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Analyzing the Effect of Recession on Auto Industry in India Using DuPont 5 Point Ratios

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***Abstract*— Global recession of 2008 had a major effect on the auto industry worldwide. This paper is an attempt at analyzing the impact of recession on the auto industry in India. The financial data of auto companies in the passenger vehicle segment having 80% share in market, is used. The DuPont 5 point ratios are compared for two different periods of pre-2008 and post-2008. To validate their correlation with the financial health of the companies, multiple linear regression was applied on 3 of the 5 ratios (as the independent variables) and net earnings (as the dependent variable). Each of the DuPont 5 point ratios were compared with their corresponding values in pre- and post- recession phase, to identify the extent of change, using T- test. The paper highlights the extent of affect, the DuPont ratios have on EAT in the two phases. An insignificant change was observed in the coefficient of equity multiplier, the ratio of total asset and share holders' equity, which implies that there was no effect of recession on Shareholder's equity and the total assets trends. On the other hand, asset turnover, the ratio of net sales and total assets, became less significant in controlling EAT after recession. This implies that even if there was an increase in total assets, the net sales were still low.**

Keywords*— *Auto Industry, Recession, DuPoint 5 point ratios, Regression, T-Test, Emperical models.

I. Literature Review

Financial evaluation of a firm can be done by various methods. Ratios is one of the method for the same. Mainly two financial statements called balance sheet and Profit and loss statement are used to calculate ratios [1]. One of the most advanced and unexplored approach is DuPont Five Point analysis. Return on equity is a multiplication of 5 ratios i.e. tax burden, interest burden, operating profit margin, asset turnover and equity multiplier where each term is individually defined:

$$Tax\ Burden = \frac{EAT}{EBT} \quad (1)$$

$$Interest\ Burden = \frac{EBT}{EBIT} \quad (2)$$

$$Operating\ Profit = \frac{EBIT}{Net\ Sales} \quad (3)$$

$$Asset\ Turnover = \frac{NSales}{Total\ Assets} \quad (4)$$

$$Equity\ Multiplier = \frac{Total\ Assets}{Total\ Equity} \quad (5)$$

Regression analysis is a statistical technique used to explore the relationship between metrically measured independent and dependent variables[2]. Regression analysis is used to relate a dependent variable with one or multiple independent variables. It can be in a linear or a non-linear fashion. Multiple regression's popularity is fostered by its applicability to varied types of data and problems, ease of interpretation, robustness to violations of the underlying assumptions, and widespread availability [3] The most widely used approach to conducting a multiple regression analysis is ordinary least[3]. Ordinary least squares estimates the parameters in a linear model by minimizing the vertical distances between responses that are observed and the responses that are predicted by the linear estimate[4]. As can be understood, the smaller is the value of the squares of errors, the better the regression model will be. A higher value of coefficient of determination, R^2, measures how well the variation in the dependent variable (DV) is explained by the variations in the independent variables (IVs).

Finally for the analysis of effect of recession on automobile industry, T-test is applied on ratios and observed whether these ratios show a significant variation due to recession or not. For 2 sets of observations, with each observation in one set having a corresponding value in another set is observed. The null hypothesis is is accepted if the probability, obtained from the T-test, $p > \alpha$ and rejected if $p \leq \alpha$ [5].

II. Ratio Analysis

Automobile companies in India that have a market share of roughly 80% are Maruti, Hyundai, Tata, Honda

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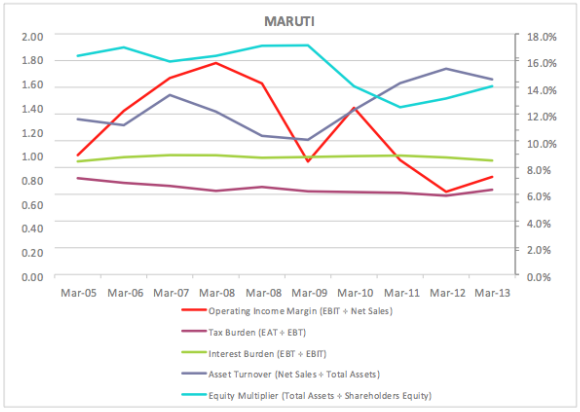
and Toyota with a market share of 45%, 21%, 8%, 5% and 5% respectively (business standard e-paper).

A. *MARUTI*

With a market share of 45% it has maintained a strong position even after the recession.

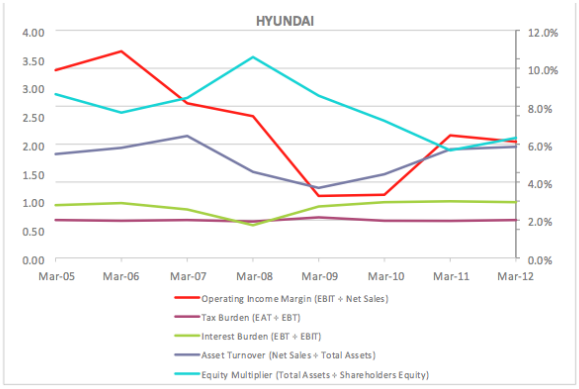


From the FY 2003-2004 to FY 2006-2007, a decreasing trend in equity multiplier and an increase in total assets and Shareholders' equity reflects that increase in shareholders' equity has been much more as compared to increase in total assets. Indicating that the company is being financed lesser by loans. Decreasing interest burden.

After 2007, there is increase in equity multiplier with increasing assets but not much significant increase in shareholders' equity shows the increased loans of the firm, leading to increasing interest burden. Asset turnover for post-recession phase increased to 1.29 in FY 2012-13.

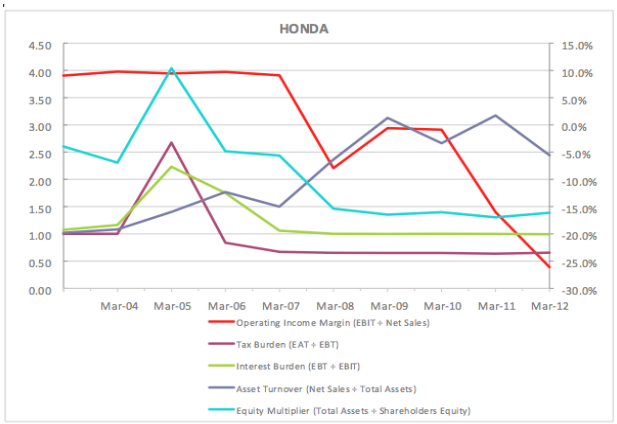
B. *HYUNDAI*

The second largest company after Maruti with a market share of 22%.



There has been a decrease in asset turnover in the pre-recession era i.e. total assets increase is more than the increase of net sales. After recession hit, equity multiplier increased from 2.85 to 3.53. After 2009, the firm tried to maintain is position and raised equity funds, EBIT increase was also huge, equity multiplier decreased and increase in interest burden ratio reflected decreasing interest burden. It increased its operating profit margins in the consequent years and recovered its ROE.

C. *HONDA*



Prior to recession, net sales and EAT increased continuously, although there was no such trend in operating profit margin, asset turnover and equity multiplier. Equity multiplier reduced from 1.39 to 1.30. ROE reflected a value 5.6% higher than value of previous year. Consequent ups and down in operating profit margins and asset turnover were seen but interest burden remained very less during the whole period.

Due to recession, operating and other expenses of the company increased. Economic slowdown and reduced demand hit the company hard with a total reported loss of 196.56 crores in FY 2008-2009 as compared to previous year. The company had taken various methods to survive the turbulent time. It launched new fuel efficient vehicles and diesel variants. Also launched its vehicles in 97 new cities[6].

III. Regression

The no. of companies under consideration have a market share of around 80%. The entre data base of ratios have been normalized with themselves before being used in regression because each represents a different quantities. They have been normalized by using the following formula

$$Y_{normalised} = \frac{Y_i - Y_{min}}{Y_{max} - Y_{min}} \quad (6)$$

The paper uses the DuPont 5 Point ratios as the IVs (Independent Variables) and EAT as the DV (Dependent Variable) for regression. However, the 5 ratios are inter-related to each other and using them all could lead to false results. Tax burden (EAT/EBT) has not been taken because it contains the DV in its expression, this will unnecessarily increase the R^2 and distort the result. In order to avoid taking highly related terms, the correlation factor for all the companies was calculated between the ratios. While a few show very high correlation, some are within the required limit. The presence of one or more large bivariate correlations 0.8 and 0.9 are commonly used cut offs, which indicates strong linear associations, suggesting co-linearity may be a problem [3].

Table 1: Pre Recession regression results

Company	IB	EM	AT	Market Share
	Pre	Pre	Pre	Pre
Maruti Suzuki	0.52	-0.05	-0.77	45.90%
Hyundai	-2.02	-5.15	-3.23	14.00%
Honda	-0.45	3.38	2.56	3.40%
Tata	-0.52	0.54	0.54	14.70%
Industry Average	-0.17	-0.70	-0.82	78.00%

Table 2: Post recession regression results

Company	IB	EM	AT	Market Share
	Post	Post	Post	Post
Maruti Suzuki	-0.02	-1.36	-0.54	49.24%
Hyundai	1.73	0.30	-0.73	21.44%
Honda	0.05	0.10	0.84	6.56%
Tata	0.80	0.23	0.17	6.18%
Industry Average	0.49	-0.70	-0.43	83.42%

The ratios chosen are Assets Turnover (Net Sales/Total Assets), Interest Burden (EBT/EBIT) (EBIT here includes income for other sources as well) and Equity Multiplier (Total Assets/Shareholders Equity). The other two ratios discarded are Equity Multiplier, which has a high correlation with Interest Burden and tax burden. Regression results are given below.

(Market Share Source: SIAM, ICRA's estimates)

Ideally, an inverse relationship of earnings after taxes is expected with equity multiplier while a direct one is expected with asset turnover and interest burden.

For Maruti, coefficients AT is negative which is primarily due to increasing EAT over years with depreciation of this ratios. Mainly because assets have grown proportionately more than net sales have increased, somehow company has managed to increase profits, so such relations is witnessed and finally the obtained coefficients with signs are shown in Table:5.

Likewise, for Hyundai, even with the decreasing asset turnover (more increase in assets than sales), there was increasing net profit, although the ROE was decreasing because of reduced earning per equity, the sign of coefficients reflect the true picture of the company.

Overall weighted averages shows that industry EAT is most affected by asset turnover with maximum negative coefficients amongst all coefficients. This negative sign is contributed by Maruti, as with more than 40% share, it is the most influential one.

Post-recession analysis shows that EAT for the whole industry is the most influential factor amongst all three regressor which affects the results most. EM coefficients are negative for all the chosen firms but its weighted average with Maruti with the highest market share has reversed the sign citing an opposite condition. Similar trend is seen with coefficients of other two regressors whose magnitudes and signs depend upon the weighted average of the companies. The pre and post-recession analysis hardly shows any difference in coefficients of equity multiplier. But coefficient of interest burden shows an opposite sign, and asset turnover coefficient dropped to half.

IV. T-Test

Table 3: T- Test results

Ratios	Probability	Observation
Interest Burden	0.47	Shows a probability of 53% for the occurrence of the null hypothesis. Hence rejected.
Operating Margin	0.06	Shows a probability of 94% for the occurrence of the null hypothesis. Hence Rejected.
Asset Turnover	0.14	Shows a probability of 86% for the occurrence of the null hypothesis. Hence rejected.

Equity Multiplier	0.11	Shows a probability of 89% for the occurrence of the null hypothesis. Hence rejected.
Net Profit	0.12	Shows a probability of 88% for the occurrence of the null hypothesis. Hence rejected.

The T-test uses 2-tailed approach for the ratios being used here. The ratios have been averaged for each of the companies for the 4 year period in the pre- and post-recession phase. The tax-burden ratio has been ignored because in some years it has been shown to be negative and in some cases it is positive even in losses as the tax provision has been shown negative (in the case of Honda for 2009 and 2010).

The null point taken here is 'no change in the DuPont Ratios in the pre- and post-recession periods'. The results given in the table below show us the probability of the occurrence of the null hypothesis. 5% is the maximum variability taken to converge at the null hypothesis.

All the ratios show significant divergence from the null point. This points to the fact that the recession has had an adverse effect on the auto sector even in India. This can be correlated with the fact that there has been a continuous contraction in sale of cars for the past 2-3 years

- Interest Burden (EBT/EBIT): Most companies are seeing lower sales, however most of the companies have loans varying from a few years to a long-term period. This has affected their EBITs more heavily and their EBT lesser so.
- Operating Income Margin (EBIT/Net Sales): Due to increasing input prices and reluctance on the part of companies to raise prices have eroded margins, thus decreasing this factor.
- Equity Multiplier (Total Assets/Shareholder Equity): This has increased over the years as companies are raising fincance via debt more than equity, this is also corroborated by the increasing interest expenditure.
- Net profit (Net profit/Net sales): Net profits of the companies have definitely reduced and some companies are incurring losses for a long time now.

V. Conclusion

Du-Pont five point ratios aids in acknowledging the effect of several factors on ROE. The five ratios mentioned take into account the key aspects in the balance sheet. However one must be careful while working with these ratios, highly negative equity multiplier and operating profit margin might combine to form a very highly positive return on equity which gives a wrong picture as in this case. The disintegrated ratios of ROE i.e. interest burden, tax burden, operating profit margin, asset turnover and equity multiplier can be observed individually to study their trend over years i.e. post and prerecession and their effect on ROE.

Empirical models derived using regression can be used to calculate net earnings of entire industry and individual companies. A comparison can also be done between both the phases by using these equations. These models show that for the auto industry, equity multiplier ratio is almost same for pre and post phases which with the ingress of du-point ratios shows that the change of rate of total assets and total equity has been same. While coefficients of other two ratios, interest burden and asset turnover have shown a significant change after the recession hit the industry. Coefficient of asset turnover has become less negative and that of interest burden has become positive, indicating that if the same values of asset turnover and interest burden are chosen and put in both the equation, it is likely to give better results for the post phase equations. This is mainly due to the reason that companies holding major market share in India maintained their financial health irrespective of recession.

All the ratios show that there has been a significant change in them from pre-recession to the post-recession period. The T-test analysis shows that except in a few cases the recession has led to increase in interest which shows that the companies have taken loans to finance their expansions, or due to non -availability of funds they have led them to take short-term loans. Many of the companies are reeling under heavy losses, but even with these adversities, efforts of some of the industries with higher market share have made them to flourish in the market and take the whole auto industry out of the deteriorating condition due to recession.

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