Semi-Strong Form of Market Efficiency : Does all Critical Information Affect Stock Price Valuations?

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Abstract

Information about company fundamentals, among many things, should determine the prices of stocks. Usually, financial markets operating under a semi strong efficient market (SSEM) hypothesis imply that market prices of equity scrips react to business and environmental information which is available in the public domain. However, the paper established that even though SSEM hypothesis may hold most of the time, all publicly available data may not necessarily be factored to buy or sell stocks. There could be instances where some critical information (say, ratios of business efficiency), which is publicly available, may not be considered in favour of more directly observed or easily derived piece of information, that is, sales or profits. The paper studied correlation of business aggressiveness or strategic intent (expenditure made by the business to improve its competitive position) and historical market value to book value ratio of select scrips. Evidence emanating from the study indicated that vital information, which may affect business performance, in many cases was ignored by the market while deriving stock prices. The paper also proposed a non-econometric technique to assess company fundamentals which could lead to assessing stocks which were likely to improve their valuations in the mid-term (1-2 years horizon). The study concerned five IT stocks listed on the BSE to examine whether market to book valuation behaved in some accordance with the firm's strategic intent (measured as business expenditure, that is, employee cost as a % of sales).

Keywords : **semi strong market efficiency (SSME), Tobin's *q*, core competency strategic intent matrix**

JEL Classification : G10, G140

Paper Submission Date : December 6, 2016 ; Paper sent back for Revision : March 9, 2017 ; Paper Acceptance Date : April 18, 2017

A security's price is an equilibrium price between rational, well-informed, profit seeking decision makers. Buy/sell decisions are based on available information, therefore, price of a financial security is based on available information. The formal hypothesis regarding market efficiency states that all available information in the public domain is discounted into the price of a financial security.
Fama(1970) suggested three levels of efficiency :

- weak form efficiency,
- semi strong form efficiency,
- strong form efficiency.

Stock prices reflect all public information - past and present. The test of SSEM theory is to examine whether security prices fully reflect all information in the public domain. If this should not always hold true, it would be theoretically possible to earn returns in excess of the market by studying the company's fundamentals, information of which is readily available. This paper investigates, whether under the SSEM, market value of an underlying asset could be speculated, especially under varying conditions of information availability. The

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attempt of the paper also extends to examining whether stocks are over or under valued in comparison to their strategic intent (business aggressiveness). Specific objectives of the study are noted below. The primary data pertains to financial years 2011 - 2016.

Objectives

(i) Does the market factor information, which could be critical, but has to be derived in factoring the price of an underlying asset? This question forms the basis of the null hypothesis.

(ii) How to identify stocks being over or undervalued purely on the basis of strategic intent or business aggressiveness (investment done by the company to improve its fundamentals) ? This question forms the basis of the alternate model to guide investment decision making for the mid-term (i.e. 2 - 3 years period).

Hypothesis

Since the market builds in all information in discounting the price of a defined asset, it should naturally correct itself for information asymmetry and incompleteness. Such condition implicitly suggests that there must be positive correlation between stock prices and market information availability. Flowing from this premise, the following null hypothesis is proposed for testing :

↳ **H0:** There exists a positive correlation between market value/book value of a stock and strategic intent (aggressiveness index), that is, spending in a "key success factor" area of a business.

The above hypothesis is framed with a view that any investment in a "key success factor" by a firm should result in improvement in the PAT, and as such, this information must be factored in determining the equilibrium price of an underlying asset even under condition of semi strong market efficiency. This paper studies the relationship between investment in human capital (employee costs as % of sales) and market value to book value of the firm (also popularly known as the Tobin's *q*) in the IT sector. Explanation for the relevance of the indices used in this analysis is given further in the paper.

The original paper relating to the idea of the *q* developed by James Tobin and W. Brainard(1968) concerned with the ratio of market value of physical assets to their replacement value at current factor cost. Since then, several interpretations of the *q* have been formulated to assess valuation. This paper considers price to book ratio interpretation of the Tobin's *q* as aforementioned.

Rationale for Human Capital Cost Factoring for the Service Sector

The service sector is strongly employee cost dominant and it would be only fair to assume that any increase in this expenditure should impact sales and consequentially, profits. A business manager would or should know the trends which are affecting his/her industry and resultantly decide on expanding or contracting his/her work force. In other words, the impact of manpower build up should, in some way, signal prospects of a growing business. Such knowledge of business prospects, which is private information known to a business manager, eventually would be known to the market and ,therefore, should affect the scrip's valuation.

We could further assume that the IT sector continuously trains its work force on new and advanced skill sets and thus, the quality of such human capital should be almost similar. In any case, the factors considered in the hypothesis, that is, human capital investment and price to market value should have positive correlation. Negative or weak correlation between the above mentioned indices, therefore, would indicate that all information is not

necessarily factored in the price of an underlying asset and the possibility of arbitrage exists. The model's further application also attempts to identify over and under-valued stocks in relation to the *q* and the firm's strategic intent. The commentary at the end of the analysis would indicate this assessment.

In light of the above, it is imperative to examine the role of information availability and its impact on stock valuation. The following section deals with the subject of information and bounded rationality limitations on scrip valuation.

Information Availability

Any piece of information can be examined through several frames, that is, consistency, credibility, completeness, symmetry, etc. Considering this, there are two principal components that are generally involved in any decision process : (a) information availability, (b) information credibility.

If we were to assume that all available information is credible or atleast thought so by the investor when he/she wishes to speculate, there could exist a chance of some information being available but not searched or known (i.e. ratios of efficiency etc.). Therefore, possibilities exist of such information not being factored in the price of the underlying asset.

Individual assumptions of information completeness are the basis of *bounded rationality* thinking, where investors ground all their decisions on understandable and available information, which is predominantly "satisfying" rather than "optimizing". This paper deals with the concept of information, though available but complex, of not being used in decision making.

SSEM hypothesis is based on the concept of partial information availability to the investment managers and their ability to derive future prices of an underlying asset. It would be interesting to know whether they (the managers) or the markets notice all or some fundamental pieces of information related with key business changes, and this remains to be tested. If they do not do so, the null hypothesis stated above has to be rejected.

Towards this end, the paper considers the CCSI matrix model developed by Hamilton, Eskin, and Michaels (1998) to perform a historical stock price data based experiment. The model and study is detailed in the next section.

The CCSI Matrix

The CCSI matrix or the core competency strategic intent matrix is a popular tool which could be used to speculate the effects of investment aggression shown by a company to improve its business position. The model is based on two relatively well known ratios in the financial world, that is, (a) the Tobin's *q,* and (b) aggressiveness index.

The Tobin's *q* is a ratio of market value of an underlying asset divided by its book value (Book value = total assets minus intangible assets minus liabilities).

The aggressiveness index *(AI)* is simply any effort considered worth undertaking by the company to improve its market position measurable through sales, shares, or profits.

The CCSI is the derived plot of the above factors of the underlying asset and presented in graphical form. The positions of these stocks at every financial year end (used in this paper) or any such suitable (interval scaled) period depicts the movement of the investigated underlying asset in relation with the factors mentioned above.

(1) The Logic of the CCSI : Companies invest to build competencies and increase their sales and PAT (profit after tax). Such changes are readily reflected in EPS and market valuations, thus, statistically stated, should have a positive correlation with the Tobin's *q*. The paper, in part, examines these effects of information availability and validation on market valuation.

Table 1. Data Pertaining to Various Indices over Financial Years (31st March or Company Closing)

	Year	Sales (Crs) (S)	Price to Book (MV/BV)	Employee Cost (Crs) (EC)	Employee cost to sales ratio (EC/S)
TCS	2011	37325	11.88	18806	0.50
	2012	48894	9.23	24683	0.50
	2013	62990	9.48	24040	0.38
	2014	81813	9.46	29860	0.36
	2015	94653	10.98	38701	0.41
Tech M	2011	5092	2.52	1944	0.38
	2012	5311	2.66	2263	0.43
	2013	5907	3.24	2514	0.43
	2014	16485	4.88	6972	0.42
	2015	19349	5.37	7201	0.37
Infosys	2011	25385	7.58	12459	0.49
	2012	31254	5.53	15473	0.50
	2013	36765	4.6	19932	0.54
	2014	44341	4.46	24350	0.55
	2015	47300	5.29	25115	0.53
Oracle	2011	2361	3.23	1052	0.45
	2012	2606	3.52	1253	0.48
	2013	2938	2.94	1442	0.49
	2014	3159	3.07	1576	0.50
	2015	3341	9.22	1597	0.48
HCL Tech	2011	5079	5.8	2138	0.42
	2012	6794	58	3259	0.48
	2013	8907	5.29	3923	0.44
	2014	16497	6.65	5124	0.31
	2015	17153	6.67	5925	0.35

Date Source : Yahoo Finance

(2) The Data : As mentioned, the study was conducted through MV/ BV ratio (Tobin's q) and company spending on employees as a percentage to sales data, which is available publicly. The period of data was considered for five financial years, from 2011 to 2016. The companies considered were in the information technology space, that is, Oracle, Tech Mahindra, Infosys, HCL Tech, and TCS. All stocks are listed on the BSE.

The data was studied across sales, employee cost to sales ratio, price to book ratio (Tobin's q), and year average market price of the stock. A cross summary of the data used for the study is presented below. The Table 1 indicates company wise data. Multiple correlation was used to analyze the strength of the relationship between the various data mentioned above. The market price is the average price of the stock for the financial period considered in the study.

Analysis and Results

The market exhibits a strong correlation between annual sales and year average prices (4 out of 5 scrips in Table 2). For instance, TCS had sales to market price correlation of 0.98 (see Table 2).

Table 2. Correlation Matrix for Relevant Indices for Individual Stocks (Data in Table 1)

		Sales	Price to Book (Tobin's *q*)	Employee cost to sales ratio (Strategic Intent)
TCS	Price to Book	-0.17		
	Employee cost to sales ratio	-0.78	**0.38**	
	Market price (average of stock)	**0.98**	-0.23	-0.88
Tech M	Price to Book	0.99		
	Employee cost to sales ratio	-0.36	**-0.27**	
	Market price (average of stock)	**0.51**	0.58	0.50
Infosys	Price to Book	-0.75		
	Employee cost to sales ratio	0.82	**-0.84**	
	Market price (average of stock)	**-0.44**	-0.08	0.09
Oracle	Price to Book	0.60		
	Employee cost to sales ratio	0.70	**-0.05**	
	Market price (average of stock)	**0.96**	0.67	0.70
HCL Tech.	Price to Book	0.83		
	Employee cost to sales ratio	-0.88	**-0.86**	
	Market price (average of stock)	**0.74**	0.44	-0.71

Table 3. Correlation Results of Aggressiveness Index and *q*, with One Year Forward Lag, that is, Aggressiveness Index of 2011 Correlated with *q* of 2012

	Correlation Between *q* and Aggressiveness Index
TCS	0.710
Tech M	-0.678
Infosys	0.201
Oracle	-0.480
HCL	0.645

The market, in this case, used information which was readily available, that is, sales increase. Such behaviour is consistent with the theory of semi-efficient market hypothesis. However, if we consider the correlational values of Tobin's *q* to strategic intent, we can see that in most of the cases (4 out of 5 companies, Table 2) a negative or weak correlation exists, implying that the markets did not see any direct linkage between the two variables. For instance, TCS has correlational indices of 0.38 for the CCSI matrix parameters. In certain cases, there is a strong positive correlation between average market prices of stocks and sales but negative correlation between the *q* and strategic intent. For example, in case of HCL Technologies, market price to sales is positive ($\rho = 0.74$), but strategic intent to *q* is negative ($\rho = -0.86$) (see Table 2).

It can be noticed that the market only considered data that was *readily available and easy to digest*. It seems that immediately unavailable data or data considered as "*above acceptable level of analytical effort*" was not factored. It is observed from the Table 2 that there is a stronger correlation between sales figures and average market price of a stock, rather than *q* to strategic intent, which determines the intrinsic value of the stock in the future, that is, employee cost. Even if we are to assume that the impact of strategic intent may not be correlated positively with the *q* in the same year, effect of this should have been seen in the subsequent year. Correlation with one year lag between the above indices is given in the Table 3.

The Table 3 shows a mixed response where only two companies have a positive relationship, that is, TCS and HCL ; whereas, others exhibit weak or negative correlation. Generally stated, the observations of the study

indicate that the condition of "*full information*" factoring is violated, not fully, but substantially for the sample considered. In context of the findings mentioned above, the H0 (null hypothesis) stands rejected as there is evidence of negative or weak positive correlation between the *q* and strategic intent.

The alternate hypothesis, which readily assumes that information does not require being complete or compelling to influence the price of an underlying asset, holds true. Under operant conditions of bounded rationality, sparse and satisfying information becomes relevant for decision making, where the investment manager may ignore how a firm is conducting itself at a strategic level and over weighs easy evidence such as sales or profits in determining the market price of a scrip.

Since most IT stocks are affected by extraneous factors such as change in employment policies in U.S. or Europe, stories of global melt down or growth etc., we can assume that such impact would be more or less uniform for all scrips considered in the sample as a significant portion of IT business is outbound. Instances, as mentioned above, of imperfections result in misspelling stock valuation and raise possibilities of arbitrageur market correction of prices. One possible extension of the above study is where the CCSI model can be employed to assess stocks by their fundamentals and comment on whether they are over or under valued. It must be mentioned here that the CCSI model considers only one factor, that is, employee cost as strategic intent. However, the model is flexible and can be created around multiple factors such as customer loyalty indices, advertising to sales ratio etc., and these could be tested with the *q*.

The following Figures indicate how Tobin's *q* and aggressiveness intent behaved over years for these stocks. The following figures provide a directional sense to the investment managers to examine a stock by its intrinsic worth and base their investment decisions accordingly. The analysis should be a good template for the mid- term investor who is looking to park funds for a year or two in a specific stock.

Figures 1- 4 indicate how the position of Tobin's *q* and the aggressiveness index (strategic intent) perform over the financial years. Index considered for aggressiveness is normalized at 1 and MV/BV is considered as average of all stocks for the financial year. For purposes of comparative convenience, the axis values for both variables are kept constant. The observations are based on year aggregate data considering the movement of price to book values and the aggressiveness index over the years. A working demonstration of the model for the year 2011 is given in the Table 4. The same process is repeated over the next 4 years.

Table 4. Calculation of Plot Values of *q* and Aggressiveness Index

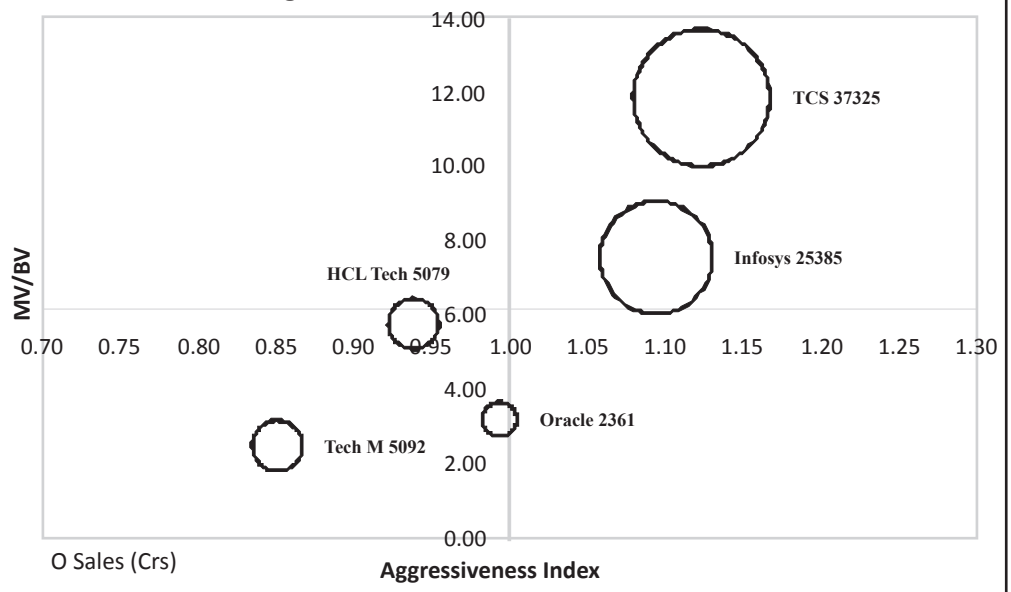
Company	Sales (Crs)	Price to Book	EC/Sales	Index Value	Employee Cost (Crs)
TCS	37325	11.88	0.50	1.12	18806
Tech M	5092	2.52	0.38	0.85	1944
Infosys	25385	7.58	0.49	1.09	12459
Oracle	2361	3.23	0.45	0.99	1052
HCL Tech	5079	5.80	0.42	0.94	2138
Average		**6.20**	**0.45**	**1.00**	

The application of the model is to denote a company's performance versus its *q* through a graphical relationship. This model is normative in nature as opposed to being descriptive. The model makes a strong case for the fund manager to favour particular scrips for holding in the medium term period of say 1 – 2 years based on the fundamentals of the CCSI model. The matrixes shown in Figures 1- 4 are transitional and will help the investor form an opinion regarding current and potential scrip valuation. The model is efficient in analyzing valuation of scrips for the medium term.

It is clear from the Figure 1 that TCS and Infosys invested strongly to improve their business capability and also enjoy high MV/ BV ratio. Others lag on both indices.

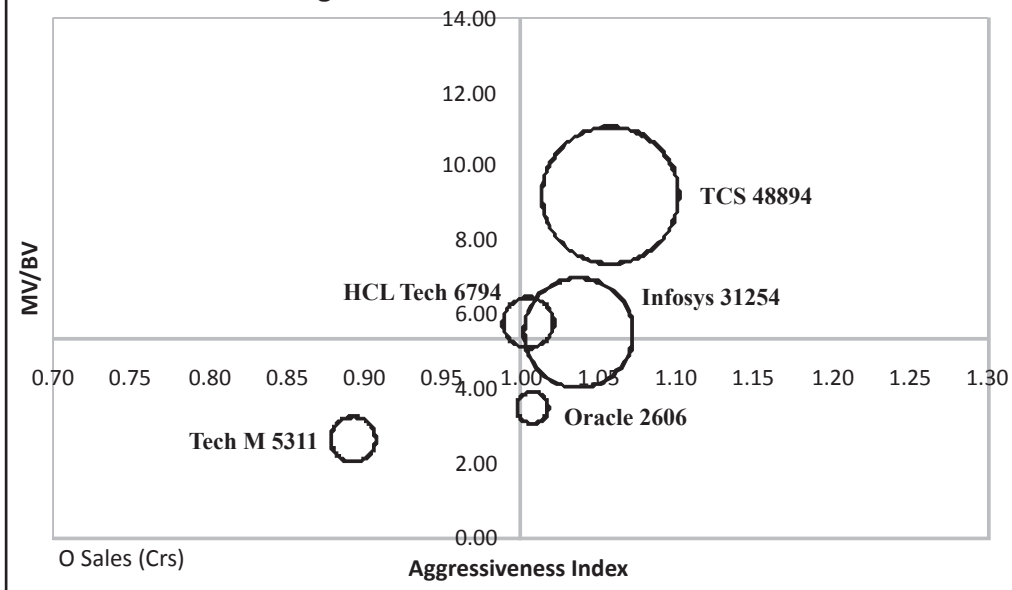
As depicted in the Figure 2, TCS and Infosys reduced their aggressiveness index and Oracle and HCL surged

Figure 1. CCSI Matrix for 2011-12 FY



Note : The *Y* – axis represents market to book value and the *X*- axis represents strategic intent or aggressiveness index (refer Table 2). The circles in the figures indicate size of sales turnover in ₹ crores.

Figure 2. CCSI Matrix for 2012-13 FY

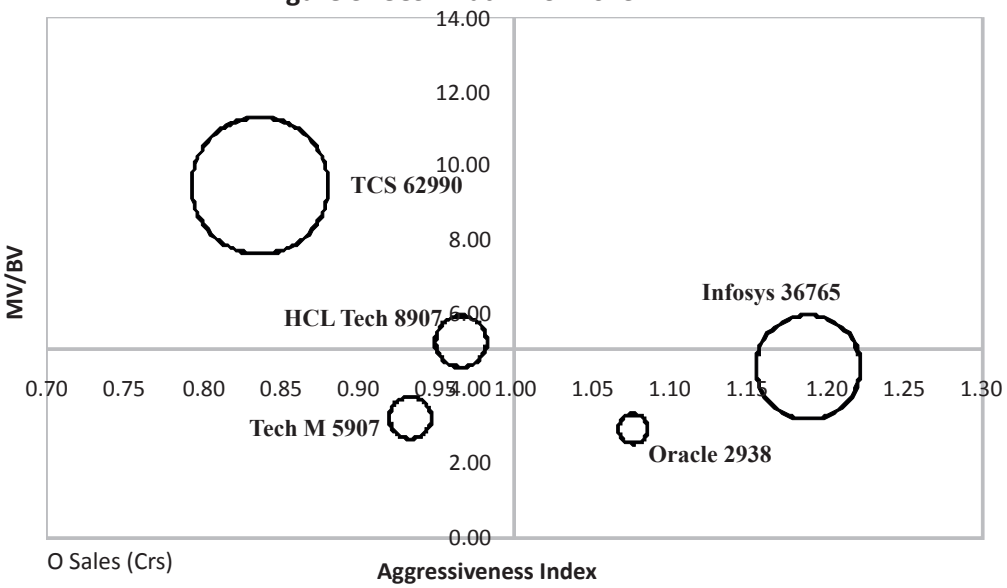


Note : The *Y* – axis represents market to book value and the *X*- axis represents strategic intent or aggressiveness index (refer Table 2). The circles in the figures indicate size of sales turnover in ₹ crores.

ahead. The logic of the model is that if an investor is looking at fundamentals, Oracle would appear to be a strong growth story scrip for investments.

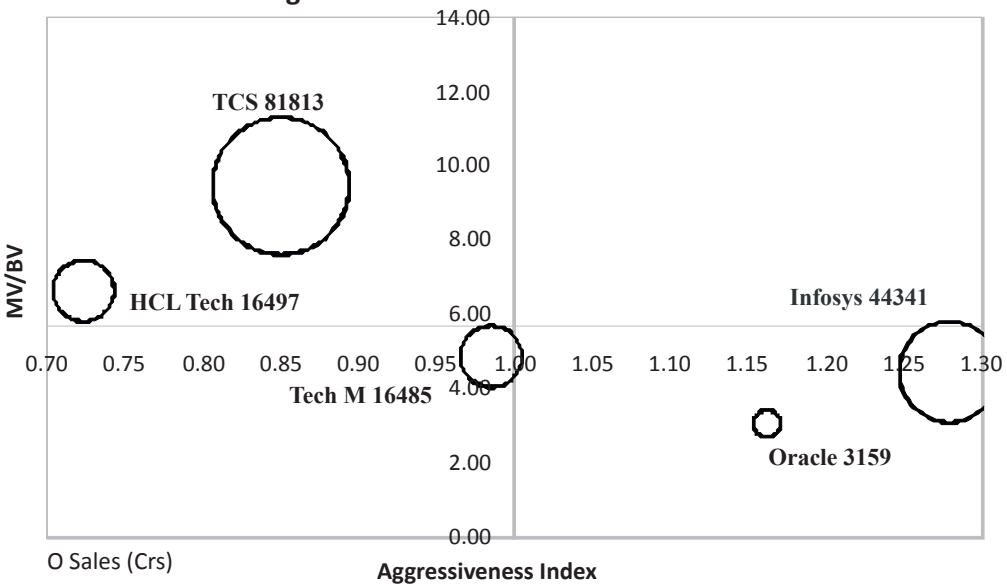
As can be inferred from the Figure 3, Oracle and Infosys maintained an aggressive investment posture, but this is not reflected in their *q*. These are fundamentally strong scrips to buy for the medium term. TCS, on the other hand, reduced spending and yet maintained a high *q* valuation, indicating overvaluation. TCS, if it corrected its

Figure 3. CCSI Matrix for 2013-14 FY



Note : The *Y* – axis represents market to book value and the *X*- axis represents strategic intent or aggressiveness index (refer Table 2). The circles in the figures indicate size of sales turnover in ₹ crores.

Figure 4. CCSI Matrix for 2014-15 FY

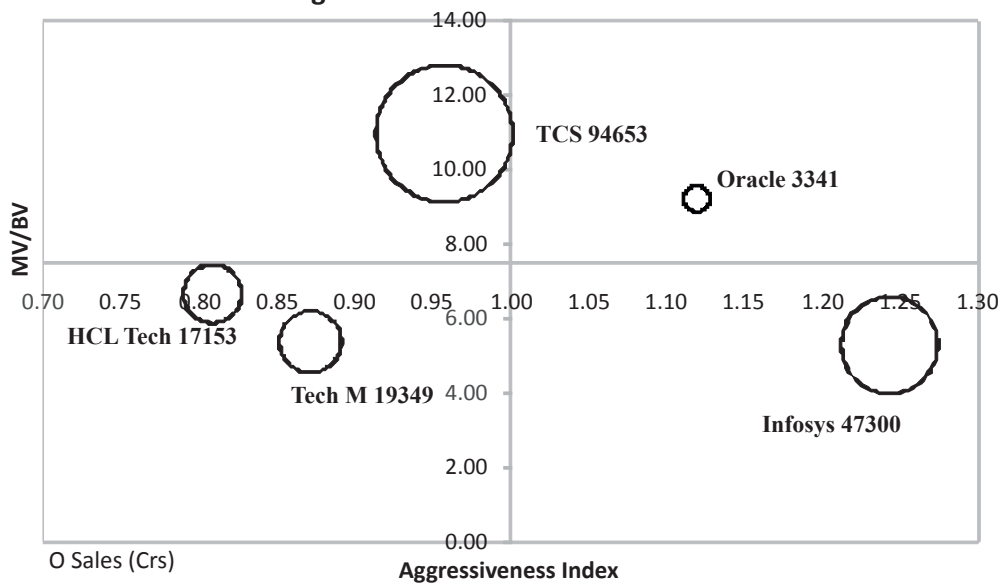


Note : The *Y* – axis represents market to book value and the *X*- axis represents strategic intent or aggressiveness index (refer Table 2). The circles in the figures indicate size of sales turnover in ₹ crores.

aggressiveness index, could move towards being a prime scrip in the next 2-3 years.

As can be inferred from the Figure 4, Oracle and Infosys maintained lead in investment in human capital and these are signs of a growing business. A fund manager should note that, there would be indications that business managers, who are privy to internal information, shape their strategic thinking accordingly. These two scrips, that is, Oracle and Infosys should appeal to medium period investors as both scrips are strong on fundamentals. TCS

Figure 5. CCSI Matrix for 2015-16FY



Note : The *Y* – axis represents market to book value and the *X*- axis represents strategic intent or aggressiveness index (refer Table 2). The circles in the figures indicate size of sales turnover in ₹ crores.

dropped its aggressiveness index further, yet maintained a relatively high *q, indicating overvaluation.*

As depicted in the Figure 5, the market seems to correct its valuation for Oracle. If we examine the Figure 4 and the commentary above, it is seen that both Oracle and Infosys were undervalued and in Figure 5, we see that Oracle corrected its valuation in the *q*. Infosys is still undervalued and has potential to be a strong medium investment opportunity. Also, we see that TCS increased its aggressiveness index (moving towards the right side of the divider line of Figure 5 as compared with Figure 4).

Discussion and Conclusion

(1) The market does not factor all information in determining the value of an underlying scrip. Information, especially related future business prospects etc., known to business managers is largely disregarded. Rejection of the null hypothesis, as concluded in the above statistical study, is the result of such behaviour.

(2) The market seems to value immediate sales growth or profit as opposed to medium term business prospects. The Table 1 indicates a mixed correlation response between sales and *q*.

(3) The market tends to correct itself over a period of time for valuations driven by pure business fundamentals. The Figure 5 indicates that Oracle, TCS, and Infosys improved their *q* ratings, and HCL and Tech. Mahindra lagged behind.

The model allows for a macro analysis of business fundamentals and their impact on medium term market valuation. The model would serve as a guide to fund managers who may consider investment horizons of 1 - 2 years for scrips. The model is also effective in assisting risk averse investors who are likely to examine business prospects rather than be guided purely by speculative interests.

Limitations of the Study and Scope for Future Research

The model makes an assumption that the market value of a stock is a reflection of its aggressiveness displayed through investment. However, it is common knowledge that market value is also influenced by several exogenous factors. The model is indicative of business fundamentals and should not be seen as a stock price prediction technique since strategic intent may vary with changes in top management, market forces, etc. The model, though, may provide insights into future valuation possibilities for scrips.

The model could be studied across mid and small cap IT brands to ascertain the strength of the relationship between aggressiveness index and Tobin's *q*. Also, a multi-factor model could be considered for development with regression weights. It also may be interesting to know the applicability of the model in other sectors with specific systemic indices.

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