Performance Analysis of Indian Companies Using Data Envelnopment Analysis

Vipul Sharma

[*] Eka Software Solutions, Banglore, India

ABSTRACT

Realty sector in India has attracted the prospective investors to commit their money in the concrete world of real estate with an anticipation to multiply the lucre than never before. This led various biggies like Omaxe, Indiabulls , Unitech and many more to emerge as market players in the realty sector too. Emergence of various realty players in the market baffles the investors as to where to invest to not just keep their hard earned money safe but also to ensure good returns. So, it is important to know how efficiently a realty company is actually working. The aim of this paper is to measure the relative efficiencies of the 40 major listed companies in realty sector using the non-parametric technique Data envelopment analysis , which is a data oriented approach to evaluate the performance of a set of peer entities. Based on the annual report for the year 2012 ,of these companies, various financial ratios have been recognized as inputs and as outputs to evaluate the efficiencies.

Keywords: Performance measurement, Financial Variables, Data Envelement Analysis

1. INTRODUCTION

With the liberalization of economy, realty sector in India projected to play a crucial role in the overall development of India's core infrastructure. Developments in hospitality(hotels,hospitals,resorts),IT,ITes,retail,entertainment industry(theatres, amusement parks, malls) is colligated with the development in the real estate sector. Traditionally ruled by small regional players ,various biggies like Omaxe, Indiabulls , Unitech and many more have emerged as market players in the realty sector to offer higher level of expertise and better quality. The cut-throat competition has led to opportunism and creative valuation of share prices methods. Thus, the has acknowledged unprecedented highs and frightening lows over the past few years making it a playing arena for enterprisers and prospective investors. The industry has undergone structural changes making the realty analysts and consultants feel skeptical about these highs and lows. These fluctuations are likely to alter and effect the competitiveness in the market ,and thus, affecting the performance and efficiency levels of the market players. We aim at evaluating relative efficiencies of the key market players in realty using the technique Data envelopment Analysis(DEA). The use of this technique in the realty sector is still rare, at least in India.

Though researchers have explored various issues related with this sector with the help of other statistical tools. But efficiency measurement on the basis of optimized use of resources is still rare. Jhingan examined the growth of real estate industry in India and tested share valuation made by six publicly listed companies and concluded that share valuation is a function of profitability and consistent growth. It is extremely difficult to justify very high share prices for a futuristic business model, driven by leveraging and very high fixed interest cost.

Anderson el al. measured overall, allocative, technical, pure technical and scale efficiencies for a sample of residential real estate brokerage firms using DEA. The results suggested that these firms have been inefficient in optimal allocation of inputs and proved to be a failure to operate at constant returns to scale Regression analysis was conducted to show that increasing size of firm increases efficiency while choosing to franchise, adding an additional multiple listing service and increasing operating leverage decreases firm performance.

Douglas Nanka-Bruce studied the effect of ownership structure on the firms performance, the effect of foreign block holders on the performance of firm and if there have been technical efficiency improvements in the real estate sector of Spain in recent times by using DEA as one of the tools.

This article aims at ranking the 25 realtors in India using Data envelopment analysis. The second section gives a brief idea of the technique and the model put to use for evaluating efficiencies. The third section is about the analysis done on the basis of results obtained by employing the mentioned technique. The fourth section describes the inputs and outputs chose for the study. The last section concludes the study followed by the references.

2. METHODOLOGY

Data envelopment analysis is a technique to assign relative efficiencies to a set of decision making units (DMU) belonging to a homogenous group based on the inputs used and outputs produced. The homogeneity, here, implies that all the DMUs in the group use the same set of inputs to produce the same set of outputs. The idea of evaluating the relative efficiencies originate from the lack of knowledge about what the "best" could be. The technique uses linear programming to assign unbiased weights to the inputs and outputs of the production process in order to yield the efficiencies. If N is the number of DMUs . x_{if} and y_{rf} are levels of the ith input and r^{th} output, respectively for DMU f. λ_f denotes the contribution of DMU f in deriving the efficiency of the rated DMU f_o. S_i^- and S_r^+ are slack variables denoting the excess input i and shortfalls in output r. l_o is the radial efficiency factor that shows the possible reduction of inputs for DMU f_o. Then ,the basic CCR model suggested by Charnes, Cooper and Rhodes in 1978 is given as follows

$$\text{Min} \quad l_0 - \varepsilon \left[\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right] \tag{1}$$

$$\text{Subject to:} \quad \sum_{f=1}^{N} \lambda_f x_{if} = l_o x_{if_o} - S_i^- \quad \text{where} \quad i = 1...m$$

$$\sum_{f=1}^{N} \lambda_f y_{rf} = S_r^+ + y_{rf_o} \quad \text{where} \quad r = 1...s$$

$$\lambda_f \geq 0, f = 1...N, \quad S_i^-, S_r^+ \geq 0 \quad \forall \; i \text{ and } r$$

[Note: ε is the Non-Archimedean small positive number]

In case where, DMUs are working on variable returns to scale ,the model suggested by Banker, Cooper and Charnes in 1984 ,that is, the BCC model is employed. It involves the addition of one more constraint known as the convexity constraint $\sum_{f=1}^{N} \lambda_f = 1$ to the classic CCR model. Its formulation is gives as

$$\text{Min} \quad l_o - \varepsilon \left[\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right] \tag{2}$$

$$\text{Subject to:} \quad \sum_{f=1}^{N} \lambda_f x_{if} = l_o x_{if_o} - S_i^- \quad \text{where} \quad i = 1...m$$

$$\sum_{f=1}^{N} \lambda_f y_{rf} = S_r^+ + y_{rf_o} \quad \text{where} \quad r = 1...s$$

$$\sum_{f=1}^{N} \lambda_f = 1$$

$$\lambda_f \geq 0, f = 1...N, S_i^-, S_r^+ \geq 0 \quad \forall \; i \text{ and } r$$

The results obtained urged us to utilize the super-efficiency model for obtaining the ranking among the DMUs which were recognized as BCC efficient units. The super-efficiency model introduced by Andersen and Petersen in 1993 enables one to distinguish between efficient units by examining the maximal radial change in inputs and/or outputs for a unit to remain efficient. The larger the value of the super efficiency measure the higher the unit is ranked among the efficient DMUs. It is formulated as follows:

$$\text{Min} \qquad l_o - \varepsilon e S_r^+ \qquad\qquad\qquad (3)$$

$$\text{Subject to :} \qquad l_o x_{if_o} = \sum_{f=1,\neq o}^{N} \lambda_f x_{if} + S_r^- \qquad \text{where} \qquad i = 1...m$$

$$y_{rf_o} = \sum_{f=1,\neq o}^{N} \lambda_f y_{rf} - S_r^+ \qquad \text{where } r = 1...s$$

$$\lambda_f \geq 0, f = 1...N, S_i^-, S_r^+ \geq 0 \quad \forall \ i \text{ and } r$$

The above model is a member of the class of Input Oriented-CCR models.

3.CHOICE OF INPUTS AND OUTPUTS

A financial ratio is a relative magnitude of two selected numerical values taken from an enterprise's financial statements. Financial ratios quantify many aspects of a business and are an integral part of the financial statement analysis. Financial ratios are categorized according to the financial aspect of the business which the ratio measures. Various ratios are put to use to assess the performance of an enterprise for example liquidity, solvency, profitability and turnover. The importance of each ratio depends on its respective attribute.

The inputs are determined by the resources utilized by the DMUs or the conditions affecting their performance. The outputs ,on the other hand, count the profits generated. Based on this criterion we have arrived at eight inputs namely current ratio, quick ratio, debt equity ratio, Interest coverage ratio, Inventory turnover ratio, debtors turnover ratio, fixed asset turnover ratio and total assets turnover ratio. The liquidity ratios like current ratio and quick ratio measure the ability of the DMU to meet its short-term obligations that is capacity of the DMU to pay its current liabilities as and when they fall due. The solvency or leverage ratios like debt equity throw light on the long term solvency of a DMU reflecting its ability to assure the long term creditors with regard to periodic payment of interest during the period and loan repayment of principal on maturity or in predetermined installments at due dates. The turnover ratios are also known as activity ratios or efficiency ratios with which a DMU manages its current assets. The outputs chosen are Returns on Capital Employed, Net Profit Margin, Operating Profit Margin and Sales. Returns on capital employed ratio establishes the relationship between net profit and the gross capital employed.Net profit margin ratio measures the relationship between net profit and sales of a DMU. Operating profit margin establishes the relationship between total operating expenses and net sales.

4. ANALYSIS

The data has been procured from BSE India website www.bseindia.com .Out of 40 companies selected for the survey,15 companies were missing on the required data. The BCC model was run using DEA-Solver Pro to obtain the relative efficiencies. Out of 25 companies assessed, only 4 were performing on increasing returns to scale (rest have CRS)and out of these 4, only one was found to be efficient. A total of 22 companies exhibited an efficiency score of 1. Alchemist was found to be least efficient with an efficiency score of 0.104284.Arihant and Godrej Properties, though not fully efficient, showed up decent efficiencies of 0.938 and 0.969 respectively.

But 22 out of 25 companies getting a score of 1 made us curious enough to further rank the efficient units using Super Efficiency-BCC model..The results obtained by employing this model depicted infeasible LPs for five DMUs(given in Table 1) Such condition for infeasibility in the Super efficiency BCC model arise when there is no referent DMU for the excluded DMU.A necessary condition for such infeasibility is that the DMU excluded be "extreme efficient". In the case when all inputs and outputs are positive ,as here, a sufficient condition for infeasibility is that the excluded DMU be strongly super efficient in the sense that it has at least one output strictly larger than the corresponding output for any other DMU in the reference set(in case of input oriented model).So to obtain ranks we get the Super-efficiency CCR scores. DLF outshined with an efficiency score of 7.739 followed by Anantraj at second and Bharat Agri Fert & Realty Ltd.at third place with efficiency scores of 5.889 and 4.520 respectively .This suggests that DLF has been most successful in extracting out maximum of outputs from the minimum of inputs thus making DLF Limited (Delhi Land & Finance)

the largest commercial real estate developer in India by revenue, profit, and market share. Anantraj's success may be attributed to its operations in only Delhi+NCR region whereas others have a wide area of operation. Another reason could be their abstinence from leverage. Godrej Properties, ranked 22, despite the pedigree of a large business group, earns 60-70 % of its revenues from Mumbai and Ahmedabad, even though it has projects in 12 cities .This suggests misallocation of resources.

Table 1. *Showing ranking of top 11 realtors and their respective super efficiency CCR and BCC scores .*

Ranking	DMU	Super BCC Scores	Super CCR Scores
1	*DLF*	1 (Infeasible LP)	7.739258387
2	*Anantraj*	5.895131243	5.889624506
3	*Bharat Agri*	1 (Infeasible LP)	4.520866134
4	*Ashiana*	1 (Infeasible LP)	3.579417702
5	*HDIL*	1 (Infeasible LP)	3.37704211
6	*Sunteck reality*	1 (Infeasible LP)	3.336199648
7	*Sobha*	3.196720352	3.040967733
8	*Unitech*	3.776294591	2.919196703
9	*Parsvnath*	2.567642106	2.535394863
10	*Hubtown*	2.68137863	1.977965415
11	*Ganesh Housing*	2.246806148	1.882644544

5. CONCLUSION

Out of 25 companies ,only 4 were working on increasing returns to scale. The key players emerged out as DLF,,Anantraj and Bharat Agri.Fert Ltd. regional players like Sobha,Anantraj cashed on there knowledge of regional market to efficiently use their resources.

6. REFERENCES

Amirteimoori, A. and A. Emrouznejad(2012),On classifying inputs and outputs in data envelopment analysis, Applied Mathematics Letters.

Andersen P and Petersen NC(1993),A Procedure for Ranking Efficient Units in Data Envelopment Analysis, Management Science,10 ,39,pp. 1261-1264.

Anderson R.I.,Fok R. el al.(1998),Measuring the Efficiency of Residential Real Estate Brokerage Firms ,Journal of Real Estate Research,2 ,16,pp.139-158,

Banker, R.D., A. Charnes, and W.W. Cooper. (1984). "Some Models to Estimate Technical and Scale Inefficiencies in Data Envelopment Analysis." *Management Science* 30(9), 1078–1092

Färe R.,Grosskopf S. and Lovell C.A.K.(1985) ,The Measurement of Efficiencies ofproduction,Boston,MA:Kluwer-Nijhoff

Jhigan S , Growth strategy, IPO and Performance of Indian Real Estate Companies ,Research Paper for MA in Practicing Management, Lancaster University.

N Author, B O Author and C I Author (1990), Article in a regular journal, *Intl. J. Autom. Control*, **4**, *11*, pp. 231–245.

Novaes, L.F.L. Doctor Thesis, "Double Perspective DEA in Real Estate Value Assessment." pp. 20–26.

Zumpano,L.V. and D.Hooks(1988),The Market of Residential Real Estate Brokerage Services: A critical Re-evaluation,The Journal of the American Real Estate and Urban Economics Association,16,1-17.