	3902.1	22.58	18.97	17.53	19.91	15.0	10.81	266	20.09
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coefficient of Variation	0.36	0.16	0.90	3.46	0.63	0.28	0.17	0.68	0.53	0.61	0.20	0.26

Source: Author's Computation

The descriptive statistics provide the average values, maximum and minimum values for different macro economic variables and the two stock indices – BSE 500 and MSCI. Results show that variables are not normally distributed as the skewness of the variables which should be close to zero for the data to be normally distributed is positively skewed for all the variables except one that is index of industrial production. Also CPI, Exchange Rate, Gold Prices, Index of Industrial Production, Money supply, Oil Prices, BSE 500 Index and MSCI stock Index have kurtosis value less than 3 showing that they are platykurtic while FDI, FPI, 10 year Bond Yield and Repo Rate are leptokurtic showing that none of the variable is normally distributed. Foreign portfolio investment has the highest volatility shown by coefficient of variation and it is therefore rightly called hot money, the period of high volatility being the subprime crisis period that is 2008-09. Exchange rate on the other hand is the least volatile and this is one reason why instead of doing analysis on the raw data all the series have been converted to log series. To make such data compatible for further analysis and to avoid spurious results unit root test has been conducted using Augmented Dickey Fuller Test and Phillips Perron test.

Augmented Dickey Fuller

The most preliminary tool for testing of unit root is the augmented dickey fuller test (ADF) test that makes use of the following equation

$$DY_t = m + dY_{t-1} + \sum_{i=1}^k b_i DY_{t-i} + e_t$$

Where $d = a - 1$

a = Coefficient of Y_{t-1}

DY_t = first difference of Y_t , i.e. $Y_t - Y_{t-1}$

And null hypothesis is that $d = 0$. To confirm that the data is stationary the null should be rejected.

Phillips Perron Test

This is another method for testing of unit root that is basically a non parametric test and is based on following equation

$$Dy_t = \rho Y_{t-1} + b_1 D_{t-1} + e_t$$

Where e_t is $I(0)$ with zero mean and D_{t-1} = deterministic trend component. It also takes care of autocorrelation and heteroskedasticity issues in the model.

Eviews 10 software has been used to find the stationarity of the data that can be used for further analysis. Stationarity has been checked using Augmented dickey Fuller Test and Phillips Perron Test both with an intercept and intercept along with trend and results obtained are presented in Table 3(a) and 3(b).

Table 3 (a) Unit root test results

At level				
	Constant and No Trend		Constant and Trend	
Variable	ADF	PP	ADF	PP
LogCPI	-0.0244	1.2340	-2.3091	-1.9359
p value	0.9543	0.9983	0.4266	0.6319
LogER	-0.0728	-0.0728	-1.1918	-1.3143
p value	0.9496	0.9496	0.9089	0.8815
LogFDI	-1.4733	-1.5462	0.7389	0.6403
p value	0.5452	0.5082	0.8733	0.8537
LogFPI	-15.5468**	-15.5917**	-15.5084**	-15.5524**
p value	0.0000	0.0000	0.0000	0.0000

LogGP	-0.7625	-0.7624	-1.1833	-1.2336
p value	0.8269	0.8270	0.9105	0.9002
LogIIP	-1.2081	-1.3365	-0.9363	-1.3156
p value	0.6710	0.6124	0.9488	0.8811
Spread	-3.6879*	-3.1758*	-2.7073	-3.6144*
p value	0.0049	0.0228	0.2348	0.0308
LogM	-1.3373	-1.6241	-0.7928	-0.0513
p value	0.6119	0.4684	0.9636	0.9954
LogOP	-1.7474	-1.5591	-2.2005	-1.7655
p value	0.4059	0.5017	0.4863	0.7179
LogMkt	-0.4114	-0.5898	-2.3174	-2.6854
p value	0.9036	0.8688	0.4222	0.2439
LogUS	-0.3497	-0.6813	-2.3373	-2.0571
p value	0.9138	0.8478	0.4115	0.5661

**Significant at 1%, *Significant at 5%

Source: Author's Computation

Table 3 (b) Unit root test results

First Difference of Variables or Returns				
	Constant and No Trend		Constant and Trend	
Variable	ADF	PP	ADF	PP
LogRCPI	-2.4721	-10.7385**	-7.7381**	-10.6714**
p value	0.1240	0.0000	0.0000	0.0000
LogRER	-12.3946**	-12.4355**	-12.3765**	-12.3954**

p value	0.0000	0.0000	0.0000	0.0000
LogRFDI	-12.8114**	-44.3205**	-12.7789**	-44.0045**
p value	0.0000	0.0000	0.0000	0.0000
LogRFPI	-11.1320**	-11.1026**	-220.8621**	-220.2756**
p value	0.0000	0.0000	0.0000	0.0000
LogRGP	-13.1820**	-13.1496**	-13.1619**	-13.1293**
p value	0.0000	0.0000	0.0000	0.0000
LogRIIP	-20.9196**	-21.0864**	-20.9435**	-21.3871**
p value	0.0000	0.0000	0.0000	0.0000
DSpread	-23.4977**	-90.4658**	-23.4397**	-101.6181**
p value	0.0000	0.0000	0.0000	0.0000
LogRM	-1.8120	-1.7809	-2.1662	-1.0883
p value	0.3739	0.4491	0.5052	0.2780
LogROP	-10.8611**	-10.8088**	-10.8566**	-10.7071**
p value	0.0000	0.0000	0.0000	0.0000
LogRMkt	-12.4582**	-12.5036**	-12.4273**	-12.4750**
p value	0.0000	0.0000	0.0000	0.0000
LogRUS	-12.6828**	-12.7752**	-12.8432**	-12.8882**
p value	0.0000	0.0000	0.0000	0.0000

**Significant at 1%, *Significant at 5%

Source: Author's Computation

Results revealed that all the variables are stationary after first difference except money supply which is integrated of order two and so log returns have been used for all variables except money supply for which second differentiation has been used and spread for which only first difference and not log difference has been taken for further analysis.

Table 4 Form of Macroeconomic variable used in the study

Macroeconomic Variables	Form	Integration Level
CPI	Log Returns of CPI	I (1)
Exchange Rate	Log Returns of Exchange Rate	I (1)
FDI	Log Returns of FDI	I (1)
FPI	Log Returns of FPI	I (1)
Gold Prices	Log Returns of Gold Prices	I (1)
Index of Industrial Production	Log Returns of IIP	I (1)
Spread	First differentiation of the difference between long term and short term interest rates	I (1)
Money supply	Log Returns of Money supply	I (2)
Oil Prices	Log Returns of Oil Prices	I (1)
Sensex	Log Returns of Sensex	I (1)
US stock Index-MSCI	Log Returns of MSCI	I (1)

Source: Author's Computation

The level of integration is not same for all the variables and it is not an issue for the present study as we are not testing the long run causality using cointegration test which requires the variables to be integrated of the same order. Most of the existing literature that is available on the estimation of risk return relationship is based on the econometric methodology of estimating correlation, testing of short run causality and long run cointegration between the macro economic variables and stock market indices. Our study though is not based on this traditional methodology we have presented the results of short run causality using Granger Causality methodology between different macro economic variables to get basic information about the cause and effect relationship that exists (if any) between the variables in the short run. The lags for the causality are selected on the basis of Akaike and Schwarz information criteria.

Granger Causality (1969)

One limitation of correlation is that it does tell the association between two variables but does not tell about the cause and effect relationship. Granger causality is based on the notion of precedence of a variable such that the inclusion of past values of a variable if is able to estimate the future values of another variable then the former one can be called the cause and the latter variable the effect of the relationship. The equation of the granger causality test can be summarised as:

$$X_t = \sum \alpha_i Y_{t-i} + \sum \beta_j X_{t-j} + \varepsilon_{1t}$$

$$Y_t = \sum \lambda_i Y_{t-i} + \sum \delta_j X_{t-j} + \varepsilon_{2t}$$

Where the equation is tested for the lagged values of the other variable and if it is significant in explaining the future values of some other variable then it is said to be granger causing the variable.

Table 5 Results of Granger Causality between Macro economic variables

Cause	Effect	F stats	P value
Interest Rate Spread	BSE 500 Index	4.3292	0.0144**
	MSCI World Index	2.8696	0.0589*
Inflation (CPI)	Exchange Rate	2.8070	0.0627*
	Money Supply	2.3428	0.0986*
Foreign Portfolio Investment	Inflation (CPI)	7.0677	0.0011***
	Exchange Rate	2.6937	0.0700*
Gold Price	Inflation (CPI)	2.4692	0.0871*
Oil Price	Inflation (CPI)	4.1591	0.0169**
	Index of Industrial Production	3.2108	0.0423**
	MSCI World Index	2.3741	0.0956*
Index of Industrial Production	Exchange Rate	5.6898	0.0039***
Exchange Rate	Index of Industrial Production	6.0543	0.0028***
Foreign Direct Investment	MSCI World Index	2.4367	0.0900*
Money Supply	Gold Price	2.8430	0.0605*

BSE 500 Index	Index of Industrial Production	7.0672	0.0011***
	Oil Price	2.7641	0.0653*
MSCI World Index	Index of Industrial Production	8.5978	0.0003***
	BSE 500 Index	3.2157	0.0421**
	Oil Price	5.0256	0.0074***

***Significant at 1%, **Significant at 5%, * Significant at 10%

Source: Author's Computation

Results of causality test reveal that exchange rate is one variable that has leading and lagging relationship with many other variables and also the world index (MSCI) is the cause that brings a change in the domestic index (BSE 500).

After stationarity and causality now the next step is to find factors to be used in multiple regression equation. The study makes use of the software SPSS 22 to reduce the above stated 11 macro economic variables both domestic and international into uncorrelated factors that can be used for further analysis. Factor analysis is required because of the fact that while running a multiple regression the independent variables might be correlated with each other which would render the analysis spurious as it saps the very power of the analysis where coefficients might have unexpected signs and model might become difficult to interpret. Factor analysis helps in identifying the underlying relationships between different variables and to assess if it can be condensed into a smaller set of factors such that the factors between themselves are not correlated and within a factor the variables are highly correlated. So the first step in running a multiple regression is to get away with the problem of multicollinearity by estimating the correlation matrix to find out strongly correlated variables so that a latent factor can be found out which is not correlated with other factors.

Table 6: Correlation between the Macro Economic Variables using stationary data

	CPI	ER	FDI	FPI	GP	IIP	OP	M3	BSE	World	Spread
CPI	1										
ER	.173*	1									
FDI	.021	-.014	1								
FPI	.087	-.198**	.039	1							
GP	-.064	.169*	.028	-.033	1						
IIP	.002	.020	-.084	.146*	.000	1					
OP	.034	-.037	.017	.009	.135	.177*	1				
M3	.009	-.060	-.081	.199**	.018	-.028	-.038	1			
BSE	-.077	-.372**	.126	.116	-.076	.034	.095	-.027	1		
World	.069	-.334**	.166*	.140*	-.286**	.040	.117	.054	.551**	1	
Spread	.007	.034	-.004	.025+-	.064	.004	.263**	.107	-.045	-.016	1

*. Correlation is significant at the 0.05 level (2-tailed). Source : Author's Computation

**. Correlation is significant at the 0.01 level (2-tailed).

The regression equation gives robust results only when certain conditions are fulfilled and one of the essential conditions in case of multiple regression is that the explanatory variables should not have high degree of correlation amongst themselves that is the independent variables should be free from the problem of multicollinearity. There are various ways to identify the problem of multicollinearity and first one includes estimating the correlations between the independent variables. A correlation coefficient more than 0.5 gives an indication of multicollinearity whereas if the coefficient is greater than 0.9 it proves that the variables are strongly correlated and multicollinearity issue should be resolved before proceeding with further tests. The correlation coefficients when calculated between the eleven macroeconomic variables used in the study revealed that the highest correlation is

55% in absolute terms between the domestic stock market proxied by BSE 500 and world stock market proxied by the MSCI world index. The correlation matrix also shows that there is a negative correlation between BSE index and few macro economic variables like exchange rate, CPI, gold prices, Interest rate spread and money supply. After this factor analysis was applied which reduced the variables into five factors on which then Fama and Macbeth two step regression was applied to derive the results.

Table 7: Rotated Component Matrix^a

	Component				
	1	2	3	4	5
BSE	.841				
World	.828				
ER	-.644				
Spread		.825			
OP		.743			
M3			.809		
FPI			.680		
IIP				.914	
CPI					.950

Extraction Method: Principal Component Analysis.

Source : Author's Computation

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

The factors so obtained are presented with their components and the factors are also named on the basis of suitable theoretical implications.

Factor 1: Market Factor - It consists of BSE 500 index (0.841), MSCI world index (0.828) and Exchange rate (0.644).

Factor 2: Investment factor - It includes interest rate spread (0.825) and oil prices (0.743).

Factor 3: Liquidity Factor - It includes money supply (0.809) and foreign portfolio investment (0.680).

Factor 4: Growth Factor - It includes index of industrial production (0.914)

Factor 5: Inflation factor - It includes CPI (0.950) and it has been named the.

Table 8: Result of Cross Section Regression of APT

Beta sorted						
	Intercept	factor 1	factor 2	factor 3	factor 4	factor 5
Average	3.8309	2.2444	-0.4483	-0.4768	2.8265	-0.253
p value (Newey West Adjusted)	0.0002**	0.0275*	0.3276	0.3176	0.0059**	0.4008
Industry Classified						
	Intercept	factor 1	factor 2	factor 3	factor 4	factor 5
Average	2.3883	1.47	-0.6719	-0.7357	2.2303	-0.4558
p value (Newey West Adjusted)	0.0192*	0.0454*	0.5035	0.464	0.0285*	0.6498
Size sorted						
	Intercept	factor 1	factor 2	factor 3	factor 4	factor 5
Average	0.0124	0.3986	0.9814	-0.0258	0.0255	0.2637
p value (Newey West Adjusted)	0.0494*	0.0170*	0.0465*	0.9513	0.8954	0.1685

**Significant at 1%, *Significant at 5%

Source : Author's Computation

Factor 1 is found to be significant and positive in all the three cases along with the constant of the cross sectional regression being significantly positive in all the three portfolio formations showing that the returns exhibited by the APT equation are not fully explained by the five factors derived from the factor analysis and still some returns are left unexplained which can be due to various reasons like the model is miss specified in the sense that some important variables are left out of the model or because of the factors that are being formed. However there are atleast two factors that are found to be significant in explaining the cross section returns which is factor 1 and factor 2 in size sorted and factor 1 and factor 4 in beta sorted and industry classified.

CONCLUSION

Results obtained in the study were found to be highly inclined towards the market factor and exchange rate. Presence of just few factors in pricing of the assets provides strong support against acceptability of the APT theory in the Indian context. The model provides that there can be an adjustment made to the one factor beta model by inclusion of variables like exchange rate, world index to make the model more robust instead of going for a multifactor model. Results can be also an indication towards the fact that there are still some factors left out of the scope of the study because of which APT cannot be said to be a conclusive theory explaining the risk return relationship. One such factor that can have an impact on the stock returns is the 'Market Psychology' and other non quantifiable factors as highlighted by Shiller. Incorporation of such variables may help the investors and academicians in better estimation of the return of a risky asset.

The findings obtained above can be further strengthened from the recent economic updates as can be seen that during the period April 2019 to November 2019 economic factors like the growth rate (GDP), unemployment, and major sectors like automobile all showed a major slump pointing towards an economic slowdown whereas the market reached an all time high with Sensex breaching the 40,000 mark and Nifty crossing the 11,900 level. The market movements suggest that APT may

not be the appropriate indicator for expected returns as there are companies generating excess returns in so called recession and it is so huge that it is overpowering the negative economic indicators which are indicative of the presence of behavioural factors and company specific factors. The study thus challenged that applying either CAPM or APT to a portfolio neither creates excess returns nor diversify risk and hence a model that combines the components of both the models such that durable competitive advantage can be created for the investors need to be identified.

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Appendix 1: Companies included in different industries (Industry sorted Portfolio)

Automobile	Diversified	Pfizer Ltd.
Apollo Tyres Ltd.	D C M Shriram Ltd.	Piramal Enterprises Ltd.
Ashok Leyland Ltd.	Nava Bharat Ventures Ltd.	Sanofi India Ltd.
Balkrishna Industries Ltd.	S R F Ltd.	Sun Pharmaceutical Inds. Ltd.
Bharat Forge Ltd.	Energy	Suven Life Sciences Ltd.
Bosch Ltd.	Bharat Petroleum Corpn. Ltd.	Torrent Pharmaceuticals Ltd.
Ceat Ltd.	C E S C Ltd.	Wockhardt Ltd.
Eicher Motors Ltd.	Castrol India Ltd.	Metals
Escorts Ltd.	Chennai Petroleum Corpn. Ltd.	Carborundum Universal Ltd.
Hero Motocorp Ltd.	G A I L (India) Ltd.	Hindalco Industries Ltd.

J K Tyre & Inds. Ltd.	Gujarat Mineral Devp. Corpn. Ltd.	Hindustan Zinc Ltd.
M R F Ltd.	Hindustan Petroleum Corpn. Ltd.	Jai Corp Ltd.
Mahindra & Mahindra Ltd.	Indian Oil Corpn. Ltd.	Jindal Steel & Power Ltd.
Motherson Sumi Systems Ltd.	Mangalore Refinery & Petrochemicals Ltd.	National Aluminium Co. Ltd.
T V S Motor Co. Ltd.	Oil & Natural Gas Corpn. Ltd.	Steel Authority Of India Ltd.
T V S Srichakra Ltd.	Reliance Industries Ltd.	Tata Steel Ltd.
Tata Motors Ltd.	Reliance Infrastructure Ltd.	Vedanta Ltd.
Tube Investments Of India Ltd.	Tata Power Co. Ltd.	Welspun India Ltd.
Chemicals	Engineering	Services
Aarti Industries Ltd.	A B B India Ltd.	3M India Ltd.
Akzo Nobel India Ltd.	Amara Raja Batteries Ltd.	Aegis Logistics Ltd.
Asian Paints Ltd.	B E M L Ltd.	Blue Dart Express Ltd.
Atul Ltd.	Bharat Electronics Ltd.	Container Corpn. Of India Ltd.
B A S F India Ltd.	Bharat Heavy Electricals Ltd.	E I H Ltd.
Berger Paints India Ltd.	Cummins India Ltd.	Great Eastern Shipping Co. Ltd.
Chambal Fertilisers & Chemicals Ltd.	Elgi Equipments Ltd.	Indian Hotels Co. Ltd.
Coromandel International Ltd.	Exide Industries Ltd.	Shipping Corpn. Of India Ltd.
Deepak Fertilisers & Petrochemicals Corpn. Ltd.	Finolex Cables Ltd.	Thomas Cook (India) Ltd.
Essel Propack Ltd.	G E T & D India Ltd.	Trent Ltd.

EMPIRICAL TESTING OF ARBITRAGE PRICING THEORY IN THE INDIAN STOCK MARKET

Finolex Industries Ltd.	Greaves Cotton Ltd.	Zee Entertainment Enterprises Ltd.
G H C L Ltd.	Havells India Ltd.	Technology
Gujarat Fluorochemicals Ltd.	Honeywell Automation India Ltd.	Cyient Ltd.
Gujarat Narmada Valley Fertilizers & Chemicals Ltd.	J S W Steel Ltd.	H C L Technologies Ltd.
Gujarat State Fertilizers & Chemicals Ltd.	Lakshmi Machine Works Ltd.	Hexaware Technologies Ltd.
Jain Irrigation Systems Ltd.	S K F India Ltd.	Infosys Ltd.
Kansai Nerolac Paints Ltd.	Siemens Ltd.	Mphasis Ltd.
Linde India Ltd.	Sundram Fasteners Ltd.	Sonata Software Ltd.
Monsanto India Ltd.	Thermax Ltd.	Tata Elxsi Ltd.
Nilkamal Ltd.	Timken India Ltd.	Wipro Ltd.
Rallis India Ltd.	FMCG	Zensar Technologies Ltd.
Rashtriya Chemicals & Fertilizers Ltd.	Avanti Feeds Ltd.	Textiles
Supreme Industries Ltd.	Bata India Ltd.	Bombay Dyeing & Mfg. Co. Ltd.
Tata Chemicals Ltd.	Bombay Burmah Trdg. Corpn. Ltd.	Himatsingka Seide Ltd.
U P L Ltd.	Britannia Industries Ltd.	Raymond Ltd.
Uflex Ltd.	C C L Products (India) Ltd.	Trident Ltd.
V I P Industries Ltd.	Colgate-Palmolive (India) Ltd.	Vardhman Textiles Ltd.
Construction	Dabur India Ltd.	Financial (Banking/Non-Banking)
A C C Ltd.	E I D-Parry (India) Ltd.	Axis Bank Ltd.
Ambuja Cements Ltd.	Eveready Industries (India) Ltd.	Bajaj Finance Ltd.

Birla Corporation Ltd.	Gillette India Ltd.	Bajaj Holdings & Invst. Ltd.
Engineers India Ltd.	Glaxosmithkline Consumer Healthcare Ltd.	Bank Of Baroda
G E Power India Ltd.	Godfrey Phillips India Ltd.	Bank Of India
Grasim Industries Ltd.	Godrej Industries Ltd.	Can Fin Homes Ltd.
Heidelberg Cement India Ltd.	Hindustan Unilever Ltd.	Cholamandalam Investment & Finance Co. Ltd.
I T D Cementation India Ltd.	I T C Ltd.	City Union Bank Ltd.
India Cements Ltd.	K R B L Ltd.	Corporation Bank
J K Lakshmi Cement Ltd.	Marico Ltd.	Crisil Ltd.
Kajaria Ceramics Ltd.	Procter & Gamble Hygiene & Health Care Ltd.	Dewan Housing Finance Corpn. Ltd.
Kalpataru Power Transmission Ltd.	Relaxo Footwears Ltd.	Federal Bank Ltd.
Larsen & Toubro Ltd.	Tamil Nadu Newsprint & Papers Ltd.	Gruh Finance Ltd.
N C C Ltd.	Tata Global Beverages Ltd.	H D F C Bank Ltd.
Phoenix Mills Ltd.	Healthcare/Drugs and Pharma	Housing Development Finance Corpn. Ltd.
Rain Industries Ltd.	AJanuaryuartya Pharma Ltd.	I C I C I Bank Ltd.
Ramco Cements Ltd.	Apollo Hospitals Enterprise Ltd.	I D B I Bank Ltd.
Shree Cement Ltd.	Astrazeneca Pharma India Ltd.	I F C I Ltd.
Communication	Aurobindo Pharma Ltd.	Indusind Bank Ltd.
Himachal Futuristic Communications Ltd.	Bliss G V S Pharma Ltd.	J M Financial Ltd.
Tata Communications Ltd.	Cadila Healthcare Ltd.	Jammu & Kashmir Bank Ltd.

Consumer durable	Cipla Ltd.	Kotak Mahindra Bank Ltd.
Bajaj Electricals Ltd.	Dr. Reddy'S Laboratories Ltd.	L I C Housing Finance Ltd.
Blue Star Ltd.	F D C Ltd.	Max Financial Services Ltd.
Johnson Controls-Hitachi Air Conditioning India Ltd.	Glaxosmithkline Pharmaceuticals Ltd.	Oriental Bank Of Commerce
Rajesh Exports Ltd.	Glenmark Pharmaceuticals Ltd.	Reliance Capital Ltd.
Symphony Ltd.	Ipca Laboratories Ltd.	S R E I Infrastructure Finance Ltd.
T T K Prestige Ltd.	J B Chemicals & Pharmaceuticals Ltd.	Shriram Transport Finance Co. Ltd.
Titan Company Ltd.	Jubilant Life Sciences Ltd.	South Indian Bank Ltd.
Voltas Ltd.	Lupin Ltd.	State Bank Of India
Whirlpool Of India Ltd.	Natco Pharma Ltd.	Syndicate Bank
		Tata Investment Corpn. Ltd.

Appendix 2 Companies included in different Beta sorted Portfolio

Portfolio 1	Portfolio 6
Himachal Futuristic Communications Ltd.	E I D-Parry (India) Ltd.
Zensar Technologies Ltd.	Bharat Petroleum Corpn. Ltd.
Uflex Ltd.	Exide Industries Ltd.
Mphasis Ltd.	Crisil Ltd.
Wipro Ltd.	J K Tyre & Inds. Ltd.
Cyient Ltd.	Finolex Industries Ltd.
Hexaware Technologies Ltd.	Aarti Industries Ltd.
Amara Raja Batteries Ltd.	Motherson Sumi Systems Ltd.
Steel Authority Of India Ltd.	Corporation Bank

India Cements Ltd.	Symphony Ltd.
Reliance Capital Ltd.	Siemens Ltd.
Vedanta Ltd.	South Indian Bank Ltd.
Tata Elxsi Ltd.	Indian Hotels Co. Ltd.
Jindal Steel & Power Ltd.	Greaves Cotton Ltd.
N C C Ltd.	Blue Dart Express Ltd.
Lupin Ltd.	Wockhardt Ltd.
Tata Power Co. Ltd.	Nilkamal Ltd.
Torrent Pharmaceuticals Ltd.	Linde India Ltd.
G E Power India Ltd.	Aurobindo Pharma Ltd.
Gujarat State Fertilizers & Chemicals Ltd.	Eicher Motors Ltd.
Rain Industries Ltd.	Thomas Cook (India) Ltd.
Escorts Ltd.	Oil & Natural Gas Corpn. Ltd.
Portfolio 2	Portfolio 7
Engineers India Ltd.	Jammu & Kashmir Bank Ltd.
Gujarat Mineral Devp. Corpn. Ltd.	Sun Pharmaceutical Inds. Ltd.
Kajaria Ceramics Ltd.	Rajesh Exports Ltd.
Sonata Software Ltd.	Trent Ltd.
Zee Entertainment Enterprises Ltd.	National Aluminium Co. Ltd.
H C L Technologies Ltd.	F D C Ltd.
Max Financial Services Ltd.	Balkrishna Industries Ltd.
Shipping Corpn. Of India Ltd.	Bombay Burmah Trdg. Corpn. Ltd.
Titan Company Ltd.	D C M Shriram Ltd.
Tata Motors Ltd.	Ambuja Cements Ltd.
Honeywell Automation India Ltd.	Coromandel International Ltd.
G E T & D India Ltd.	S R F Ltd.
Larsen & Toubro Ltd.	J B Chemicals & Pharmaceuticals Ltd.
Gruh Finance Ltd.	C C L Products (India) Ltd.

EMPIRICAL TESTING OF ARBITRAGE PRICING THEORY IN THE INDIAN STOCK MARKET

I D B I Bank Ltd.	Tata Chemicals Ltd.
Shree Cement Ltd.	Bharat Electronics Ltd.
Mahindra & Mahindra Ltd.	Cummins India Ltd.
Ceat Ltd.	3M India Ltd.
Hindustan Zinc Ltd.	Oriental Bank Of Commerce
N L C India Ltd.	Hindalco Industries Ltd.
Rashtriya Chemicals & Fertilizers Ltd.	Balmer Lawrie & Co. Ltd.
Aegis Logistics Ltd.	Great Eastern Shipping Co. Ltd.
Portfolio 3	Portfolio 8
Bata India Ltd.	Suven Life Sciences Ltd.
B E M L Ltd.	Finolex Cables Ltd.
J S W Steel Ltd.	Raymond Ltd.
Eveready Industries (India) Ltd.	Monsanto India Ltd.
Heidelberg Cement India Ltd.	Welspun India Ltd.
S R E I Infrastructure Finance Ltd.	Blue Star Ltd.
Federal Bank Ltd.	T V S Srichakra Ltd.
Infosys Ltd.	Tamil Nadu Newsprint & Papers Ltd.
Atul Ltd.	Bajaj Finance Ltd.
Tata Global Beverages Ltd.	Grasim Industries Ltd.
T V S Motor Co. Ltd.	Reliance Infrastructure Ltd.
L I C Housing Finance Ltd.	Kalpataru Power Transmission Ltd.
Supreme Industries Ltd.	Elgi Equipments Ltd.
Ipca Laboratories Ltd.	Astrazeneca Pharma India Ltd.
J K Lakshmi Cement Ltd.	Sundram Fasteners Ltd.
U P L Ltd.	B A S F India Ltd.
Chennai Petroleum Corpn. Ltd.	Voltas Ltd.
Rallis India Ltd.	G H C L Ltd.
Gillette India Ltd.	City Union Bank Ltd.

Birla Corporation Ltd.	Bosch Ltd.
Bombay Dyeing & Mfg. Co. Ltd.	Bajaj Holdings & Invst. Ltd.
Bank Of India	Cipla Ltd.
Portfolio 4	Portfolio 9
A B B India Ltd.	Himatsingka Seide Ltd.
Indian Oil Corpn. Ltd.	Jain Irrigation Systems Ltd.
Bank Of Baroda	Sanofi India Ltd.
Whirlpool Of India Ltd.	Ramco Cements Ltd.
J M Financial Ltd.	Johnson Controls-Hitachi Air Conditioning India Ltd.
S K F India Ltd.	Kansai Nerolac Paints Ltd.
Trident Ltd.	Pidilite Industries Ltd.
Mangalore Refinery & Petrochemicals Ltd.	Deepak Fertilisers & Petrochemicals Corpn. Ltd.
Glenmark Pharmaceuticals Ltd.	I T C Ltd.
Apollo Tyres Ltd.	Cholamandalam Investment & Finance Co. Ltd.
Essel Propack Ltd.	Tube Investments Of India Ltd.
Bharat Heavy Electricals Ltd.	Glaxosmithkline Pharmaceuticals Ltd.
Axis Bank Ltd.	Avanti Feeds Ltd.
Kotak Mahindra Bank Ltd.	Can Fin Homes Ltd.
Tata Steel Ltd.	Godfrey Phillips India Ltd.
M R F Ltd.	Relaxo Footwears Ltd.
Indusind Bank Ltd.	Shriram Transport Finance Co. Ltd.
G A I L (India) Ltd.	Bliss G V S Pharma Ltd.
Godrej Industries Ltd.	Dabur India Ltd.
Ashok Leyland Ltd.	Carborundum Universal Ltd.
Syndicate Bank	Hindustan Unilever Ltd.
Natco Pharma Ltd.	Dewan Housing Finance Corpn. Ltd.

Portfolio 5	Portfolio 10
Thermax Ltd.	Reliance Industries Ltd.
Tata Investment Corpn. Ltd.	Vardhman Textiles Ltd.
Timken India Ltd.	Chambal Fertilisers & Chemicals Ltd.
Gujarat Narmada Valley Fertilizers & Chemicals Ltd.	Cadila Healthcare Ltd.
V I P Industries Ltd.	Housing Development Finance Corpn. Ltd.
A C C Ltd.	Bajaj Electricals Ltd.
Jai Corp Ltd.	Dr. Reddy'S Laboratories Ltd.
Apollo Hospitals Enterprise Ltd.	Akzo Nobel India Ltd.
Lakshmi Machine Works Ltd.	Havells India Ltd.
Piramal Enterprises Ltd.	Procter & Gamble Hygiene & Health Care Ltd.
Container Corpn. Of India Ltd.	Marico Ltd.
Hindustan Petroleum Corpn. Ltd.	Phoenix Mills Ltd.
I C I C I Bank Ltd.	E I H Ltd.
T T K Prestige Ltd.	Castrol India Ltd.
Gujarat Fluorochemicals Ltd.	Hero Motocorp Ltd.
AJanuaryuaryta Pharma Ltd.	Pfizer Ltd.
Jubilant Life Sciences Ltd.	I F C I Ltd.
K R B L Ltd.	Colgate-Palmolive (India) Ltd.
Bharat Forge Ltd.	Berger Paints India Ltd.
I T D Cementation India Ltd.	H D F C Bank Ltd.
Nava Bharat Ventures Ltd.	Britannia Industries Ltd.
State Bank Of India	Glaxosmithkline Consumer Healthcare Ltd.
	Asian Paints Ltd.

Appendix 3: Companies included in different size sorted Portfolio using average Market Capitalisation of January 2000 to 30th June 2004

Portfolio 1		Portfolio 6	
Oil & Natural Gas Corpn. Ltd.	897268.96	Torrent Pharmaceuticals Ltd.	6666.32
Reliance Industries Ltd.	599883.79	Apollo Tyres Ltd.	6632.47
Indian Oil Corpn. Ltd.	430412.5	Motherson Sumi Systems Ltd.	6467.28
Wipro Ltd.	371608.67	Himatsingka Seide Ltd.	6346.91
Infosys Ltd.	369305.46	Lakshmi Machine Works Ltd.	5981.89
Hindustan Unilever Ltd.	280218.33	Essel Propack Ltd.	5863.23
State Bank Of India	226650.61	M R F Ltd.	5676.56
I T C Ltd.	219914.05	Shree Cement Ltd.	5573.96
I C I C I Bank Ltd.	179364.64	Thomas Cook (India) Ltd.	5393.65
G A I L (India) Ltd.	143845.34	Bombay Dyeing & Mfg. Co. Ltd.	5276.21
Tata Motors Ltd.	136107.84	I F C I Ltd.	5090.25
Housing Development Finance Corpn. Ltd.	127538.04	3M India Ltd.	4875.52
Bharat Heavy Electricals Ltd.	122832.81	Berger Paints India Ltd.	4822.91
Hindustan Petroleum Corpn. Ltd.	114133.65	B E M L Ltd.	4673.9
Steel Authority Of India Ltd.	112966.45	Welspun India Ltd.	4597.41
Tata Steel Ltd.	110989.76	Gujarat Mineral Devp. Corpn. Ltd.	4563.3
Bharat Petroleum Corpn. Ltd.	106575	Jain Irrigation Systems Ltd.	4533.06
H D F C Bank Ltd.	105676.46	Titan Company Ltd.	4525.67
Reliance Infrastructure Ltd.	105000.4	Astrazeneca Pharma India Ltd.	4411.25
Hero Motocorp Ltd.	101341.41	Gujarat State Fertilizers & Chemicals Ltd.	4299.57

EMPIRICAL TESTING OF ARBITRAGE PRICING THEORY IN THE INDIAN STOCK MARKET

Grasim Industries Ltd.	92725.45	J B Chemicals & Pharmaceuticals Ltd.	4232.35
Hindalco Industries Ltd.	92290.32	Tata Investment Corpn. Ltd.	4152.48
Portfolio 2		Portfolio 7	
Bajaj Holdings & Invst. Ltd.	89501.87	India Cements Ltd.	4137.52
H C L Technologies Ltd.	88291.19	Max Financial Services Ltd.	4136.57
Larsen & Toubro Ltd.	86714.27	Eicher Motors Ltd.	4130.83
National Aluminium Co. Ltd.	86563	Escorts Ltd.	4045.01
N L C India Ltd.	70715.46	Godfrey Phillips India Ltd.	3858.99
Sun Pharmaceutical Inds. Ltd.	67934.26	Tamil Nadu Newsprint & Papers Ltd.	3704.74
Mangalore Refinery & Petrochemicals Ltd.	66259.71	Blue Dart Express Ltd.	3643.42
Cipla Ltd.	63690.63	S K F India Ltd.	3618.74
Dr. Reddy'S Laboratories Ltd.	56272.04	Trent Ltd.	3496.54
Nestle India Ltd.	53404.67	Finolex Cables Ltd.	3494.66
Zee Entertainment Enterprises Ltd.	52016.88	Voltas Ltd.	3472.64
Mahindra & Mahindra Ltd.	51270	E I D-Parry (India) Ltd.	3440.53
Ambuja Cements Ltd.	51030.32	Tata Elxsi Ltd.	3437.66
Oriental Bank Of Commerce	46276.92	Vardhman Textiles Ltd.	3392.56
Tata Communications Ltd.	46027.5	D C M Shriram Ltd.	3360.29
Tata Power Co. Ltd.	45912.3	B A S F India Ltd.	3353.22
Glaxosmithkline Pharmaceuticals Ltd.	44260.49	Deepak Fertilisers & Petrochemicals Corpn. Ltd.	3188.61
Bank Of Baroda	44019.14	Honeywell Automation India Ltd.	3139.62
A C C Ltd.	43121.7	Coromandel International Ltd.	2953.4
Bosch Ltd.	43015.94	Trident Ltd.	2893.5
Container Corpn. Of India Ltd.	36710.39	Blue Star Ltd.	2882.45

Corporation Bank	35788.28	Himachal Futuristic Communications Ltd.	2770.04
Portfolio 3		Portfolio 8	
Hindustan Zinc Ltd.	32788.48	Bata India Ltd.	2599.39
Bharat Electronics Ltd.	31276	Crisil Ltd.	2575.88
Axis Bank Ltd.	30105.85	Elgi Equipments Ltd.	2526
Asian Paints Ltd.	30022.89	S R F Ltd.	2474.58
Piramal Enterprises Ltd.	29482.88	Godrej Industries Ltd.	2383.46
Siemens Ltd.	29196.59	Timken India Ltd.	2348.63
Shipping Corpn. Of India Ltd.	28808.96	Carborundum Universal Ltd.	2339.45
A B B India Ltd.	28486.84	Greaves Cotton Ltd.	2331.98
Wockhardt Ltd.	27793.98	Supreme Industries Ltd.	2301.88
I D B I Bank Ltd.	27320.95	Balkrishna Industries Ltd.	2104.06
Ashok Leyland Ltd.	27115.91	G H C L Ltd.	2082.44
Great Eastern Shipping Co. Ltd.	25779.79	Cholamandalam Investment & Finance Co. Ltd.	2026.34
Bharat Forge Ltd.	23046.94	Aarti Industries Ltd.	2010.75
Bank Of India	22785.89	Zensar Technologies Ltd.	1950.38
Tata Chemicals Ltd.	21288.27	Whirlpool Of India Ltd.	1899.27
Kotak Mahindra Bank Ltd.	20696.56	City Union Bank Ltd.	1896
Tata Global Beverages Ltd.	20641.12	Natco Pharma Ltd.	1877.54
Castrol India Ltd.	20116.28	Linde India Ltd.	1850.48
Cummins India Ltd.	19483.2	Nava Bharat Ventures Ltd.	1842.67
Mphasis Ltd.	18509.37	South Indian Bank Ltd.	1839.77
Gillette India Ltd.	18239.58	Eveready Industries (India) Ltd.	1787.72
Dabur India Ltd.	17878.76	Cyient Ltd.	1712.55
Portfolio 4		Portfolio 9	
Sanofi India Ltd.	17479.09	N C C Ltd.	1687.19

EMPIRICAL TESTING OF ARBITRAGE PRICING THEORY IN THE INDIAN STOCK MARKET

Colgate-Palmolive (India) Ltd.	17243.89	Nocil Ltd.	1531.35
Chennai Petroleum Corpn. Ltd.	16525.25	Gujarat Fluorochemicals Ltd.	1528.3
Aurobindo Pharma Ltd.	16510.4	Schaeffler India Ltd.	1512.17
T V S Motor Co. Ltd.	16105.45	G E T & D India Ltd.	1429.97
Rashtriya Chemicals & Fertilizers Ltd.	16026.54	Bajaj Finance Ltd.	1409.09
Indian Hotels Co. Ltd.	15819.47	Uflex Ltd.	1376.43
Britannia Industries Ltd.	15667.44	J K Tyre & Inds. Ltd.	1342.92
Reliance Capital Ltd.	15461.34	Suven Life Sciences Ltd.	1336.25
U P L Ltd.	15376.25	Havells India Ltd.	1219.97
Syndicate Bank	15291.77	Sonata Software Ltd.	1213.54
Jindal Steel & Power Ltd.	13684.08	Shriram Transport Finance Co. Ltd.	1185.74
Jammu & Kashmir Bank Ltd.	13179.77	Balmer Lawrie & Co. Ltd.	1164.45
Procter & Gamble Hygiene & Health Care Ltd.	13028.12	I T I Ltd.	1131.68
Pfizer Ltd.	12986.25	Ceat Ltd.	1102.18
Jubilant Life Sciences Ltd.	12893.38	Kajaria Ceramics Ltd.	1030.17
E I H Ltd.	12854.83	Dewan Housing Finance Corpn. Ltd.	1009.42
Engineers India Ltd.	12722.46	S R E I Infrastructure Finance Ltd.	967.3
Raymond Ltd.	11579.5	Apar Industries Ltd.	946.68
Monsanto India Ltd.	11431.56	Rajesh Exports Ltd.	930.1
J S W Steel Ltd.	11412.58	H S I L Ltd.	926.16
Indusind Bank Ltd.	11231.58	Atul Ltd.	904.68
Portfolio 5		Portfolio 10	
Glaxosmithkline Consumer Healthcare Ltd.	11095.56	Kalpataru Power Transmission Ltd.	858.06

L I C Housing Finance Ltd.	10310.73	I T D Cementation India Ltd.	834.25
Sundram Fasteners Ltd.	10112.43	Rallis India Ltd.	828.14
Apollo Hospitals Enterprise Ltd.	9128.82	C C L Products (India) Ltd.	816.13
Thermax Ltd.	9076.14	J K Lakshmi Cement Ltd.	768.81
Hexaware Technologies Ltd.	8862.89	K R B L Ltd.	765.44
Chambal Fertilisers & Chemicals Ltd.	8749.3	Gruh Finance Ltd.	757.9
Glenmark Pharmaceuticals Ltd.	8052.83	Bombay Burmah Trdg. Corpn. Ltd.	739.58
Exide Industries Ltd.	7990.96	Can Fin Homes Ltd.	708.79
Ramco Cements Ltd.	7763.61	Johnson Controls-Hitachi Air Conditioning India Ltd.	688.8
F D C Ltd.	7648.87	Amara Raja Batteries Ltd.	623.47
Vedanta Ltd.	7573.25	Heidelberg Cement India Ltd.	611.27
Kansai Nerolac Paints Ltd.	7560.47	Jai Corp Ltd.	603.45
Akzo Nobel India Ltd.	7236.14	V I P Industries Ltd.	439.92
Ipca Laboratories Ltd.	7173.13	Nilkamal Ltd.	408.58
Finolex Industries Ltd.	7155.83	Bajaj Electricals Ltd.	386.34
Birla Corporation Ltd.	7126.84	T V S Srichakra Ltd.	369.84
Federal Bank Ltd.	7103.28	Phoenix Mills Ltd.	362.81
Marico Ltd.	7052.8	J M Financial Ltd.	320.5
Pidilite Industries Ltd.	7050.79	Relaxo Footwears Ltd.	288.03
Gujarat Narmada Valley Fertilizers & Chemicals Ltd.	6950.3	Aegis Logistics Ltd.	263.25
Abbott India Ltd.	6719.42	Avanti Feeds Ltd.	245.58
		Rain Industries Ltd.	206.95

