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Measurement of degree of leverage for Indian manufacturing sector

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Abstract
This paper aims to measure the degree of operating leverage (DOL) and degree of financial leverage (DFL) by applying classical formula and compare the resulting coefficient with ex ante definition of leverage. The leverage is calculated for 10 year period ranging from 2010-11 to 2019-20 for 20 companies including 10 from Cement industry and 10 from Iron and Steel industry. The study resulted that there is much variation in leverage coefficient when compares to classical definition which states that coefficient of leverage can only be equal to or greater than one. The study concluded that there is a need of more adequate proxy measure for leverage instead of classical measure due to the importance of DOL and DFL in risk assessment.

Keywords: degree of operating leverage, degree of financial leverage, coefficient

Introduction
At present, a significant portion of research is dedicated to the measurement of effect of managerial decisions on market value and profitability of firms (Lev, 1974). Thus, the effect of capital structure, investment decisions and dividend decision are the crucial areas of research in the field of finance (Pandey, I.M.; Sheel, 1994) [14]. Due to stiff competition, a business firm can't stick to its present position and need further advancements that create the urgency of decisions on finance and assets structure. The structure of finance and assets are directly related to the risk where former is related to financial risk and later is operating risk (Gupta and Sur, 2013) [15]. In this context, degree of operating leverage (DOL) and degree of financial leverage (DFL) are two universally recognized measures of risk where DOL measures operating risk and DFL measures the financial risk and their joint product can measure total risk faced by any firm (Gupta and Sur, 2013; Duett et.al.,1996) [15, 2]. To timely counter the total risk, it is vital that risk should be adequately calculated with proper proxies that generate the need of developing measures that can calculate the leverage with utmost perfection. As per ex ante text book theory the coefficient of leverage must be greater than or equal to one if firms are operating above the breakeven point because if there is no fixed cost than numerator will be equal to denominator and resulting value will be one, but if there is presence of fixed cost than denominator will be less than numerator and value will be greater than one, so there could be only two outcomes (Gupta and Sur, 2013; Lord, 1998; O'Brien and Vanderheiden, 1987) [15, 10, 11].

Leverage
A firm which makes fixed commitment out of uncertain revenue stream always opens up the doors of risk for shareholders (Huffman, 1983) [7]. This fixed commitment is termed as 'leverage' in the language of finance. Leverage means the use of fixed cost to magnify the returns to the shareholder either its fixed operating cost or fixed financial cost. As fixed cost has a tendency to remain fixed up to a certain level irrespective of change in sale (in case of OL) and change in operating income (in case of FL) the residual over and above the coverage of that fixed cost will magnify the operating income and earnings per share (EPS) and this is the positive face of leverage. . As against the expectations, if there is decrease in sales, the presence of high amount of fixed operating cost will decrease the operating income more than decrease in sales called negative operating leverage and if there is a decrease in operating income, the presence of high amount of fixed finance cost will decrease EPS more than decrease in operating income called negative financial leverage. So, Leverage is a technique which is applied by corporations to enhance their earnings by taking the help of risk in the form of debt or the level of fixed operations cost or by combining the both (Tahalele & Mekel, 2014) [15].
As opposed to a simple text book definition, the major concern is to develop a proxy that work as per ex ante theory and unfortunately producing such a measure has proven utmost difficult specially in case of operating leverage due to inseparability of cost in fixed and variable components so, operating leverage has significant implications and that open the way for further research (Dugan & Shriver, 1992; Lord, 1998) [3, 10]. It shows the degree of substitution of fixed cost than variable cost in total production cost structure (O'Brien and Vanderheiden, 1987) [11]. It is defined that *DOL= Contribution/ EBIT; where Contribution = Sales – Variable cost; EBIT = Sales- Variable cost- Fixed cost.*

As stated earlier in this paper, that separation of cost into fixed and variable components is tedious task for an external analyst because it's internal unpublished information and not available in public domain so, elasticity measure of leverage is generally used that is:

DOL= % change in EBIT / % change in sales

In the same way DFL is calculated as EBIT/EBT as a static measure and elasticity measure is

DFL= % change in EPS/ % change in EBIT.

These measures are earlier applied in various researches such as (Tayyaba, 2013; Shahzad et al. 2016; Hiran, 2016; Gatsi et al.2013; Sahrma et al.2014; Alao and Azeez, 2019; Kumar M.S et al, 2016; Tahalele and Mekel, 2014; Maji, 2005) [12, 6, 9, 15]

In spite of universal applicability of these measures, there are some irregularities when applied in practice that contradicts the ex ante theory as some coefficients of DOL and DFL are negative, some are positive, some values are extreme negative while some other are extreme positive. There is a logical explanation behind the happening of this phenomenon. When the values are optimally positive (say slightly higher than one), which fulfills the classical ex ante theory, there is less difference in the percentage change in both numerator and denominator and both values are moving in same directions. If sale is increasing, so the EBIT is also increasing and if sale is decreasing so EBIT is also decreasing (in case of DOL). It justifies the theoretic definition of leverage. The values are negative when there is less difference in the percentage change in both numerator and denominator in two years and both changes are moving in opposite directions to each other. When sale is increasing the EBIT is instead decreasing and vice-versa resulting coefficient become negative in case of DOL. The same is true in case of DFL also. Some values are extreme and highly positive or extreme low positive, becomes when both changes in numerator and denominator are moving in same direction either both increasing or decreasing but there was a high variation in their level of change. If change is large in numerator the resulting coefficient will be extreme high and if change is large in denominator the resulting coefficient will be less than zero but not negative. The reason behind this irregularity in the elasticity measure of operating and financial leverage found because this method is based on the assumption that operating parameters, such as selling price, variable cost per unit and fixed cost will remain unchanged during the period (Lord, 1998; Ferri and Zones, 1979) [10].

Data and Methodology

The secondary data required for the analysis conducted in this study is collected from the annual reports of the selected sample of 20 companies having place in BSE 500 index including 10 from Cement industry and 10 from Iron and Steel industry during 10 year period ranging from 2010-11 to 2019-20. These heavy manufacturing industries are selected due to their dependence on high amount of fixed investment. The calculations are done through Microsoft excel software for two variables, that are the Degree of operating leverage and degree of financial leverage. In which DOL is measured by % change in EBIT/ % change in sales and DFL is measured by % change in EPS/ % change in EBIT.

Cement Industry

Table 1

Cement Industry Degree of Operating Levearge										
Year /co's	**ACC**	**Ambuja**	**Birla**	**Grasim**	**Heidelberg**	**India Cement**	**JK Cement**	**JK lakshmi**	**Orient**	**Prism johnson**
2010-11	1.410	0.388	3.670	0.991	7.444	13.590	5.443	2.895	-	-2.499
2011-12	0.814	1.767	-1.037	-2.535	273.7*	5.729	3.981	2.400	-	-0.678
2012-13	-2.58	1.992	0.750	-1.901	0.595	-0.853	0.586	1.567	-	-0.174
2013-14	-1.51	1.884	-2.149	-3.273	2.749	11.274	8.289	-368.2*	7.999	-11.16
2014-15	1.963	-2.614	2.856	-1.740	3.254	-48.4	0.557	0.632	5.775	4.764
2015-16	1.872	-4.297	-2.620	3.284	1.470	-3.424	2.114	-1.572	9.049	-6.548
2016-17	2.913	-34.22	15.694	2.434	4.600	0.591	5.489	3.232	-0.14	0.817
2017-18	1.67	-0.291	-12.265	1.011	-15.207	2.584	1.122	1.614	11.06	34.64
2018-19	3.088	4.967	1.272	1.142	3.780	-1.473	1.386	0.084	0.245	5.863
2019-20	0.199	-9.130	9.102	4.579	5.409	0.815	4.734	14.940	-5.70	0.924
Mean	0.984	-3.956	1.527	0.399	1.566	-1.958	3.370	2.866	4.042	2.595
SD	1.831	11.349	7.398	2.649	6.614	17.231	2.613	4.767	6.056	12.318

(**Source:** author's calculation from data available in various annual reports)

Table one shows the degree of operating leverage for cement industry and its evident that there is much variation in the DOL for all companies during the selected time frame and there is no trend. The mean value of Ambuja

cement is lowest as it is -3.956 and for orient cement its highest at 4.042. The SD of India cement is highest it means there is highest fluctuation in its DOL while the SD of acc ltd is the lowest. The figures in * are excluded from the calculation of descriptive as these values are much higher as compared to others so they are outliers and can distort the whole value. The DOL for Heidelberg in 2011-12 is 273.7 that is due to the % change in EBIT is 37% but % change in sales is approx. 0% which cause resulting coefficient very high but the change was in same direction. Opposite to it the DOL of JK Lakshmi in the year 2013-14 is -368.2 that is highly negative value because the % change in EBIT is -30% but % change is approx. 0% resulting coefficient become highly down in negative side.

Table 2

Cement Industry Degree of Financial Leverage										
Year/ Co's	**ACC ltd**	**Ambuja cement**	**Birla corp**	**Grasim ind**	**Heide lberg**	**India cement**	**JK cement**	**JK lakshami**	**Orient**	**Prism Johnson**
2010-11	1.064	-0.482	1.124	1.004	1.308	1.889	1.925	1.332	-	1.881
2011-12	-1.393	0.199	1.183	0.024*	1.463	3.045	2.057	1.170	-	5.885
2012-13	-0.126	0.014	1.116	-0.302	0.312	4.991	3.774	2.212	0.007	-
2013-14	-0.889	0.916	1.495	1.293	-7.228	5.162	1.768	1.593	1.150	-0.811
2014-15	-24.87	2.243	2.000	1.793	-1.141	-3.366	2.878	0.177	2.169	-1.153
2015-16	-0.231	-0.934	1.907	0.560	1.441	28.803	-2.521	4.118	1.723	-6.208
2016-17	1.496	2.330	1.191	-1.844	5.593	2.159	3.364	34.449	37.670	-15.347
2017-18	9.098	-7.603	5.928	-0.454	2.475	2.151	5.984	0.194	-3.329	8.719
2018-19	-0.550	0.206	1.071	-2.203	1.988	3.975	-2.152	-6.015	3.300	2.316
2019-20	-1.738	0.740	1.945	-3.383	2.333	18.319	0.507	3.156	3.626	10.317
mean	-1.814	-0.237	1.896	-0.351	0.854	6.713	1.758	4.239	5.789	0.622
SD	8.680	2.794	1.465	1.580	3.318	9.518	2.604	10.959	13.066	7.894

(**Source:** Authors calculation from data available in various annual reports)

The table 2 shows the DFL of companies in cement industry. It is evident from the table that in DFL also the overall valuesare fluctuating and varying from highly negative to positives. The mean value of ACC ltd is lowest at -1.814 while the value of DFL in India cement is highest at 6.713. These values show the corresponding change in EPS when there was 1% change in denominator that is EBIT. SD of Birla corp. is lowest at 1.465 and it is highest in orient cement at 13.066. The DOL coefficient of Grasim ind. In the year 2011-12 is 0.024 that is extreme low the reason being that the % change in EPS during this two year is approx 0% but % change in EBIT is 17% here, numerator is very low than denominator resulting coefficient become near about 0. In the same way DOL of Orient ltd in the year 2012-13 is 0.007, again the % change in EPS is -1.36 but % change in EBIT is -201.39 so resulting coefficient is near about 0.

Iron and Steel industry

Table 3

Iron & steel industry degree of operating leverage										
Year	**APL**	**Jai Corp**	**Jindal steel**	**Jindal Saw**	**Jindal stain (H)**	**Jindal stain**	**JSW steel**	**Maharashtra**	**Ratanmani**	**Sail**
2010-11	1.356	0.925	1.890	0.914	-	0.135	0.586	0.504	1.001	-2.378
2011-12	0.409	-0.17	0.341	-1.001	-	-1.064	0.477	-0.264	0.803	-2.621
2012-13	0.483	2.904	-0.115	-0.697	-	-0.781	0.573	2.317	-2.237	11.51
2013-14	-0.017	2.634	1.372	6.482	-	5.890	1.462	1.681	0.761	-3.158
2014-15	-1.491	1.197	0.138	2.140	-	1.429	0.455	2.172	0.500	-7.889
2015-16	0.434	-0.78	-120.1*	-1.238	-0.954	7.478	1.491	2.971	-1.638	11.43
2016-17	14.062	-1.55	3.465	-0.140	2.259	4.237	2.068	13.86	0.511	-7.544
2017-18	0.214	-0.62	2.819	0.334	0.941	0.703	1.162	1.034	0.159	0.749
2018-19	0.688	-1.68	0.884	0.727	4.029	-0.765	2.100	2.806	0.980	8.161
2019-20	-16.29	1.980	0.742	1.477	0.611	-1.626	1.934	1.169	-0.687	-0.603
mean	-0.016	0.482	1.282	0.900	0.688	1.563	1.231	2.826	0.015	0.767
SD	7.2136	1.684	1.229	2.241	1.4437	3.1909	0.6744	4.011	1.149	7.201

(**Source:** Author's calculation from data available in various annual reports)

The table-3 shows the DOL of iron & steel industry for the ten years ranging from 2010-11 to 2019-20. It is evident that as in case of cement, the iron and steel industry's leverage also show fluctuations and values vary significantly. The lowest mean value is shown by APL as it is -0.016 and highest is shown by Maharashtra seemless as it is 2.826.The SD is lowest in JSW steel which means that it is less risky in terms of its DOL while the SD of APL is highest at 7.213 which makes it more risky than others. The figure in * shows the outliers and

excluded from the descriptive. The DOL of Jindal steels in the year 2015-16 is -120.1 that is against the theoretical definition. The reason being that % change in EBIT is -34% and % change in sales is approx 0%.
The table-4 shows the DFL of iron & steel industry and it is crystallize that the lowest mean is shown by jai corp. as it is -.253 and the lowest SD is in Ratanmani at 1.412 while the highest mean value is depicted by Jindal saw at 8.384 and the highest SD is in APL oppolo 18.288 which makes it highest risky in terms of its DFL. The overall trend is fluctuating showing the mixture of negative and positive values. The values in * are ignored to avoid the distortion of descriptive values.

Table 4

Iron & steel industry degree of financial leverage										
Year/ Co's	**APL Oppolo**	**Jai corp**	**Jindal steel**	**Jindal saw**	**Jindal stain(H)**	**Jindal stain**	**JSW Steel**	**Mahar ashtra**	**Ratan mani**	**Sail**
2010-11	0.601	4.590	0.971	1.049	-	-10.51	-1.411	3.430	-0.492	1.422
2011-12	0.285	-1.432	0.166	2.167	-	8.079	-1.086	1.199	0.888	1.330
2012-13	0.502	-0.863	8.036	2.799	-	-19.82	0.911	0.899	1.376	1.736
2013-14	58.417	0.151	3.758	-9.45	-	1.374	-0.816	0.712	0.561	-1.36
2014-15	16.639	6.329	87.70*	1.792	-	1.755	62.8*	1.153	1.245	-1.06
2015-16	-0.103	3.122	-10.42	-2.15	1.353	-3.806	9.395	0.973	1.165	1.800
2016-17	1.925	12.452	-1.614	31.4	88.56*	-0.963	-1.356	0.477	1.172	0.292
2017-18	4.324	-24.46	-1.769	3.181	3.500	22.536	1.528	0.934	1.528	-0.007
2018-19	0.519	0.922	-0.530	1.197	1.609	4.976	2.186	0.276	1.261	-4.968
2019-20	0.735	-3.339	81.04*	4.195	-5.338	2.418	1.089	6.356	5.038	-1.510
mean	8.384	-0.253	-0.176	3.627	0.281	0.603	1.160	1.641	1.374	-0.233
SD	18.288	9.65	5.26	10.54	3.866	11.17	3.372	1.86	1.412	2.096

(**Source:** Authors calculation from data available in various annual reports)

It is suggested by the empirical data that the coefficients of DOL and DFL as calculated by classical elasticity measure has a tendency to be not in tune with the available theoretical foundation which states it equal to or greater than one only. Individual values are highly fluctuating so we can calculate average of all years.

Table 5: Mean DOL and DFL of Cement and Iron and Steel industry

Year	Cement Industry		Iron and Steel Industry	
	DOL	**DFL**	**DOL**	**DFL**
2010-11	3.704	1.227	0.493	-0.039
2011-12	1.305	1.515	-0.309	1.288
2012-13	-0.003	1.333	1.396	-0.492
2013-14	1.567	0.445	1.711	5.927
2014-15	-3.296	-1.928	-0.135	3.979
2015-16	-0.067	2.866	2.134	0.131
2016-17	0.140	7.106	3.123	4.876
2017-18	2.596	2.316	0.749	1.129
2018-19	2.036	0.194	1.793	0.745
2019-20	2.587	3.582	-1.129	1.072

(**Source:** Author's calculation from data available in various annual reports

Results and Discussion

The tables presented above are the clear description of DOL and DFL of two heavy industries when computed as per classical text book elasticity formula. The values are varying throughout the study period and resulting coefficients are fluctuating from highly positive to negative as opposed to classical theory. The classical leverage formula is based on the assumption that during the study period operating parameters such as selling price per unit, variable cost and fixed cost will remain unchanged (Lord, 1998; Ferri and Jones, 1979) and the percentage change in EBIT is solely associated with the percentage change in sales. In the same way EPS is only affected by the changes in EBIT during the two year period. In practice, both in DOL and DFL the numerator and denominator vary in unequal amounts and further opposite directions that make the coefficient negative.

Conclusion

This paper computed the leverage to the data on 20 manufacturing companies in India for the period ranging from 2010-11 to 2019-20. The study revealed that coefficients computed through classical formula are not fitted in the traditional text book definition of leverage due to its reliance on some old age assumptions that does not hold true in practice. Perhaps, this revelation reflects that there is need of further development of some suitable proxies for measuring DOL and DFL as their correct assessment is vital to understand the total risk faced by business firms.

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