



Production Performance of Selected Indian Cement Companies

KEYWORDS

Cobb-Douglas Production function, Marginal Productivity of Labour, Marginal Productivity of Capital, Indian Cement Companies.

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ABSTRACT

The most widely used production function for empirical estimation purpose, the Cobb-Douglas production function has been used to measure the influence of the independent variables on the depend variable. It is concluded from the analysis that the coefficient of labour of five selected companies has registered positive growth whereas in the case of the remaining seven companies it registered negative growth. The Marginal Productivity of Capital (MP_K) registered positive growth for ten companies out of twelve. The Marginal Productivity of Labour (MP_L) registered positive growth for only five companies out of twelve companies. The remaining seven companies registered negative growth implying that an increase of one unit of additional labour will decrease the overall output.

INTRODUCTION

The production function is a highly abstract concept that has been developed to deal with the technological aspect of the theory of production. The most widely used production function for empirical estimation purpose, the Cobb-Douglas production function has been used to measure the influence of the independent variables on the depend variable. It is observed from the analysis that the coefficient of capital of nine companies registered positive growth and the other three companies have registered negative growth during the study period.

Cement is a generic term used for all powdered material which, when mixed with water has a plastic form, but becomes a solid structure within a few hours. The structure gains strength and binding properties with age. History tells that lime and volcanic ash formed "Cement" used in the construction of classic Roman and Greek structures. Burnt gypsum was the cement used for the pyramids of Egypt. Evidence exists of its use in the Indus Civilization of Mohanjodaro.

The India Cement industry is one of the major industries in India. It is the oldest manufacturing industry in the modern sector of the Indian economy. It is one of the key, capital-intensive, energy and transport-intensive industries in India. It is both a basic and consumer-based industry. It is an indigenous industry in which the country is well endowed with all the necessary raw materials, skilled labour, machinery, equipments, technology and know-how.

OBJECTIVE OF THE STUDY

The growing importance and need for cement, an attempt has been made to study the selected Indian cement companies with the following objectives. The first objective of the study is to analyse production performance of the selected Indian cement companies for the period of 1999-2008. The second objective of the study is to estimate the MP_K and MP_L of the selected Indian cement companies.

DATA BASE

For the present study 12 companies of the cement industry have been selected on the basis of their performance in terms of market share during the period 2000-2009. The study uses only secondary data. The data is drawn from the Centre for Monitoring Indian Economy (CMIE) – PROWESS data base. The proWESS data base provides information on a large number of firms operating in the industrial sector. The study compiled the company level data on Output, Capital,

and Labour, for estimating production performance of following companies 1. A C C Ltd.(ACCL), 2. Birla Corporation Ltd.(BCL), 3. Cement Corporation of India Ltd.(CCIL), 4. Chettinad Cement Corporation Ltd.(CCCL), 5. Grasim Industries Ltd.(GIL), 6. Gujarat Sidhee Cement Ltd.(GSCL), 7. Heidelberg Cement India Ltd.(HCIL), 8. India Cements Ltd.(ICL), 9. Kalyanpur Cements Ltd.(KCL), 10. Madras Cements Ltd.(MCL), 11. Mangalam Cement Ltd.(MGCL), 12. Shree Cement Ltd.(SCL).

Deflators

Since the data collected regarding the whole sale price index is obtained from "Index Number of Whole Sale prices in India, base shift into 1993-94=100 to 2000-01=100" published by Economic Adviser Corporation of Commerce and Industry, Government of India. The output (sales) is deflated by the respective wholesale price index of industrial production, Capital (Net Fixed Capital) is deflated by the composite price index of machinery (electrical and non-electrical), Labour (Number of employees) is deflated by consumer price index for industrial workers, Energy and raw material inputs are deflated by the respective wholesale price index of power, fuel and raw material (with base 2000-01=100).

The price indices are taken from the various issues of Reserve Bank of India (RBI) bulletins. The consumer price index (General) for industrial workers are collected from <http://labourbureau.nic.in/indtab.html>

METHODOLOGY

Production Function

The production function is a highly abstract concept that has been developed to deal with the technological aspect of the theory of production. It is an embodiment of the technology, which yields maximum output from the given set of inputs. This relationship is determined by technical considerations. Production function is a technology relationship between input and output flows which shows the alternative combinations of input and the resultant levels of output.

The most widely used production function for empirical estimation is the Cobb-Douglas production function and it is given by

$$V=AK^{\beta}L^{\alpha}2e^u$$

where V = Value added

K = Capital input

L = Labour input

β_1, β_2 = elasticities of capital and labour respectively

u = Stochastic disturbance term.

A natural logarithmic transformation of Cobb-Douglas production function is given by

$$\log V = \log A + \beta_1 \log K + \beta_2 \log L + u$$

The often used method of OLS has been used to estimate this equation and compute estimates of β_1 and β_2 . The sum of β_1 and β_2 is a measure of returns to scale and it was tested by the following t-statistic.

$$t = \frac{|C'\hat{\beta} - C'\beta|}{\hat{\sigma}_y \sqrt{C'(X'X)^{-1}C}}$$

The Marginal Productivity Value (MPV) indicates expected increase in output forthcoming from the use of an additional unit of the relevant input when the levels of other inputs remain unchanged. This is obtained by differentiating the production function. In general, the marginal productivity of any resource depends on the quantity used and on the levels of other resources with which it is combined in the production process. The formula used for computing marginal productivity value is

$$MPV \text{ of } X_i = b_i \cdot \frac{\bar{Y}}{\bar{X}}$$

Where \bar{Y} = mean of output

\bar{X} = mean of the respective input

b_i = Elasticity of output of a given variables

Hence, in this section an attempt has been made to examine the nature of production function and returns to scale in these selected cement companies in India. From the table-1, the following conclusions can be drawn. The constant term 'A' explains the technology effect. The sum of the elasticity parameters explains returns to scale. Marginal Productivity indicates expected increase in output forthcoming from the use of an additional unit of the relevant input when the levels of other inputs remain unchanged. The value of R^2 explains the combination effect of capital and labour on output.

RESULTS AND DISCUSSIONS

In the case of Acc Ltd, the coefficient of capital is positive and is significant at 5 per cent level. It indicates that an increase of one unit of capital will increase the output by 1.25 units. The coefficient of labour is also positive but not significant, that is, an increase of one unit of labour will increase the output by 0.33 units. Even though the sum of the elasticity parameters is 1.58, it is not significant. It implies that the company is operating under the constant return to scale. The MP_K and MP_L are registered positive, and it indicates that an increase of one unit of additional capital and labour will increase the output by 1.27 and 0.31 units respectively.

From the table - 1 it is observed that in Birla Corporation Ltd, the coefficient of capital is positive and insignificant. The coefficient of labour is registered -0.17, that is, an increase one unit of labour will decrease the output by 0.17 units. The sum of the elasticity parameters is registered -0.14 and it is significant. It means the company is operating under the diminishing return to scale. The MP_K is registered positive and MP_L is registered negative, implying that one unit of additional capital will increase the output by 0.03 units and an increase in additional one unit of labour will decrease the output by 0.16 units.

Company Name	Dependent Variable	Constant 'A'	Independent Variable		MP_K	MP_L	Sum of the Elasticities	Remarks	R^2	F- value
			log K	log L						
ACCL	Log V	-2.74	1.25* (2.99)	0.33 (0.67)	1.27	0.31	1.58 (0.65)	Constant	0.79	13.26
BCL	Log V	5.23	0.03 (0.32)	-0.17 (2.17)	0.03	-0.16	-0.14* (6.80)	Decreasing	0.63	5.86
CCIL	Log V	8.97	-1.01* (2.38)	0.15 (0.68)	-0.83	0.11	-0.86* (7.43)	Decreasing	0.67	7.24
CCCL	Log V	-0.25	1.36* (3.35)	-0.25 (0.73)	1.26	-0.22	1.11 (0.19)	Constant	0.66	6.8
GIL	Log V	3.77	0.20* (2.93)	-0.04 (0.40)	0.22	-0.04	0.16* (5.05)	Decreasing	0.81	15.38
GSCL	Log V	6.06	1.66 (1.93)	-1.93* (2.93)	1.48	-1.71	-0.28* (2.56)	Decreasing	0.57	4.59
HCIL	Log V	6.55	0.39 (3.05)	-0.83* (7.45)	0.36	-0.76	-0.44* (14.12)	Decreasing	0.9	30.19
ICL	Log V	-1.39	0.92 (1.20)	0.33 (0.73)	1.00	0.31	1.25 (0.28)	Constant	0.51	3.62
KCL	Log V	-1.92	-1.69 (2.12)	3.03* (2.34)	-1.67	3.13	1.34 (0.60)	Constant	0.45	2.91
MCL	Log V	3.13	0.97* (6.22)	-0.63 (1.65)	0.94	-0.59	0.34 (1.63)	Constant	0.85	20.22
MGCL	Log V	10.39	-0.03 (0.08)	-1.29* (2.58)	0.03	-1.26	-1.33* (3.53)	Decreasing	0.49	3.23
SCL	Log V	-7.95	0.47 (0.64)	2.18* (5.71)	0.46	2.20	2.65* (2.64)	Increasing	0.88	25.92

Note: * indicates significant at 5 % level. Values in Parenthesis are t-value

From table -1 it is observed that, the coefficient of capital is negative for the Cement Corporation of Ltd and it indicates that an increase of one unit of capital will decrease the output by 1.01 units. The coefficient of labour is positive implying that an increase of one unit of labour will increase the output by 0.15 units. Hence, we say that the existing technology in the company will show the positive effect on the output. The sum of the elasticity parameters is registered -0.86, implying that it is in decreasing returns to scale. It means the company is operating under the diminishing return to scale. The MP_K is registered negative and MP_L is registered positive indicating that an increase in one unit of additional capital will decrease the output by 0.83 units and an increase in one unit of additional labour will increase the output by 0.11 units.

In the case of Chettinad Cement Corporation Ltd, the coefficient of capital is registered 1.36 and it is significant at 5 per cent level, implying that one unit of capital will increase the output by 1.36 units. The coefficient of labour is negative but not significant indicating that an increase of one unit of labour will decrease the output by 0.25 units. Hence, we say that the existing technology in the company will show the negative effect on the output. From table -1, even though sum of the elasticity parameters is 1.11, we conclude that the company is operating under the constant return to scale. The MP_K is registered positive and MP_L is registered negative implying that an increase of one unit of additional capital will increase the output by 1.26 units and an increase of one unit of additional labour will decrease the output by 0.22 units.

Table -1 shows that the Grasim Industries Ltd, the coefficient of capital is positive and it indicates that an increase of one unit of capital will increase the output by 0.20 units. The coefficient of labour is registered -0.04. It means that explains an increase one of unit of labour will decrease the output by 0.04 units. The sum of the elasticity parameters is registered 0.16. It means explains the company is operating under the diminishing return to scale. The MP_K is registered positive and MP_L is registered negative indicating that an increase of one unit of additional capital will increase the output by 0.22 units and an increase of one unit of additional labour will decrease the output by 0.04 units.

In the case of Gujarat Sidhee Cement Ltd, The coefficient of capital is positive. It indicates explains that an increase of one unit of capital will increase the output by 1.66 units. The coefficient of labour is registered -1.93 indicating that an increase of one unit of labour will decrease the output by 1.93 units. Hence, we say that the existing technology in the company will show the positive effect on the output. From the sum of the elasticity parameters -0.28, it is clear that the company is operating under the diminishing return to scale. The MP_K is registered positive and MP_L is registered negative indicating that an increase of one unit of additional capital will increase the output by 1.48 units and an increase of one unit of additional labour will decrease the output by 1.71 units.

In the case of Heidelberg Cement India Ltd, the coefficient of capital is registered 0.39 and it is significant at 5 per cent level, implying that an increase in one unit of capital will increase the output by 0.39 units. From the sum of the elasticity parameters (-0.44), it is clear that the company is operating under the diminishing return to scale. The MP_K is registered positive and MP_L is registered negative indicating that an increase of one unit of additional capital will increase the output by 0.36 units and an increase of one unit of additional labour will decrease the output by 0.76 units.

In the case of India Cements Ltd, the coefficient of capital and the coefficient of labour are positive and are insignificant implying that an increase of one unit of capital and one unit of labour will increase the output by 0.92 and 0.33 units respectively. From the sum of the elasticity parameters (1.25), it is clear that the company is operating under the constant return to scale. The MP_K and MP_L are registered positive im-

plying that an increase of one unit of additional capital and labour will increase the output by 1.00 and 0.31 units respectively.

Table-1 shows that in the case of Kalyanpur Cements Ltd, the coefficient of capital is negative and insignificant, implying that an increase in one unit of capital will decrease the output by 1.69 units. The coefficient of labour is positive indicating that an increase of one unit of labour will increase the output by 3.03 units. Hence, we say that the existing technology in the company will show the negative effect on the output. From the sum of the elasticity parameters (1.34), it is clear that the company is operating under the constant return to scale. The MP_K is registered negative and MP_L is registered positive indicating that an increase of one unit of additional capital will decrease the output by 1.67 units and an increase of one unit of additional labour will increase the output by 3.13 units.

In the case of Madras Cements Ltd, the coefficient of capital is positive, implying that an increase of one unit of capital will increase the output by 0.97 units. The coefficient of labour is negative indicating that an increase of one unit of labour will decrease the output by 0.63 units. From the sum of the elasticity parameters (0.34), it is clear that the company is operating under the constant return to scale. The MP_K is registered positive and MP_L is registered negative implying that an increase of one unit of additional capital will increase the output by 0.94 units and an increase of one unit of additional labour will decrease the output by 0.59 units.

In the case of Mangalam Cement Ltd, the coefficient of capital and labour are negative, implying that an increase in one unit of capital and labour will decrease output by 0.03 and 1.29 units respectively. The sum of the elasticity parameters (-1.33), indicates the company is operating under the diminishing return to scale. The MP_K is registered positive and MP_L is registered negative suggesting that an increase of one unit of additional capital will increase the output by 0.03 units and an increase of one unit of additional labour will decrease the output by 1.26 units.

In the case of Shree Cements Ltd, the coefficient of capital and labour are positive implying that an increase of one unit of capital and labour will increase the output by 0.47 and 2.18 units respectively. From the sum of the elasticity parameters (2.65), it is clear that the company is operating under the increasing return to scale. The MP_K and MP_L registered positive values, indicating that an increase of one unit of additional capital and labour will increase the output by 0.46 and 2.2 units.

CONCLUSIONS

It is concluded from the analysis that the coefficient of labour of five selected companies has registered positive growth whereas in the case of the remaining seven companies it registered negative growth. Similarly, it is observed from the sum of the elasticity of parameters, that only one company is under increasing return to scale, five companies are under constant returns to scale and that six companies are under diminishing return to scale among the selected companies of the study.

The Marginal Productivity of Capital (MP_K) registered positive growth for ten companies out of twelve and it indicates that an increase of one unit of additional capital will increase the overall output. The remaining two companies are registered negative growth and this indicates that an increase of one unit of capital will decrease the overall output. It is also observed that the marginal productivity of Labour (MP_L) registered positive growth for only five companies out of twelve companies, and it implies that an increase of one unit of additional labour will increase the overall output. The remaining seven companies registered negative growth implying that an increase of one unit of additional labour will decrease the overall output.

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