Research article

Pre and Post-Recession Operating Performance of Indian Manufacturing Firms: A Sectoral Approach using application of 5-point Du Pont Analysis on BSE Sectoral Indices

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Abstract

The paper investigates the impact of recession on the operating performance of Indian manufacturing firms. It compares the performance of the industry in the pre-recession and post-recession phases using sectoral approach, applied on 65 Indian manufacturing firms with highest market capitalizations. The Du Pont 5-Point Ratios are compared for two periods – following and preceding the recession of 2008 and paired T-test is used to identify the significance of recession on the Indian Manufacturing sector and its sub-sectors – Capital Goods, Consumer Durables, Fast Moving Consumer Goods (FMCG), Auto and Metal. Performance of the sector is analyzed by taking weightages according to the market capitalizations of the constituent firms and sub-sectors as per the Bombay Stock

Exchange (BSE) sectoral indices. This analysis is supported by a sampled paired T-test performed on all the companies under study. The results pertaining to financial ratios show that the Metal and Capital Goods sub-sectors were significantly affected by the recession, with the Consumer Durables sub-sector being minutely affected. However the Indian manufacturing sector as a whole was shielded from the impact of the global crisis due to very low impact on its 2 major constituting sub-sectors – FMCG and Auto.

1. Introduction

Today, India is much more integrated to the world economy than before. As an outcome, the global financial downturn left its imprint on the Indian economy as well. Though, many academicians and economic experts have been advocating the impact of recession on Indian economy as minimal, the situation that prevailed in some sectors like capital inflows and exports, proved otherwise [1]. The GDP growth rate in India in particular, declined from 9.6% in 2006-07, to 9.3% in 2007-08 and fell to 6.8% in 2008-09 [2]. The manufacturing sector has been a very important contributor to the GDP in India. With the government employing a new scheme under the 'Make in India' policy in 2014, the significance of the manufacturing sector is only bound to increase. The government plans to increase the contribution of the sector to the GDP from 16% to 25% and create 100 million jobs by 2022 [3]. In such a scenario, it becomes important to study the trends in performance of the sector under critical circumstances.

Recession is one of the mechanisms that can influence the economic situation of a country in a drastic manner. But can India be strong enough to withstand another instance of a financial meltdown and not have huge repercussions? Did the manufacturing sector actually face adverse financial effects due to the recession in 2008? The present paper wishes to answer these questions by the proper analysis of the sector in pre-recession and post-recession periods using appropriate financial tools and analyzing the long term impact of recession on the sector as a whole. It investigates the profitability of the firm from the shareholders' point of view and the financial performance of the firm in the period before and after the recession of 2008. A sufficiently long period is required to anticipate the impact of such an event on the sector and hence data for an 11-year period was collected and analysis performed on 2 sets – 5 years before 2008 (2003-2007) and 5 years after 2008 (2009-2013). Du Pont 5 point analysis helps analyze various financial aspects under profitability and operating performance viz. Tax Burden, Interest Burden, Operating Profit Margin, Asset Turnover, Equity Multiplier and Return on Equity. The Du Pont analysis in terms of its components provides insights into sources of the economic performance [4]. DuPont components represent an important and viable form of equity's abnormal returns analysis [5].

For the sake of clarity, the remainder of the paper has been organized in 4 sections. The second section deals with the Literature review of related topics. Section 2 explains sources of data and research methodology; while also describing the financial quantities and empirical or statistical methods used in analysis of pre-recession and post-recession financial performance. Section 3 documents the empirical findings. Section 4 concludes the observations and inferences, further explaining the scope of the study in a broader picture.

2. Materials and Method

The impact of recession on the Indian manufacturing sector has been a topic of discussion for long. Various methods have been employed using different financial tools to study the impacts of recession. However, one of the most

efficient analysis is Du Pont Ratios coupled with paired T-testing. Studies have been conducted on the top 3 firms in Pharmaceutical sector in India to measure their profitability [6]. A similar analysis has been conducted on Indian companies undergoing mergers and acquisition, under which 5 years' data for both post-merger and pre-merger periods has been collected and analyzed to conclude that mergers and acquisition result in increased profitability of the acquiring firms [4].

It has been suggested that traditional ratio analysis is no longer an important analytical technique in the academic environment, however ratios, if analyzed within a multivariate framework, will take on greater statistical significance than the common technique of sequential ratio comparisons [7]. The presence of collinearity between financial ratios is both a blessing and a curse for financial ratio analysis, which means that only a small number of financial ratios are required to capture a company's performance, but it also means that these ratios should be carefully chosen [8]. Du Pont 5 point ratios represent such an effective collection of ratios.

Du Pont method was originally initiated in 1918 by an engineer DuPont who was charged with understanding the finances of a company that was being acquired [9]. Early work focussed on how the product of two frequently computed ratios, net profit margin and total asset turnover, resulted in return on assets (ROA). The significance of ROA and its applications in the judgement of operating performances and efficiency measurement led to its wide acceptance. Du Pont analysis, decomposed return on net operating assets into two multiplicative components: profit margin and asset turnover [10]. Many modifications were made to the original Du Pont analysis, such as the 'Really modified Du Pont' keeping in mind the implications for the model's use as a strategic management tool for small business owners, managers, and consultants [11]. A modified DuPont approach to ratio analysis was effectively used to analyse financial performance problems in small manufacturing businesses [12]. Emphasis in financial analysis translated from ROA to return on equity (ROE), resulting in inclusion of a factor to modify the Du Pont model to give the return on equity. The modified Du Pont model of financial ratio analysis is used to identify the drivers of financial success under alternative business strategies [13]. In order to more effectively evaluate operational managers, Nissim & Penman (2001) suggested using a modified version of the traditional Du Pont model in order to eliminate the effects of financial leverage and other factors not under the control of those managers [14]. In addition, Soliman (2004) found that industry-specific Du Pont multiplicative components provide more useful valuation than do economy-wide components, suggesting that industry-specific ratios have increased validity [15].

In 2004 it was found that industry-specific DuPont multiplicative components provide more useful valuation than do economy-wide components, suggesting that industry-specific ratios have increased validity [6]. Du Pont has been extensively used in both a business and a classroom setting [16]. A model of analysis has also been developed for financial institutions consisting of the DuPont return on equity and investment models [17]. The financial ratios of the DuPont analysis is an effective means of comparing firm performance and has been used by researchers throughout the years (Ou & Penman, 1989 [18]; Eisemann, 1997 [19]; Abarbanell & Bushee 1997 [20]; Fairfield & Yohn, 2001 [21]; Milbourn & Haight, 2005 [22]; Soliman, 2008 [23])

The primary ratio of concern in the Du Pont analysis is the Return on Equity which is calculated using Earnings After Taxes (EAT) divided by Average Equity, where equity comprises of issued ordinary share capital plus the share premium and reserves [24]. Return on equity (ROE) is fairly representative index of performance evaluation, which comprehensively reflects operation level and financial position of enterprises. For more detailed analysis and evaluation of enterprise operational efficiency, DuPont analysis is used utilizing the intrinsic link between the major indicators of financial ratios [25]. The Return on Equity can be split into 5 other constituent ratios in the 5-point model namely Tax Burden, Interest Burden, Operating Profit Margin, Asset Turnover and Equity Multiplier which further help in inferring reasons behind a particular financial performance, assigning factors

contributed by these ratios.

More efficient and detailed modifications have been made with regard to Du Pont, although they are not included in this paper, they can be included in further research and extension. Some of these include a formula relating the percent changes in the return on equity (ROE) to the percent changes in the DuPont components [26].

The methodology aims at examining the financial performance of the manufacturing sector in India along with its individual constituent sub-sectors and exploring whether the economic crisis of 2008 had an evident impact on the operations of these. Secondary sources of data were used to collect the financial records of the constituent firms. The major sources include the website of Bombay Stock Exchange (BSE), Ace Equity Databases (developed by Accord Fintech Pvt. Ltd.) and Capitaline Databases. The study is done on 11 years data of 65 Indian companies contributing to the manufacturing sector and falling under 5 broad sub-sectors. Analysis is performed individually for each sub-sector as well as the combined data.

The tools used for testing the financial performance of the firms are Du Pont ratios namely Tax Burden, Interest Burden, Operating Profit Margin, Asset Turnover, Equity Multiplier and Return on Equity. The significance of each is discussed in detail in the section that follows. The ratios are calculated according to the following formulae:

$$TaxBurden = \frac{EarningsAfterTaxes(EAT)}{EarningsBeforeTaxes(EBT)}$$

$$InterestBurden = \frac{EarningsBeforeTaxes(EBT)}{EarningsBeforeInterestAndTaxes(EBIT)}$$

$$OperatingProfitMargin = \frac{EarningsBeforeInterestAndTaxes(EBIT)}{NetSales}$$

$$AssetTurnover = \frac{NetSales}{TotalAssets}$$

$$EquityMultiplier = \frac{TotalAssets}{AverageEquity}$$

$$ReturnOnEquity = \frac{EAT}{AverageEquity}$$

Alternatively, the other formula for ROE that can be used is:

$$ReturnOnEquity = \frac{EAT}{EBT} * \frac{EBT}{EBIT} * \frac{EBIT}{NetSales} * \frac{NetSales}{TotalAssets} * \frac{TotalAssets}{AverageEquity}$$

Details about the subsectors constituting the manufacturing sector are chosen from the Bombay Stock Exchange (BSE) website. The primary constituents are Capital Goods, Consumer Durables, FMCG, Auto and Metal. Corresponding indices developed by BSE are selected namely S&P BSE CAPITAL GOODS, S&P BSE

CONSUMER DURABLES, S&P BSE FAST MOVIG CONSUMER GOODS, S&P BSE AUTO and S&P BSE METAL. The constituent companies for each index were determined and data collected for each firm. The companies have been listed in Table 1 below:

Table 1. Sectoral Indices included in Manufacturing by BSE and constituent companies

Capital Goods		Consumer Durables	FMCG	Auto	Metal
ABB	Lakshmi Machine	Bajaj Electric	Britannia Industries	Apollo Tyres	Coal India
AIA Engineering	Larsen	Blue Star	Colgate Palmolive India	Bajaj Auto	Hind Zinc
Alstom T&D	Pipavav Defence	PC Jeweller	Dabur India	Bharat Forge	Hindalco
BEML	Sadbhav Engg	Rajesh Exports	Emami	Bosch	Jindal Steel
Bharat Elec	Siemens	Symphony	Godrej Consumer Products	Cummins	JSW Steel
BHEL	SKF India	Titan Company	Hindustan Unilever Ltd.	Eicher Motors	NALCO
Carborundum	Suzlon Energy	TTK Prestige	ITC	Exide Industries	NMDC
Crompton Greave	Thermex	Videocon Industries	Jubilant Foodworks	Hero Motocorp	SAIL
FAG Bearing	Va tech Wabag	VIP Industries	Marico	M&M	Sesa Sterlite
Greaves Cotton	Welspun Corp		Nestle India	Maruti Suzuki	
Havells India		Whirlpool of India	Tata Global Beverages	Motherson Sumi	Tata Steel
			United Spirits Breweries	MRF	
				Tata Motors	

Some companies were neglected from the analysis due to discrepancies in the data available. PC Jeweller Ltd. was excluded because data was made available for the firm first in 2007 and financial data pertaining to our period of interest (2003-2013) did not hold relevance in this case. Similarly, Jubilant Foodworks Ltd., Sadbhav Engg. Ltd., Suzlon Energy Ltd., Va Tech. Wabag Ltd. and Pivavav Defence and Offshore Engineering Ltd. had public records starting from 2004, 2006, 2006, 2011 and 2008 respectively and hence records prior to those years are not available. Bajaj Auto Ltd. followed the same pattern as data is available post 2008. Videocon Industries Ltd. was neglected due to irregularities in the financial period followed for publishing financial records. Since all records were not made in March or December of every year, there could be discrepancies in analyzing the financial performance over the time period discussed. Jindal Steel & Alloy Ltd. And NALCO Ltd. were excluded from the research due to unavailability of data. Table 2 represents the final list of companies used for analysis of each sector's financial performance. AIA Engg. Ltd. was removed from the set owing to unavailability of complete data.

        Table 2. Companies chosen for final analysis corresponding to the 5 constituent sub-sectors

Capital Goods		Consumer Durables	FMCG	Auto	Metal
ABB	Greaves Cotton	Bajaj Electric	Britannia Industries	Apollo Tyres	Coal India
Alstom T&D	Havells India	Blue Star	Colgate Palmolive India	Bharat Forge	Hind Zinc
BEML	Lakshmi Machine	Rajesh Exports	Dabur India	Bosch	Hindalco
Bharat Elec	Larsen	Symphony	Emami	Cummins	JSW Steel
BHEL	Siemens	Titan Company	Godrej Consumer Products	Eicher Motors	NMDC
Carborundum	SKF India	TTK Prestige	Hindustan Unilever Ltd.	Exide Industries	SAIL
Crompton Greave	Thermex	VIP Industries	ITC	Hero Motocorp	Sesa Sterlite
FAG Bearing	Welspun Corp	Whirlpool of India	Marico	M&M	Tata Steel
			Nestle India	Maruti Suzuki	
			Tata Global Beverages	Motherson Sumi	
			United Spirits Breweries	MRF	
				Tata Motors	

The final samples comprised of 55 manufacturing companies categorized into the 5 mentioned sub-sectors. The distribution of samples has been shown in Fig. 1. For each collection of data, extreme values were excluded from the data set to remove the influence of outliers. Only values within 3 standard deviations of the mean were kept for analysis, while the rest were neglected.
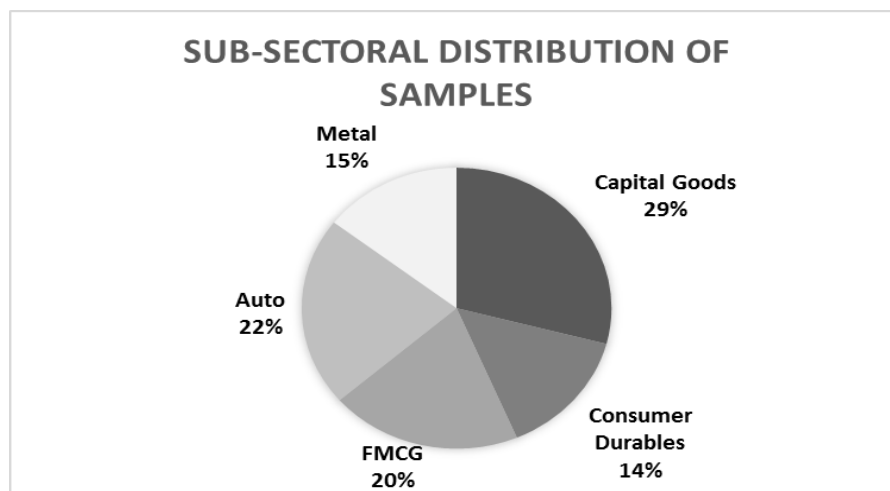

Fig. 1. Distribution of samples according to the sub-sectors

Sectoral averages for each of the constituent ratios in Du Pont Analysis were calculated using weighted averages of the ratio values for different companies under a sub-sector with their corresponding market capitalizations. This resulted in average values of Du Pont ratios for each sub-sector. Further, average values of Du Pont ratios for the manufacturing sector taken as a whole were calculated by repeating the process on the sub-sectors i.e. taking the weighted averages of Sub-Sectoral values of the Du Pont ratios based on each sector's market capitalization. As a result, trends in variation of the Du Pont ratios were obtained for the manufacturing sector in the period between 2003 and 2013.

To test the relationship between pre-recession and post-recession periods for the financial performance of each sub-sector, a 2-sample paired t-test was conducted for mean values in the pre-recession and post-recession periods for each measure in the study. The null hypothesis for each test was assumed to be that the mean level for the post-recession period is not significantly different from the mean level of the pre-recession period. A positive t-value indicates a higher mean value for post-merger and acquisition period and vice-versa. The paired t-test was also done for the combined manufacturing sector, listing all companies under one section. These helped in achieving the impact of the recession on each sub-sector as well as the complete manufacturing sector (in particular, the impact of recession on different Du Pont ratios for the above mentioned sets).

The present work uses the long-term financial data of five years prior to and subsequent to the recession to investigate the long-term performance of the manufacturing sector and its constituent sub-sectors. The operating performance of the companies for ten years, five years before and five years after recession has been reported. The year 2008 has been excluded from the analysis as its inclusion may cause distortions.

3. Results and Discussion

3.1 Analysis of Sectoral Financial Performance:

In the view of analyzing the manufacturing industry which has emerged as the major driver of an economy, it is quite imperative to look at the financial performance at the sectoral level. In this paper, we have evaluated the constituent ratios of Du Pont for each sub-sector of manufacturing to obtain a comprehensive understanding of the impact of recession on the sector.

Table 3. Tax Burden ratio for the 5 manufacturing sub-sectors

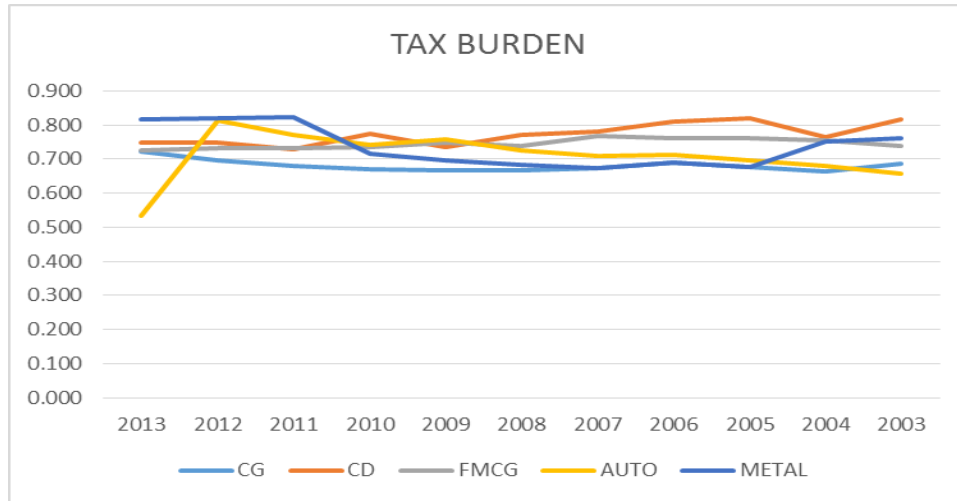| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	0.721	0.697	0.679	0.669	0.668	0.667	0.672	0.688	0.677	0.665	0.687
CD	0.748	0.748	0.730	0.773	0.735	0.772	0.780	0.809	0.820	0.763	0.816
FMCG	0.725	0.732	0.730	0.736	0.749	0.737	0.767	0.762	0.762	0.754	0.739
AUTO	0.532	0.814	0.770	0.740	0.756	0.727	0.710	0.713	0.696	0.679	0.658
METAL	0.816	0.821	0.823	0.716	0.695	0.683	0.675	0.688	0.677	0.751	0.762

Fig. 2. Plot of Tax Burden ratio for the 5 manufacturing sub-sectors

Figure 2 indicates that between the FY 2003-2013, the tax burden has fairly remained the same across the sub sectors with the mean value of 0.728. It is quite evident that recession did not bring a change in the corporate taxing policies.

Table 4. Interest Burden ratio for the 5 manufacturing sub-sectors

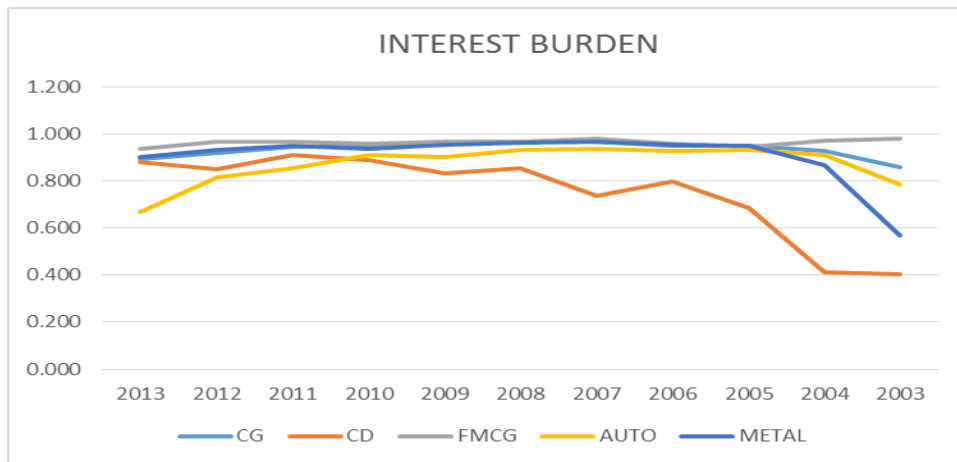| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	0.894	0.921	0.944	0.952	0.959	0.965	0.968	0.949	0.949	0.927	0.857
CD	0.880	0.849	0.909	0.890	0.832	0.855	0.738	0.799	0.687	0.411	0.402
FMCG	0.938	0.966	0.965	0.957	0.968	0.966	0.978	0.957	0.944	0.973	0.981
AUTO	0.668	0.816	0.856	0.909	0.901	0.932	0.937	0.930	0.930	0.912	0.785
METAL	0.901	0.932	0.948	0.939	0.955	0.964	0.967	0.952	0.948	0.868	0.567

Fig. 3. Plot of Interest Burden ratio for the 5 manufacturing sub-sectors

While looking at the interest burden ratio, it was observed that post 2008, there was a change from the increasing trend for consumer durables sector. It increased 2.06 times from FY2003-2009, and it saturated to 0.88 in the post-recession phase. Most companies in this subsector were seeing lower sales, however they have loans varying from a few years to a long time-period. This has affected their EBITs more heavily than EBT.

Table 5. Operating Profit Margin ratio for the 5 manufacturing sub-sectors

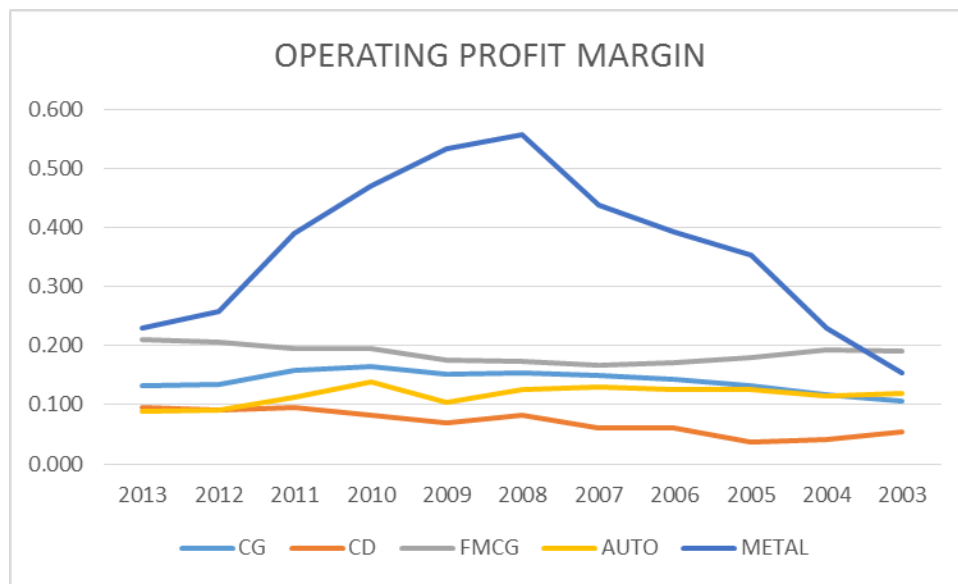| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	0.132	0.135	0.158	0.164	0.151	0.155	0.150	0.143	0.133	0.116	0.106
CD	0.096	0.092	0.096	0.083	0.070	0.082	0.061	0.060	0.036	0.040	0.055
FMCG	0.210	0.206	0.196	0.195	0.175	0.174	0.166	0.171	0.181	0.193	0.190
AUTO	0.089	0.092	0.113	0.140	0.105	0.126	0.129	0.127	0.125	0.114	0.119
METAL	0.230	0.257	0.391	0.471	0.533	0.557	0.438	0.392	0.353	0.229	0.154

Fig. 4. Plot of Operating Profit Margin ratio for the 5 manufacturing sub-sectors

The operating margin ratio showed a peak in 2008 for metal sub sector. The decreasing trend post the recession can be attributed to the increasing input prices and reluctance on the part of the companies to raise prices have eroded margins. The metal industry demand is being derived from other sectors like automobile, consumer durables and infrastructure, its fortune is dependent on the growth of these user industries.

Table 6. Asset Turnover ratio for the 5 manufacturing sub-sectors

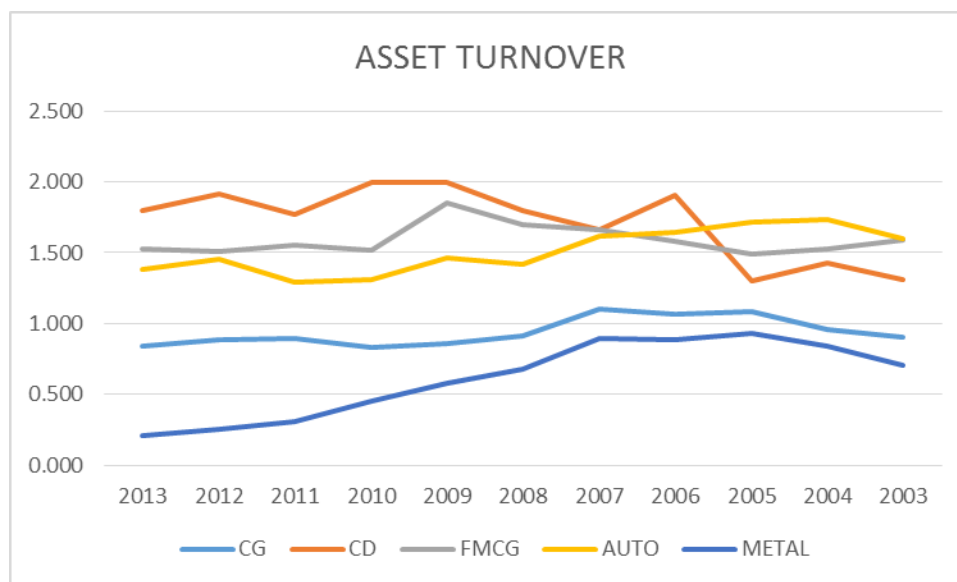| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	0.845	0.888	0.895	0.834	0.858	0.916	1.104	1.066	1.081	0.960	0.906
CD	1.798	1.914	1.767	1.993	1.993	1.794	1.663	1.904	1.299	1.424	1.308
FMCG	1.529	1.512	1.555	1.519	1.855	1.698	1.660	1.579	1.495	1.527	1.587
AUTO	1.384	1.451	1.291	1.307	1.465	1.417	1.613	1.648	1.719	1.734	1.603
METAL	0.209	0.252	0.310	0.453	0.578	0.677	0.895	0.889	0.927	0.839	0.704

Fig. 5. Plot of Asset Turnover ratio for the 5 manufacturing sub-sectors

There has also been a decrease in the asset turnover in the post-recession era for the metal industry, indicating that total asset increase was more than the increase of net sales. However, the impact was reverse on the consumer durables industry, with the increasing net sales over assets resulting in an increasing trend for the asset turnover.

Table 7. Equity Multiplier ratio for the 5 manufacturing sub-sectors

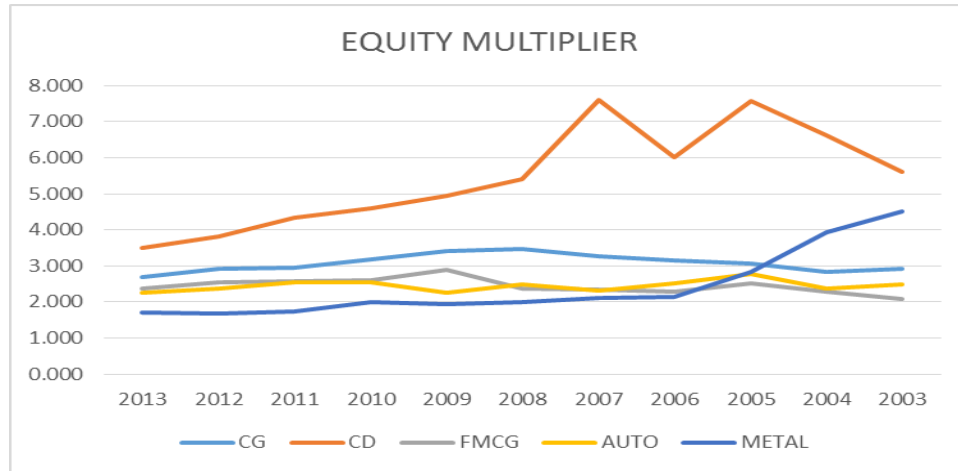| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	2.677	2.913	2.941	3.167	3.419	3.471	3.253	3.155	3.067	2.845	2.909
CD	3.495	3.825	4.348	4.587	4.945	5.394	7.591	6.005	7.565	6.616	5.617
FMCG	2.381	2.553	2.559	2.613	2.877	2.365	2.332	2.295	2.517	2.270	2.087
AUTO	2.248	2.358	2.554	2.540	2.259	2.495	2.315	2.509	2.770	2.372	2.494
METAL	1.708	1.689	1.748	1.986	1.928	2.009	2.107	2.152	2.829	3.918	4.518

Fig. 6. Plot of Equity Multiplier ratio for the 5 manufacturing sub-sectors

After FY 2007, there is a sharp decrease in the 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. This reveals that companies are raising finance via debt less than equity which is corroborated by decreasing financial expenditures.

Table 8. Plot of return on Equity (ROE) for the 5 manufacturing sub-sectors

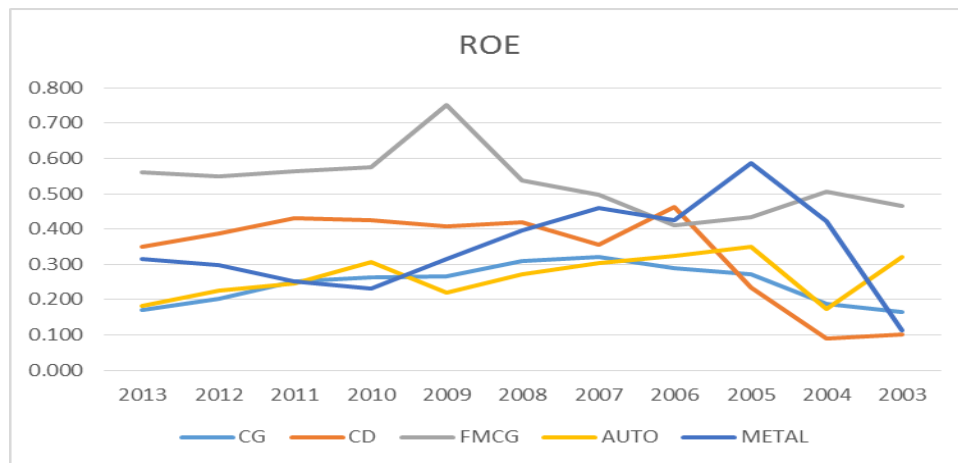| Subsector	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
CG	0.169	0.203	0.251	0.264	0.267	0.309	0.321	0.290	0.270	0.189	0.165
CD	0.351	0.387	0.431	0.426	0.406	0.419	0.357	0.461	0.233	0.090	0.101
FMCG	0.562	0.550	0.563	0.575	0.751	0.537	0.496	0.409	0.434	0.506	0.464
AUTO	0.181	0.226	0.247	0.306	0.219	0.273	0.302	0.324	0.350	0.173	0.321
METAL	0.316	0.298	0.251	0.231	0.317	0.396	0.459	0.426	0.587	0.423	0.113

Fig.7. Plot of return on Equity (ROE) for the 5 manufacturing sub-sectors

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The data pertaining to *Table 8* reveals the ROE of the various sub sectors of the manufacturing sector. The results reveal interesting trends with significant variation across the sub sectors. Only the FMCG and Consumer durables sub sector showed an overall increasing trend post-recession. Metal industry had a bit hit on the ROE falling from .458 in FY 2007 to .316 in 2013 (30% decrease). Similar was the case in auto sector, with nearly a decrease of 20%.

3.2. Analysis of the Financial Performance of the complete Manufacturing Sector:

Table 9. Effective Du Pont Ratios for the complete Manufacturing Sector

| RATIOS	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
TAX BURDEN	0.712	0.773	0.763	0.712	0.712	0.696	0.704	0.715	0.706	0.720	0.725
INTEREST BURDEN	0.866	0.915	0.934	0.940	0.950	0.959	0.961	0.946	0.941	0.925	0.878
OPERATING PROFIT MARGIN	0.177	0.186	0.223	0.270	0.250	0.300	0.218	0.206	0.209	0.167	0.163
ASSET TURNOVER	1.046	0.985	0.887	0.939	1.173	1.065	1.288	1.295	1.286	1.344	1.359
EQUITY MULTIPLIER	2.240	2.317	2.355	2.566	2.717	2.614	2.638	2.581	2.819	2.754	2.621
ROE	0.357	0.340	0.319	0.324	0.413	0.383	0.393	0.364	0.426	0.350	0.350
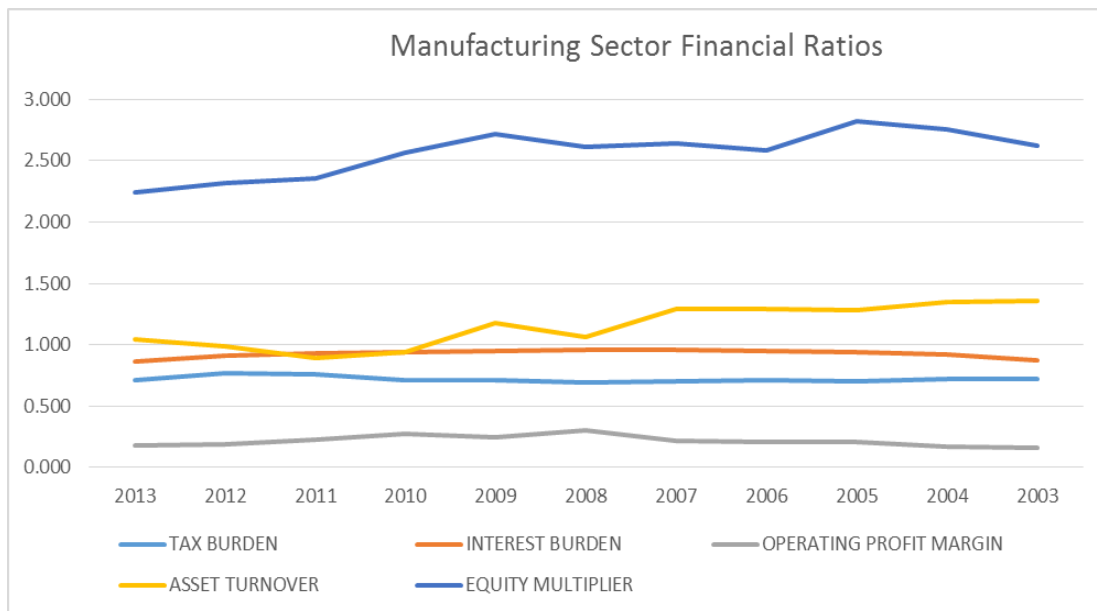
Fig. 8. Plot of constituent Du Pont ratios for the complete Manufacturing Sector
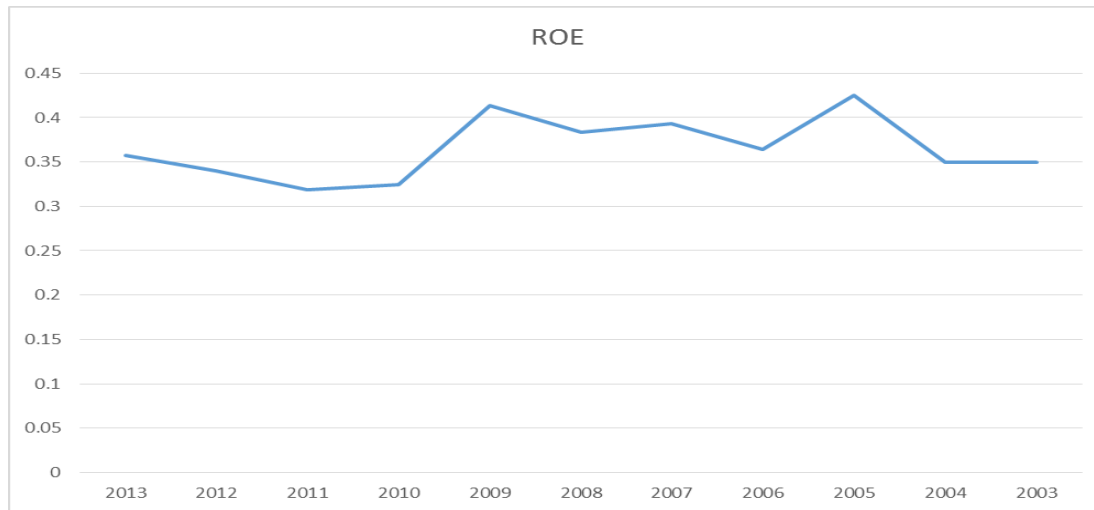
Fig. 9. Plot of the Du Pont Return on Equity for the complete Manufacturing Sector

The market capital distribution of the subsectors reveals that FMCG and Auto sector together have 70% as mean market capital share in post–recession period. This is strongly reflective of the manufacturing sector being dominated by these two sub sectors. Therefore, the impact of the recession on the manufacturing sector in general is largely represented by changes in the dominant market driver subsectors – FMCG and Auto. Unlike the paired-T test which as a statistical measure merely compares the pre and post-recession values takes all the firms irrespective of their sizes into consideration including the firms with much less market share.

The weighted plot of the financial ratios for the complete manufacturing sector strongly indicates no impact of the global recession.

The automobile industry interestingly epitomizes the impact of the crisis on the consumer durables sector. It is essentially an assembly industry and its significance lies in both scale and other manufacturing industries linkages. India has suffered a reduction in exports of steel, owing to fall in prices and the recession in the consumer durables sector. Overall post-recession period observed a fall in the exports of manufactured goods which deeply affected the low value goods. Rising interest rates besides appreciating rupee were also important factors of change.

3.3. Pre and post-Recession Analysis of Individual Sub-sectors:

The purpose of the study is to determine the impact of the recession on the financial performance of manufacturing sub-sectors by analyzing the Du Pont ratios as a measure of the profitability of a firm. The primary tool used to perform this analysis is paired sample t-test. For each sub-sector, the paired t-test is performed on 5 years data each for the post-recession and pre-recession periods (2009-2013 and 2003-2007).

A change in the return on equity, following recession can arise due to numerous reasons like better operating margins, greater assets productivity, lower labor costs or higher volume or higher sales etc. In order to ascertain the sources of the results observed on the return on equity, the measure of operating performance has been split into its components in terms of Du Pont analysis – Tax Burden, Interest Burden, Operating Profit Margin, Asset Turnover and Equity Multiplier.

This sub-section overviews the performance of each sub-sector and predicts whether the recession had a significant impact on the sector or not.

Table 10. Pre-recession and Post-recession paired sample t-test for Capital Goods sub-sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.703	0.711	-0.007	-0.479	2.131	15	0.639
INTEREST BURDEN	0.860	0.830	0.030	0.420	2.131	15	0.680
OPERATING MARGIN	0.123	0.125	-0.002	-0.231	2.131	15	0.820
ASSET TURNOVER	1.255	1.078	0.177	3.728	2.131	15	0.002
EQUITY MULTIPLIER	3.023	2.595	0.428	1.781	2.131	15	0.095
ROE	0.263	0.196	0.066	3.042	2.131	15	0.008

The observed rate of equity is seen to present a significance of 0.008 (p=0.008<0.05) as an outcome of the paired T-test. This implies that there is a 99.2% probability that the null hypothesis is incorrect. Thus, it can be concluded with fair certainty that the recession did have a significant impact on the Capital Goods sub-sector. Fig. 7. clearly indicates that the weighted average return on equity for the sub-sector showed a decline following the period in which recession affected the economy, implying that recession had a negative impact on this sub-sector. Further analysis of the constituent Du Pont ratios indicates that the significance value of only the Asset Turnover is found to be less than 0.05. Thus, it can be inferred that only the Asset Turnover was significantly affected by the recession in the Capital Goods sub-sector and is the most significant contributor to changing trends in return on equity in the pre and post-recession periods. Fig. 5. indicates that Asset Turnover on the net sales per unit total assets declined for capital goods, resulting in a decline in the operating profitability of the sub-sector.

Table 11. Pre-recession and Post-recession paired sample t-test for FMCG sub-sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.774	0.789	-0.016	-0.848	2.228	10.000	0.416
INTEREST BURDEN	0.920	0.932	-0.012	-1.232	2.228	10.000	0.246
OPERATING MARGIN	0.172	0.146	0.025	2.219	2.228	10.000	0.051
ASSET TURNOVER	1.561	1.758	-0.197	-0.975	2.228	10.000	0.353
EQUITY MULTIPLIER	2.685	2.707	-0.022	-0.053	2.228	10.000	0.959
ROE	0.533	0.491	0.042	0.319	2.228	10.000	0.756

The paired sample T-test values for the FMCG sub-sector are found to be greater than 0.05 for all the ratios analyzed, indicating that recession did not have a significant impact on the performance of this sub-sector- neither on the return on equity nor on the constituent ratios. However, it should be noted that the Operating Profit Margin had a significance value of 0.051 which is very close to the cutoff. Further analysis into related factors could help us in concluding whether or not this ratio was affected by recession.

Table 12. Pre-recession and Post-recession paired sample T-test for Consumer Durables sub-sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.760	0.794	-0.033	-0.673	2.365	7.000	0.523
INTEREST BURDEN	0.839	0.715	0.124	1.838	2.365	7.000	0.109
OPERATING MARGIN	0.106	0.032	0.074	1.772	2.365	7.000	0.120
ASSET TURNOVER	1.793	1.562	0.232	1.336	2.365	7.000	0.223
EQUITY MULTIPLIER	4.077	4.738	-0.661	-0.603	2.365	7.000	0.566
ROE	0.383	0.217	0.166	2.235	2.365	7.000	0.061

The analysis for the Consumer Durables sub-sector shows that none of the constituent Du Pont ratios was significantly affected by the recession as all significance values are greater than 0.05. However, the significance value for Return on Equity is 0.061 which is very close to 0.05. Since our study is restricted to the paired T-test, we cannot confirm whether such a close result can result in the conclusion that ROE was not affected by recession. However, for the scope of our study, we will follow the standards defined and infer that Consumer Durables were relatively immune to recession.

Table 13. Pre-recession and Post-recession paired sample t-test for Auto sub-sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.746	0.699	0.048	1.484	2.201	11.000	0.166
INTEREST BURDEN	0.847	0.862	-0.015	-0.408	2.201	11.000	0.691
OPERATING MARGIN	0.118	0.117	0.001	0.085	2.201	11.000	0.934
ASSET TURNOVER	1.356	1.522	-0.166	-2.602	2.201	11.000	0.025
EQUITY MULTIPLIER	2.442	2.629	-0.187	-1.176	2.201	11.000	0.264
ROE	0.231	0.271	-0.040	-1.207	2.201	11.000	0.253

For the Auto sub-sector, the Return on Equity did not show any signs of impact due to recession as the p-value is 0.253 i.e. .0.05. The same is true for the constituent ratios except Asset Turnover. A declining trend in Asset Turnover as inferred from Fig. 5. Implies that for the same amount of assets used by the firms in the sector, the net sales have declined over the years post-recession.

Table 14. Pre-recession and Post-recession paired sample t-test for Metal sub-sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.763	0.699	0.064	1.733	2.365	7.000	0.127
INTEREST BURDEN	0.874	0.876	-0.002	-0.035	2.365	7.000	0.973
OPERATING MARGIN	1.694	1.698	-0.005	-0.062	2.365	7.000	0.952
ASSET TURNOVER	0.430	0.736	-0.306	-3.293	2.365	7.000	0.013
EQUITY MULTIPLIER	1.947	3.003	-1.056	-2.006	2.365	7.000	0.085
ROE	0.212	0.355	-0.144	-2.400	2.365	7.000	0.047

The metal sub-sector shows a significant impact of recession on the Return on Equity and Asset Turnover. Although the other ratios remain invariant of recession, these are some of the most important indicators for the financial performance indicating an overall decline in the financial performance of this sub-sector. An important aspect to be considered for this sub-sector is that it is a primary sector i.e. all other sectors are heavily dependent on metal. Thus, even if the impact of recession was minor on other firms and sectors, their dependence on the metal sub-sector results in an aggravated impact on this sub-sector.

3.4. *Pre and Post-Recession Analysis of the complete Manufacturing Sector:*

Analysis of the complete manufacturing sector is done by treating all the 55 companies as equal samples for the paired T-test without any market capitalization weightages attached. The significance values for each ratio is observed and appropriate conclusions made.

Table 15. Pre-recession and Post-recession paired sample t-test for the complete Manufacturing sector

Paired Sample	Mean Ratio Post Recession	Mean Ratio Pre Recession	Mean Difference	T-Stat Value	T-Critical two-tail Value	Degree of Freedom	Significance
TAX BURDEN	0.163	0.138	0.024	0.634	2.005	54.000	0.529
INTEREST BURDEN	0.872	0.857	0.015	0.843	2.005	54.000	0.403
OPERATING MARGIN	0.123	0.125	-0.002	-0.231	2.005	54.000	0.028
ASSET TURNOVER	1.243	1.387	-0.144	-2.617	2.005	54.000	0.011
EQUITY MULTIPLIER	2.668	3.144	-0.476	-2.344	2.005	54.000	0.023
ROE	0.292	0.318	-0.026	-0.897	2.005	54.000	0.374

For the combined Manufacturing Sector, the Return on Equity has a significance value of 0.374 ($p > 0.05$), which implies that there is no significant relation between the discussed recession and financial performance of the sector over the considered period. 3 out of the 5 constituent ratios (operating Profit Margin, Asset Turnover and Equity Multiplier) had significance values less than 0.05 indicating that these ratios were indeed affected by the recession. However, the important point to note here is that although individual ratios are affected, the overall impact on the return on equity is not significant and the Manufacturing Sector has been strong enough to withstand the effects of recession.

4. Conclusion

The present paper aims at analyzing the impact of the global recession on the operating performance of the companies in the manufacturing sector in India, which is one of the fastest growing economies in the world. The empirical evidence using the paired-T test in the pre and post-recession phases validates the hypothesis that the manufacturing sector in general was shielded from the global financial crisis.

The study looks at the sectoral approach which indicated that although the complete manufacturing sector showed no impact, subsectors such as Metal and Capital Goods unlike FMCG, Auto and Consumer Durables, had been significantly impacted by the recession. The weighted analysis takes into picture the fact that the sectors are more appropriately represented by the dominant firms. Since these firms viz. FMCG, Auto and Consumer Durables remained immune to the impacts of the recession, consequently a weighted approach to the manufacturing sector also yielded stable results, similar to the analysis performed on manufacturing sector taken as a whole.

The findings are in coherence with some of the previous work in the area. Anindam Mandal, for instance, did not find any significant statistical difference between the pre and post-recession returns of SENSEX indices [27]. Nakul Bhardwaj predicted that Indian economy has been hit by the recent global meltdown but India may remain in better position than many of the other economies [28]. Similarly, Mangal Sain et. al. predicted that Indian economy has been hurt by the global financial recession, but India may be in better position with quick recovery and for future growth than many of the other economics as Indian banks did not have significant exposure to Sub-prime loans in the U.S [29]. The existence of an informal economy combined with an emerging middle class, a growing financial

regulatory environment, and the creation of more SEZs makes India uniquely situated to survive the economic storm [30].

It is also worth mentioning that standard statistical measure of the null hypothesis for the consumer durables subsector was significantly close to standard measure, indicating that it was also strongly impacted by recession. The weakened activities were attributed to a combination of external and domestic factors, including reduced global demand, lagged effects of earlier interest rate rises and emergence of a domestic credit crunch [31]. Perhaps, further detailed findings into the subsector which have not been covered in this study, may reveal the exact scenario.

It appears that the global recessionary conditions resulted in the year 2008 resulted in low asset turnover ratio. Much of the other constituents of the Du Pont (operating cash flow ratio based on sales and total asset turnover based on sales) remained significantly unchanged although the paired T test suggested that asset turnover, operating margin and equity multiplier had been impacted by the recession.

On the basis of Du Pont analysis, it may be concluded that the manufacturing sector in India was largely not impacted by the global recession and the reason can be attributed to its strong domestic market.

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