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Papers based on application oriented research or field studies in the areas of industry, commerce, business studies and management are invited. The length of a paper including tables, diagrams, illustrations, etc., should not exceed 20 double space pages. Short communications (not more than 5 double spaced pages) relating to review articles, report of conferences, summary/views on various governments reports, debatable issues, etc., are also published. Book reviews and summary of Ph.D. dissertations not exceeding two double spaced pages, are welcome. Manuscripts sent for publication in this journal should not have been published or sent for publications elsewhere. All correspondence will be held with the senior (first) author only.

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# **The Estimation of the Cobb-Douglas Production Function : An Analytical View**

SURAT SINGH AND POOJA RANI

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The present study surveys the empirical and theoretical literature on macroeconomic production functions and assesses whether the translog or constant elasticity of substitution (CES) or the Cobb-Douglas specification is more appropriate for the Indian Economy. The Cobb-Douglas's major strengths are its ease of use and its seemingly good empirical fit across many data sets. Unfortunately the Cobb-Douglas still fits the data well in our model where some of its fundamental assumptions like constant returns to scale are violated. The study reveals that Cobb-Douglas function has been found more appropriate than translog and CES production function. Our study conforms the operation of diminishing returns to scale. The study also reveals that the technology has contributed significantly in the production during our study period and its contribution is about 3 per cent. The stability of the function has also been checked and it has been found that the function has improved during the post economic reforms era in India. The study also reveals that the performance of capital has improved in post economic reforms era while that of labour has been deteriorated but not significantly.

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## **Introduction**

Macro economic production function is a mathematical expression that describes a systematic relationship between inputs and output in an economy. The Cobb-Douglas and Constant Elasticity of Substitution (CES) are two functions that have been used extensively. These functions play an important role in the economic forecasts and policy analysis of the country. The Cobb- Douglas is a simple production function that is thought to provide a reasonable description of actual economics. It was formulated by labour economist Paul H. Douglas and mathematician Charles W. Cobb in an effort to fit Douglas empirical results for production, employment and capital stock in U.S. manufacturing into a simple function (Cobb and Douglas, 1928). This functional form has been extremely popular among economists because of its ease of use and its extreme flexibility.

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The Cobb-Douglas regression was estimated in 1928, using aggregate time series data from US manufacturing sector on labour, capital and physical capital, with goal of understanding the relationship between the level of output and the quantities of inputs employed in production. This was the beginning of twenty year research programme in which Paul Douglas working with various collaborators estimated the regression using a variety of time series and cross section data. The Cobb Douglas specification is the only linearly homogenous production function with a constant elasticity of substitution in which each factor's share of income is constant over time.

The latter implication of Cobb Douglas specification is thought to be consistent with one of Kaldor's (1961) "Stylized facts" of growth that the shares of income accruing to capital and labour are relatively constant over time. Most of the researchers have not questioned the use of Cobb-Douglas production function to study the question of growth and development. Of course, the linear homogeneity and constant elasticity of substitution properties of Cobb-Douglas specification may also explain the popularity of this functional form. Solow (1957) was perhaps the first to suggest the use of the Cobb-Douglas specification to characterize aggregate production. He noted that there was little in the way of evidence to support the choice of such specification.

The Cobb-Douglas production function in which the elasticity of substitution is precisely equal to one, is still today ubiquitous form in theoretical and empirical analysis of growth and productivity. Every economy is being progressively influenced by technological advances. It will therefore, be interesting and rewarding to look into the various technological issues that appear important from a macro point of view are technical efficiency, returns to scale, substitutability, output elasticities, factor intensities etc. However empirical and theoretical work has often questioned the validity of Cobb-Douglas as a model of the US economy. Some economists believe that the more general form of production function may be more appropriate choice.

### **Review of Literature**

Antras (2004) finds that Cobb-Douglas is the only functional form in which Hicks-neutral technical change can be equivalently expressed as labour augmenting technical change and the latter can deliver the theoretical results of a constant labour share that has approximately been seen in the data. Chirinko (2008) looked at modern studies of the elasticity parameter and found considerable variation in cross study results. Felipe and Holz (2001) used Monte Carlo simulation to empirically test the conditions under which equivalence between the Cobb-Douglas and the accounting identity holds whenever factor shares are roughly constant and the capital labour ratio is weakly correlated with changes in technology parameter<sup>1</sup>. They found that the Cobb-Douglas is well described by the accounting identity even when there are large variations in the factor shares. However, the link between the Cobb- Douglas and the accounting identity begins to break down when there are variations in the growth rates of wages and returns to capital.

Fisher (1971) defended aggregate production function on instrumentalist grounds and fit the Cobb-Douglas to the generated data and found that without exception it yielded an almost perfect fit. Fisher et. al. (1977) conducted a similar experiment and found that as the labour share decreased, the Cobb-Douglas's fit decreased substantially. When the experiment was repeated using the CES the authors were unable to predict the model's fit based on changes in the labour share. Fraser (2002) reexamined five of original time series studies that claimed that the Cobb-Douglas provided an excellent fit to the data. He also examined the time series properties of the given data sets and found a mix of stationary and non stationary variables. In the presence of non stationary variables standard ordinary least squares estimates are dubious because they may lead to spurious regressions. Greenwood et al (1997) strongly supported the Notion that capital augmenting technology has a significant effect.

Nelson and Winter (1982) used Simulation analysis for the U.S. economy to generate a data set from their evolutionary model of the economy. The fitted Cobb-Douglas function provided an excellent description of this data and generate elasticity of substitution parameters that were very close to the factors shares of revenue. Pereira (2003) used Monte Carlo Simulation to test the reliability of econometric estimates of the CES substitution parameter. Shaikh (1974) showed that any production series Y, K would fit the Cobb-Douglas well, provided that factors shares are constant and capital and labour are uncorrelated with the rate of technological growth. Shaikh fitted the Cobb-Douglas to his data and found an extremely high R<sup>2</sup> value.

**Research Methodology**

The study is based on secondary data on gross domestic product (Y), labour (L) and capital (K), which have been taken from Economic Survey of India 2011-2012 and 2012-2013. The present study covers the time period from 1971 to 2011.

**Production Analysis**

The chief analytical tool used for carrying out production analysis is the production function. As is well known production function can be put to use for studying some important technological issues such as technical efficiency, scale, substitutability, output elasticities etc. Accordingly, these issues have been studied for the economy as a whole through production function of the Cobb-Douglas type which was found appropriate for the present study on economic and statistical grounds. This function for n inputs is specified as:

$$Y = A X_1^{\alpha_1} X_2^{\alpha_2} \dots X_n^{\alpha_n} \dots\dots\dots (1)$$

or

$$\text{Log } Y = \text{Log } A + \alpha_1 \text{ Log } X_1 + \alpha_2 \text{ Log } X_2 + \dots + \alpha_n \text{ Log } X_n$$

Where Y denotes the output, X<sub>1</sub>, X<sub>2</sub> ..... X<sub>n</sub> the n inputs, A, and α<sub>1</sub>, α<sub>2</sub>....., α<sub>n</sub> the n +1 parameters. In particular, A is the efficiency parameter. The

parameters  $\alpha_1, \alpha_2, \dots, \alpha_n$  measure the elasticity of output with respect to inputs  $X_1, X_2, \dots, X_n$ . That is,

$$\alpha_i = \frac{\partial Y}{\partial X_i} \times \frac{X_i}{Y}, \quad i = 1, 2, \dots, n \quad \dots (2)$$

The sum  $\sum_{i=1}^n \alpha_i$  measures the degree of homogeneity of the production function. Constant, increasing and decreasing returns to scale prevail according to whether  $\sum_{i=1}^n \alpha_i$  is equal to unity, greater than unity, or less than unity, respectively. Certainly, the analysis in terms of the production function involves the measurement of output and inputs. Thus, it would be appropriate to briefly discuss the measurement of output and inputs.

As is well known, output and inputs refer to certain flow magnitudes. As regards the measurement of inputs, the study identifies two types of inputs, namely, capital and labour. We first take up the measurement of capital input. The measurement of capital raises very nasty problems because: (i) It is usually not hired but purchased, (ii) It lasts long, and (iii) Its cost is ambiguous. All these difficulties could be avoided if, like labour, capital were rented by hour or the month<sup>2</sup>. Capital can be taken after allowing for depreciation or gross of depreciation. Also it can be total productive capital (fixed plus working) or fixed capital only. In the present work, we have taken gross fixed capital stock after allowing for depreciation as a measure of capital input.

Now we discuss the measurement of labour input. In spite of similarities of labour and capital measurement, the measurement of labour is somewhat easy. Sometimes a methodological problem regarding units of its measurement is also raised, i.e. whether it should be measured in terms of efforts, dis-utility, sacrifice, cost or its contribution to output. However, in most of the empirical studies it is measured either in time units (i.e. man-hours or man-days) or number of persons employed. Thus, there are two alternatives available before us as regards the measurement of labour input. Theoretically it is more appropriate to measure labour input in terms of man-hours used in a specified period of time rather than in terms of number of persons employed.

There are other considerations also for not taking man-hours as a measure of labour input. Denison (1961) argues that a reduction in man-hours per week leads to an increase in the labour input per hour. Thus, measuring labour by number of persons is more satisfactory because it gets crudely adjusted for one form of quality change, namely, the change in the quality of one hour's work that is due to shortening of hours.

For these reasons we have taken the number of persons employed as the measure of labour input. It may, however be pointed out that this measure of labour input includes workers, and persons other than workers such as



supervisors, managers etc., and thus involves the unrealistic assumption of perfect substitutability between these categories of employees.

### **Empirical Results**

The production function technique has been used to analyse the technical aspect of Indian economy. Under production analysis, we address ourselves to several issues of technology such as technical efficiency, returns to scale, substitutability, output elasticities, and factor intensities. These, issues, whose importance from policy stand point has already been noted (somewhere in introduction) are analysed by using the traditional (parametric) production function approach. This approach consists in characterizing the technology of a production unit through the parameters of a production function of an appropriate functional form. Given a production function/model and a set of behavioural assumptions, if any, one derives a corresponding econometric model by incorporating into the model a stochastic term with an appropriate specification. The econometric model is empirically implemented and the results thus obtained are interpreted with a view to drawing conclusions in respect of the relevant technological economic aspects.

### **The Production Model**

In the literature several production functions have been suggested, each designed to model production in real world situations. Thus, one faces a problem of choice of multiple starting points to represent the production situation under consideration. Sometimes this choice is determined or facilitated by the objectives of analysis themselves, particular industry under consideration or a prior information, if any, about one or more characteristics of underlying technology. Further a number of criteria (desirable properties) have been suggested for choosing alternative production function. Of these, some important ones are :

**Parsimony in Parameters:** The functional form should contain no more parameters than are necessary for characterizing the usual comparative statistics of a production function at a point as excess parameters add to the problem of multicollinearity and involve a loss of degrees of freedom.

**Flexibility:** The functional form should have a large degree of generality (flexibility) in that it imposes no, or a least number of prior restrictions (as maintained hypothesis) on the underlying state of technology.

**Ease of Interpretation:** The functional form should admit an easy and clear interpretation of production structure, an excessively complex form may contain implausible implications, and further may make it difficult to compute and assess economic effects of interest.

**Computational Ease:** The statistical model resulting from the functional form should be easily computed (estimated) with the available computational technology fully backed by statistical theory.

**Interpolative Robustness:** Within the range of observed data, the chosen functional form should be well behaved, displaying consistency with the

usually maintained hypothesis such as positive marginal products, convexity, finite positive factor substitutability.

Given the objectives of our analysis and the above listed criteria we can consider three production functions that between them have been used for fitting most-observed production situations. These are Cobb-Douglas production function due to Douglas and Cobb (1928), the constant elasticity of substitution (CES) production function (Arrow, Chenery, Minhas and Solow, 1961), and the transcendental logarithmic or, simply, the translog production function (Christensen –Jorgenson and Lau, 1971). Out of these the translog production function which is well known for its generality and flexibility, is of the form<sup>3</sup>:

$$\text{Log } Y = \alpha_0 + \sum_{i=1}^n \alpha_i \text{Log}(X_i) + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \alpha_{ij} \text{Log}(X_i) \text{Log}(X_j) \quad \dots (3)$$

Where Y is the output,  $X_1, X_2, \dots, X_n$  are the n inputs,  $\alpha_i$  and  $\alpha_{ij}$  are the parameters of the function. This functional form which is well known for its flexibility, admits as easy and clear interpretation, and, as being linear in parameters, is easy to estimate with available statistical techniques. However, its application to the present sets of data revealed that it lacks in interpolative robustness. In particular, it displayed inconsistency with the maintained hypothesis of convexity across the sample observations. The above functional form in two inputs labour (L), capital (K) alongwith technical progress (T) can be written as:

$$\begin{aligned} \text{Log } Y = & \alpha_0 + \alpha_l \text{Log}L + \alpha_k \text{Log}K + \alpha_t T + \frac{1}{2} \beta_{ll} (\text{Log}L)^2 \\ & + \frac{1}{2} \beta_{kk} (\text{Log}K)^2 + \frac{1}{2} \beta_{tt} T^2 + \gamma_{lk} (\text{Log}L)(\text{Log}K) \\ & + \lambda_{lt} (\text{Log}L)T + \gamma_{kt} (\text{Log}K)T \quad \dots(4) \end{aligned}$$

In continuation of our search for an appropriate production function, we consider next the CES production function. The CES production function provides the most general form for the class of production function with a common elasticity of substitution between different pairs of inputs which remains constant at all levels of output and inputs. The CES production function is

$$Y = A \left[ \delta X_1^{-\beta} + (1-\delta) X_2^{-\beta} \right]^{\frac{h}{\beta}} \quad \dots (5)$$

Where Y and  $X_i$  's denote output and inputs, respectively, A ( $A>0$ ) is scale parameter measuring technical efficiency;  $\delta$  ( $0<\delta<1$ ) is the distribution parameter; h is the degree of homogeneity of the function, and  $\beta$  ( $\beta \geq -1$ ) is the substitution parameter, in particular,  $\sigma=1/1+\beta$  is the constant elasticity of substitution. Following Kmenta (1967), we assume that  $\beta$  is not far from zero and apply Taylor series approximation at  $\beta=0$  and the result is

$$\text{Log } Y = \text{Log } A + h\delta \text{Log } L + h(1-\delta) \text{Log } K - \frac{1}{2} \beta h\delta(1-\delta) [\text{Log } K - \text{Log } L]^2 \dots\dots\dots(6)$$

Note that the right hand side of (6) can be conveniently separated into two parts, one corresponding to the Cobb-Douglas production function and one representing a correction due to the departure of  $\beta$  from zero. We write equation (6) after adding a stochastic term  $u$ , as follows :

$$\text{Log } Y = \alpha_1 + \alpha_2 \text{Log } L + \alpha_3 \text{Log } K + \alpha_4 [\text{Log } K - \text{Log } L]^2 + u \dots\dots(7)$$

Where  $A = \text{anti log } \alpha_1$ ,

$$\delta = \frac{\alpha_2}{\alpha_2 + \alpha_3}$$

$$h = \alpha_2 + \alpha_3$$

$$\beta = \frac{-2\alpha_4(\alpha_2 + \alpha_3)}{\alpha_2\alpha_3}$$

Now if the estimate of  $\alpha_4$  is not significantly different from zero we would reject the CES model in favour of the Cobb-Douglas model. The estimates of the above model are presented in Table 1

Table 1: Results of CES Regression – OLS estimates

Log Y = $\alpha_1 + \alpha_2 \text{Log } L + \alpha_3 \text{Log } K + \alpha_4 [\text{Log } K - \text{Log } L]^2$				
	Constant ( $\alpha_1$ )	$\alpha_2$	$\alpha_3$	$\alpha_4$
	4.77	0.307	0.103	0.032
	(0.734)	(0.694)	(0.476)	(0.059)
	6.504	0.443	0.216	0.544
$R^2 = 0.85$	DW = 2.06	F = 71.14		

Standard Errors are given in parenthesis.  
 \*\*Significant at 5 per cent probability level.

As is evident from Table 1, the estimate of  $\alpha_4$  is insignificant at 5 per cent level of probability, suggesting the rejection of CES model in favour of the Cobb-Douglas model.

Thus, in the light of the estimate of  $\alpha_4$  and on consideration of simplicity, we shall adopt the Cobb-Douglas functional form for modeling production in the Indian economy.

The Cobb-Douglas production function in general form is

$$Y = A X_1^{\alpha_1} X_2^{\alpha_2} X_3^{\alpha_3} \dots\dots\dots X_n^{\alpha_n} \dots\dots\dots (8)$$

or

$$\text{Log } Y = \text{Log } A + \alpha_1 \text{Log } X_1 + \alpha_2 \text{Log } X_2 + \dots\dots\dots + \alpha_n \text{Log } X_n$$

Where  $Y$  is output,  $X_1, X_2, \dots\dots\dots, X_n$  are inputs,  $A$ , and  $\alpha_1, \alpha_2, \dots\dots\dots, \alpha_n$  are parameters.  $\alpha_1, \alpha_2, \dots\dots\dots, \alpha_n$  are the output elasticities with respect to  $X_1,$

$X_2, \dots, X_n$ , respectively. In general  $\alpha_i$  is the output elasticity with respect to factor  $X_i$ , i.e.

$$\alpha_i = \frac{\partial \text{Log} Y}{\partial \text{Log} X_i}, \quad i = 1, 2, \dots, n \quad \dots\dots\dots (9)$$

The parameter A, as in the case of CES production function above, is an index of technology or technical efficiency. Two firms or economies have the same  $\alpha$ 's and, therefore, use the same techniques, but the firm (economy) with the higher value of A would produce more, for every combination of inputs, than the other firm (economy), and would be called technically more efficient.

In passing, we note that the sum  $\sum_{i=1}^n \alpha_i$  measures the degree of homogeneity of the production function. Constant, increasing and decreasing returns to scale prevail according to whether  $\sum_{i=1}^n \alpha_i$  is equal to unity, greater than unity or less than unity, respectively.

#### Estimation of the model

To begin with, we estimated the following model:

$$Y = A L^\alpha K^\beta e^u \quad \dots\dots\dots(10)$$

or

$$\text{Log } Y = \text{Log } A + \alpha \text{Log } L + \beta \text{Log } K + u$$

Where Y = output, L= Labour and K = Capital. As before, the parameter A is the efficiency parameter,  $\alpha$  and  $\beta$  are the output elasticities, and u is the random disturbance term. This disturbance term is introduced to take care of possible errors arising out of omitted variables, mis-specification of the functional form, and non-optimizing firm's (economy's) behaviour.

Secondly, we estimated the following model :

$$Y = A L^\alpha K^\beta e^{\lambda t + u} \quad \dots\dots (11)$$

or

$$\text{Log } Y = \text{Log } A + \alpha \text{Log } L + \beta \text{Log } K + \lambda t + u$$

Where Y, L and K are the output and inputs, respectively. A,  $\alpha$  and  $\beta$  are the parameters of the function and u is the random disturbance term as before. The most important thing to be noted here in this function is the introduction of trend variable whose coefficient is  $\lambda$  which is the index for technical progress, i.e. Total Factor Productivity Growth (TFPG).

Thirdly, we estimated the following model :

$$Y = b_0 + \alpha L + \beta K + u \quad \dots\dots (12)$$

Here the equation is estimated in growth rates.

Lastly, we estimated the following model:

$$Y = A + \alpha L + \beta K + \lambda D + u \quad \dots (13)$$

Where Y, L and K are the output and inputs and A,  $\alpha$ ,  $\beta$  and u are the parameters of the model and u is the random disturbance term as before. D is the dummy variable which has been used to check the stability of the function before and after economic reforms. The results of all these models have been summarized in the Table 2 and their interpretation is given below:

Table 2: Results of Cobb-Douglas Regression and others – OLS estimates

1. $\text{Log } Y = \text{Log } A + \alpha \text{ Log } L + \beta \text{ Log } K$				
	Constant	$\alpha$	$\beta$	
	4.34	0.011	0.35	
	(0.15)	(0.18)	(0.16)	
	28.94	0.063	2.21	
	$R^2 = 0.85, \quad t = 2.65, \quad F = 108.31$			
2. In Per Capita Terms				
	Constants	$1-\alpha-\beta$	$\beta$	
	4.56	0.876	0.372	
	(0.041)	(0.031)	(0.004)	
	112.27	28.72	91.69	
	$R^2 = 0.99, \quad F = 4510$			
3. $\text{Log } Y = \text{Log } A + \alpha \text{ Log } L + \beta \text{ Log } K + \lambda t$				
	Constant	$\alpha$	$\beta$	$\lambda$
	5.83	0.176	0.291	0.029
	(0.37)	(0.086)	(0.037)	(0.007)
	15.59	2.05	7.83	4.38
	$R^2 = 0.99, \quad F = 71.93$			
4. $Y = A + \alpha L + \beta K$				
	Constant	$\alpha$	$\beta$	
	96508.7	3.15	1.55	
	(55419.74)	(1.37)	(0.08)	
	17.41	2.30	19.80	
	$R^2 = 0.95, \quad F = 399.24$			
5. $Y = A + \alpha L + \beta K + \lambda D$				
	Constant	$\alpha$	$\beta$	$\lambda$
	831061.43	0.880	1.378	593232.66
	(38408.8)	(0.897)	(0.0531)	(75583.61)
	21.64	0.980	25.87	7.85
	$R^2 = 0.983, \quad F = 711.16$			

Table 2 reports several regressions and results dissimilar to those obtained by Cobb and Douglas. The first regression reports unrestricted estimates of the regression  $Y = A L^\alpha K^\beta$  in logarithms. The results indicate that the constant returns to scale restriction (hypothesis) is rejected by the data and favours

the diminishing returns to scale because calculated (observed) value (2.65) is found to be much higher than the Table (theoretical) value. The second regression shows the estimates of the regression in per capita terms and the results indicate that the constant returns to scale restriction (hypothesis) is rejected by the data again. Thus both the equations, equation (1) in unrestricted form and equation (2) in per capita terms but unrestricted reveals that the diminishing returns to scale prevails in the economy. These estimates are obtained without including a measure of technical progress. Samuelson (1979, 924) claims that Schumpeter was shocked that the Cobb-Douglas formula did not allow for technical progress.<sup>4</sup> The solution proposed was to add an exponential time trend (T), that is  $Y = A L^\alpha K^\beta e^{\lambda T}$ , in logarithms and unrestricted. The results, shown in the third regression of Table 2, reveal that the contribution of technological progress (TFPG) in the increase in output is significant and the contribution of total factor productivity growth (TFPG) which is also called technical progress is about 3 per cent in the total output. The fourth regression has been estimated in growth rates form and shows the contribution of labour and capital in total output is significant.

Finally, to test the stability of the function in the pre and post economic reforms, the fifth regression was estimated for the period 1971-2011. The coefficient ( $\lambda$ ) of dummy variable (D) was found to be significant at 1 per cent probability level and the sign of the coefficient being positive reveals that the function has improved in the post economic reforms era. In other words, the function has not been remained stable during post liberalization era in the comparison of pre liberalization era. As far as the goodness of fit is concerned, the first regression displays a fit of 0.85 and rest of the four regressions (second, third, fourth and fifth) display a fit of 0.99, 0.99, 0.95 and 0.98 respectively which shows that the explanatory variables (labour and capital) explain the maximum variation in the dependent variable (output).

One thing which should be noted here is that the overall view (i.e. an aggregate view) for the stability of the function has been revealed by the fifth regression. But if we want to know which variable has improved and which has deteriorated in terms of its contribution towards output, the researcher has to apply the Chow test in its traditional form as shown in Table 3.

Table 3: Economic reforms

Before economic reforms			
$Y = b_0 + b_1L + b_2K$			
	Constant ( $b_0$ )	$b_1$	$b_2$
	599733.5	95.5	-2.48
	(10145.58)	(11.26)	(1.005)
	59.11	8.49	-2.46
$R^2 = 0.98, \quad F = 724.97$			

After economic reforms

$$Y = b_0 + b_1L + b_2K$$

Constant (b <sub>0</sub> )	b <sub>1</sub>	b <sub>2</sub>
14434.3	0.619	1.37
(58891.44)	(0.778)	(0.046)
24.51	0.795	29.76

$$R^2 = 0.98, \quad F = 556.48$$

Pooled regression

$$Y = b_0 + b_1L + b_2K$$

Constant (b <sub>0</sub> )	b <sub>1</sub>	b <sub>2</sub>
965082.7	3.15	1.55
(55419.74)	(1.368)	(0.0782)
17.41	2.30	19.80

$$R^2 = 0.95, \quad F = 399.24$$

The F-test is given below as:

$$F = \frac{\left[ \sum e_p^2 - \left( \sum e_1^2 + \sum e_2^2 \right) \right] / k}{\left( \sum e_1^2 + \sum e_2^2 \right) / (n_1 + n_2 - 2k)} = \frac{2,620,998,207,907 / 3}{406,878,537,751 / 35} = 75.15 \quad \dots(14)$$

This reveals that the hypothesis of stability is rejected and the function changes from pre-economic reforms era to post-economic reforms era. The analysis of the above Table 3 shows that the performance of capital has improved in the post-economic reforms era while that of labour has deteriorated in the post-economic reforms era though it is insignificant.

### Conclusion

The results of the function revealed that there is diminishing returns to scale. The contribution of technical progress (TFPG) has been found significant which is about 3 per cent. The stability of the function has also been checked by making use of Chow-test in its alternative form (dummy variable technique) and in its traditional form. The alternative form of Chow-test reveals that the function has not been stable during our study period and a significant improvement has been noticed in the post economic reforms era as compared to pre-economic reforms era. To know which variable has been the major cause of its improvement the Chow-test in its traditional form has been used. It has been found in our study that the contribution of capital has improved much in the post economic reforms era while that of labour is deteriorated but not significantly.

**Notes**

- 1) This deviation applies to time series data. For a similar transformation of cross-sectional data see Felipe and McCombie (2005a)
- 2) Domar, E.D., op. cit., p.602
- 3) The translog functional form provides a second order approximation to an arbitrary twice differentiable production function and places no a priori restrictions on elasticities of substitutions. [See, Christensen, -Jorgenson and Lau (1971)].
- 4) Some of the same points made here were previously made by McCombie (1998).

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## **Interrelationship among Indian Stock Market and Selected Stock Price Indices of the Asia-pacific Region**

K. MALLIKARJUNA RAO

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The purpose of the study is to investigate the short-run and long-run relationships between Indian stock market (Sensex) and stock indices of major countries in the Asia-Pacific region. Monthly closing stock market indices of India (Sensex) and that of the Australia [All Ordinaries (AORD)], Hong Kong [Hang Seng Index (^HIS)], Indonesia [Composite Index (^JKSE)], Japan [Nikkei 225 (^N225)], Malaysia [Composite Index (^KLSE)], Korea [KOSPI Composite Index (^KS11)], Singapore [Straits Times Index (^STI)] and Taiwan [TSEC Weighted Index (^TWII)] for the period of April, 2004 to March, 2014 are taken as sample. The study is tested with cross correlation, Unit root test, Granger causality test and Johansen cointegration test to seek the relationship, stationarity, directional causality and either short or long run equilibrium between the Sensex and the selected indices of various stock markets. The result obtained by the econometric tools shows that the correlation between the sensex and the other selected indices is high and significant, the data are stationary in the first difference, both unidirectional and bidirectional causality occurs and the long term relationship is found between sensex and other selected indices.

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### **Introduction**

The globalization of the world stock markets is the most significant development that has occurred during the last decade. Various factors contributed to this including: the advancement of technology and remote access which have been utilized in security trading, the emergence of new international financial institutions offering financial services regardless of geographical jurisdictions, trends of liberalization and the removal of restrictions used to be imposed on foreign ownership, and the movement towards regional integration of the stock exchanges, clearing and settlements organizations, and other financial institutions. Along with various measures, opening up of the home market for the foreign investors is one of the important steps taken by the Indian Government that may lead the Indian stock market to be strongly integrated with the stock market of the rest of the world.

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The globalization phenomenon may be blessing, since many experts believe that globalization may improve market efficiency, lower its risk due to the possibility of diversification, and use arbitrage in a relevant way. On the other hand, it may increase pricing volatility and trading instability, due to the high correlation between leading - major - stock markets and other markets as well as to the fact that the irrational trading in one market may move to other markets as witnessed in the last two decades.

### **Literature Review**

Bailey & Stulz (1990) applied simple correlation technique to find interrelationship among US and Pacific basin stock market and found that the correlation differed in terms of daily, weekly and monthly time series data. Arshanapalli & Doukas (1996) applied Johansen cointegration technique on daily data belonging to different Asian markets and found that there was no long term relationship among the Asian stock market. Ghosh (1999) in contrary to Arshanapalli & Doukas (1996) found that some of the Asian market showed a long run equilibrium relationship with the world's major stock market. Floros (2005) found a long term relationship among the stock prices of US, Japan and UK. He also observed that through Granger causality test some of the stock indices have shown bidirectional effect and some other showed unidirectional effect.

Amanulla & Kamaiah (1995) examined the long run equilibrium between the RBI stock price indices of Bombay, Calcutta, Madras, Delhi and Ahmedbad and found that there existed long run equilibrium.

Nath & Verma (2003) tested the cointegration between India and other selected countries with daily price indices and found that no cointegration existed among India, Taiwan and Singapore for the period January 1994 to November 2002. Jayanthi & Pandiyan (2008) tested the cointegration between the stock price indices of India, Malaysia, Taiwan, China, South Korea, US, UK, Germany, Singapore, Hong Kong and Japan. The study period was from April 2000 to March 2007 and found no correlation and cointegration among the selected stock price indices. Chakravarty & Ghosh (2011) made an attempt to find the relationship among the indices of Sensex 30, S&P 100 and FTSE 100 through Granger causality test and found that unidirectional causality occurred for S&P 100 and FTSE 100 from Sensex. Sen (2011) made an attempt to investigate the relationship between Sensex and some selected Stock Price Indices of the Asia Pacific region and found that the correlation among the selected Stock Price Indices were highly correlated and significant. Granger causality test revealed the unidirectional effect from the Asian tigers to Sensex and Johansen cointegration test clearly showed that there existed a long run relationship between sensex and stock indices of the major Asian Pacific countries.

It is worth mentioning that the present study is carried out as an extension of the study of Som (2011) with the time interval from January 2000 to June 2013 to find out the relationship among the selected market indices in amidst recent recessionary trends.

### Objectives of the Study

1. To test the stationarity of the selected Stock Market Indices
2. To examine directional effect among the selected Stock indices
3. To examine the effect of Long term relationship among the selected market.

### Methodology

This study is conducted by using secondary data gathered from monthly stock market indices of India (Sensex) and that of the Australia [All Ordinaries (AORD)], Hong Kong [Hang Seng Index (^HIS)], Indonesia [Composite Index (^JKSE)], Japan [Nikkei 225(^N225)], Malaysia [Composite Index (^KLSE)], Korea [KOSPI Composite Index (^KS11)], Singapore [Straits Times Index (^STI)] and Taiwan [TSEC Weighted Index (^TWII)].

Monthly time series data of the above mentioned indices have been used for the purpose of empirical investigation covering the study period from April, 2004 to March 2014. The data for these indices were collected from the website [www.Finance-yahoo.com](http://www.Finance-yahoo.com)

The following standard statistical and economic tools have been applied for empirical investigation.

**Cross-Correlation:** Cross-Correlation is a useful statistical tool to measure the co movement of variables and the lead-lag relationship between them. Using the following formula, pair-wise cross-correlations between Sensex and other prices indices have been computed:

$$r = \frac{\sum [(x_i - \bar{x})(y_{i-d} - \bar{y})]}{\sqrt{\sum_i (x_i - \bar{x})^2} \sqrt{\sum_i (y_{i-d} - \bar{y})^2}} \quad \dots(A1)$$

Where r is greater than, equal or less than zero.

From the cross-correlations, it would be clear whether Nifty is correlated to other selected stock price indices in different times (monthly) lags.

**Unit Root Test:** Before using the time series data for further investigation, all the time series data must be tested for stationarity. Mean, Variance and Covariance of such stationary time series data do not change with the time shift. If the data is non-stationary, then regression results using such data would be spurious, as the usual t test would not be applicable to test the significance of coefficients.

To test the stationarity, the unit root test has been applied on the time series index data. In this, regard, the Phillips-Perron unit root test has been preferred against ADF test, as the latter is considered the low power test. In Phillips-Persson test, non-parametric statistical methods are used to take care of the serial correlation in the error term( $\mu_t$ ) of the following equation.

$$\nabla y_t = \nabla y_{t-1} + \mu_t$$

Where  $Y_t$  is the time series data under consideration.

The test is based on the null hypothesis  $H_0: Y_t$  is not I (0). If the computed PP statistics are less than the critical value, the  $Y_t$  is non-stationary.

**Granger Causality Test:** Granger causality test has carried out to observe the direction of the short-run relationship between the sensex and other indices. To test for Granger causality between two stock price indices  $Y_t$  and  $X_t$ , the following two equations have been estimated.

$$Y_t = \sum_{i=1}^m \alpha_i Y_{t-i} + \sum_{i=1}^m \beta_i X_{t-i} + u_i$$

$$X_t = \sum_{i=1}^m \gamma_i Y_{t-i} + \sum_{i=1}^m \delta_i X_{t-i} + e_i$$

Where  $Y_t$  and  $X_t$  are the first difference of time series variable.

Therefore, F-test has been conducted for joint insignificance of the coefficients. The null hypothesis of such test  $Y_t$  does not Granger cause  $X_t$  and vice versa. A rejection of the null hypothesis indicates the existence of Granger causality; for each of the stock indices, two Granger causality tests have been performed to investigate whether  $Y$  Granger causes  $X$  or  $X$  Granger causes  $Y$  or both or there is no causal relationship between the variables.

**Johansen Cointegration Test:** The condition for testing Johansen cointegration test for any time series data is that the data should be non stationary at their level i.e. the natural logarithm of time series data should be non stationary and the first difference in the data should be stationary. If the return indices of different markets are correlated, the value may raise or fall. On the other hand, if the time series data are cointegrated, then the series in the long run will come to equilibrium point.

Table 1: Descriptive statistics of monthly returns of selected stocks indices

Statistic	SEXSEX	AORD	HIS	JKSE	N225	KLSE	KS11	STI	TWII
Mean	1.42658	0.46495	0.66439	1.79375	0.36870	0.67248	0.85270	0.59966	0.42775
Median	1.29107	1.28166	1.36277	2.88210	0.24096	1.03495	1.12065	1.41595	0.88519
Maximum	28.2551	7.6422	17.0737	20.1315	12.8499	13.5454	13.5211	21.2886	15.0020
Minimum	-23.8901	-14.004	-22.466	-31.421	-23.826	-15.222	-23.134	-23.939	-18.830
Std. Dev.	7.26638	4.02116	6.26213	6.55672	5.81001	3.80359	5.84887	5.40832	5.87414
Skewness	-0.21682	-0.9872	-0.4605	-1.1111	-0.6331	-0.4235	-0.5007	-0.6209	-0.2722
Kurtosis	4.83708	4.10032	4.60820	7.75032	4.65711	5.80796	4.60789	7.68282	3.75021
Observations	120	120	120	120	120	120	120	120	120

Source: Computed Data

### Cross-Correlation

The pair-wise cross correlation co-efficient between Sensex and other indices are presented in Table 2. It is noted that there is very high correlation between the Sensex and other selected indices at 1% level of significance. NIKKEI and JKSE alone showed an exception in such a way that the negative

correlation existed in some of the lags and the correlation coefficient for other lags are very low and also insignificant

Table 2: Cross- Correlation between BSE Sensex to other Selected Indices

Lag	AORD	HIS	JKSE	N225	KLSE	KS11	STI	TWII
-5	0.2989	0.5986	-0.6499*	-0.1185*	0.6928	0.7324	0.6253	0.5545
-4	0.3446	0.6676	-0.6778*	-0.0953*	0.7425	0.7894	0.6781	0.6219
-3	0.3930	0.7366	-0.7055*	-0.0711*	0.7920	0.8425	0.7293	0.6854
-2	0.4327	0.8002	-0.7328*	-0.0596*	0.8342	0.8852	0.7738	0.7391
-1	0.4694	0.8531	-0.7584*	-0.0439*	0.8772	0.9200	0.8123	0.7805
0	0.4992	0.8934	-0.7796*	-0.0319*	0.9159	0.9555	0.8473	0.8228
1	0.4522	0.8437	-0.7541*	-0.0607*	0.8891	0.9145	0.7960	0.7800
2	0.3985	0.7937	-0.7322*	-0.0939*	0.8588	0.8683	0.7396	0.7350
3	0.3490	0.7444	-0.7161*	-0.1222*	0.8284	0.8280	0.6884	0.6937
4	0.2930	0.6921	-0.7050*	-0.1535*	0.7945	0.7840	0.6353	0.6390
5	0.2249	0.6304	-0.6933(	-0.1929*	0.7573	0.7355	0.5740	0.5760

Source: Computed Data

### Unit Roots test Results

The selected stock market indices have been tested whether they are stationary or not. For that PP test has been used. The results are reported in Table 3. It is clear that all the time series data are non-stationary at their level, but stationary after first differencing. Therefore, all the times series data have been first differenced to achieve stationarity.

Table 3: Phillips-Perron Unit Root Test results

Index	Level	1 <sup>st</sup> Difference
BSE Sensex (India)	-9.876842	-26.67702
All Ordinaries (AROD) Australia)	-8.766711	-25.15889
Hang Seng Index (^HIS) (Hong Kong)	-10.05754	-48.72659
Composite Index (^JKSE) (Indonesia)	-8.744528	-23.70242
Nikkei 225(^N225)(Japan)	-9.154610	-24.82557
Composite Index (^KLSE) (Malaysia)	-9.601473	-50.56939
Kospi Composite Index (^KS11) (Korea)	-10.82504	-20.61227
Straits Times Index (^STI) (Singapore)	-8.899458	-33.95411
Tsec Weighted Index (^ TWII) (Taiwan)	-9.625629	-34.62427

Source: Computed Data

The pair wise Granger causality test is shown in Table 4. The study has taken the choice of lag length from 1 to 5. The empirical result shows that at lag 1 either unidirectional or bidirectional effect was not seen in most of the cases. In lag 2 to 4 Sensex showed unidirectional causality to HSI, JKSE,

and KSII. In Lag 5 both unidirectional and bidirectional causality effect were seen in most of the selected indices.

Table 4: Granger Causality Test-results

Null Hypotheses	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
AORD does not Granger cause Sensex	0.51443	1.13455	0.68512	1.01414	0.80257
Sensex does not Granger cause AORD	0.64152	0.53472	0.48422	1.90282	1.12864
HSI does not Granger cause Sensex	5.08892	5.10703	7.74746	5.89830	4.73527
Sensex does not Granger cause HSI	0.46868	0.06193	0.77451	1.60430	1.52187
JKSE does not Granger cause Sensex	0.26876	3.24397	1.99613	2.46718	1.91701
Sensex does not Granger cause JKSE	1.04512	0.43770	0.14435	1.43545	1.09892
N225 does not Granger cause Sensex	0.68937	1.45418	1.30687	1.02103	0.85650
Sensex does not Granger cause N225	0.02261	0.08541	0.16389	0.91864	0.78012
KLSE does not Granger cause Sensex	3.03267	0.89359	0.65591	0.46904	0.42843
Sensex does not Granger cause KLSE	2.58441	1.26463	1.75961	1.76377	1.49139
KS11 does not Granger cause Sensex	0.33740	3.82889*	3.08052*	2.56025*	1.95826
Sensex does not Granger cause KS11	2.69634	1.87130	1.43359	1.54556	0.98790
STI does not Granger cause Sensex	0.63564	2.81001	2.29735	1.63350	1.31348
Sensex does not Granger cause STI	0.03898	1.36652	0.90474	1.58538	1.31135
TWII does not Granger cause Sensex	0.88068	4.16020*	2.74759*	1.90317	1.49993
Sensex does not Granger cause TWII	0.00225	0.71568	0.48254	1.35066	1.23423

The result obtained in the Table 5 through Johansen cointegration test revealed that trace statistics is significant at 5% level in only two cases and it leads to conclude that there is long run equilibrium between the Sensex and selected indices of the stock market. The Null hypothesis of no cointegration effect is rejected in most cases.

Table 5: Johansen Cointegration Test results

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None*	0.494017	255.7977	197.3709	0.0000
At most 1*	0.359834	177.4536	159.5297	0.0036
At most 2*	0.314866	126.1604	125.6154	0.0463
At most 3	0.205042	82.67420	95.75366	0.2808
At most 4	0.177444	56.28563	69.81889	0.3666
At most 5	0.137137	33.82174	47.85613	0.5116
At most 6	0.076990	16.85930	29.79707	0.6504
At most 7	0.064185	7.646109	15.49471	0.5040
At most 8	0.000150	0.017288	3.481466	0.8953

**Note:** Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values  
(Lags Interval: 1 to 4)

### Conclusion

The study reveals certain facts that there is high correlation between Sensex and other selected indices during the study period April, 2004 to March 2014. It is worth noting that both unidirectional and bidirectional causality effect took place among the selected indices. The result obtained through cointegration test proved long run equilibrium between the Sensex and other selected market indices. Due to this cointegration prices in different markets cannot move away far from each other and therefore the investor community cannot get abnormal gain due to the price difference among the markets.

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## **Performance Comparison of Index Funds and ETFs in India**

PRIYA MAHAJAN AND SANJEEV SAXENA

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In this paper we compared the index funds and ETFs performance during the time period from 1<sup>st</sup> April 2008 to 31<sup>st</sup> March 2013 using the daily NAV's of 7 ETFs and 14 Index funds that track the same index. Various statistical techniques i.e. risk, return, beta, Sharpe ratio, Treynor ratio, Jensen Alpha, tracking error have been used with respect to these two passive investment vehicles tracking the same benchmark Index. Only those ETF and Index funds schemes have been taken for the study which are benchmarked against S&P CNX Nifty. The study is an attempt to find out whether these two passive investment schemes are being successful in beating their benchmark index and further which of the schemes have performed better than the other in the given study period.

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### **Introduction**

A mutual fund is a professionally managed type of collective investment scheme that pools money from many investors and invests in stocks, bonds, short term money market instruments and other securities. Mutual funds have fund manager who invests money on behalf of the investors by buying/selling stock, bonds etc.

The Indian mutual fund industry is one of the fastest growing and the most competitive segments of financial sector and the contributions of international players in its growth is inevitable. With the improvement in deployment of investment through markets, the need and scope for mutual fund operations has increased tremendously. Today the industry offers different schemes ranging from equity and debt to fixed income and money market. The mutual fund industry offers diverse products such as Gold funds, Exchange Traded Funds, Index Funds and Capital protection oriented funds and even thematic funds to suit the various needs of the investors. UTI is the first mutual fund set up in India in the year 1963 by Government of India and the industry during the last five decades has grown in leaps and bounds. It is mandatory to all mutual funds have to be registered with the SEBI. During the last 50 years, UTI has grown to be a dominant player in the industry with assets of over Rs 69450.3972 Crores. As on June 30, 2014 there were 46 mutual

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funds in India with a total of 1819 schemes of which income/debt oriented schemes were 1343 (73.8%) Growth/equity oriented schemes were 378 (20.8%) Exchange traded funds were 42 schemes (2.3 %) Balanced schemes were 26 (1.5%) and funds of fund investing overseas schemes were 29 (1.6%). The assets under management of the mutual fund industry as on Aug 2012 was Rs 760833 crore and has been increased to Rs 974715 crore i.e. about 28% increase in the two years but even with this surge in popularity of Mutual funds as an investment alternative we have a long way to catch up with the developed world as Indian mutual funds contribute a meager in the total assets as compared to the world total assets contribution.

Mutual fund as a medium to long term investment option is preferred as a suitable investment option by the investors. However, with several market entrants the question is the right choice of mutual fund. Though the investment objectives define investors' preference among fund types (balanced, income, growth, dividend etc), the choice of fund is based on a sponsor's reputation.

### **Emergence of Index Funds and Exchange Traded Funds**

An Exchange Traded Funds and Index Funds are an innovative products which put together favorable characteristics of open-ended and closed-ended mutual funds and presents a more flexible and liquid products for investors ( Prashanta and Raj, 2011)). As equity markets in US evolved and became more sophisticated, the fund managers found it more and more difficult to outperform over the index considering net of trading costs, broker commission, market spreads and taxes etc. The literature has shown that the active management does not produce above-normal average returns. Malkiel (1995) and Gruber (1996) attribute the managerial inability to beat the market to the increased expenses incurred by the managers. As a result, the above-normal returns they achieve on a gross level are reduced to normal level after expenses are deducted. Investors direct most of their money to mutual funds that track a market index rather than searching a mutual fund that promises to beat the market. These investors preferences led to the growth of index funds making index providers the world's largest asset managers (Gerasimos, 2008). Besides tracking the market, investors prefer to take position in and out of the entire market quickly with just one order, with minimum transaction costs, lower tax burden and with greater risk diversification and flexibility. The attempt to incorporate all expected features in a product led to the development of ETFs with a successful proliferation throughout the developed capital markets. Leonard ( 2003) advocated that the goal of index funds and ETFs is essentially the same i.e. to provide investors with a way to own a well diversified indexed portfolio by using the principle of economies of scale to buy large quantities of stock at low cost. They accomplish this goal in two different ways. Index-linked products, such as ETFs, have been increasingly successful because they provide investors with the benefits of diversification through one investment product, improved tax efficiency relative to active portfolio management and lower expenses (David and Reuben, 2004). Study of Anna, 2006 and Ilan and Jennifer, (2009)

suggested that while ETF industry is growing and becoming popular investment product but it will neither replace the conventional index funds nor both of them are perfect substitutes.

### **Index Funds**

An index fund is essentially a mutual fund that invests in the securities of the target index in the same proportion or weightage. In the U.S. the first index mutual fund was launched in 1976 by Vanguard group inc., however it has only been in the last decade that indexing has grown significantly. (Gruber, 1996; Frino and Gallagher, 2001). The first Index Fund in India was launched in June 1999. There are 15 mutual fund companies which are offering approx. 131 index fund schemes. In India, Index funds are generally targeted to popular indices like BSE Sensex or Nifty, though index funds benchmarked to sector specific indices are also in vogue. Index funds are designed to provide returns that closely track the benchmark index. They also carry all the risks associated with the class of securities invested. So, when the overall market falls, the securities comprising the index fund too fall and so would returns from index funds. Index funds do not eliminate market risk. They merely ensure that returns will not stray far from returns on the indices that the fund mimics. Index funds can be either for equity or debt. The underlying assumption of indexed management is that financial markets are efficient over the long term it is virtually impossible for active managers to consistently outperform the market. That is why indexing has become popular with investors who prefer steady returns through a conservative, long-term, low-risk investment strategy.

### **Exchange Traded Funds**

Exchange Traded Funds (ETFs) are just what their name implies: baskets of securities that track an index, a commodity or a sector like an index fund or a sectoral fund but trades like a stock on exchange. Unlike regular open-end mutual funds, ETFs can be bought and sold throughout the trading day at its Net Asset Value (NAV). ETF's experiences price changes throughout the day as they are bought and sold. ETFs have emerged as a viable alternative for investors seeking to tie their holdings to a major market index (Kostovetsky, 2003). The Indian experience with ETFs is a little limited. Benchmark MF (now a day's Goldman Sachs) launched the first ETF in 2002. It was based on the 50-stock S&P CNX Nifty index. To this date, this Benchmark Nifty ETF continues to be the most actively traded ETF on the national stock exchange (NSE). Apart from the specialized Benchmark MF, other fund houses that have ETF products are few in number — UTI, Quantum, Kotak Mahindra, Birla Sunlife, Motilal Oswal, Reliance Capital, SBI, Religare, ICICI Prudential, and IIFL etc. The Indian ETF market experience has not coincided with the global experience, but a matured investor base might very well help the growth curve shoot up in the next few years.

**Review of Literature**

Frino & Gallagher (2002) examined the performance of index equity funds in Australia and found that the magnitude of tracking error is related to fund cash flows, market volatility, transaction costs and index replication strategies used by the manager. Further reported that the passive funds are not necessarily a superior alternative to active funds. Fernandes (2003) exhibited the performance of index funds in India. His study shows that incorrect data handling can result in significantly exaggerated values of tracking error. The result showed that tracking error of index funds in India ranges between 0.68% and 10.97%.

Kostovetsky (2003) showed that the main factors that induce the tracking error of index funds are the bid/ask spreads, the obligation of index funds to maintain a significant amount of money in cash to meet redemptions needs, the dividend policies and the transaction costs arising from index's changes or corporate activity.

Rompotis (2005) found that though ETFs and Index funds offer analogous performance possibilities but they do not achieve any excess return than their benchmarks. Sethu and Baid (2008) found that 1. Tracking error increases with index return volatility, 2. Tracking error decreases with increases in net flows. 3. The magnitude tracking error is asymmetric w.r.t. average net flow direction. Sharifzadeh and Hojat (2011) found with 230 paired matches that ETFs outperformed index mutual funds in 134 of the times of Sharpe ratio; however the test of the hypothesis showed no statistically significant difference between ETFs and index funds performance in terms of Sharpe ratio. Sharma (2013) showed that majority of sampled equity mutual funds are successful to beat their benchmarks. Also the result of T- test showed the significant relationship between the market index return and the return of mutual fund scheme.

Objectives of the study

1. To study the growth and performance of ETFs and Index Funds in India.
2. To compare the performance and analyze the risk & return characteristics of ETFs and Index Funds.

**Research Methodology**

In India 46 mutual funds companies are registered. Out of 46, 15 fund companies are issuing 131 different schemes i.e. growth, dividend, income. of index funds. In our study we have taken 14 Index funds of growth schemes which are tracking the S&P CNX Index for the performance evaluation. From each mutual fund company which is issuing index funds we took only one index fund particularly of growth scheme. One index fund i.e. IIFL Dividend opportunities index fund is not included in the study because all of their NAV schemes are benchmarked against CNX Dividend Opportunities index. On the other hand sample of 7 ETFs which are tracking the S&P CNX Nifty Index out of 37 ETFs are taken for the study. Study period ranges from March 2008 to March 2013.

In the present study the daily NAV data of equity ETFs and Index funds has been processed by using Microsoft excel. From the daily NAV's of ETFs and Index funds we calculated the daily return. We evaluated the performance of Equity ETFs and Index funds by computation of various performance parameters like systematic risk (Beta), Returns, volatility (Standard Deviation) and Tracking error. Apart from these techniques, risk adjusted measures like Sharpe Ratio, Treynor Ratio and Jensen alpha are also being computed.

Risk-free rate ( $R_f$ ): The risk free rate is the rate of return that investors require for investment with no risk. In the present study Govt. Bonds 10 years are taken as risk free securities.

### **Growth and Performance of ETF and Index Funds in India**

A closer look at the Table 1 and Table 2 clearly indicate that in terms of popularity and sheer quantum of asset under management the first ETF launched in India GS Nifty ETF is a winner hands down across ETFs and Index funds. Also it is evident that ETFs other than GS Nifty are recent phenomena in Indian context but since their launch in late 2000s they have competed well with Index funds for shelf space as can be seen from the AUM of ETFs and Index funds launched in and after 2008.

Table 3 puts forward the returns earned by sample Index funds during the period of study. Unlike ETFs, most Index Funds do not suffer from the limitation of data being not available for a 5 year period horizon. The average returns from sample Index funds over a short period up to 2 years outperform the S&P CNX Nifty returns but beyond the 2 year period, in the long run, they seem to lag behind the S&P CNX Nifty returns. This result is crucial because from Table 5, we have seen that the average returns of ETFs, for a period longer than 2 years, were better than S&P CNX Nifty returns. Thus it would be fair to assume that an investor looking to invest in passively managed funds tracking S&P CNX Nifty as the benchmark index, for a period longer than 2 years, should be better off investing in ETFs rather than Index funds.

Table 4 gives us the Returns achieved by the ETFs during the period of study. Most ETFs suffer from the limitation of being recently launched, however, among the older ETFs, Q Nifty ETF seems to have delivered better returns than the GS Nifty ETF. Also, if we compare the average returns of Nifty ETFs with the average returns of S&P CNX Nifty for different periods, it clearly emerges from the Table 5 that in the short run up to 2 years the returns from S&P CNX Nifty beats ETFs returns. However, in the long run i.e. beyond 2 year period ETFs average returns outperform the S&P CNX Nifty average returns.

### **Risk-Return analysis of Index Funds and ETFs**

To analyze and evaluate the performance of Exchange Traded Funds (ETFs) and Index Funds individually and with respect to their benchmarks, we have taken into consideration various performance parameters like Systematic Risk (Beta), R-Square, Returns, Volatility (Standard Deviation), and Tracking Error. Apart from these techniques, risk adjusted measures

Table 1: The assets of sample ETFs operating in India

Sl. No.	Name of the ETF	Launch date	Underlying Index	31 <sup>st</sup> March 2009	31 <sup>st</sup> March 2010	31 <sup>st</sup> March 2011	31 <sup>st</sup> March 2012	31 <sup>st</sup> March 2013
1	GS Nifty ETF	Dec 2001	S&P CNX Nifty Index	-	-	-	564.16	482.21
2	Quantum Index Fund	May 2008	S&P CNX Nifty Index	1.04	1.20	1.42	1.69	2.25
3	Kotak Nifty ETF	Jan 2010	S&P CNX Nifty Index	-	-	34.97	107.02	48.16
4	Motilal Oswal MOST shares 50	July 2010	S&P CNX Nifty Index	-	-	212.85	86.05	75.18
5	Birla Sun Life Nifty ETF	Aug 2011	S&P CNX Nifty Index	-	-	-	5.94	1.37
6	IIFL ETF	Oct. 2011	S&P CNX Nifty Index	-	-	-	28.22	15.71
7	Religare Nifty ETF	May 2011	S&P CNX Nifty Index	-	-	-	2.94	1.93

**Source:** Compiled from [www.nseindia.com](http://www.nseindia.com), <http://money.rediff.com/mutual-funds>, [www.amfindia.com](http://www.amfindia.com)

Table 2: The assets of sample Index funds operating in India

Sl. No.	Index Fund	Launch date	Bench Bark	31 <sup>st</sup> March 2009	31 <sup>st</sup> March 2010	31 <sup>st</sup> March 2011	31 <sup>st</sup> March 2012	31 <sup>st</sup> March 2013
1	Birla Sun Life Index Fund- Plan B (Growth)	Sep 17, 2002	S&P CNX Nifty	15.97	17.35	22.62	14.53	18.29
2	Canara Robeco Nifty Index- Regular Plan-Growth	Sep 27, 2004	S&P CNX Nifty	1.76	4.72	2.27	2.00	2.17
3	Franklin India Index Fund-NSE -Growth	Aug 04, 2000	S&P CNX Nifty	40.59	82.23	83.37	122.20	160.06
4	HDFC Index fund- Nifty Plan (FV Rs 10.326)	Jul 10, 2002	S&P CNX Nifty	25.82	52.21	53.47	80.66	67.15
5	ICICI Prudential index Plan-Regular Pan	Feb 15, 2002	S&P CNX Nifty	35.05	96.60	92.00	87.28	91.54
6	IDBI Nifty Index Fund Growth	May 31, 2010	S&P CNX Nifty	NA	NA	85.67	92.39	84.17
7	IDFC Nifty Fund Regular plan-Growth	Apr 23, 2010	S&P CNX Nifty	NA	NA	5.75	7.48	7.20
8	LIC NOMURA MF Index Fund-Nifty-Growth	Nov 28, 2002	S&P CNX Nifty	29.44	13.56	13.97	15.06	18.21
9	Principal Index Fund-Growth	Jul 27, 1999	S&P CNX Nifty	10.78	15.88	16.38	11.97	17.33
10	Reliance index fund Nifty plan-Direct Plan Growth Plan-Growth	Sep 23, 2010	S&P CNX Nifty	NA	NA	44.40	44.87	47.09
11	SBI Magnum index fund- Regular Plan-Growth	Jan 14, 2002	S&P CNX Nifty	11.30	15.61	20.20	29.97	35.06
12	Tata Index Fund-Nifty plan A	Feb 24, 2003	S&P CNX Nifty	5.79	9.81	7.72	9.15	6.23
13	Taurus Nifty Index Fund-Growth Option	Jun 10, 2010	S&P CNX Nifty	Na	NA	1.04	1.00	0.54
14	UTI Nifty Index Fund-Growth option	Feb 26, 2000	S&P CNX Nifty	113.32	179.06	140.24	134.48	120.64

Source: Compiled from [www.nseindia.com](http://www.nseindia.com), <http://money.rediff.com/mutual-funds>, [www.amfiindia.com](http://www.amfiindia.com)

Table 3: Return of selected Index Funds

Sl.	Index Fund	1 week	1 Month	1 Year	2 Years*	3 Years*	4 Years*	5 Years*
1	Birla Sun Life Index Fund-Plan B (Growth)	0.8%	-0.5%	6.4%	-2.0%	1.8%	15.9%	3.0%
2	Canara Robeco Nifty Index – Regular Plan-Growth	0.9%	-0.6%	6.8%	-1.0%	2.5%	16.5%	3.5%
3	Franklin India Index Fund-NSE –Growth	0.8%	-0.7%	7.0%	-1.14%	2.5%	11.7%	3.6%
4	HDFC Index fund- Nifty Plan (FV Rs 10.326)	0.8%	-0.75	7.3%	-1.4%	2.1%	15.5%	2.9%
5	ICICI Prudential index Plan-Regular Pan	0.8%	-0.7%	-	-	-	-	-
6	IDBI Nifty Index Fund Growth	0.9%	-0.7%	7.1%	-1.2%	-	-	-
7	IDFC Nifty Fund Regular plan-Growth	0.9%	-0.6%	8.7%	0.60%	-	-	-
8	LIC NOMURA MF Index Fund-Nifty-Growth	0.8%	-0.7%	7.0%	-0.87%	2.7%	15.97%	2.63%
9	Principal Index Fund-Growth	0.8%	-0.2%	7.0%	-1.0%	2.5%	16.46%	3.11%
10	Reliance index fund Nifty plan-Direct PlanGrowth Plan-Growth	0.8%	-0.6%	7.8%	0.33%	-	-	-
11	SBI Magnum index fund –Regular Plan-Growth	0.7%	-0.9%	6.3%	-1.72%	2.04%	15.26%	3.0%
12	Tata Index Fund- Nifty plan A	1.0%	-0.5%	7.2%	-0.86%	2.56%	16.54%	3.4%
13	Taurus Nifty Index Fund- Growth Option	0.8%	-0.7%	7.2%	-2.06%	-	-	-
14	UTI Nifty Index Fund-Growth option	0.8%	-0.7%	7.4%	-1.1%	2.4%	16.4%	3.4%
	Average of Index funds	0.8%	-0.6%	7.2%	-1.0%	2.3%	15.5%	3.2%
	S&P CNX Nifty	0.9%	-0.2%	6.8%	-1.2%	2.4%	16.7%	3.7%

\*Compounded Annualized Return.



Table 4: Returns of selected Exchange Traded Fund

Sl. Funds	1 week	1 Month	1 Year	2 Years*	3 Years*	4 Years*	5 Years*
1. Kotak Nifty ETF	0.8%	-0.1%	8.1%	-0.29%	3.3%	-	-
2. GS Nifty ETF	0.9%	-1.4%	6.8%	-1.69%	2.6%	16.5%	3.5%
3. QNifty ETF	0.9%	-1.1%	8.1%	-0.22%	3.5%	17.6%	-
4. Motilal Oswal 50	1.0%	-1.9%	1.5%	-4.2%	-	-	-
5. Birla Sun Life	0.9%	-1.1%	1.5%	-4.2%	-	-	-
6. Religare invesco ETF	0.8%	-0.2%	6.7%	-	-	-	-
7. IIFL ETF	0.9%	-1.1%	-	-	-	-	-
Average of Nifty ETF	0.9%	-1.0%	5.4%	-2.1%	3.13%	17.05%	3.5%
S&P CNX NIFTY	0.9%	-0.2%	6.8%	-1.2%	2.4%	16.7%	3.7%

\*Compound Annualized Return<sup>2</sup>.

Table 5: Risk- Return Profile of Index Funds

Sl. No.	Index Fund	$\beta^3$	Annualized Return	Annualized Std. Dev <sup>4</sup>	Sharpe <sup>5</sup>	Treynor <sup>6</sup>	Jensen <sup>7</sup> Alpha	Annualized Tracking Error <sup>8</sup>
1	Birla Sun Life Index Fund-Plan B (Growth)	0.9981	3.13%	27.3%	-0.179	-0.049	-0.007	3.16%
2	Canara Robeco Nifty Index – Regular Plan-Growth	0.9479	3.62%	26.51%	-0.164	-0.046	-0.004	0.24%
3	Franklin India Index Fund-NSE-Growth	0.9904	5.36%	37.15%	-0.071	-0.027	-0.002	1.82%
4	HDFC Index fund- Nifty Plan (FV Rs 10.326)	0.9780	3.10%	27.01%	-0.184	-0.050	-0.009	1.07%
5	ICICI Prudential index Plan-Regular Plan	1.0052	5.88%	33.88%	-0.063	-0.021	-0.008	1.58%
6	IDBI Nifty Index Fund Growth	0.9706	-3.16%	18.23%	-0.613	-0.115	-0.005	4.57%
7	IDFC Nifty Fund Regular plan-Growth	0.9834	-5.13%	18.25%	-0.522	-0.097	0.012	2.70%
8	LIC NOMURA MF Index Fund-Nifty-Growth	0.9763	2.84%	26.87%	-0.192	-0.0523	-0.012	2.40%
9	Principal Index Fund-Growth	0.9895	3.24%	26.81%	-0.178	-0.048	-0.006	0.78%
10	Reliance index fund Nifty plan-Direct PlanGrowth Plan-Growth	1.0009	-2.06%	18.40%	-0.547	-0.100	0.008	3.91%
11	SBI Magnum index fund –Regular Plan-Growth	0.9768	3.25%	26.84%	-0.177	-0.048	-0.007	3.22%
12	Tata Index Fund- Nifty plan A	0.9884	3.54%	26.82%	-0.166	-0.045	-0.004	0.69%
13	Taurus Nifty Index Fund-Growth Option	0.9654	-3.63%	17.29%	-0.689	-0.1235	-0.015	1.35%
14	UTI Nifty Index Fund-Growth option	0.9920	3.55%	26.98%	-0.164	-0.044	-0.0033	0.52%
	S&P CNX Nifty	1	3.84%	27.11%	-0.153	-0.042		

Table 6: Risks -Return profile of ETFs

Sl. No.	Index Fund	$\beta$	Annualized Return	Annualized Std. Dev	Sharpe Ratio	Treynor Ratio	Jensen Alpha	Annualized Tracking Error
1	GS Nifty ETF	0.996	3.5%	26.9%	-0.165	-0.045	-0.002	1.27%
2	Quantum Nifty ETFS	0.994	6.3%	26.3%	-1.002	-0.017	0.006	0.39%
3	Kotak Nifty ETF	0.997	6.3%	17.4%	-0.094	-0.016	0.009	0.32%
4	Motilal Oswal MOST shares 50	1.017	-7.3%	19.1%	-0.802	-0.150	-0.040	5.93%
5	Birla Sun Life Nifty ETF	0.988	1.4%	17.6%	-0.372	-0.066	0.008	0.38%
6	IIFL ETF	0.995	8.1%	16.1%	0.008	0.001	0.012	0.34%
7	Religare Nifty ETF	0.987	3.1%	17.6%	-0.277	-0.049	-0.0002	1.73%
	S&P CNX Nifty	1	3.84%	27.11%	-0.153	-0.042		

like Sharpe Ratio; Treynor Ratio and Jensen has also been computed to get a fair view of returns yielded by these ETFs and index funds with respect to risk associated with it.

Table 5 gives us the risk return profile of the sample Index funds under study. Franklin India Index Fund Nifty and ICICI regular index fund seems to be performing the best among all the Index funds tracking the same benchmark S&P CNX Nifty as these two are the only Index funds that have higher annualized returns than the S&P CNX Nifty for the period under consideration. However, when we consider the Sharpe ratios, Treynor ratios and Jensen alpha of all these Index funds, we find that across all Index funds the ratios are negative except IDFC Nifty regular plan and Reliance index fund Nifty plan which have positive Jensen alpha but overall results clearly indicates that the investor would have been better off in putting his money in risk free asset classes rather than taking excess risk to achieve the same returns.

Table 6 gives us the risk-return profile of the ETFs. Among all the ETFs under study, IIFL ETF seems to performing the best with regards to annualized returns as at 8.1 % it has the highest returns. Also, another notable point is that IIFL ETF has a positive Sharpe ratio, Treynor Ratio and Jensen alpha which clearly indicate that investors holding this ETF are being properly compensated for the additional risk they are taking for not holding a risk-free asset. Kotak Nifty ETF and Quantum Nifty ETFs seem to be doing quite well in terms of providing good annualized returns among the ETFs under study as both of them like IIFL ETF beats S&P CNX Nifty in terms of annualized returns for the period under consideration but when risk is factored in, they also fail to justify the extra risk taken in yielding those returns as both of them have their Sharpe ratio and Treynor ratio negative but their Jensen alpha is positive. Among the worst performing is the Motilal Oswal MOST shares 50 which is not only giving negative annualized returns but also has high tracking error and beta value greater than 1.

### **Conclusion**

Index Funds and ETFs appeal to the set of investors who are risk averse or are unable to keep track of the markets on a regular basis. From our analysis above on various parameters with respect to these two passive investment vehicles tracking the same benchmark Index, we can safely conclude that ETFs, although are a recent phenomena, but have grown at a faster pace than Index funds in terms of AUMs and NAVs. And this can be very well attributed to the fact that the returns of the sample ETFs are higher than the Index Funds. Also for the excess risk taken in achieving those returns, ETFs fare better than the Index funds as the Sharpe ratio and Treynor ratio of at least two ETFs are positive while none of the Index Funds under study justifies the risk taken for returns achieved and are all negative. Also the average tracking error of ETFs is lower than Index funds clearly suggesting that ETFs fulfill their basic assumption of tracking the Index as perfectly as

possible, better than the Index Funds. Considering all these empirical evidence and factoring in the inherent advantage of ETFs over Index funds with respect to low expense cost and trading like stock, the balance between these passive investment strategies gravitates more towards ETFs. But these passive forms of investments still have not caught the attention of the average Indian investor in a big way. One reason that might explain this phenomena is the fact that the markets in India, unlike in the west, are still not so deep and developed, and to a large extent inefficient that they still provide active mutual fund managers to pick stocks in their portfolio which are undervalued and ultimately deliver better returns than the market. Also the whole point of an index fund and ETFs is that it should be extremely low cost since there is no active management needed but that low cost has not really become a norm in the Indian market barring a few ETFs. Thus until and unless, the markets get evolved and there is lot of information symmetry, the active fund managers will keep on attracting investor by delivering better returns. So for a passive investor, who do not have a risk appetite to invest in active funds and trying to choose between ETFs and Index Funds. It is imperative to do the analysis with respect to returns and risk parameters rather than picking up any funds just because of its passive nature.

#### Notes

$(\text{NAV of current day} - \text{NAV of previous day}) / \text{NAV of previous day} * 100$

$(\text{NAV on 31st Mar'13} / \text{NAV on inception date}) ^ (250/N) - 1$

The systematic risk or beta is a measure of volatility and can be defined as the tendency of a security's returns to respond to swings in the market.

$\text{Covariance (stock vs. market index returns) / Variance (market index returns) Daily Standard Deviation (250)}$

Sharpe ratio =  $(R_t - R_f) / \sigma_i$  this ratio is referred as an excess return to variability measure.

Treynor ratio this ratio is referred as an excess return to volatility measure.

Jensen Alpha  $\hat{\alpha} = R_{it} - R_{ft} + \hat{\alpha} (R_{mt} - R_{ft}) + \hat{\alpha}_i$  this is used to calculate the expected return implied by the zero Beta CAPM for a portfolio with the same risk as the portfolio being evaluated. The differential return is the return on the portfolio being evaluated, less the return implied by the zero Beta CAPM.

The percentage amount a fund's returns deviate from its benchmark returns is referred to as the Tracking Error.

St Dev (Fund Return - Index Return)

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## Determinants of Return on Equity: A Comparative Study of Tata Motors and Maruti Suzuki

AJAY PRATAP YADAV

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Present study aims at finding out extent of impact of factors affecting ROE. Consequently purpose of the study is to evaluate the extent to which, factors (identified as per Du Pont analysis) affect ROE with reference to a case study on Tata Motors and Maruti Suzuki. The study reveals that in case of Maruti Suzuki, ROE is primarily driven by the net profit margin and asset turnover ratio while in case of Tata Motors, Du Pont analysis exhibit that none of the factors have significant impact upon ROE in case of Tata Motors. Off-putting factors like tax burden ratio and interest burden ratio seem to offset the impact of positive factors like net profit margin, asset turnover ratio and asset equity ratio.

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### Introduction

One of the most important profitability metrics is Return on Equity (ROE). ROE reveals how much profit a company earns on total amount of shareholder equity found on the balance sheet. It measures a firm's efficiency at generating profits from every unit of shareholders' equity. ROE shows how well a company uses investment funds to generate earnings growth. Shareholders equity is what the shareholders own. ROE reveals how a company is deploying its capital to build a profitable business. The higher the ROE, the more wealth the company is creating for its shareholders and the better return they can expect from their investment. Thus ROE serves towards achieving a company's ultimate goal of shareholders wealth maximization.

ROE is accepted as the best profit metric to evaluate the performance of a business. However, the primary emphasis on financial ratio analysis must be on operating performance. That is, after all, where value creation takes place (*Burns, Timothy and Stephan 2008*). In light of above justification about ROE, it is imperative to look into those factors that have important bearing with ROE of Companies. To examine the impact of various factors on ROE, the study follows the Du Pont system of financial analysis created in 1919 by a finance executive at E.I. du Pont de Nemours and Co. of Wilmington.

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### Du-Pont Model (ROE)

#### Three -Step Model

Basically there are three components in the calculation of return on equity using the traditional Du Pont model;

- Net Profit Margin
- Asset Turnover and
- Equity Multiplier. (Asset Equity Ratio)

$$\text{ROE} = \frac{\text{EAT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average Assets}} \times \frac{\text{Average Assets}}{\text{Average shareholders' Equity}}$$

In the DuPont system one can drill back into these three levers to determine where profit performance is coming from and potentially determine where management time should be spent for improving profits. Specifically DuPont measures (Bernhardt Kevin, *UW-Extension, UW-Platteville, and UW Center for Dairy Profitability, 2009*):

1. How efficiently inputs are being used to generate profits [earnings]
2. How well capital assets are being used to generate gross revenues [turnings]
3. How well the business is leveraging its debt capital [leverage]

By examining each input individually, we can observe the extent of impact on ROE.

*Net Profit Margin:* The net profit margin is simply the after-tax profit a company generated for each rupee of revenue. Net profit margins vary across industries, making it important to compare a potential investment against its competitors. Net profit margin tells us relative efficiency of the firm after taking into account all expenses and income taxes, but not extraordinary charges, (Horne & Dhamija, 2012). It is calculated as follows:

$$\text{Net Income} \div \text{Revenue}$$

Although the general rule-of-thumb is that a higher net profit margin is preferable, but management often purposely lower the net profit margin in a bid to attract higher sales. This low-cost, high-volume approach has turned companies such as Wal-Mart and Nebraska Furniture Mart into veritable behemoths.

It should bear in the mind that an increase in sales does not mean as a proportionate increase in profits. With increase in sales, its expenses also increase. With the increase in expenses, the net profit margin may shrink. If increased expenses would be compensated with an increase in the sales price of the product, there may be a decrease in the sales volume due to the higher price. Consequently, total revenues could decrease despite the increase of price per product. However, the opposite may happen as the cost of production could decrease as production increases.



*Asset Turnover Ratio (ATR):* The asset turnover ratio is a measure of how effectively a company converts its assets into sales. It is calculated as follows:

$$\text{Asset Turnover} = \text{Revenue} \div \text{Assets}$$

This ratio determines the efficiency with which assets are being utilized. This measures the company's ability to generate sales revenue in relation to the size of asset investment (*Kishore, 2004*).

It should be noted that the asset turnover ratio formula does not look at how well a company is earning profits relative to assets. The formula only looks at revenues and not profits. This is the distinct difference between return on assets (ROA) and the asset turnover ratio, as return on assets looks at net income, or profit, relative to assets.

The asset turnover ratio tends to be inversely related to the net profit margin; i.e., the higher the net profit margin, the lower the asset turnover. The result is that the investor can compare companies using different models (low-profit, high-volume vs. high-profit, low-volume) and determine which one is the more attractive business.

*Equity Multiplier:* The equity ratio is a financial ratio indicating the relative proportion of equity used to finance a company's assets. The two components are often taken from the firm's balance sheet or statement of financial position (book value). A higher equity multiplier indicates higher financial leverage, which means the company is relying more on debt to finance its assets.

It is possible for a company with terrible sales and margins to take on excessive debt and artificially increase its return on equity. Thus equity multiplier allows the investor to see what portion of the return on equity is the result of debt. The equity multiplier is calculated as follows:

$$\text{Equity Multiplier} = \text{Assets} \div \text{Shareholders' Equity.}$$

### **Objectives of the Study**

Central part of objectives of this study is to evaluate the extent to which, factors identified as per three step Du Pont analysis and five step Du- Pont analysis affects ROE with reference to a case study on Tata Motors and Maruti Suzuki.

However, detailed objectives have been outlined as under:

- i) To examine impact of net profit margin, asset turnover ratio and asset equity ratio on return on equity.
- ii) To evaluate extent of impact of pre-interest pretax margin, the interest burden ratio, and the tax efficiency ratio on net profit margin.
- iii) To examine impact of asset turnover ratio, asset equity ratio, pre-interest pretax margin, interest burden ratio, and the tax efficiency ratio on return on equity.

### **Research Design**

The research design followed for this study is hybrid in nature.

*Period of Study:* The study covers 10 years period (2003-2012).

The three factors namely net profit margin, asset turnover ratio and asset equity ratio have been considered as independent factors and ROE as dependent factor. Multiple regression analysis has been conducted for the purpose of examining degree of impact of independent factors on ROE. To justify the above mentioned objectives, following three equations have been formulated as:

$$\text{ROE} = \beta_0 + \beta_1 (\text{net profit margin}) + \beta_2 (\text{ATR}) + \beta_3 (\text{asset equity ratio}) + e \quad \dots (i)$$

Where,

ROE = Dependent factor

$\beta_0$  = the intercept of the equation

$\beta_1$ - $\beta_3$  = coefficients of variables

e = Error term

$$\text{ii) Net Profit Margin} = \beta_0 + \beta_1 (\text{operating profit margin}) + \beta_2 (\text{tax burden ratio}) + \beta_3 (\text{interest burden ratio}) + e \quad \dots (ii)$$

Where,

Net Profit Margin = Dependent factor

$\beta_0$  = the intercept of the equation

$\beta_1$ - $\beta_3$  = coefficients of variables

e = Error term

$$\text{iii) Return on Equity (ROE)} = \beta_0 + \beta_1 (\text{net profit margin}) + \beta_2 (\text{ATR}) + \beta_3 (\text{asset equity ratio}) + \beta_4 (\text{tax burden ratio}) + \beta_5 (\text{interest burden ratio}) + \beta_6 (\text{operating profit margin}) + e \quad \dots (iii)$$

Where,

ROE = Dependent factor

$\beta_0$  = the intercept of the equation

$\beta_0$ - $\beta_6$  = coefficients of variables

e = Error term

**Limitations of the Study** The study has some limitations. The study is limited to the extent of analyzing only ROE. The findings from the historical data may not be representative of the future. Further, findings and conclusions are purely based on statistical testing that may have certain limitations. The study is completely based upon financial figures with respect to concerned firms. The study have not considered the actions of concerned company in the capital market (buyback) Further, there may be a number of company specific factors and macro economic factors in general having enough impact on ROE but the study is concerned with possible identification of factors affecting ROE with the assistance of DuPont analysis.

Moreover, to reach a feasible conclusion, there must be combined examination of all concerned financial ratio. This study however, does not

attempt to analyse overall profitability and financial performance rather it is concerned with already mentioned objectives only.

Table 1: Maruti Suzuki

Descriptive Statistics (10 Years)						
	Average	Standard Deviation	Median	Skewness	Kurtosis	CV
ROE	16.54	5.59	18.06	-1.10	1.10	0.35
Net Profit Margin	6.97	2.57	6.86	-0.648	0.269	0.39
Asset Equity Ratio	1.07	0.037	1.07	0.19	1.168	0.036
Asset Turnover Ratio	2.22	0.20	2.21	0.343	-0.636	0.093
Tax Burden Ratio	0.70	0.25	0.75	-2.18	5.95	0.37
Interest Burden Ratio	0.55	0.14	0.60	-0.40	-1.78	0.27
Return on Sales	0.13	0.02	0.13	-0.91	-0.50	0.19

Table 2: Tata Motors

Descriptive Statistics (10 Years)						
	Average	Standard Deviation	Median	Skewness	Kurtosis	CV
ROE	17.20	7.91	16.75	0.204	-1.8	0.48
Net Profit Margin	5.37	1.79	6.18	-0.538	-1.57	0.35
Asset Equity Ratio	1.70	0.23	1.59	0.701	-0.28	0.14
ATR	2.02	0.59	2.25	-0.775	-1.11	0.31
Tax Burden Ratio	0.66	0.063	0.67	-2.65	7.63	0.10
Interest Burden Ratio	0.73	0.12	0.75	-1.09	1.21	0.18
Return on Sales	0.14	0.03	0.14	-0.54	-1.20	0.23

Statistical Results (Three Step Model):

With reference to equation -I

$$(ROE = \beta_0 + \beta_1 (\text{net profit margin}) + \beta_2 (\text{ATR}) + \beta_3 (\text{asset equity ratio}) + e$$

following results have been observed.

Table 3: Maruti Suzuki

### Regression

Particulars	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
Intercept ( $\beta_0$ )	-25.61	13.00	-1.97	0.096	Insignificant
Net Profit Margin ( $\beta_1$ )	2.26	0.11	20.32	<0.001	Significant
Asset Turnover Ratio( $\beta_2$ )	7.22	1.54	4.70	0.003	Significant
Asset to Equity Ratio( $\beta_3$ )	9.67	9.13	1.05	0.330	Insignificant

Adjusted R<sup>2</sup> = 0.98

Contd...

**Analysis of Variance**

Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	310.69	3	103.56	235.29	< .001
Error	2.64	6	0.44		
Total	313.33	9			

**Tata Motors****Regression**

Particulars	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
Intercept ( $\beta_0$ )	-14.74	25.22	-0.58	0.580	Insignificant
Net Profit Margin ( $\beta_1$ )	2.64	0.58	4.51	0.004	Significant
Asset Turnover Ratio( $\beta_2$ )	8.03	4.47	1.79	0.123	Insignificant
Asset to Equity Ratio( $\beta_3$ )	0.89	10.77	0.082	0.937	Insignificant

Adjusted R<sup>2</sup> = 0.91

**Analysis of Variance**

Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	587.73	3	195.91	30.81	< .001
Error	38.16	6	6.36		
Total	625.89	9			

The t-statistic measures how many standard errors the coefficient is away from zero, therefore higher the t-value, the greater the confidence we have in the coefficients as predictors. In case of Maruti Suzuki, the results (coefficients of variables) that all the independent variables have positive impact on ROE shows Table 2. But net profit margin and asset turnover ratio significantly affect ROE of Maruti Suzuki. Leverage does not appear to be an important factor in determination of ROE in case of Maruti Suzuki. The adjusted R<sup>2</sup> also called the coefficient of multiple determinations is the percent of the variance in the dependent variable explained uniquely or jointly by the independent variables. R<sup>2</sup> = 98.00% which shows that there is 98.00% variation in the dependent variable attributable to the independent variables. The intercept is the constant, where the regression line intercepts the y axis, representing the amount the dependent y will be when all the independent variables are 0. In this case the intercept is -25.61 (insignificant). F- Test examines for a significance of linear regression relationship between the response variable and the predictor variables. According to the observation above, it can be inferred that relationship of dependent variable and independent variables (F static: 235.29, P value: <.001) is significant.

Further, if a company's ROE goes up due to an increase in the net profit margin or asset turnover, this is a very positive sign for the company. However, if the equity multiplier is the source of the rise, and the company was already appropriately leveraged, this signifies that financial risk of company is increasing thereby making it more risky. The company could be under-leveraged as well. In this case it could be positive and show that the company is managing itself better. (Pinsent Wayne, 2008). In case of Maruti Suzuki, it appears to be factual.

Furthermore, examination with DuPont analysis may reveal that despite decreasing net profit margin and asset turnover, stability of ROE may be the result of large increase in leverage. This may possibly be bad sign irrespective of earlier situation of any company (Pinsent, 2008). As far as Maruti Suzuki in concerned, its ROE is mostly dependent on net profit margin since trend of net profit margin and ROE are almost similar for the company. Asset turnover ratio is observed to be almost constant over the period and low leverage obviously has infrequent bearing with ROE.

Statistically speaking, in case of Tata Motors (Table-3), Positive coefficients indicate that all the concerned independent factors have positive impact on ROE. Observations indicate that net profit margin is most important determinant in explaining ROE of the company. Asset turnover ratio does not seem to have impressive effect on behavior of ROE. In case of Tata Motors also, leverage has been observed to be insignificant component in deciding ROE. The adjusted  $R^2$  is 91.00% which shows that there is 91.00% variation in the dependent variable attributable to the independent variables. The intercept in this case is -14.74 (insignificant). F static is 30.81 (P value = <.001) indicates significant relationship between dependent and independent variables.

However, level of leverage is high in case of Tata Motors as compared to Maruti; therefore it may be possible that further increase in leverage would make it more risky. Moreover in case of Tata Motors situation appears to be more complicated because both net profit margin and asset turnover ratio have been observed to show decreasing trend while equity multiplier is exhibiting increasing trend. It may be possible reason behind less consistency in ROE of Tata Motors (Table-1) as compared to Maruti Suzuki (Table-2) despite having higher average ROE.

Statistical observations under three step Du Pont model reveal that net profit margin significantly affects and determine ROE for both the companies.

#### Limitations of Three Step Model

The three-step DuPont Model exhibits determinants that define a Company's return on equity. ROE can be improved by improving profitability, efficient utilization of its assets more efficiently, or by taking on additional leverage. But the fact must be kept in mind that inclusion of debt capital beyond an appropriate level, will, bring down profit margins and decrease asset turnover. However, the three step model does not reveal the impact borrowing cost associated with leverage.

### Five Step Du-Pont Model

Keeping in mind inadequacy, of three-step model, it has been redefined with expanded, *five-step model*, which breaks down the net profit margin further to assess the impact of higher borrowing costs associated with increased leverage. Obviously, if a company has a high cost of borrowing, its interest expense on more debt could offset the positive effects of increased leverage. Further, interest expenses for most Companies are tax-deductible, so the extended model considers interest charges (EBT/EBIT) and the company's tax burden (EAT/EBT). (Thorp, 2012).

The extended five-step DuPont Model breaks return on equity down into five components:

- Operating Profit Margin = EBIT ÷ sales;
- Asset turnover = Sales ÷ Average total assets;
- Interest burden = (EBIT – interest expense) ÷ EBIT;
- Tax Burden = EAT ÷ EBT; and
- Leverage ratio (equity multiplier) = average total assets ÷ average shareholders' equity.

$$ROE = \frac{EBIT}{Sales} \times \frac{Sales}{Average\ Assets} \times \frac{EBT}{EBIT} \times \frac{EAT}{EBT} \times \frac{Average\ Assets}{Average\ shareholders'\ Equity}$$

Multiplication of the pre-interest pretax margin, the interest burden ratio, and the tax efficiency ratio give us net profit margin (net income ÷ sales). Multiplication of all five ratios together gives us return on equity.

Since findings of three step model detect that net profit margin is one of the most important factor in deciding company's ROE. Therefore, an attempt has also been made to access the impact of pre-interest pretax margin, the interest burden ratio, and the tax efficiency ratio on net profit margin. To serve the purpose, following equation (ii) has been developed:

$$Net\ Profit\ Margin = \beta_0 + \beta_1 (operating\ profit\ margin) + \beta_2 (tax\ burden\ ratio) + \beta_3 (interest\ burden\ ratio) + e$$

Table 4: Maruti Suzuki

### Regression

Particulars	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
Intercept ( $\beta_0$ )	-19.09	6.76	-2.82	0.30	Insignificant
Operating Profit Margin( $\beta_1$ )	35.86	40.59	0.88	0.41	Insignificant
Tax burden Ratio( $\beta_2$ )	16.52	4.93	3.35	0.01	Significant
Interest burden ratio( $\beta_3$ )	15.76	5.19	3.04	0.02	Significant
Adjusted R <sup>2</sup> = 0.79					

Contd...

**Analysis of Variance**

Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	56.96	3	18.98	12.18	< .0006
Error	09.35	6	1.56		
Total	66.31	9			

**Tata Motors****Regression**

	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
Intercept ( $\beta_0$ )	-0.62	1.05	-0.59	0.57	Insignificant
Operating Profit Margin ( $\beta_1$ )	71.45	5.26	13.57	<.001	Significant
Tax Burden Ratio( $\beta_2$ )	-1.52	2.12	-0.72	0.50	Insignificant
Interest Burden Ratio( $\beta_3$ )	-3.90	1.59	-2.46	0.05	Insignificant

Adjusted R<sup>2</sup> = 0.98

**Analysis of Variance**

Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	31.66	3	10.55	123.05	< .001
Error	0.51	6	.086		
Total	32.17	9			

In case of Maruti, tax burden is increasing but interest burden and operating profit margin are decreasing while net profit margin exhibits a trivial increasing trend over the years (Annexure-1). Reason may be attributed to operating efficiency of Maruti Suzuki. Statistically, while examining impact of operating profit margin, tax burden ratio and interest burden ratio, it has been observed that, in case of Maruti Suzuki, tax and interest as deciding factors for net profit margin found to be most important. The adjusted R<sup>2</sup> is 79.00% which shows that 79.00% of net profit of Maruti Suzuki is being affected by the factors namely operating profit, Tax burden and interest burden. The intercept in this case is -19.09 (insignificant). Value of F static is 12.18 (P value = <.0006) indicates significant relationship between net profit and other three factors mentioned above (Table: 3) as a whole.

In case of Tata Motors, net profit margin is observed to be very much affected by operating profit and interest burden. Though interest burden and tax burden both have observed to be negatively correlated with net profit but interest played important role in downsizing profitability of Tata Motors. Moreover, during the study period, interest and tax burden observed with increasing trend while operating profit margin exhibited a minor decreasing trend. Net impact resulted in decreasing trend in net profit margin over the

years. The adjusted R<sup>2</sup> is 98.00% which shows that 98.00% of net profit of Tata Motors is, to great extent, being decided by the factors namely operating profit, Tax burden and interest burden. The intercept in this case is -0.62 (insignificant). Value of F static is 123.05 (P value = <.001) indicates significant relationship between net profit and other three independent factors.

Further, all the factors of five step model are integrated together to find out a comprehensive impact on ROE. According to five step model, the previous equation (i) can be further extended as:

$$\text{iii) Return on Equity (ROE)} = \beta_0 + \beta_1 (\text{net profit margin}) + \beta_2 (\text{ATR}) + \beta_3 (\text{asset equity ratio}) + \beta_4 (\text{tax burden ratio}) + \beta_5 (\text{interest burden ratio}) + \beta_6 (\text{operating profit margin}) + e$$

Table 5: Maruti Suzuki

	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
<b>Regression</b>					
Intercept ( $\beta_0$ )	-22.99	17.77	-1.29	0.286	Insignificant
Net Profit Margin( $\beta_1$ )	1.86	0.27	6.92	0.006	Significant
Asset Turnover Ratio ( $\beta_2$ )	6.19	1.84	3.37	0.043	Significant
Asset Equity Ratio( $\beta_3$ )	1.56	12.40	0.13	0.908	Insignificant
Tax Burden Ratio (EAT/EBT) ( $\beta_4$ )	6.47	4.38	1.48	0.236	Insignificant
Interest Burden Ratio (EBT/EBIT) ( $\beta_5$ )	4.07	4.46	0.91	0.428	Insignificant
Return on sales(EBIT/Sales) ( $\beta_6$ )	30.62	21.49	1.43	0.249	Insignificant
Adjusted R <sup>2</sup> = 0.98					
<b>Analysis of Variance</b>					
Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	312.08	6	52.01	125.06	< .001
Error	1.25	3	0.41		
Total	313.33	9			
<b>Tata Motors</b>					
<b>Regression</b>					
	Coefficient	St. Error	t value	P (2 tail)	Result at 5% significance level
Intercept ( $\beta_0$ )	-23.01	34.98	-0.66	0.558	Insignificant
Net Profit Margin( $\beta_1$ )	-02.14	04.31	-0.50	0.654	Insignificant

Contd...



Asset Turnover Ratio( $\beta_2$ )	8.81	05.48	1.61	0.206	Insignificant
Asset Equity Ratio( $\beta_3$ )	2.05	13.41	0.15	0.888	Insignificant
Tax Burden Ratio(EAT/EBT) ( $\beta_4$ )	-3.24	23.31	-0.14	0.898	Insignificant
Interest Burden Ratio (EBT/EBIT) ( $\beta_5$ )	-20.83	23.79	-0.87	0.446	Insignificant
Return on Sales(EBIT/Sales) ( $\beta_6$ )	346.04	305.32	1.13	0.339	Insignificant

Adjusted  $R^2 = 0.87$

#### Analysis of Variance

Source	Sum of Square	Degree of Freedom	Mean Sq	F	P value
Regression	599.22	6	99.87	11.23	< .037
Error	26.66	3	8.89		
Total	625.88	9			

According to statistical analysis it can be observed that in case of Maruti, net profit margin and asset turnover ratios found to be most significant factors in determination of return on equity. Other independent factors though affect positively but do not hold noteworthy impact on ROE of Maruti. The adjusted  $R^2$  is 98.00% which shows that there is 98.00% variation in the dependent variable attributable to the independent variables. The intercept in this case is -22.99 (insignificant). Value of F static is 125.06 (P value = <.001) indicates significant relationship between response variable and predictor variables. The results as per five step model are almost same as compared to three step DuPont analysis.

In case of Tata Motors, the results appear to be different than that of Maruti Suzuki. Tax burden ratio and interest burden ratio have negative impact on ROE. Further observation expose that all independent factors have insignificant impact on ROE of Tata Motors. Off-putting factors like tax burden ratio and interest burden ratio seem to offset the impact of positive factors like net profit margin, asset turnover ratio, asset equity ratio and return on sales ratio. The adjusted  $R^2$  is 87.00% which shows that there is 87.00% variation in the dependent variable attributable to the independent variables. The intercept in this case is -23.01 (insignificant). F static is 11.23 (P value = <.037) indicates significant relationship between dependent and independent variables.

#### Conclusion

The study reveals that in case of Maruti Suzuki, ROE was primarily driven by the net profit margin and asset turnover ratio (under both three step as well as Five step Du-Pont model) while in case of Tata Motors, net profit margin observed to be important determinant of ROE (under three step Du Pont model) but the extended model (five step DuPont model) observed that none of the factors could significantly affect in defining ROE. Though average

ROE of Tata Motors is more than that of Maruti Suzuki (Table-1 & Table -2), despite declining trend in net profit margin and asset turnover ratio. The reason may be attributed to increasing level of leverage during the study period. However though higher, but ROE of Tata Motors is observed to be declining as compared to Maruti Suzuki. In case of Tata Motors, leverage does not seem to change significantly and asset turnover ratio is almost stable than it is only profit margin that require a major concern. Tata Motoris more leveraged (average debt proportion observed to be 40 percent during study period) as compared to Maruti Suzuki during the study period. With reference to statistical findings, impact of leverage, in both the cases observed to be irrelevant in defining ROE.

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**ANNEXURE-I****Maruti Suzuki**

Particulars Years	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Ratios</b>										
Profit Margin	1.56	6.33	7.39	10.16	10.22	9.34	5.72	8.34	6.13	4.53
ATR	2.08	2.42	2.36	2.21	1.98	1.94	2.06	2.32	2.59	2.22
ROE	3.93	17.10	19.03	23.24	22.63	19.20	13.23	20.29	16.08	10.75
Asset Equity Ratio	1.15	1.08	1.07	1.01	1.09	1.10	1.07	1.07	1.02	1.07
Tax Burden Ratio (EAT/EBT)	0.57	0.63	0.75	0.74	0.74	0.78	0.97	0.79	0.82	0.94
Interest Burden Ratio (EBT/EBIT)	0.43	0.67	0.69	0.68	0.69	0.68	0.39	0.54	0.43	0.32
Return on sales (EBIT/Sales)	0.13	0.15	0.14	0.15	0.14	0.13	0.10	0.15	0.10	0.087

**Tata Motors**

Particulars Years	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Ratios</b>										
Profit Margin	3.29	6.10	7.02	7.35	6.94	6.96	3.77	6.26	3.74	2.26
ATR	2.21	2.68	2.63	2.40	2.49	2.06	1.02	1.14	1.35	2.29
ROE	12.32	22.98	30.12	24.77	24.67	21.18	7.45	9.61	9.46	9.44
Asset Equity Ratio	1.56	1.35	1.60	1.53	1.58	1.80	2.06	2.12	1.79	1.57
Tax Burden Ratio (EAT/EBT)	0.48	0.68	0.64	0.67	0.67	0.67	0.70	0.68	0.70	0.71
Interest Burden Ratio (EBT/EBIT)	0.45	0.60	0.74	0.85	0.89	0.82	0.71	0.82	0.76	0.68
Return on sales (EBIT/Sales)	0.093	0.14	0.16	0.17	0.17	0.17	0.12	0.15	0.12	0.095

**Components of Capital Employed**

Year	Tata Motors (%)			Maruti Suzuki (%)		
	Share Capital	Reserve & Surplus	Loan	Share Capital	Reserve & Surplus	Loan Capital
2003	8	56	36	4.0	83.0	13.0
2004	7	67	26	4.0	88.0	8.0
2005	5	57	38	3.0	90.0	7.0
2006	4	61	35	3.0	96.0	1.0
2007	3	60	37	2.0	90.0	8.0
2008	3	53	44	1.6	89.0	9.5
2009	2	46	52	1.0	92.0	7.0
2010	2	46	52	1.0	93.0	6.0
2011	2	54	44	1.0	97.0	2.0
2012	2	62	36	0.8	92.5	6.6

## Determinants of Capital Structure – A Comparative Study of Chemical and Computer Industry

HARVINDER SINGH MAND AND MANJIT SINGH

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*The purpose of this study is to find and compare the determinants of capital structure in the Indian Chemical and Computer Software industry. A sample of 23 companies from each sector has been selected from BSE-500 for the period 2001-02 to 2010-11. The results for Chemical industry reveals the use of static trade-off and pecking order theory for framing the policies for their capital structure whereas the capital structure of Computer industry has been framed as consistent with the expectations of Pecking order theory. This study contributes to the literature on the factors that determine the capital structure of the firm. The findings may be useful for financial managers, investors, and financial management consultants.*

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### Introduction

Capital structure is a mix of securities required for financing the investment needs. A firm can use a specific mix of debt and equity to finance its operations (Abor, 2005) and to have an optimal capital structure. The capital structure decision is important to minimize the risk of bankruptcy and to maximize the shareholders' wealth. Since the seminal work of Modigliani and Miller (1958) there are so many authors who developed capital structure theory and tried to depart from their assumptions. However, the empirical evidence regarding the alternative theories is still inconclusive (Rajan & Zingales, 1995). What makes the capital structure debate so exciting is that only a few of the developed theories have been tested by empirical studies and the theories themselves lead to different, not mutually exclusive and sometimes opposed results and conclusions (Gill *et al.*, 2009).

The dependent and independent variables for this study have been selected on the basis of previous empirical studies on capital structure. Different variables that determine the capital structure of the firm can be found in the literature but most of the studies include four or five independent variables only. There are so many other variables that have not been considered in studies but the selection of exploratory variables for this study is based on the previous empirical studies on capital structure. The choice is sometimes

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limited, however, because of lack of relevant data, the final set of proxy variables includes fifteen variables.

### **Literature Review**

Huang and Song (2001) employed a database which contained the market and accounting data from more than 1000 Chinese listed companies up to the year 2000. Authors found that leverage increases with firm size and fixed assets, and decreases with profitability and correlates with industries. Nguyen and Neelakantan (2006) used small and medium Vietnamese firms to collect data and found that leverage is positively related to firm growth and firm size and negatively related to tangibility. Biger *et al.* (2008) collected data from enterprise's census 2002-2003 conducted by the General Statistical Office, Vietnam and found that leverage increases with firm size and decreases with profitability and growth opportunities. Gill *et al.* (2009) collected data from American firms and found that leverage is negatively correlated with profitability and collateralized assets. Al-Qaisi (2010) collected data from United Arab Emirates (UAE) and found a negative relationship between profitability and leverage and a positive relationship between firm size and leverage. Odit and Gobardhun (2011) collected data from Mauritius firms and found a positive relationship between leverage and firm growth. Gill and Mathur (2011) collected data from 166 Canadian firms and found a positive relationship between firm size and leverage and negative relationships between i) profitability and leverage and ii) collateralized assets and leverage.

### **Objectives and Scope of the Study**

To identify the most significant factors considered by Chemical and Computer industry for the design of capital structure and then compare them, the proposed study has been based on secondary data. The necessary data has been procured from the 'Prowess' maintained by Centre for Monitoring Indian Economy (CMIE). The present study covered period of ten years from 2001-02 to 2010-11. From the list of 500 top companies from Bombay Stock Exchange, firms relating to Chemical and Computer Industry have been selected. After critically examining for the consistency and availability of data for each firm we are left with a sample of 23 firms from both the industries.

### **Research Design**

**Dependent Variable** Capital structure refers to the mix of securities issued for financing the assets used by a firm. The definition of leverage depends on the objective of the analysis (Rajan and Zingales, 1995). In this study, two different measures of capital structure have been used. Following the literature survey, total debt to total assets and debt equity ratio has been used as the proxy for measuring capital structure in the present study. Debt equity being the true measure of leverage in the sense that fixed interest commitment acts as a lever to enlarge return to shareholders. Total debt

includes debt from banks (short term as well as long term) and financial institutions, inter-corporate loans, fixed deposits from public and directors, foreign loans, loan from government, etc. Funds rose from the capital market through the issue of debt instruments such as debentures (both convertible and non-convertible) and commercial paper are also included here. The equity includes equity share capital, preference share capital and reserve & surpluses minus revaluation reserves & miscellaneous expenses not written off. This study has used book value of debt and equity. Total assets include both fixed assets and current assets but excluding fictitious assets. The leverage has been defined for the purpose of this study as follows:

$$\text{Capital Structure} = \text{Debt/Equity}$$

$$\text{Capital Structure} = \text{Total Debt/Total Assets}$$

**Independent Variables:** The measures used for independent variables have been defined on the lines of previous literature available on this concept. The empirical evidences for those factors have been discussed in the following section:

**Growth:** Percentage change in total assets has been used to measure growth.

**Size:** Size (SZ) of the firm has been measured by taking the natural log of total assets.

**Profitability:** Profitability has been measured by dividing the earnings before interest and taxes (EBIT) by total assets.

**Tangibility:** The percent of net fixed assets to total assets has been used to measure tangibility.

**Age:** Age has been measured by number of years since incorporation.

**Earning Volatility:** The value of deviation from mean of net profit divided by total number of years for each firm in a given year has been used as a proxy for measuring earning volatility.

**Debt Service Capacity :** The ratio of earnings before interest and taxes to fixed interest charges has been used as proxy for measuring the debt service capacity.

**Dividend Payout Ratio :** This study has used dividend per share to earnings per share to measure the dividend payout ratio.

**Liquidity:** This study has used the ratio of current assets to current liabilities as a proxy for liquidity.

**Non-Debt Tax Shields (NDTS):** This study has used the depreciation scaled down by total assets to measure non-debt tax shield.

**Degree of Operating Leverage :** The percentage change in EBIT to percentage change in sales is being used for measuring the operating leverage.

**Price-Earning Multiplier (P/E):** MPS/EPS has been used as a proxy for price-earning multiplier.

**Promoters Shareholding:** Promoter shareholdings have been measured as a percentage of shares held by the promoters to the total number of shares outstanding.

Effective Tax Rate: The effective tax rate has been measured as:

$$TR = 1 - (\text{Earnings after Tax} / \text{Earnings before Tax})$$

Uniqueness : This study has used selling and distribution expenses over sales as a proxy for uniqueness.

All variables were calculated using book value.

**Panel Data Model:** The panel data model has been adopted from Cuong and Canh (2012). This study has been conducted for a period of ten years and 23 companies from both the sectors have been included in final sample, hence, Panel data regression model should have been appropriate test to observe the relation among dependent and independent variables. Panel data have space as well as time dimension (Gujrati, 2004).

First, we perform panel data techniques of Fixed Effects model and Random Effects model, then; we compare the beta values from both models for Hausman's Specification test to check the suitability of model. If the results of this test rejects the null hypothesis, which is, "difference in coefficients not systematic", then Fixed Effects model should have been used otherwise Random Effects model should be preferred. Further, we test the validity of Fixed Effects model and Random Effects model by applying F-test and Wald's Chi-square test respectively. Variance Inflation Factor (VIF) has been applied to check the multi-collinearity among independent variables. In the present study, analysis has been performed with the help of software package STATA.

Following statistical tools have been used for establishing the relationship among the dependent and independent variables.

**VIF Test:** Gaud *et al.* (2003) has quoted that the collinearity should not constitute a problem, if VIF values are lower than 10. The results reveal that VIF values for all independent variables in all models have been found to be less than 3, therefore, collinearity should not be problem for all the models of this study.

**Hausman Test for Fixed versus Random Effects:** To deal with the problem of heteroskedasticity and serial correlation, we select an appropriate model by testing Fixed versus Random Effects models by applying Hausman's Specification test. Only appropriate models on the basis of outcome from Hausman's Specification test have been used for the interpretation.

## Results

### Regression Analysis

After applying Hausman's Specification test, appropriate regression models for both the measures in Chemical and Computer industry have been displayed for interpretation in Table 1.

Fixed-effects and Random-effects regression model have been applied on data, thereafter coefficients are compared to get the value of Hausman's test. The p-value for Hausman's Specification test is small enough to reject the null hypothesis that indicates the use of Fixed-effects model over Random-

effects model. Therefore, Fixed-effects model has been exhibited for both the models of Chemical industry in the Table for interpretation. The F-statistics is 5.64 and 5.27 respectively with p-value for both are 0.0000 which show the validity and significance of these models. Therefore, these models are fit for interpretation. R-square (within) is 0.3058 and 0.2918 respectively which divulges that these models have explained 30.58 per cent and 29.18 per cent of variation in leverage due to change in independent variables within companies over the time period selected for present study.

The value of Hausman's Specification test is 9.62 with a p-value of 0.5651 which fails to reject the null hypothesis. Therefore, Random-effects model has been considered appropriate for TD/TA in Computer industry. The value of Wald chi-square test has been statistically significant at .01 level specifying the validity and robustness of model. The value of Hausman's Specification test for D/E model in Computer industry is 47.78 and p-value is small enough to reject the null hypothesis in favour of Fixed-effects regression. F-test shows the strength of model. The value of R-square (within) discloses that 54.86 per cent of variation in leverage over time within a company has been explained by model.

The relation of size with the capital structure has been found positive in both the models and the relation is statistically significant at .01 and .10 level respectively for TD/TA and D/E models in Chemical industry but the relation between them have been found negative and statistically significant at .01 level for both models in Computer Software industry. Positive relation between size and capital structure supports the prediction of Static trade-off theory and the negative relation in case of Computer Software industry is as per the expectation of Pecking order theory. The relation of profitability with capital structure has been found negative for Chemical industry and relation has been found statistically significant at .05 level under both the models consistent with the expectations of Pecking order theory whereas profitability has not been found statistically significant variable for capital structure.

The beta coefficients for tangibility has shown the relation as positive with capital structure and p-value of less than .01 supports the statistical significance of variable for determining the capital structure in Chemical industry. But the relation of tangibility with capital structure has been found negative and statistically significant in Computer Software industry. The relation of tangibility with leverage has been supporting the predictions of Static trade-off theory in Chemical industry and consistent with the Pecking order theory in Computer Software industry. The negative relation of age with capital structure has been supporting the expectation of Pecking order theory whereas the relation has been found positive for both the models in Computer Software industry but the relation is statistically significant at .01 level in D/E model only.

The relation of earning variability with capital structure has been found positive and statistically significant under TD/TA model in Chemical industry contradicting the Static trade-off and Pecking order theory but the relation



Table 1: Regression results for determinants of capital structure

Regression Model	Chemical Industry		Computer Software Industry	
	TD/TA	D/E Ratio	TD/TA	D/E Ratio
	Fixed-effects	Fixed-effects	Random-effects	Fixed-effects
R-Square	R-sq: within = 0.3058 Between = 0.0317 overall = 0.0316	R-sq: within = 0.2918 between = 0.0245 overall = 0.0257	R-sq: within = 0.4482 between = 0.2691 overall = 0.4057	R-sq: within = 0.5486 between = 0.0128 overall = 0.0920
F-test results	F (15,192)= 5.64 p-value = 0.0000	F (15,192) = 5.27 p-value = 0.0000	Wald- $\chi^2$ (15) = 146.09 p-value = 0.0000	F (15,192) = 15.56 p-value = 0.0000
Variable	Regression Coeff.	Regression Coeff.	Regression Coeff.	Regression Coeff.
Size (Assets)	0.139 (3.62)*	0.368 (1.67)***	-0.545 (3.19)*	-2.787 (4.81)*
Growth (Assets)	-0.012 (0.84)	0.031 (0.36)	0.001 (0.20)	-0.009 (0.68)
Profitability	-0.418 (2.33)**	-2.497 (2.44)**	0.481 (0.55)	-0.276 (0.18)
Tangibility	0.266 (3.35)*	1.696 (3.74)*	-7.170 (8.40)*	-12.912 (7.00)*
Age	-0.023 (5.18)*	-0.104 (3.97)*	0.001 (0.19)	0.392 (4.18)*
Earnings Variability	0.001 (2.21)**	0.001 (1.47)	0.001 (0.18)	-0.001 (1.85)***
Debt Service Capacity	-0.001 (4.54)*	-0.003 (3.17)*	-0.001 (0.81)	-0.001 (0.74)
D P R	0.001 (0.04)	-0.028 (0.58)	0.144 (2.75)*	0.733 (7.63)*
Liquidity	0.009 (1.87)***	0.050 (1.71)***	-0.052 (1.37)	0.027 (0.34)

Contd...

Contd...

Non-debt Tax Shield	-3.574 (3.25)*	-24.546 (3.91)*	35.059 (8.51)*	47.627 (5.73)*
D O L	0.001 (1.32)	0.001 (0.85)	-0.001 (0.75)	0.001 (1.08)
Price-earnings Ratio	-0.001 (0.15)	0.001 (0.46)	0.001 (3.54)*	0.001 (1.45)
Promoter Holdings	0.339 (4.28)*	2.179 (4.81)*	0.381 (0.64)	-3.365 (1.88)***
Tax Rate	-0.042 (0.55)	0.160 (0.36)	-0.294 (0.33)	3.663 (1.95)***
Uniqueness	-0.256 (0.76)	-1.011 (0.53)	-1.175 (0.36)	4.006 (0.49)
Cons	0.464 (3.32)	2.205 (2.77)	2.066 (2.68)	5.022 (2.25)

\*\*\* indicates significance at 10 per cent level

\*\* indicates significance at 5 per cent level

\* indicates significance at 1 per cent level

**Note:** The figures given in parentheses indicate the t-values/z-values.

has been found negative and statistically significant under D/E model in Computer Software industry supporting the expectations of above theories. The relation of debt service capacity with capital structure has been found negative and statistically significant at .01 level for both the models in Chemical industry as consistent with pecking order theory whereas the relation has turned out to be statistically insignificant for Computer Software industry. The relation of dividend payout ratio with capital structure has been found positive and statistically significant for both models in Computer Software industry whereas insignificant for determining the capital structure of Chemical industry.

The positive relation of liquidity with capital structure is consistent with the Static trade-off theory in Chemical industry but the relation is insignificant for Computer Software industry. NDTS variable has shown negative beta value with p-value of less than .01 in Chemical industry which indicates that the relation among NDTS and capital structure is negative and statistically significant as consistent with Static trade-off theory. But the positive and statistically significant relation among them is contradicting the predictions of Static trade-off theory in Computer Software industry. Beta value for price-earnings ratio have shown positive relation with capital structure with TD/TA model only in Computer Software industry whereas the relation for Chemical industry is not statistically significant.

The relation of promoter shareholdings with capital structure has been found positive and statistically significant at .01 level in Chemical industry whereas the relation is positive insignificant with TD/TA model and negative significant with D/E model in Computer Software industry. Higher tax rate motivates the firms to use higher level of debt in their capital structure to avail maximum amount of tax benefit and increase the amount available for equity shareholders, thus, Static Trade-off theory is expecting positive relation between tax rate and leverage. This view has been supported in Computer Software industry by using D/E model but in all other cases the tax rate has turned out to be insignificant variable for determining the capital structure.

### **Conclusion**

The regression analysis results show that capital structure (dependent variable) is:

- i) Positively related to firm size, tangibility, liquidity, and promoter shareholdings supporting the prediction of Static trade-off theory.
- ii) Negatively related to the profitability of the firm, age of the firm and debt service capacity supporting the predictions of Pecking order theory and the negative relation of non-debt tax shield is consistent with the Static trade-off theory in the Indian Chemical industry.
- iii) Negatively related to firm size, tangibility and earnings variability supporting the predictions of Pecking order theory.
- iv) Positively related to age of the firm, dividend payout ratio, non-debt tax shield and tax rate.

Capital structure of the Chemical firms are influenced by firm size, profitability, asset tangibility, age of the firm, debt service capacity liquidity and non-debt tax shield whereas the capital structure of the Computer firms are influenced by firms size, tangibility, age of the firm, earnings variability, dividend payout ratio, price-earnings ratio, promoter shareholdings ratio and tax rate. The regression results reveal that both the industries frame their capital structure pursuing the different theories of capital structure. The results for Chemical industry reveals the use of Static trade-off and Pecking order theory for framing the policies for their capital structure whereas the capital structure of Computer industry has been framed as consistent with the expectations of Pecking order theory.

### Limitations

This study is limited to two industries from the Indian Corporate sector. The findings of this study could only be generalized for the firms similar to those that were included in this research. In addition, the sample size is small.

Future research should investigate generalization of the findings beyond these two sectors. Further the findings can be generalized to pre-liberalized and post liberalized industries also.

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## **Effect of Leverage Ratio and Ownership Structure on Internationalization of Indian Firms**

RASHMI AND SWATI MATTA

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The study attempts to find a relation between internationalization of firms & the amount of leverage and ownership stake in the capital structure. The multivariate dummy regression was run on the data of 100 firms to determine the nature of relationship between the capital structure and internationalization of firms. Further, t-test was applied to find the strength of this relationship. The study found that a significant relationship exists between the degree of internationalization and capital structure. Ownership impacts internationalization, much more than leverage. Also the number of years used in the study was found insignificant to influence the nature of relationship.

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### **Introduction**

Degree of internationalisation has an impact on the overall capital structure of the company. The opportunity to diversify risks across various markets directly helps in reducing the overall cost of capital of the firm. The choice of capital to finance the new opportunity in the international market can thereby influence the overall capital structure and the cost of capital. Due to difference in legal, cultures of different nations and increase in the degree of asymmetry, monitoring firms across regions becomes difficult. The arbitrage opportunity and increase in the number of choices for investment leads to conflict of interests between shareholders and debt holders which can increase the cost of capital and change the capital structure of the firm. Therefore, given the market imperfections firms usually avoid costly external market transaction and utilise internal market transaction.

Increase in the degree of internationalisation of a firm leads higher risks for the equity shareholders this can be due to the high exchange rate fluctuations hence, the demand for higher returns from the shareholders. There is a counter view to this which suggests that some equity holders view internationalisation operations as view to diversify the risk of shareholder which can also reduce the cost of equity.

Many studies have suggested that higher the degree of internationalisation higher the amount of total and long term debts. The diversification risks for

the shareholders increase the cost of equity hence financing from debt becomes cheaper which help in reducing the overall cost of capital of the firm. Internationalisation can also offer opportunity of product diversification for a firm which increases the debt capacity of the firm as diversification reduces risks and bankruptcy costs for a firm. The counter view to this suggest that internationalisation of a firm provides growth opportunity for the firm and whenever there is a growth opportunity the portfolios of investment increase which can lead higher agency cost. Therefore MNCs having better growth opportunity tends to be financed by equity rather than debt.

These effects on debt and equity affects the overall capital structure of the firm thereby changing the cost of capital. Most companies follow the strategy of financing through debt to reduce the cost of capital but after a point the shareholders demand higher return due to increase in bankruptcy cost there by increasing the overall cost of capital. The debt financing is the preferred choice and MNCs use foreign currency financing as instrument of hedging the risks. The origin of the firm also plays a crucial role in the capital structure of the firm .When firm from a developed and stable country make investments in an unstable country it has higher risks and debt usage decreases. Whereas when firms invest in more stable countries the risks decreases and the debt capacity of the firm increases. For example: Canadians MNCs have higher debt to equity ratio compared to that of US MNCs.

### **Objective of the Study**

To study the internationalization of a firm as a function of leverage ratio and onwership structure

### **Hypotheses**

1. A firms' leverage do not increases with higher degree of internationalization.
2. The promoter's/ family's stake in the firm do not decreases with increasing degree of internationalization.

### **Literature Review**

Aggarwal, & Kyaw, (2010). supported that keeping other factors constant, multinational firms have considerably lower debt ratios than comparable domestic firms, and moreover debt ratios further decrease with increasing multinationality. With increasing degrees of internationalization, firms play a trade off with risk and debt in capital structure. Singh, & Nejadmalayeri (2003). substantiate that internationalized firms have a higher degree of long-term debt, that greatly reduces the cost of capital, despite increasing equity risk. Despite the debt servicing cost, agency cost, equity risk, the overall cost of debt-equity financing is reduced. Mitto, & Zhang (2008) gave empirical evidence to Canadian multinational Corporations operating in U.S. have higher leverage than the domestic counterpart, due to lower agency costs of debt in the U.S. operations. Drobetz, (2013) found that asset tangibility has a positive relationship with the degree of leverage, factors like profitability,

operating leverage volatile macro-economic environment are all inversely related to leverage in the shipping industry. Charlotta et al, (2001) found that an SME with a higher degree of internationalisation ends up paying lower interest rates on bank loans and its debt ratio is inversely related to its internationalisation degree. Tsai (2013) found that an SME with a higher degree of internationalisation ends up paying lower interest rates on bank loans and its debt ratio is inversely related to its internationalisation degree. Saito (2010) claimed that access to international capital market is frequently suggested as a motivation for companies to internationalise.

Michael, Hannah and Jan (2013) concluded that the degree of internationalisation and the ownership structure does not have a linear relationship rather it is a U shaped curve. There are three points identified in this curve, when the ownership of a single shareholder is quite low they have lesser control over managers and managers do pursue their own interests over the firm and internationalise. As the ownership of a single shareholder increases it reaches a point where the degree of internationalisation is negatively related as influence over the manager increases. At the third point the internationalisation is again positively related as a single shareholder has maximum stake in the company it tries to diversify risks and therefore internationalise.

Adrian (2003) found that the rearrangement in the ownership of the assets in the case of Grindlays Bank was gradual and incremental rather than being abrupt. There are various factors that proved these changes which can be external such as political governments nationalised or internal such as managerial decisions to acquire a company. Gerard (2005) stated that ability to take risks and expand the scope of the firm is dependent on who are the owners. The internal owners that are CEO and other executives are risk averse and therefore to increase the scale and scope of an MNC is lower. On the other hand, the venture capitalists are more likely to take risky decisions which can help in the internationalisation of an MNC. Tschoegl (2002) stresses on the point that if one wants to understand the internationalisation process of the firm including the full evolution of the geographical scope of operations, then one has to take into consideration the rearrangement the ownership of its assets over a period of time.

### **Methodology**

In order to develop a relationship between the family ownership of a firm, the internationalization of a firm and the amount of debt employed in the capital structure of the firm, first these variables were defined in terms of quantifiable values, next a statistical technique- Multivariable Dummy Regression was chosen to develop the relationship and finally the strength of the relationship was determined using t- test statistics. We briefly describe each step below-

#### **Variables**

1. The degree of Internationalization was defined as the percentage of total sales coming from foreign operation i.e.

$$\text{Degree of Internationalization (DOI)} = \frac{\text{Total Forex Earnings}}{\text{Total Sales}}$$



Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F
1	0.320 <sup>a</sup>	103	0.092	22105	103	9.566	7	586	000

a. Predictors : (Constant), 2011, Ownership, Leverage, 2008, 2010, 2009, 2012

Table 2: ANOVA<sup>a</sup>

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	3.272	7	0.467	9.566	0.000b
	Residual	28.633	586	0.049		
	Total	31.904	593			

a. Dependent Variable: DOI

b. Predictors: (Constant), 2011, Ownership, Leverage, 2008, 2010, 2009, 2012

Table 3: Correlations

	DOI	Ownership	Leverage	2007	2008	2009	2010	2011
Pearson Correlation	DOI	0.294	0.157	-0.03	0.016	-0.007	-0.019	-0.015
	Ownership	1.000	0.113	0.018	0.003	-0.006	-0.024	-0.018
	Leverage	0.157	1.000	-0.046	0.017	-0.085	0.061	-0.039
	2007	-0.003	0.018	1.000	-0.200	-0.200	-0.200	-0.200
	2008	0.016	0.003	-0.200	1.000	-0.200	-0.200	-0.200
	2009	-0.007	-0.006	-0.200	-0.200	1.000	-0.200	-0.200
	2010	-0.019	-0.024	-0.200	-0.200	-0.200	1.000	-0.200
	2011	-0.015	-0.018	-0.200	-0.200	-0.200	-0.200	1.000

Table 4: Coefficients<sup>a</sup>

Model	Unstandardized coefficients				Standardized Correlations			
	B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	0.137	0.024	5.614	0.000			
	Ownership	0.004	0.001	7.089	0.000	0.294	0.281	0.277
	Leverage	0.019	0.006	3.153	0.002	0.157	0.129	0.123
	2008	0.008	0.031	0.253	0.960	0.016	0.010	0.010
	2009	0.004	0.031	0.126	0.899	-0.007	0.005	0.005
	2010	-0.009	0.032	-0.294	0.769	-0.019	-0.012	-0.012
	2012	0.005	0.032	0.159	0.873	0.027	0.007	0.006
	2011	-0.002	0.031	-0.052	0.959	-0.015	-0.002	-0.002

2. The Ownership of a firm was defined as the shares of the firm held by Individuals or Hindu Undivided Family (HUF)
3. Finally, the Leverage ratio used was the Debt/Equity ratio defined as  

$$\frac{\text{Total Debt}}{\text{Total Equity}}$$

The data for 100 firms was taken from Prowess 4 database. The predefined company set of CNX 500 was taken for the purpose of this study. Firms were first filtered out on the basis of forex earnings i.e. firms having no forex earnings were removed from the data set. Next, firms having no number of percentages of shares held by 'individuals or HUF' were filtered out. In this way we reached a data set of around 190 companies. Amongst these we chose the top 100 firms on the basis of sales. Data was taken for the 6 years- 2007, 2008,2009,2010,2011 and 2012. Reason being that the Ownership data prior to 2006 was not available in the Prowess database.

Regression analysis is a technique used to estimate the relationship between variables. The variable on the left side of the equation is the dependent variable or response variable and it depends on the variables on the right side of the equation called independent variables or predictor variables. When a dependent variable is dependent on two or more independent variable, then the regression is called a multivariable regression.

A dummy variable is one which takes either the values 0 or 1 to indicate the absence or presence of some categorical effect that can shift the outcome. It is used most often when the measure of variable is nominal or ordinal.

In our analysis,

1. Degree of Internationalization (DOI) is the dependent variable
2. Ownership is one of the independent variables
3. Leverage- Debt/Equity is the second independent variable
4. Corresponding to the 6 years we have taken 5 dummy variables – DT1 DT2 DT3 DT4 and DT5 corresponding to years 2008, 2009,2010, 2011, 2012, 2007 has been taken as the base year.

The regression equation can be described as:

$$\text{DOI} = A_0 + \beta_1 \times (\text{Ownership}) + \beta_2 \times (\text{Leverage}) + \beta_3 \times \text{DT}_1 + \beta_4 \times \text{DT}_2 + \beta_5 \times \text{DT}_3 + \beta_6 \times \text{DT}_4 + \beta_7 \times \text{DT}_5$$

where  $\beta_i$  are the partial regression coefficients.

Analysis

Liner Regression Findings

- Model summary and ANOVA table shows F-test is significant and we can conclude that 9.2% variability in the degree of internationalization (DOI) can be explained by these two variables (ownership and leverage ratio) (Table 1 and 2)
- Correlations table values suggest that there is no correlation among ownership and leverage as the value of 0.113 is insignificant to define any correlation. So there is no multi collinearity in the model (Table 3).

- From the Coefficients Table 4, we can write the regression equation as follows:

$$\text{DOI} = 0.137 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage}) + 0.008 \times \text{DT}_1 + 0.004 \times \text{DT}_2$$

However, By conducting the t- test we find that the values of DT1, DT2, DT3, DT4, DT5 do not lie in the 5% confidence interval and hence are not significant in the regression.

Therefore the final regression equation comes to be:

$$\text{DOI} = 0.137 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage}) \text{ (This is in decimal units)}$$

Moreover, we see from the standardized Beta values that ownership affects the degree of internationalization more than the leverage since,

The Standardized Beta value for Ownership is 0.279 which means that 1 unit change in Ownership leads to a 0.279 unit change in DOI , whereas a 1 unit change in leverage leads to 0.125 unit change in DOI

- If we look at the regression equation across different time periods with 2007 as the base we find the following equations:

$$\text{DOI} = (2008) = 0.145 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage})$$

$$\text{DOI} = (2009) = 0.141 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage})$$

$$\text{DOI} = (2010) = 0.128 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage})$$

$$\text{DOI} = (2011) = 0.142 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage})$$

$$\text{DOI} = (2012) = 0.135 + 0.004 \times (\text{Ownership}) + 0.019 \times (\text{Leverage})$$

We observe that across the years there is not much change in the degree of internationalization measurement compared to the base year 2007.

### **Conclusion**

There is significant relationship between degree of internationalization, leverage ratio and ownership structure of a firm though ownership has a larger impact on DOI. Ownership and leverage ratio are not correlated and one does not affect other. Years in consideration do not have much affect on DOI. This is interesting to note specially given the fact that the economic scenario post 2008 was in a bad shape compared to 2007. However, it seems that the firms degree of internationalization was not much affected when analyzed in terms of the family ownership and leverage levels. But, this cannot be concluded from this analysis alone and has scope for further research since the time dummy variables lie outside the chosen 5% confidence interval.

### **Limitations**

- Number of independent variables taken for the study are too small to make a significant inference out of the model.

- Top 100 companies(CNX 500 Index: based on Sales in 2012) were selected for the purpose of this study so there is a constraint to generalize the findings of this study to other companies.
- Degree of Internationalization as defined in the paper may not be appropriate indicator of internationalization of a firm
- Number of years taken for the purpose of this study were constrained by the ownership data availability .

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## **Performance Evaluation of Mutual Funds in India**

RENU GHOSH

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In this paper the performance evaluation of mutual funds is carried out through risk-return analysis, Treynor's ratio, Sharpe's ratio, Jensen's measure and Fama's measure. The data used in the study is daily closing NAVs for the period from 1<sup>st</sup> January 2010 to 31<sup>st</sup> December 2013. The schemes selected for study consist of three public-sponsored, three private-sponsored and three private (foreign)-sponsored mutual fund schemes. The results of performance measures suggest that out of nine, three schemes namely Franklin India Tax shield-Growth, HSBC Tax Saver Equity Fund – Growth and ING Tax Savings Fund-Growth schemes, perform better in comparison to benchmark index according to all the measures applied in the study and among these Franklin India Tax shield-Growth fund is the best performer. Overall it can be concluded that the private foreign companies sponsored mutual fund scheme performance is better than public and private companies-sponsored mutual fund schemes.

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### **Introduction**

A mutual fund is the mediator that brings together a group of people who wants to invest their money in stocks, bonds and other securities. Mutual fund has become an important tool for mobilization of savings particularly from the household sector. The investment in mutual fund is denoted as unit and is represented by the value called Net Asset Value (NAV). In a mutual fund, the amount to be invested after deducting for all charges are pooled together to form a fund. The value of fund at any time is equal to the amount of units multiplied by value of unit at that time.

The returns in a mutual fund depend upon the performance of the fund in the capital market. The investors in mutual fund are given with an option to choose from various schemes i.e. equity funds, balanced funds, debt funds etc. Mutual fund is the most viable investment option for the small investor because it provides an opportunity to invest in a fund which is professionally managed by the experts.

### Literature Review

Panwar and Madhumati (2006) investigated the differences in characteristics of public-sector sponsored and private-sector sponsored mutual funds companies and found that public-sector sponsored funds do not differ significantly from private-sector sponsored in terms of portfolio characteristics but significantly differ in terms of performance. Mutual funds outperforms the benchmark i.e. market and gives the benefit of diversification even after adding back the management fees and transactions costs (Otten and Bams, 2000; Rao and Ravindran, 2003; Petajisto, 2013; Kumar, 2011; Essayad, 1988) whereas the contrary results were given by the studies (Jayadev, 1996 and Cai et al., 1997) that mutual funds underperform the benchmark because they tend to invest in large stocks with low book-to-market ratios.

### Objectives

1. To examine the performance of mutual funds with regard to risk-return adjustment, models given by Sharpe, Treynor, Jensen and Fama.
2. To examine which mutual fund outperforms the market i.e. Public sector, Private sector or Foreign Private sector sponsored.

### Hypotheses

1. There is no significant difference in the performance of the tax saver mutual fund- growth scheme of the selected mutual fund company.
2. Mutual funds do not outperform the market i.e. NIFTY.

### Data and their Sources

The present study evaluates the performance of the tax saver mutual fund-growth scheme of the selected mutual fund company (Annexure 1). The study is primarily based upon the secondary data. The main source of secondary data is AMFI website, books, journals, brochures, financial advisors and web sites of the selected mutual fund companies. The study spans the period from 1<sup>st</sup> January 2010 to 31<sup>st</sup> December 2013. For the study daily closing NAVs of the nine selected mutual fund company's scheme have been taken from their websites and other sources. Benchmark Index for the present study is S&P CNX NIFTY 500 as it is the widely accepted market index and covers the majority of companies.

### Research Methodology

- 1) Return: For each mutual fund scheme under study the daily returns are computed as

$$r_p = \ln(\text{ending NAV}/\text{beginning NAV})$$

Where  $r_p$  = Return of portfolio

The market returns are computed on similar lines with NIFTY (National Stock Exchange Index) as benchmark where  $r_m$  = return of market.

- 2) Risk: risk is the measure of variability in returns.

Standard deviation: Measure of Total Risk.

$$Var(r) = \frac{1}{n} \sum_{i=1}^n \left[ r_p - r_{am} \right]^2$$

Where  $r_p$  = return of portfolio

$r_{am}$  = mean rate of return on individual mutual fund scheme. (portfolio)

$$\text{Standard deviation} = \sqrt{Var(r)}$$

The variance and standard deviation are computed from daily returns.

Beta: Measure of Systematic Risk

For obtaining the beta of selected mutual fund schemes, regression model is applied. Mathematically:

$$Y = \alpha + \beta X$$

Where Y = return on mutual fund scheme

X = market return called NIFTY return

$\alpha$  = intercept

$\beta$  = slope of the beta coefficient

- 3) Risk Free Asset: risk less asset has zero variability in returns. For this purpose the Treasury bill rate-91 days have been taken as the risk free asset and the interest rate on such deposits are considered as risk free return.
- 4) Treynor's Ratio: Treynor's ratio is a reward to volatility ratio based on systematic risk (beta) developed by Jack Treynor (1965).

$$T_p = \frac{\text{Riskpremium}}{\text{SystematicRiskIndex}} = \frac{r_p - r_f}{\beta_p}$$

Where  $T_p$  = Treynor's ratio

$r_p$  = portfolio return

$r_f$  = risk free return

$\beta$  = beta coefficient for portfolio

- 5) Sharpe's Ratio: it is a reward to volatility ratio based on total risk (standard deviation) developed by William F. Sharpe (1966).

$$S_p = \frac{r_p - r_f}{\sigma_p} = \frac{\text{Riskpremium}}{\text{TotalRisk}}$$

Where  $S_p$  = Sharpe's Ratio

$r_p$  = portfolio return

$r_f$  = risk free return

$\sigma_p$  = standard deviation of portfolio returns.



- 6) Jensen's Measure: the Sharpe's and Treynor's ratio provides ranking of portfolio in comparison to benchmark whereas Jensen's measure developed by Michael C. Jensen (1968) indicate that the portfolio provides a higher return over CAPM returns if its value is positive and vice-versa for negative value of Jensen's measure.

$$J_p = \text{Portfolio Return} - \text{CAPM Return} = r_p - [r_f + \beta_p (r_m - r_f)]$$

Where  $J_p$  = Jensen's measure for portfolio  
 $r_p$  = portfolio return  
 $r_f$  = risk free return  
 $\beta_p$  = beta coefficient of the portfolio.  
 $r_m$  = market return

- 7) Fama's Measure: Jensen model uses the systematic risk as measure of premium for computing the excess returns over expected returns whereas Eugene F. Fama (1972) model suggests to measure the fund performance in terms of excess returns over expected returns with total risk as measure for premium

$$F_p = (r_p - r_f) - (\sigma_p / \sigma_m)(r_m - r_f)$$

Where  $F_p$  = Fama's measure for portfolio  
 $r_p$  = portfolio return  
 $r_f$  = risk free return  
 $\sigma_p$  = standard deviation of portfolio returns  
 $\sigma_m$  = standard deviation of market returns  
 $r_m$  = market return.

Table 1: Return, Std. deviation, Beta and R<sup>2</sup> of selected mutual fund scheme

Name of the Mutual fund Scheme	Average Return	Std. deviation	Beta	R <sup>2</sup>
<b>Public Sector</b>				
1. Baroda Pioneer Growth Fund - Plan A - Growth	0.00003	0.010	1.01	0.978
2. Canara Robeco Equity TaxSaver - Regular Plan - Growth	0.00035	0.008	0.78	0.92
3. LIC Nomura MF Tax plan-Growth	0.00033	0.010	0.06	0.003
<b>Private Sector</b>				
1. Reliance Tax Saver (ELSS) Fund-Growth	0.00033	0.009	0.83	0.83
2. Escorts Tax Plan-Growth	-0.00030	0.010	0.84	0.70
3. SaharaTax Gain-Growth	0.00026	0.0092	0.82	0.88
<b>Foreign Private Sector</b>				
1. Franklin India Tax shield-Growth	0.0003	0.008	0.799	0.92
2. HSBC Tax Saver Equity Fund - Growth	0.0002	0.009	0.87	0.92
3. ING Tax Savings Fund-Growth.	0.0002	0.0097	0.88	0.94
Benchmark-NIFTY	0.0001	0.010		

Table 1 shows the average return earned by the various schemes. The results show that the highest return is given by Franklin India Tax shield-Growth fund against the benchmark-Nifty returns. It can also be seen here that 8 out of 9 mutual fund schemes have outperformed the market and among it Franklin India Tax shield-Growth scheme is the best.

Table 1 gives the standard deviation of the selected mutual fund schemes which is a measure of total risk. Higher is the value of standard deviation higher is the risk being carried out by the particular mutual fund scheme. The results show that the Canara Robeco Equity TaxSaver – growth scheme has the minimum value of standard deviation. So it can be concluded that it is the least risky scheme of mutual fund against the benchmark-Nifty.

Beta is a measure of systematic risk. It can be seen that 8 out of 9 mutual fund schemes have beta value less than 1 implying that they are less risky than benchmark-nifty portfolio and lowest beta value is given by LIC Nomura MF Tax plan (Tables).

The coefficient of determination (adjusted  $R^2$ ) of the selected mutual fund schemes measures the extent to which the mutual fund scheme returns is being explained by market returns (Table 1). The maximum and minimum value of  $R^2$  is given by Baroda Pioneer Growth Fund - Plan A – Growth and LIC Nomura MF Tax plan-Growth schemes. Higher value of ( $R^2$ ) indicates that the market explain substantial part of variation in the return of a particular mutual fund scheme selected under study.

Table 2: Sharpe's, Treynor's, Jensen's and Fama's value of the selected mutual fund scheme

Name of the Mutual fund Scheme	Sharpe's Measure	Treynor's Measure	Jensen's Measure	Fama's Measure
<b>Public Sector</b>				
1. Baroda Pioneer Growth Fund - Plan A – Growth	-0.01	-0.0001	-0.0008	-0.0001
2. Canara Robeco Equity TaxSaver - Regular Plan - Growth	0.01	-0.00019	0.00021	0.0004
3. LIC Nomura MF Tax plan-Growth	-0.005	-0.0008	-0.0052	0.0006
<b>Private Sector</b>				
1. Reliance Tax Saver (ELSS) Fund-Growth	0.012	-0.0001	0.00020	0.00039
2. Escorts Tax Plan-Growth	-0.047	-0.0006	-0.00043	-0.0007
3. SaharaTax Gain-Growth	0.006	0.0007	0.00013	0.0002
<b>Foreign Private Sector</b>				
1. Franklin India Tax shield-Growth	0.017	0.0001	0.00027	0.0004
2. HSBC Tax Saver Equity Fund - Growth	0.003	0.0004	0.00011	0.0002
3. ING Tax Savings Fund-Growth.	0.001	-0.0002	0.0006	0.0001
Benchmark-NIFTY	0.008	-0.0009	0.00003	0.00005

Table 2 shows the Sharpe's value. It is a measure of reward to volatility ratio. It gives the excess return over risk free return with respect to the total

risk of a portfolio. The results shows that 8 out of 9 mutual fund schemes have outperformed against the benchmark and Franklin India Tax shield-Growth is the best among all as it is having the highest positive value implying that it has given the excess return over risk free return.

Table 2 shows the Treynor's value. It gives the excess return over risk free return with respect to the systematic risk of a portfolio. The results shows that 4 out of 9 mutual fund schemes have outperformed against the benchmark and Franklin India Tax shield-Growth is the best among all as it is having the highest positive value implying that it has given the excess return over risk free return.

Table 2 shows the Jensen's value. Higher value of the Jensen measure means better performance of the mutual fund scheme. The results shows that 6 out of 9 mutual fund schemes have outperformed against the benchmark and Franklin India Tax shield-Growth is the best among all as it is having the highest positive value implying that it has given the excess return over risk free return.

Table 2 shows the Fama's measure value. Higher value of the Fama's measure indicates better performance. The results shows that 7 out of 9 mutual fund schemes have outperformed against the benchmark and Franklin India Tax shield-Growth is the best among all as it is having the highest positive value implying that it has given the excess return over risk free return.

### **Conclusions**

The analysis of the tax saver mutual fund growth scheme of the selected mutual fund company shows that out of nine, three schemes namely Franklin India Tax shield-Growth, HSBC Tax Saver Equity Fund Growth and ING Tax Savings Fund-Growth schemes, performs better in comparison to benchmark index according to all the measures applied in the study and among these Franklin India Tax shield-Growth fund is the best performer. Overall it can be concluded that the private foreign companies sponsored mutual fund scheme performance is better than public and private companies sponsored mutual fund schemes.

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**Annexure-I**

List of mutual fund schemes

Name of the Mutual fund Scheme

Public Sector

1. Baroda Pioneer Growth Fund - Plan A - Growth
2. Canara Robeco Equity TaxSaver - Regular Plan - Growth
3. LIC Nomura MF Tax plan-Growth

Private Sector

1. Reliance Tax Saver (ELSS) Fund-Growth
2. Escorts Tax Plan-Growth
3. SaharaTax Gain-Growth

Foreign Private Sector

1. Franklin India Tax shield-Growth.
2. HSBC Tax Saver Equity Fund - Growth
3. ING Tax Savings Fund-Growth.

## **Improving Government Accounting Practices**

RAJAT DEB

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The study examines the perception about Government Accounting of the Accountants working in different State Government Departments, PSUs and in Centrally sponsored schemes in Tripura. Different statistical tests like Mann-Whitney U test, Pearson's Chi-square test, factor analysis like Principal Component Analysis, Regression analysis were performed to assess support for the hypotheses. The result of the study suggests that in spite of having many unique features, the Government Accounting suffers from a number of limitations which need to be addressed for better disclosure and reporting. The adoption of Accrual basis of Accounting with structural changes in the Consolidated Fund; the change in the system of recording transactions using tier and digits are the need of the hour.

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### **Introduction**

In earlier years after independence, the accounting system of India was carried on the techniques and patterns followed in pre-independence period as per provisions of the Government of India Act, 1935. This Government Accounting System was drawn on the basis of setting Departments rather than functions and programmes of the Government. Due to rapid planned economic development of India and launching of multiple social welfare programmes by the Central and State Governments, some changes were carried out at the major Head levels in the early 1960s. By the passage of time and increase in governmental activities, a number of urgent changes in the Government Accounting System were felt, such as (i) Radical change in the basic principles of classification of receipts and payments, (ii) Change in the information system about the functions, programmes and schemes of the Government rather than the Government Departments, (iii) Change in Performance Budgeting System, (iv) Change in Administrative Information System, (v) Change in the integration of the responsibility for keeping the accounts as part of the executive functions of the Central Ministries and Departments to enable the Comptroller and Auditor General of India (CAGI) for carrying out audit functions effectively.

At present Indian Government expenditure is classified into six tier and fifteen digits viz.:

- 1) Major Head (4 digits)-representing a major function of the Government.
- 2) Sub-Major Head (2 digits) - representing a sub-function of the Government.
- 3) Minor Head (3 digits)- representing a programme of the Government.
- 4) Sub Head (2 digits) - representing a scheme.
- 5) Detailed Head (2 digits) - representing a sub-scheme and;
- 6) Object Head (2 digits) - representing economic nature of expenditure.

### **Literature Review**

Rubin(1987) advocated that the development of government accounting is related to the constitutional form of government that provides for separation of powers, and checks and balances among the legislative, executive, and judicial branches of government. Chan (2001) concludes that more than a century after its Declaration of Independence, the United States still needed a municipal reform movement to emphasize basic financial record keeping fighting corruption in local Governments. Simonetal (1954) found that counselled corporate controllers to go beyond their score-keeping function to direct management's attention to problem are help to solve problems. Thomas(2001), observed that heavily indebted, poor countries' lack the practices and procedures necessary for budgeting, monitoring, and reporting on the use of public resources. while it is tempting to link corruption with dictatorship, corruption can also occur in a democracy, despite the checks and balances built in to the machinery of Government to thwart and expose fiscal mis-conduct. Downs (1957) found that the advanced purpose of Government Accounting is to help Government discharge its Public accountability. Public accountability exists in three levels of principal-agent relationship: accountability of the bureaucracy to the chief executive, of the executive to the legislature, and of the Government to the people. This purpose can be better achieved by increasing the agent's incentive to disclose and by lowering the principal's information costs. He has cautioned that it is rational for voters to be ignorant because of the high cost of becoming informed. Sunder (1997) applied contract-cost theory to explain and justify the differences between accounting for Government and non-profit organizations and business accounting.

Pessina and Steccolini (2003) are in opinion that concerns the advantages of Accrual Accounting for external users. They empirically demonstrated the important role of cash based information narrowed to resources and consumption to the great majority of external users. Despite the limited empirical evidence of its usefulness in the public sector and the reservations expressed by academics, the adoption of Accrual Accounting is regarded nowadays, as Lapsley et al. (2009) comment, as self-evident. There are several studies that assert the primacy of accrual based accounting over cash based accounting as the reason why a large number of countries took on, or are in the process of implementing, Accrual Accounting principles in the public sector (Luder and Jones, 2003; Paulsson, 2006; Connoly and Hyndman,

2006). McKinnon (2003) cited by Elwood and Newberry, (2007) advocated that the reform of public sector accounting is a component of the global economic reform, based on neoliberal principles such as: counter inflationist monetary policy, fiscal discipline at macroeconomic level which would lead to balanced public budgets and microeconomic reforms for free trade and extension of the business sector. Deaconu et al., (2009) say that these are all measures used to reduce the size and power of governments while supporting the development of businesses.

Hoque and Hopper (1994) argued that the accounting system alone with no connection to tradition, culture, economic and political factors is not sufficient in order to reflect correctly the management's system needs. This idea is also supported by Blöndal (2003) who acknowledges the importance of public sector accounting reforms along with other managerial reforms so as to improve decision making in the government. Berman and Wang, (2000); Poister and Streib, (1999); Gray and Haslam, (1990), demonstrated the advantages of the Accrual based system through the content analysis of the financial statements, both related to cost and efficiency and also referring to benefits of the internal and external users.

### **Objectives**

The objectives of the study are:

- i) *To analyze the perception of the respondents about their experience of practicing Government Accounting in State Government Departments, PSUs and in different Centrally sponsored schemes.*
- ii) *To suggest the ways of reforms in Government Accounting.*

### **Research Methodology**

#### **Data**

A sample of 120 accountants/accounts officers working in different State Government Departments, Public Sector Undertakings (PSUs), Central Government Projects has been selected as respondents of the present study. Out of 120 sample officials 92 percent were males and 8 percent were females, which indicate a skewed profile of accountants working in different Departments. The age group of the respondents oscillated between 25-60 years, having experience ranging from 00-35 years and above.

#### **Research Design**

In the light of the stated objectives of the present study a schedule was framed and a survey on 120 officials from different state Government Departments was conducted. The schedule comprising of 40 questions including socio-economic background of the respondents was used to collect the primary data. 120 respondents were chosen by Judgement sampling of which 110 were male and 10 were female.



The hypotheses are as follows:

$H_0$ : There is no association in the perception of the respondents towards strategies for reforms in Government Accounting.

#### **Sub-hypotheses**

- $H_{01}$ : The present Government Accounting system has not got unique features.
- $H_{02}$ : The existing accounting system suffers from number of structural problems.
- $H_{03}$ : There are problems in Object head, Plan head and in disclosure of information.
- $H_{04}$ : There is no standardization in the classification of major heads for schemes and resources are directly transferred skipping State Consolidated Fund.

#### **Analysis**

The study has revealed that majority of the respondents are male (92%), Hindus (54 percent), General (48 percent), having education up to Graduation (86 percent) with 15-25 years of experience (62 percent ) and did not participated in any Accounting Software training programme (88 percent).

To measure the effectiveness of the questions of the schedule were tested for its reliability. The value of Cronbach alpha was found to be 0.82. A close ended schedule with a 5 point Likert scale has been used for analyzing the perception of the respondents. The 5 point scale in the schedule bears the corresponding prefix, e. g. *1 strongly agree, 2 agree, 3 neutral, 4 disagree and 5 strongly disagree*. According to Cooper (2000), this type of scale is considered to be an interval scale. Since, Alpha score above 0.70 is treated as good in social sciences. To consolidate the data, factor analysis was carried out. On the factors obtained through factor analysis, the Mann-Whitney U test was applied to see if there is any difference in the opinion of male and female respondents on the factors so obtained. We have used various statistical tools like Descriptive Statistics, Mann-Whitney Test, multiple regression analysis and factor analysis to test the hypotheses which we generated from the primary data.

Factor analysis was being chosen as a method for data reduction, since it is suitable for identifying correlations among variables in a complex sets of data (Mitchel and Rowley, 2013). Prior to performing the PCA, the suitability of data for factor analysis was assessed. The KMO value was .797, exceeding the recommended value of 0.6 which indicates that the data is adequate for factor analysis (Kaiser, 1974). The Bartlett's test of Sphericity (Pallant, 2005) relates to the significance of the study and thereby shows the validity and suitability of the responses collected for the problem being addressed through this study, as well as tests the presence of correlations among variables. A small value less than 0.05 of significance level has been recommended suitable for the study (Kline, 1994). On the basis of the results it was implied that the data set was fit for conducting factor analysis.

Table 1: Factors extracted through PCA

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.329	37.257	37.257	5.329	37.122	37.122	2.787	20.973	20.973
2	3.458	12.887	50.144	3.458	11.718	48.840	2.773	19.258	40.231
3	2.267	10.784	60.928	2.267	10.448	59.288	2.177	18.511	58.742
4	1.148	8.674	69.602	1.148	8.650	67.938	1.329	9.359	68.101

Four factors have been extracted for this study whose eigenvalue is greater than 1, as they explain nearly 70 percent about the total variables taken into account (Table 1). The rotation sums of squared loadings shown in the table represent the distribution of the variance after the Varimax rotation. Varimax rotation is an orthogonal rotation which is commonly used, as it tries to maximize the variance of each of the factors in such a way that the total amount of variance accounted is distributed over the four extracted factors.

On the basis of Rotated Component Matrix, the *twenty* parameters in the schedule are segregated into four components. For each parameter, the highest factor loading has been taken for consideration under different components. Hence, the four components derived from PCA are as under:

Table 2: Test Statistics

Particulars	Mean_C1	Mean_C2	Mean_C3	Mean_C4
Mann-Whitney U	2893.500	3153.000	3089.000	3301.500
Wilcoxon W	3042.500	3257.000	3197.000	3304.000
Z	-.448	-.739	-.087	-0.498
Asymp. Sig. (2-tailed)	.678	.581	.835	.701

Grouping Variable: Gender

At 5 percent level of significance, The Mann-Whitney test statistic is insignificant for all the factors. Hence, we conclude that:

- There is no significant difference in the perception of male and female respondents that the existing accounting system has some unique features.
- There is no significant difference in the perception of male and female respondents that the present accounting system suffers from some structural problems.
- There is no significant difference in the perception of male and female respondents in the system that there are problems in Object head, Plan head and in disclosure of information.

- There is no significant difference in the perception of male and female respondents that there is no standardization in the classification of Major heads for schemes and resources are directly transferred skipping State Consolidated Fund.

In order to examine the extent to which the four extracted factors affect the Government Accounting practice, the data are further utilized in regression for validation. All the four factors are found to be significant for functional competencies (accounting practice) and considered as predictors of the criterion variable (quality of report). The model summary in Table 3 depicts the value of  $R^2$  which refers to the proportion of variance in the dependent variable (quality of report) that can be explained by the independent variable (accounting practice). The explanatory power of a model increases with a higher value of  $R^2$ . The value of  $R^2$  is 0.648, which indicates that 65 percent of the variance in the dependent variable is explained by the predictor variables. The adjusted  $R^2$  is an adjustment of  $R^2$  that penalizes the addition of extraneous predictors to the model and indicates the fitness of a model. In this model the value of adjusted  $R^2$  is 0.641, which is close to the value of  $R^2$  (0.648), thus indicating the fitness of the model. The standard error of the estimate is 0.720 which signifies that the value is good enough to imply reliable prediction of the model. The value of F is 84.571, with a significance level of ( $p < 0.001$ ) which indicates that the model is statistically significant.

Table: 3 Model summaries and Anova for accounting practice

Model	R	$R^2$	Adjusted $R^2$	Standard error of estimate	F	Sig.
1	.734	.648	.641	.72014	84.571	.000*

Notes: Predictors: (Constant), Unique features, Structural problems, problems in Object head, Plan head and in disclosure of information; and No standardization in the classification of Major Heads for schemes. \* $p < 0.05$

The model summaries in Table 3 indicates that all extracted factors are considered as predictors of the criterion variable (quality of report). The value of  $R^2$  indicates that 69 percent of the variance in the dependent variable is explained by the predictor variables. Similarly, the value of adjusted  $R^2$  is 0.688, which is close to the value of  $R^2$  (0.697), thus indicating the fitness of the model. The standard error of estimate is 0.578 which signifies that the value is good enough to imply reliable prediction of the model. The value of F is 224.128, with a significance level of ( $p < 0.001$ ) which indicates that the model is statistically significant.

Table 4: Model summaries and Anova for Quality of Report

Model	R	$R^2$	Adjusted $R^2$	Standard error of estimate	F	Sig.
1	.768	.697	.688	.57842	224.128	.000*

Notes: Predictors: (Constant), Unique features, Structural problems, problems in Object head, Plan head and in disclosure of information; and No standardization in the classification of Major Heads for schemes. \* $p < 0.05$

Table 5: The Regression Coefficients for accounting practice

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Tolerance	VIF	Collinearity Statistics
(Constant)	3.576		88.298	.000			
1. Existing accounting system has some unique features	.157	.142	3.258	.000	1.000	1.000	1.000
The present accounting system suffers from some structural problems	.779	.673	20.126	.000	1.000	1.000	1.000
The system there laid problems in Object head, Plan head and in disclosure of information.	.241	.142	3.847	.000	1.000	1.000	1.000
No standardization in the classification of Major heads for schemes and resources are directly transferred skipping State Consolidated Fund.	.149	.141	3.841	.000	1.000	1.000	1.000

Table 6: The Regression Coefficients for quality of report

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Tolerance	VIF	Collinearity Statistics
(Constant)	3.562		113.561	.000			
1. Existing accounting system has some unique features	<b>.895</b>	.782	34.215	.000	1.000	1.000	1.000
The present accounting system suffers from some structural problems	.214	.215	6.125	.000	1.000	1.000	1.000
The system there laid problems in Object head, Plan head and in disclosure of information.	1.129	.104	3.029	.000	1.000	1.000	1.000
No standardization in the classification of Major heads for schemes and resources are directly transferred skipping State Consolidated Fund.	0.325	.159	2.012	.000	1.000	1.000	1.000

The size of the coefficient for each independent variable gives the size of the effect that variable is having on the dependent variable and sign of the coefficient (positive or negative) gives the direction of the effect. The regression coefficient table illustrates a range of unstandardized and standardised coefficients. The unstandardized coefficients indicate that how much the dependent variable goes for one unit. Similarly, the standardised coefficients estimates resulting from an analysis carried out on independent variables that have been standardized so that their variances are 1. So, standardized coefficients refer to how many standard deviations a dependent variable will change, per standard deviation increase in the predictor variable. In Table 5 the highest beta coefficient is professional obligation (0.779). The t-value for the significance of each of the four predictors indicates significance at 0.000 levels. In the collinearity statistical test both the tolerance and VIF level is equal to 1, which indicates that there is no multicollinearity problem in the study. It is evident that the predictors extracted are significant indicators of superior managerial performance in case of functional competencies.

In Table 6 the highest beta coefficient is (0.895). The t-value for the significance of each of the three predictors indicates significance at 0.000 levels. In the collinearity statistical test both the tolerance and VIF level is equal to 1, which indicates that there is no multicollinearity problem in this study. On the basis of the results we can conclude that the predictors extracted are significant indicators of superior managerial performance in case of social competencies.

A Chi Square Test has been conducted to test the hypotheses generated for the strategies to reforms. A Chi-Square test for independence is applied when two categorical variables are generated from a single population. It is used to determine whether or not there is a significant association between two variables.

A Chi-square test was performed and no relationship was found between the participants' perception (independent variable) and 8 (out of 10) questions (dependent variable) asked about the strategies for reforms in Government Accounting.

$\chi^2(8, N=120) = 0.05, p = [.653, .647, .567, .812, .960, .964, .161, .948]$ .

The Pearson chi-square statistic tests whether the two variables are independent or not. If the value is significantly high ( $p < .05$ ), indicating that a variable have no significant effect on the other. In other words, the highly significant result indicates that there is no association (pattern of response) between the (respondents) male and female Accountants.

Table 7: Chi-square results

<b>Question No.</b>	Pearson Chi-Square	Value	df	Asymp. Sig. (2-sided)
1	Pearson Chi-Square	4.819	8	.653
2	Pearson Chi-Square	6.006	8	.647
3	Pearson Chi-Square	48.085	8	<b>.010</b>
4	Pearson Chi-Square	28.681	8	<b>.015</b>
5	Pearson Chi-Square	4.115	8	.567
6	Pearson Chi-Square	0.474	8	.812
7	Pearson Chi-Square	2.539	8	.960
8	Pearson Chi-Square	2.455	8	.964
9	Pearson Chi-Square	9.328	8	.161
10	Pearson Chi-Square	1.125	8	.948

### Conclusion

The study examined the perception of Accountants employed in different State Government Departments and in centrally sponsored schemes about the Government Accounting system and strategies to reform the same. Through factor analysis, four major factors viz. Unique features of Government Accounting, Structural problems, Problems in Object Head, Plan Head and in disclosure of information; and no standardization in the classification of major Heads for schemes were extracted. Based on such factors, a factorial regression analysis and Mann-Whitney test were carried out. All the four factors are found to be significant for functional competencies (accounting practice) and considered as predictors of the criterion variable (quality of report). The Mann-Whitney test statistic is insignificant for all the four factors. A Chi-square test was performed and no relationship was found between the male and female Accountants' perception. The study has its limitations, as it has only been focused towards Government accounting practices but it could also have been tested for other issues like budgets, auditing and so on. The sample size taken for this study is low, as well as sample has been selected from some selected Government Departments of Tripura, a north eastern state.

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# **Consumer Preference for Eco-Friendly Products of Home Appliance Companies**

BHAGWAN SINGH AND SACHIN KUMAR

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Green marketing process includes the activities that are designed to satisfy the human needs and wants, by delivering environmental friendly goods (Polonsky, 1994; Soonthomsai, 2007). Different businesses are the users of natural resources and are draining these resources in a large quantity. Protection of natural resources and preservation of the environment are the need of the hour. This research paper aims to find out the reasons why people prefer eco-friendly products; either for environment protection, health/ personal benefits or latest technology requirements? The study is based on empirical data analysis of respondents from Himachal Pradesh.

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## **Introduction**

Due to continuous efforts by government and companies, now a shift towards environmental concerns is in progress. The Companies are now working to reduce the waste products and carbon emission from the factories. They are also continuously working to produce eco-friendly products, not causing any harm to the society and made by optimum utilization of resources. Sachdev (2011) advocated that the society has become more anxious about the natural environment, so the businesses have started to adjust their behaviour to address society's new concerns for environment. Some businesses have quickly accepted concepts like environmental management systems and waste minimization, and have integrated environmental issues into all organizational activities. It is consumer's concern for environment and their want for own wellbeing which drives demand for eco-friendly products, which in turn encourages improvements in the environmental performance of many products and Companies. Increased awareness of customers regarding their health & environment has also made the companies to focus on manufacturing of eco-friendly products (Smith, 2013). Green products can be categorized as a product that will not pollute the earth or deplete natural resources and can be recycled or conserved (Shamdasani, Chon-Lin, & Richmond, 1993). Some examples of these

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products are household items manufactured with post-consumer plastics or paper, recyclable or reusable packaging, energy-efficient light bulbs and detergent containing ingredients that are biodegradable, non-polluting and free of synthetic dyes or perfumes (Mostafa, 2007). In this globalized era the companies are adopting, Internet/ Web Based Advertising as the best media for promotion by the green companies (Biloslavo, & Trnavcevic, 2009).

The electronic home appliance Companies are also working through Internet for their promotion. Most of the Home Appliance sites were found to be positive for working on environmental issues. They are promoting eco-friendly products; adopting the recycling program; generating awareness of people towards the environmental issues; and are using the green promotional tools like Internet and television as compared to traditional tools. The websites of LG, Panasonic, Sony, Godrej, Whirlpool, IFB are networked through the social networking sites like Facebook and Twitter for their promotion. For a consumer green means sustainability of products with features like a fair price, renewability, less consumption of energy, health caring, having green label, made by recycling material, cause less pollution and waste, also with an environmentally friendly promotional tool like the Internet (Shamdasani, Chon-Lin, & Richmond, 1993)

### **Review of Literature**

Sachdev (2011) advocated that no consumer product has a zero environmental impact. Lin, & Huang (2012) found that the main influencing factors on consumer choice behaviour regarding green products include: psychological benefit, desire for knowledge, novelty seeking, and specific conditions. Functional values, price and quality did not influence on consumer choice behaviour regarding green products. Irawan, & Darmayanti (2012) advocated that environmental concern, perceived seriousness of environmental problems, and perceived environmental responsibility significantly affect green purchasing behaviour. Mohammad (2012) reviewed various factors like consumer belief (CB), social influence (SI), environmental attitude (EA), perceived quality (PQ), green purchasing behavior (GPB) that influence the customers. Gan, Wee, Ozanne, & Kao, (2008) found that consumers who are environmentally conscious are more likely to purchase green products. Traditional product attributes such as price, quality, and brand are still the most important attributes that consumers consider when making green purchasing decision.

### **Objectives of Study**

- a) To Judge the awareness, attitude and preferences of people towards eco-friendly products.
- b) To examine the best promotional tool to generate the awareness of people towards eco-friendly products?
- c) To find out factors affecting preference of people towards eco-friendly products.

**Hypotheses of Study**

1. H1: There is no significant difference among genders for preference of different brands those manufacture eco-friendly products.
2. H2: Knowledge about eco-friendly friendly products is not positively correlated with preference for eco-friendly products.
3. H3: Health features/personal benefits using eco-friendly products have negative influence on preference for eco-friendly products.
4. H4: Type of Brand of eco-friendly products has negative influence on preference for eco-friendly products.

**Sampling Technique**

Simple random sampling is used for selecting the sample of study from students of Central University of Himachal Pradesh. The University students are taken for sampling not because of convenience but these constitute a large population of environmentally conscious persons providing a picture of future green buying behavior (Paco, 2013).

**Analysis**

The majority of respondents are educated male and female; and people from age group between 18-25 years who enthusiastically participated in the study. 78% (36%+42%) of people buy eco-friendly products due to environmental and health factors. The health factor as major concern being reported by 42% of respondents showing people are much more concerned towards their own health/Personal benefits rather than the environmental concern.

About 82% (52%+30%) people come to know about green marketing and eco-friendly products through Web Based Advertising/Internet and TV. The Web Based Advertising/Internet is best promotional tool for eco-friendly products. The results are supported with (Biloslavo, & Trnavcevic, 2009) & (Ottman, 2011) which shows that consumers trust for information in advertising on brand websites and consumer opinions published online, followed by ads on TV, newspaper, magazine and radio respectively.

Among 8 different Companies LG got 42% for a green company adopting green marketing strategy for producing and promoting eco-friendly products followed by Godrej (16%). Website of LG revealed that LG is a manufacturer of eco-friendly ACs, Refrigerators etc.

Rediff (2011) advocated that a large number of Companies are working to save the environment including home appliance manufacturers, other e-appliances Companies etc. Among these companies LG is rated at first position followed by Haier, Samsung and Panasonic.

Top appliances Kitchen Brands in India also listed LG as most preferred and available kitchen brand in India. Shah (2011) listed top home appliances manufacturing companies as LG, Samsung, Godrej, Philips, Sony, Panasonic, Bajaj etc. Among all these Companies LG, Samsung found significant place as top manufacturer of home appliances by most of the previous studies.

Table 1: Respondents personal and survey information

	Frequency	Percent	Cumulative (%)
<b>Age</b>			
18 - 25 years	35	70%	70%
25-30 years	13	26%	96%
30-35 years	2	4%	100%
<b>Gender</b>			
Male	28	56%	56%
Female	22	44%	100%
<b>Education Level</b>			
Graduate	29	58%	58%
Post graduate	19	38%	96%
Doctorate	2	4%	100%
I prefer eco-friendly products for:			
Environmental factors	18	36.0%	36.0%
Health factors/Personal Benefits	21	42.0%	78.0%
Latest technology	8	16.0%	94.0%
Others (Safety/ Ease of handling)	3	6.0%	100.0%
<b>Information source of green Products</b>			
WBA/internet	26	52.0%	52.0%
TV	15	30.0%	82.0%
Newspaper	4	8.0%	90.0%
Magazine	2	4.0%	94.0%
Radio	1	2.0%	96.0%
Reference groups	2	4.0%	100.0%
<b>Company adopting green marketing strategy and producing eco-friendly products</b>			
LG	21	42.0%	42.0%
Samsung	5	10.0%	52.0%
Godrej	8	16.0%	68.0%
Whirlpool	2	4.0	72.0%
IFB	2	4.0%	76.0%
Sony	2	4.0%	80.0%
Philips	4	8.0%	88.0%
Panasonic	5	10.0%	98.0%
Others	1	2.0%	100.0%

The comparative analysis for these 4 brands revealed that 50% of individuals prefer LG electronics home appliances followed by Samsung 38%, Panasonic and Haier 6% each. Among these, 23 male preferred LG electronics and only 5 preferred Samsung, whereas 2 female prefer LG electronics, 3 female

preferred Haier, 14 Female preferred Samsung and only 3 Preferred Panasonic home appliances. This shows that people prefer for LG electronics the most because of its eco-friendly product manufacturing feature.

Table 2: Comparative preferences of the brands

	Male	Female	Frequency (Male+ Female)	Percentage
LG	23	2	25	50%
Haier	—	3	3	6%
Samsung	5	14	19	38%
Panasonic	—	3	3	6%
Total	28	22	50	100%

Source: Primary Data

The independent sample t test shows that there is a significant difference among genders for preference of different brands which manufacture eco-friendly products.

Table 3: Preference of genders for different brands

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Preference	Male	28	1.3571	0.78004	0.14741
	Female	22	2.8182	0.79501	0.16950

Table 3 shows the preference of genders for different brands which manufacture eco-friendly products. The group statistic illustrates that there were 28 male and 22 female respondents in the study. The mean value for preference of male respondents is 1.35 and for female 2.81 with standard deviation for male and female 0.78 and 0.79 respectively.

The independent sample test shows the *Levene's test for equality of variance* and *t-test for equality of means*. Since the value of Levene's test is significant  $p = 0.000$  ( $p > 0.05$ ), so statistics associated with equal variance not assumed has been used for further analysis. The value of *t* statistic for equal variance assumed is 6.504 with 44.833 degrees of freedom. The corresponding two tailed p-value is 0.000, which is highly significant. Therefore we accept the alternate hypothesis at 5% significance level. This shows that *there is a significant difference between genders for their preference of different brands manufactured eco-friendly products*. Hence alternate hypothesis (H1) is accepted.

Here a moderate positive correlation between two variables preference & knowledge has been found which is significant at  $p < 0.05$  i.e. (0.000). Hence, alternate hypothesis (H2) is accepted which reveals that people buy eco-friendly products only if they have a knowledge about them. The knowledge of people increases their preference for eco-friendly products .

Table 4: Independent sample t-test

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Preference	0.048	0.827	-6.519	48	0.000	-1.46104	0.22411	-1.91164	-1.01044
Equal variances assumed									
Equal variances not assumed			-6.504	44.833	0.000	-1.46104	0.22463	-1.91352	-1.00856

Source: Primary Data

Table 5: Correlation between preference and knowledge about eco-friendly friendly products

		Preference	Knowledge
Preference	Pearson Correlation	1	0.554(**)
	Sig. (2-tailed)		0.000
	N	50	50
Knowledge	Pearson Correlation	0.554(**)	1
	Sig. (2-tailed)	0.000	
	N	50	50

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

The regression coefficient value i.e.  $R = 0.650$  or 65.0% which shows that correlation between dependent and independent variables is positive. The coefficient of determination values shows that 65% variance in dependent variable is caused by independent variable (Table 6). The F value is 13.281 which is significant  $p = 0.000$ . Thus correlation between dependent and independent variables is statistically significant and valid. The regression model specifies that factors positively affect the consumer's preference towards eco-friendly products except latest technology. The type of media and company name has a significant impact on consumer preference towards eco-friendly products.

Table 6: Relationship between variables affecting consumer preference

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.806 <sup>a</sup>	0.650	0.601	0.67562

a. Predictors: : (Constant), Company, Environmental factors, Latest Technology, Safety, Health, Types of Media

ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.372	6	6.062	13.281	0.000 <sup>b</sup>
	Residual	19.628	43	0.456		
	Total	56.000	49			

a. Dependent Variable: Preference

b. Predictors: (Constant), Company, Environmental factors, Latest Technology, Safety, Health, Types of Media



		Coefficients <sup>a</sup>			t	Sig.
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
1	(Constant)	2.356	1.077		2.188	0.034
	Safety Features	0.389	0.169	0.210	1.777	0.044
	Environmental Features	-0.420	0.173	-0.240	-2.427	0.019
	Latest Technology	-0.218	0.164	-0.129	-1.330	0.190
	Health/ Personal Benefits	0.409	0.187	0.236	2.189	0.034
	Type of Media	-0.616	0.180	-0.727	-3.419	0.001
	Company	0.585	0.089	1.439	6.581	0.000

a. Dependent Variable: Preference

Based on the findings, the health/personal factors and type of brand positively affect the preference of people towards eco-friendly products with p values of 0.034 and 0.000 respectively. It supports Hypothesis H<sub>3</sub> and H<sub>4</sub>. Further Factor analysis is applied to find out which factors among these influence the people preference.

Table 7: Mean standard deviation and reliability values

ID	Variable Name	Mean	N (Items)	Cronbach's Alpha
E	Environmental Features	3.91	5	0.571
S	Safety Features/Personal Benefits	3.80	4	0.521
H	Health Features	4	4	0.582
LT	Latest Technology	2.833	3	0.605

The KMO value is 0.614 which is the adequate value to be considered for factor analysis. It shows that the statements can be considered for factor analysis. The Chi-square value is 225.798 highly significant (0.000) with 120 degrees of freedom. The values of Cronbach's Alpha are greater than 0.5 showing a greater internal consistency. The total variance explained reveals that these four factors cause 56.65% variance in the preference for eco-friendly products.

Health Features/Personal Benefits yielded highest mean value (4.00) followed by Environmental Features (3.91), Safety Features (3.80) and Latest Technology (2.83) (Table 7). Since all variables yielded mean value of greater than 3, this shows that these factors are useful in assessing the people preference towards different brands of eco-friendly products.

Table 8: Factor analysis

Sr.No.	Item	Factor loading	Average Variance of factor in Percentage	Factor
1.	S1	0.704		Safety
2.	S2	0.808	13.46%	Feature(S)
3.	S3	0.625		
4.	H1	0.829	22.13%	Health Feature/
5.	H2	0.764		Personal Benefits (H)
6.	H3	0.495		
7.	E2	0.482	10.83%	Environmental
8.	E3	0.776		Features (E)
9.	E4	0.712		
10.	E5	0.522		
11.	LT1	0.495	9.69%	Latest
12.	LT2	0.728		Technology(LT)

### Conclusion

The study shows that the respondents are aware of eco-friendly products; they prefer to buy these, because they are safe for health/ personal benefits like reduction in electricity bills using eco-friendly appliances. The correlation analysis revealed that as the knowledge or awareness of people about eco-friendly products increases, their preference for eco-friendly products also increases. The results of factor analysis revealed that people prefer for eco-friendly products because these products do not cause any negative effect on the health of user, reduces electricity bills, are easy to handle and safe for environment, and adopts latest technology. All these four factors accounts for 56.65% variance in preference of people. The study also reveals that LG is the most preferred brand among all the home appliances as LG preference is 50% and Samsung is next leading brand with 38%. Web Based Advertising (WBA) or Internet is the best promotion tools for eco-friendly products.

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