

EMPLOYMENT OF WORKERS AND CAPITAL BY SIZE OF FIRMS—A STUDY OF INDIAN PHARMACEUTICAL INDUSTRY

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ABSTRACT

This paper analyses employment of workers and capital by size of firms in Indian Pharmaceutical Industry and covers the period 1994–95 to 2016–17. This paper examines the trends in the employment of labour and capital that determines the performance and productivity in the pharma-industry based on the size of the firms. The Indian Pharmaceutical industry has undergone massive structural changes and contributed immensely in the Government's flagship programme of 'Make in India' initiative. The Pharma industry has established itself of ensuring quality, affordable and accessible medicine to the world market. World class capabilities and favorable market conditions over the last many years have ensured that India continues to be one of the most lucrative pharma markets in the world. The favorable market for the Indian health care products to be one of the most lucrative market is more pronounced in the second decade of the 21st century (2007–08 and thereafter), compared with the pre-recession period (1994–95 to 2006–07). Smaller sized firms have experienced excess capacity while the mid sized firms exhibit increased labour productivity with a near constant capital productivity.

KEYWORDS: *Employment of Workers and Capital by Size of Firms, Indian Health Care Products*

INTRODUCTION

The Indian Pharmaceutical Industry has traveled a long way since the colonial days from packaging pharmaceutical goods, producing formulations and importing of bulk drugs to becoming an industry which is driving product development and breaking research worldwide. The industry has thrived so far on reverse engineering skills exploiting the lack of process patent in the country. This has resulted in the Indian Pharmaceutical players offering their products at some of the lowest prices in the world. In the recent years, the Indian companies are dominating the market place with local players dominating large number of therapeutic segments. The market is also fragmented with over 20,000 units with the organised sector consisting of about 300 entities.

Traditionally, the Indian pharmaceutical industry has been characterized by core competency in generics manufacturing and relatively immature capabilities in R & D. This outlook is also changed since the 1990s and the Indian companies have been making investments towards expanding drug discovery and development capabilities. The acceptance of patent laws and the rise of contract manufacturing have led to the diversification of revenue streams, enabling Indian pharma companies to experience high market growth.

One of the important ways of ensuring global competitiveness of this industry is to increase its resource use efficiency or otherwise called productivity. However, a blanket study on productivity of this industry may not bring out

clear-cut picture of its competitiveness and therefore may not be very useful from the point of view policy formulations and influence.

This article is an attempt to study the employment of labour and capital by size in the Indian pharmaceutical industry. Analyzing performance on the basis of size makes the analysis touching and useful.

This paper is organized in the following fashion. Section 2 reports concept of size of the firms followed by the data and methodology in Section 3. Section 4 explains the determination of the size of the firms. The size and growth of workers and capital in the Indian pharmaceutical industry is reported in the Section 5. Lastly, Section 5 summarizes the main findings.

Concept of Size and its Determination

Size of firm is an important structural variable mainly because it is the source of many technical and pecuniary economies in industrial activities such as production, innovation, marketing in raising capital etc, and also diseconomies such as those resulting from a large management. It is also thought to be a source of market power (Nagrajan and Bharthawal, 1988). It is believed that large size firms are in a position to take full advantage of technical and pecuniary economies in manufacturing, marketing, supervision and in raising capital. They are also efficient in spending larger sum on research and development and advertising which raises cost of entry of new entrants.

However, the protagonist of small sized units believed that it is more economical and advantageous to have small sized units where the demand is not large, uniform and standard and where the type of the goods produced would conform to individual taste, preferences and requirements. Further, small sized units have the advantage in their flexibility to respond to sudden changes in demand (Mehta, 1955). It is also argued that developing countries are more prone to labour intensive technology and capital & skilled labour are scarce. This leads to less efficient use of local resources and thereby lesser productivity. It would be interesting to look into the size of the firms and its impact on output and employment.

The environment faced by large and small firms could be different. Large firms have more options than the smaller ones with regard to choice of technology, products and markets. By and large, smaller firms may not be able to produce goods where minimum-size economies are significant and they may also be serving the more restricted local markets (Siddharthan and Lall, 1982). As per this argument, size is a definite advantage for growth and larger firms operate in a different environment. However, most studies that tested for the importance of size on the growth of firms (Rowthorn, 1971, Buckley et al 1978, Siddharthan and Lall, 1982), did not find size an advantage for growth.

In pharmaceutical industry, there prevails the view that economies of scale in manufacturing may be ruled out as product become obsolete too quickly before any real improvements in manufacturing processes takes place (Cooper, 1966). However, there are well established bulk drugs such as vitamins whose production is undertaken on a sufficiently large scale for economies to exist. The large pharmaceutical firms by diversifying into areas where economies of scope can be fully exhausted may have lower operating cost and this puts them in a position where they can show better performance when compared with smaller firms in a situation of rigid price controls such as those that face the industry in India. It is therefore meaningful to test whether a size-performance relationship exist in this pharmaceutical industry.

Table 1 shows Nagrajan and Bharthawal (1990), for their study of the size and profitability of firms, sought to have measured the size alternatively by total sales revenue and total assets. In our study, we have undertaken to measure the size of the

firms on the basis of total workers employed in the Indian pharmaceutical firms. This is reported in Table 1. We have divided the firms in 7 groups or sizes based on the workers employed. The size 1 reports to be the firms employing less than 25 workers, Size 2 with an employment of workers 26 to 50, Size 3 with an employment of 51 to 100, Size 4 with 101 to 250, Size 5 with 251 to 500, Size 6 with 501 to 1000 and Size 7 are the firms which employs more than 1000 workers.

Table 1: Size of Firms and Workers

Number of Workers	Size Group
< 25	1
26–50	2
51–100	3
101–250	4
251–500	5
501–1000	6
> 1000	7

Source: Authors' grouping based on unit record data from ASI.

DATA AND METHODOLOGY

As outlined in the preceding section, this study aims to see the size and performance of the firms with special reference to the Indian pharmaceutical industry. The main objective of this section is to outline the methodology used to analyze the data to draw various conclusions in the subsequent sections.

Data Sources and Period of Study

For measuring Total factor productivity at the firm level, there is a need for firm level data on output, capital stock and employment. As these data are readily available in standardized form in National Accounts statistics (NAS) and Central Statistical Organizations (CSO), they are not comparable.

We have used the firm level data obtained from Annual Survey of Industries from 1994-95 to 2016-17 to estimate the above mentioned measures of production function.

Methodology

Statistical techniques have been used to test the initial relation among the variables being used for the study. Analysis of growth rates proceeds in various steps.

The rate of growth of different variables calculated to check the change over time. There are two ways in which growth rate can be calculated. One way of calculating growth rate could be to consider the values of relevant variables at the initial time period (t_0) and the terminal time period (T). If $T=2$, we have the growth rate for consecutive observations. Secondly, the compound growth rate can be calculated using semi-log regression model. In the first case, growth over two time points is defined as:

$$g = \frac{X_i - X_{i-1}}{X_{i-1}} \times 100 \quad (1)$$

Where, ($i = 0, 1, \dots, t$)

The ASI data on value added is the basic building block of the National Accounts data on GDP in the manufacturing sector. Since the ASI data are available with some time-lag, typically the National Accounts data for the latest year use the index of industrial production to prepare the provisional estimates of value added but the final estimates are based on the ASI data. In this study, we have used the implicit deflators of gross output of the registered manufacturing available at the two-digit level to deflate the gross value added in the manufacturing sector.

Studies on Firm Size

There are also number of studies that have tested the size-profitability relationship across industries, like Stekler (1963), Hall and Weiss (1967), Sephered (1972), Whittington (1983), Pomfret and Shapiro (1980). The tendency to study the relationship across industries has been criticized because the size-profitability relationship can differ across industries and also because all inter-industry differences cannot be controlled for in estimating the relationship (Nagrajan and Barthwal, 1988).

Marcus (1969) made a study on size-profitability relationship separately for different industries and succeeded in showing that the relationship differs from industry to industry. Lall (1974) hinted at a direct relationship and along with the Hathi Committee (1974) felt that size does not have any significant influence on profitability. Incidentally, for the pharmaceutical industry, Lall (1974) discovered a positive relationship. Ramachandran (1980) tried to study the relationship between size and profitability of firm in pharmaceutical industry. He discovered a positive but insignificant relationship using Semi-logarithmic regression specification. His study was carried out with sample size of small 19 firms and the period of study was 1965-72. Narayana (1984) focused mainly on pricing as a determinant of profitability and performance for a pharmaceutical industry. He explained that size-profitability has a direct relationship but the size does not have a significant influence on the profitability.

Nagrajan and Barthwal (1988) measured the profitability and size of the firms in Indian pharmaceutical industry for the period 1970-83. The analysis using cross-section data could not detect any systematic relationship between size and profitability. In another study, Nagrajan and Barthwal (1990) while studying the Profitability and Structure at a Firm Level Study of the Indian Pharmaceutical Industry have mentioned that the structure of this industry can be best approximated by monopolistic competition. Competition among firms is thus largely on price lines. The analysis demonstrated that under the condition of price controls the most significant determinant of the profitability of firms in this industry is vertical integration. The size does not appear to be the major determinant of profitability in the pharmaceutical industry. The absence of technical economies in many areas of pharmaceutical production and the absence of significant R&D among Indian firms may have contributed to the negligible size effect.

Certain studies have attempted to analyze the aspect of size and profitability in few industries. But there are very few instances that these studies could arrive at any definite conclusion in case of the size and labour productivity of the firms for Indian industries in general and Indian pharmaceutical industry in particular. In this present paper, we have reported the changes on the effect of size on the Indian pharmaceutical industry.

Employment of Labour & Capital

The determination of size of the firms is a contentious issue. There are various indicators of a firm that can be used to classify the firms into different sizes. The study by Nagrajan and Barthwal (1990), for the size of firm, were sought to have been measured alternatively by total sales revenue and total assets. Similarly, in many policy exercises, both numbers

of workers as well as value of plant and machinery is used to determine the size of the firm. But in India, the most important consideration of the size of the firm has been the number of workers used in the production process. In fact, the division of entire manufacturing sector into small scale and large-scale sector is done using the number of workers (GOI, 1997). Keeping this in mind, we have used the number of workers in the firms in the pharmaceutical sector to divide this sector into seven mutually exclusive size groups or categories.

Table 2 reports the distribution of firms by size as estimated on the basis of the firms reported in ASI. The number of firms in the Indian Pharmaceutical Industry has increased over the years. This is expected that the number has increased irrespective of the size of firms. Table 2 shows that there is more concentration of firms in the category that employs lesser number of workers. About 90 per cent of the firms in the Indian pharmaceutical industry were employing less than 250 workers. On the other hand, we find that there has been general decrease of firms for small and large sized firms. It is the middle sized firms that show a higher gain in case of the distribution of firms.

The distribution of firms by size gives an interesting picture when we make a comparison in the pre and post-recession period. In the pre-recession period that is, 1994–95 to 2007–08, the percentage distributions of firms for the firms employing less than 25 workers were much higher. However, in the post-recession, there has been a general shift of the firms to the middle sized categories.

Table 2 shows there has been a general decrease in the number of firms employing more than 1000 workers from 1.23 per cent in 1994–95 to 0.84 per cent in 2007–08 and further to 0.33 per cent in 2016–17. It is the number of middle sized firms employing between 50 and 250 workers that has shown an upward trend.

Table 2: Distribution of Firms by Size (in Percent)

Year	Size							Total
	1	2	3	4	5	6	7	
1994–95	36.14	22.59	17.04	13.55	6.37	3.08	1.23	100.00
1996–97	36.49	23.17	18.15	11.78	5.21	4.25	0.97	100.00
1997–98	37.57	22.50	17.03	12.92	4.89	3.91	1.17	100.00
1998–99	38.36	21.97	16.76	13.59	4.66	3.54	1.12	100.00
1999–00	38.86	21.75	17.65	13.01	4.28	3.74	0.71	100.00
2000–01	38.23	24.87	16.69	12.52	3.67	3.17	0.83	100.00
2001–02	40.66	21.98	18.02	12.40	3.47	2.64	0.83	100.00
2002–03	19.24	24.05	20.04	25.45	6.21	3.81	1.20	100.00
2003–04	22.49	22.86	22.30	21.19	7.06	2.97	1.12	100.00
2004–05	39.20	19.31	16.63	17.21	4.02	2.49	1.15	100.00
2005–06	40.00	20.19	15.38	16.54	4.42	2.88	0.58	100.00
2006–07	42.23	17.98	15.01	15.71	5.93	2.27	0.87	100.00
2007–08	38.11	19.73	14.67	17.20	6.91	2.53	0.84	100.00
2008–09	35.81	22.74	15.97	17.10	5.48	2.10	0.81	100.00
2009–10	38.04	20.71	14.11	18.56	5.37	2.45	0.77	100.00
2010–11	18.08	20.02	23.68	26.80	8.83	2.05	0.54	100.00
2011–12	14.26	15.46	18.47	29.12	14.66	7.23	0.80	100.00

2012–13	33.04	15.20	15.79	21.35	10.53	3.22	0.88	100.00
2013–14	35.44	17.42	12.01	18.02	10.81	5.41	0.90	100.00
2014–15	26.02	15.34	19.22	26.02	9.32	3.30	0.78	100.00
2015–16	24.75	18.18	19.87	24.58	9.09	3.20	0.34	100.00
2016–17	19.74	18.42	22.37	26.48	9.05	3.62	0.33	100.00

Note: Firm sizes as reported in Table 1

Source: Calculated by the author using unit record data from ASI.

Employment of Labour

The size and growth of workers and capital in a firm is an important determinant of the industrial profitability and productivity. It is generally believed that the performance of a firm shows positive result with the increase in the number of workers and also increases the use of capital of the firms.

Table 3 reports the average number of workers employed by firm size in the Indian pharmaceutical industry. The average number of worker for each firm in the Indian Pharmaceutical industry in 1994–95 was only 125, increased marginally to 142 in 2007–08 and further to 150 in 2016–17 with a growth rate of 4.6 per cent during the entire period of study. This indicates that the employment ratio per firm in the pre-recession period was much lower and as expected the trend has caught up in the post-recession.

The average number of the workers by size shows that the firms employing lesser numbers of workers have actually increased their workers fleet. Contrast to that, the bigger sized firms employing more than 500 workers has shown a declining trend in average workers employed. The firms employing more than 500 workers in the Indian pharmaceutical industry experiences a decline in the average number of workers employed over the years. This may be due to the fact that large firms are mostly capital intensive and with the rapid growth and more use of science and technology in the recent years, the use of capital is more intensified for the large firms resulting in the decline in employment of workers.

Table 3: Average Number of the Workers by Firm Size

Year	Size							Total
	1	2	3	4	5	6	7	
1994–95	13	29	59	156	343	665	1950	125
1996–97	14	29	60	159	347	666	2082	123
1997–98	14	29	58	159	351	672	2243	127
1998–99	15	28	56	165	349	675	2030	121
1999–00	14	27	55	167	356	647	2177	110
2000–01	12	29	57	153	351	657	2217	106
2001–02	11	29	52	158	347	654	1862	101
2002–03	10	31	52	155	345	651	2071	133
2003–04	13	33	51	153	351	649	2015	127
2004–05	14	35	55	159	357	646	1795	138
2005–06	16	36	58	164	360	643	1738	126
2006–07	15	36	62	165	363	640	1665	133
2007–08	17	38	65	173	368	638	1732	142

2008–09	19	40	71	177	372	635	1578	142
2009–10	20	41	76	181	376	632	1386	139
2010–11	19	42	80	187	379	629	1842	140
2011–12	17	45	83	191	376	627	1533	141
2012–13	21	46	89	198	374	624	1375	143
2013–14	20	47	93	199	386	621	1367	145
2014–15	22	47	99	200	390	618	1318	146
2015–16	21	48	106	199	391	616	1186	148
2016–17	23	49	116	200	398	613	1072	150

Note: Firm sizes as reported in Table 1

Source: Calculated by the author using unit record data from ASI.

Firm Size and Value of Capital

Capital forms a formidable part of increase in productivity and profitability of firms in an industry. It is generally understood that the large sized firms are more capital intensive than the smaller sized firms and thus they are in a better position to increase their productivity and profitability. It would be interesting to look at the average value of capital according to the size of the firms in the Indian pharmaceutical industry.

Table 4 reports the average value of capital by size of firms. It shows that the average value of capital use was Rs. 362.63 lakhs in 1994–95; it has increased to Rs. 438.11 lakhs in 2005–06 and further to Rs. 2254.16 lakhs in 2016–17. The use of capital in the pharmaceutical sector has increased by over 6 times during 1994–95 to 2016–17. The large sized firms are using capital much excess of what the small firms possess. However, the use of average value of capital has increased irrespective of the size of the firms. During 1994–95 to 2016–17 the average value capital has shown a declining trend till 2001–02 and then has shown a mild upward trend thereafter. During this period, the growth rate in the capital was 0.8 per cent while the growth rate during the post-recession period it was 5 percent.

A broader look at the table 4 suggests that there has been huge difference between the uses of capital for the large and small sized firms. The difference between the firms employing less than 25 workers and the firms employing more than 100 workers were 278 times in 1994–95 while the difference was reduced to a considerable extent to 165 in 2016–17. The is expected that the small size firms employing less workers are less capital intensive and has lower intensity of using capital than the bigger sized firms. Further, the use of capital has shown an upward trend in the post liberalization period which was quite expected because of changing nature of the industry in the recent years. It is to be noted that the middle sized firms employing more than 250 workers are using capital at a higher rate and this has shown a massive growth particularly after 2005–06.

The growth rate in average capital during 1994–95 to 2016–17 was 4.5 per cent while during 2006–07 to 2016–17 it was 5 per cent (Table 4). If we look at the growth rate by size of the firms, we find that the growth rate in the use of capital is much higher for the middle sized firms compared to the large sized firms and very small sized firms. Thus, the firms in the Indian pharmaceutical industry are moving towards more capital intensive techniques of production process. There was some fluctuating trend in the increase in the use of average value of capital of the firms but in the broader sense, the average capital has increased over the years and it is more pronounced in the post-liberalization period.

Table 4: Average Value of Capital by Size of Firms (in Rs. Lakh)

Year	Size							Total
	1	2	3	4	5	6	7	
1994-95	27.16	53.75	131.50	385.60	1002.69	2598.48	7557.66	362.63
1996-97	23.98	60.02	145.83	394.36	1013.26	2633.73	7990.09	337.35
1997-98	23.99	66.29	146.16	403.12	1333.20	2336.78	7379.45	336.12
1998-99	29.44	69.58	136.04	411.88	1327.62	2033.61	7661.18	314.28
1999-00	32.19	61.64	131.77	430.67	1272.01	2205.07	7990.04	299.14
2000-01	38.46	66.91	185.62	437.42	1445.66	2085.78	7876.44	299.13
2001-02	39.72	74.00	224.82	431.36	1418.34	2081.99	7930.02	258.95
2002-03	46.39	92.90	253.49	403.40	1401.40	2515.71	7983.61	404.67
2003-04	46.57	104.72	196.22	445.43	1512.84	2473.21	8037.19	426.00
2004-05	49.66	98.42	219.85	650.92	1601.31	2741.28	8090.78	354.49
2005-06	52.74	103.71	295.21	890.77	1727.64	2967.28	8144.36	438.11
2006-07	55.83	108.96	321.37	753.82	1808.08	3260.21	8197.95	441.13
2007-08	58.92	105.04	276.10	896.47	1750.85	3610.80	8251.53	480.71
2008-09	62.01	115.29	327.56	1077.18	2643.98	4972.89	8305.12	566.35
2009-10	65.10	121.20	545.35	1085.76	3057.06	5035.58	8358.70	688.22
2010-11	68.19	126.11	635.29	1313.55	3790.17	5694.19	8412.29	996.05
2011-12	71.28	131.02	694.96	1173.16	4443.28	6108.67	8311.18	1179.91
2012-13	74.37	135.94	724.61	2676.13	5096.38	6469.32	10112.42	1394.76
2013-14	77.46	140.85	799.42	3182.63	5749.49	8058.34	13460.77	1609.61
2014-15	80.54	145.76	859.16	2115.28	6402.59	8288.52	15528.69	1824.46
2015-16	83.63	150.67	918.90	2202.26	7055.70	8721.26	15977.00	2039.31
2016-17	86.72	155.58	978.65	2254.33	7708.80	8769.75	14366.51	2254.16

Note: Firm sizes as reported in Table 1

Source: Calculated by the author using unit record data from ASI.

Table 5: Distribution of Firms and Average Capital by Size (in Percentage)

Variable	Period	Size							Total
		1	2	3	4	5	6	7	
Distribution of Firms by size	1994-2006	6.5	0.1	0.5	2.8	-0.2	1.7	-3.5	1.1
	2007-2017	-3.4	3.2	11.8	6.2	9.8	6.3	0.5	2.0
	1994-2017	1.3	1.7	6.5	4.6	5.0	4.1	-1.4	1.6
Average Capital by Size	1994-2006	7.3	7.2	10.0	9.8	6.0	1.8	0.8	3.6
	2007-2017	4.6	3.8	12.8	14.1	15.2	10.8	5.9	16.5
	1994-2017	5.9	5.4	11.5	12.1	10.9	6.5	3.5	10.4

Note: Firm sizes as reported in Table 1

Source: Calculated by the author using unit record data from ASI.

CONCLUSIONS

The main objective of this paper is to determine the size of the Indian pharmaceutical industry and then correlate it with employment of labour and capital. From the unit level data of the firms in the pharmaceutical industry, we have classified into seven classes, which have given us an in-depth analysis of the size of the firms according to the number of workers

employed. The distribution suggests that there are fewer firms in the Indian pharmaceutical sector employing more than 1000 workers, which is only 1 per cent of the total firms in the industry. This suggests that there have been concentration of firms happens to be in the first four categories. As the size increases, the concentration of firms decreases.

The use of capital is always significant in the large size firms compared to the small sized firms despite greater number of work force. The use of capital has grown consistently over the years in the Indian pharmaceutical industry along with the number of workers employed. However, the growth in average capital is higher in the post 2006–07 periods. The middle sized firms have shown a higher growth in capital than the small and large sized firms in the post 2006–07 periods.

Thus it can be concluded that though the large size firms have the advantage of higher labours employed and the use of more capital in the Indian pharmaceutical industry, it is the small sized firms and the middle sized firms which are showing higher growth.

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