

MEASURING THE EFFICIENCY OF INDIAN REAL ESTATE FIRMS DURING THE PRE- AND POST- DEMONETIZATION PERIOD BY ADOPTING DATA ENVELOPMENT ANALYSIS

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Abstract. Indian real estate segment has been one of the utmost affected segments of economy contemplating the changes in economic policies. The Indian economy experienced a radical change as an outcome of demonetization and the consequences are perceived on the real estate segment. The current study has been proposed to evaluate the efficiency of Indian real estate firms by adopting the technique of data envelopment analysis during the pre- and post-period of demonetization. The aim of the research is to understand the effect of demonetization on the performance of the Indian real estate firms during the post-demonetization period compared to pre-demonetization period. Eight real estate firms have been considered for the analysis. The firms have been ranked on the basis of the efficiency score. It is evident from the results of the study that there is a significant difference between the ranks of the firms during the period of pre and post demonetization; and it can be elucidated that the demonetization has an impact on the performance of the firms.

Keywords: *Data envelopment analysis (DEA), demonetization, efficiency, real estate*

INTRODUCTION

Demonetisation is a procedure of introducing a new currency in place of a particular currency which was prohibited. Demonetisation is practical in any economy owing to change in national currency (Vaishali, Aman & Sehrawat, 2018). The Indian government has announced the implementation of demonetization on 8th November 2016 with an aim to curb black money, fake currency, cashless transactions and corruption. Similar initiatives were enforced by few countries in the past due to debacle in economy but the decision of the government of India was uncommon as the economy was steady.

The Indian real estate segment comprises housing, retail, hospitality, and commercial sectors. The development of the real estate segment is supplemented by the improvement of the corporate environment and the requirement for office space in addition to housing. Investing in real estate is a decisive step for individuals and business establishments (Indian Brand Equity Foundation, 2019). Indian real estate segment is growing in many folds, particularly in cities and semi-urban areas and its contribution to the national gross domestic product (GDP) is significant. Traditionally, the Indian real estate segment involved black money and cash

transactions (Verma & Verma, 2017). In recent past, the Indian government has introduced crucial laws pertaining to the real estate segment to ensure transparency. The initiatives of the Indian government will strengthen the real estate segment in the long term prospective (Sanjeevkumar, 2017).

The demonetization drive initiated by the government of India has led to setback in completion of existing real estate projects due to cash transactions and it is directed towards transparency in real estate segment in the future (Sridevi & Pragyan, 2017). The implementation of demonetization is a rare step initiated by the government and it created a turbulence in the Indian real estate segment. The demonetization has caused sudden disruption of work in ongoing projects. The abrupt check on withdrawals resulted in a situation that contractors were unable to make payments to workers as they were done in cash only. Owing to elimination of cash transactions, the real estate segment was in search of alternate ways of payment. The demonetization of old currency has introduced a transformation for the real estate industry in India that would be transparent, systematic and dependable (Vaishali, Aman & Sehrawat, 2018). At the beginning of the initiative, demonetization disturbed the real estate business across the country, affecting new launches and sales. However, after the early setback, the real estate business noticed a stable growth in customer enquiries, out of which turned out to be positive (Ashwani & Geethanjali, 2018).

The aim of conducting this study is to understand if demonetization affects the performance of the Indian real estate firms during the post-demonetization period compared to pre-demonetization period. The task of the study is to measure the efficiency of Indian real estate firms during the pre- and post-demonetization period. The study evaluates the effects of demonetization on the cash dependent real estate sector and reveals the expectations of customers regarding pricing of properties in the post – demonetization period in India. The study adopts the data envelopment analysis technique to measure the efficiency of real estate firms by considering two inputs and two outputs. Linear program (LP) has been developed to attain the above-mentioned aim.

1. LITERATURE REVIEW

The real estate segment is the second largest employer in India, next to agriculture, and it is slated to improve further in the near future. The Indian real estate segment has been facing threats in the past few years in terms of sales and long-term improvement. Owing to the initiatives taken by the Indian government, the segment was guiding in the direction of recovery (Indian Brand Equity Foundation, 2019). The Indian real estate segment is known for unaccounted money and the business in the secondary market deals with high cash component. The initiative of the Indian government to curb unaccounted money led to the demonetization on 8th November 2016. The outcome of demonetization on the Indian real estate segment will lead to exponential rise in institutionalization funding (Ajinkya, Sujaan, Harshet, & Geetha, 2018).

Many developers in India reveal that their major investors have pulled out of the market, when it comes to land financing, as well as investments in under-construction inventory. This is not just due to demonetisation, but also due to the temporary disruption caused by the implementation of the Goods and Services Tax (GST) and the Real Estate Regulation and Development Act (RERA) (Verma & Verma, 2017). Implementation of RERA, GST and demonetization in the Indian real estate sector has created short - term problems (Development India Real Estate, 2018). The housing sector alone contributes 5–6 % to the total GDP (Sridevi & Pragyan, 2017). Any impact on the real estate sector will greatly affect the entire economy. Demonetization greatly affect the real estate in Bengaluru city due to 7.6 % fall in the market price and 10 % drop in supply of new owner properties for sale (Muthukumar & Shashikumar, 2017). Demonetization along with other legal reformatories is expected to make a clear road for real estate business in order to play a major role in promoting cashless economy (Verma & Verma, 2017).

During demonetization, the impact on gross value added was felt in the real estate segment, but to some extent, it was balanced by growth in other segments. Construction sector is worst affected by demonetization move as the growth decreased from 6 % to 3.4 % (Geethanjali, 2017). The beginning of the year 2016 registered a substantial shift in terms of positive growth rate of the real segment in the Indian economy. Post-demonetization created confusion and ambiguity in the real estate market. Demonetization initiative was a crucial step which was assured to bring back black money, wherever it had been involved. In future, the real estate segment in India will accomplish sustainable growth and development (Mansi, Pallabi & Jolly, 2017).

The immediate impact of demonetisation on real estate economy has been significant; signs of the segment diverting back to high costs have been observed late (Charan, 2018). Impact of demonetization is more prominent in an unorganized sector comprising small builders and real estate agents. Due to demonetization, it has been assumed that the price will be reduced by 30 % – 40 % in property. In the real estate segment, demonetization is expected to bring increased transparency which is likely to improve the affordability of real estate in medium to long term (Ashima & Gagan, 2017).

Though demonetisation has an impact on the real estate segment in general, it is understood that long-term benefits for GDP growth will offset the short-term transitional impact (Himanshu, Ashwani & Zainab, 2018). Demonetization had an impact on the operation of the majority of the builders as the major portion of transactions depend on cash rather than bank transactions. The demonetization initiative by the Indian government in November 2016 affected the purchasing power of people (Charan, 2018). However, during 2016, the government introduced laws such as RERA and GST which draw attention of the investors to investing in real estate. The dip of real estate market sales was as high as 40 %, while new project announcements dropped down by 11 % immediately after demonetization (Smitha & Akshay, 2018). Cash transactions are vital in the real estate segment and the basic reason is “the actual value of the property can be undermined to the extent of cash payment and for loan purposes; some other value or the balance of the property can be given” (Radhakrishnan, Selvan & Senthilkumar, 2017).

Demonetization initiative is essential at any time when there is transformation of national currency and it will minimize the flow of black money into the real estate segment. This will assist in accomplishing the much - needed improvement in the real estate segment. From the available literature particularly in the Indian context, it is evident that the demonetization initiative by the Indian government had an impact on the performance of real estate firms and basing on the theoretical background, an attempt has been initiated to ascertain the performance levels of the firms before and after the demonetization.

2. METHODOLOGY

“Efficiency can be easily measured if there is one input and one output, but the problem arises if there is more than one input and output” (Arindam, 2018). Data envelopment analysis (DEA) is a technique adopted to measure efficiency involving multiple inputs and outputs (Arindam, 2018). DEA is a quantitative technique to measure the efficiency of multiple units (in this research – for DMUs - decision-making units) and “the major advantage of DEA over other methods that determine efficiency, such as cost–benefit analysis or regression, is that the relative weights of the variables do not need to be known” (Janet & Daniel, 2007; Staníčková & Skokan, 2012). DEA method as a quantitative analysis for measuring the efficiency of real estate firms is suitable because it does not evaluate only one factor, but a set of different factors that determine the efficiency.

2.1. Data Envelopment Analysis

“DEA as a non-parametric approach is able to provide relative efficiency for a series of DMUs based on multiple inputs/outputs with no assumptions of production function” (Tsou & Huang, 2010). The DEA methodology calculates a measure of the relative efficiency of each DMU. This is performed by comparing each DMU to all of the remaining ones. The problem of evaluating each DMU is formulated as a linear program. Estimating the performance of “n” different DMUs involves the solution of “n” unusual LP problems (Pourjavad & Shirouyehzad, 2014). “It is well known that adding or deleting an inefficient DMU does not alter the efficiencies of the existing DMUs” (Berih, Patnaik & Mahapatra, 2011). “The inefficiency scores change only if the efficient unit is altered. The performance of DMUs depends only on the identified efficient unit, characterised by the DMUs with a unity efficiency score, if the performance of inefficient DMUs declines or improves, the efficient DMUs still may have a unity efficiency score; although the performance of inefficient DMUs depends on the efficient DMUs, efficient DMUs are only characterised by an efficiency score of one; the performance of efficient DMUs is not influenced by the presence of inefficient DMUs” (Pourjavad & Shirouyehzad, 2014).

DEA is a mathematical programming technique that has been applied in numerous applications for evaluating the performance of similar units, such as a set of banks, insurance companies, state transport sectors and manufacturing units (Grmanová & Ivanová, 2018; Canan & Nazan, 2012; Saxena & Saxena, 2010). Data

envelopment analysis is a methodology based upon the application of linear programming. “It was originally developed for performance measurement and successfully employed for assessing the relative performance of a set of firms that use a variety of identical inputs to produce a variety of identical outputs” (Mostafa, 2007). Mathematical Formulation of DEA is described in the next subpart.

2.2. Mathematical Formulation of DEA

DEA is a reliable tool for evaluating the relative performance of a group of firms or departments that are generally treated as decision-making units (DMUs). The inputs are converted into outputs in a decision-making unit whose efficiency is measured. “DEA makes use of fractional programming problem and corresponding linear programming problem together with their duals to measure relative performance of DMUs” (Charnes, Cooper, Golany, Seiford, & Stutz, 1985). “The Charnes, Cooper and Rhodes (CCR) model is a fractional programming problem model that measures the efficiency of DMUs by calculating the ratio of weighted sum of its outputs to the weighted sum of its inputs. DEA also determines the level and amount of inefficiency for each of the inputs and outputs and the magnitude of inefficiency of the DMUs is determined by measuring the radial distance from the inefficient unit to the efficient one” (Arindam, 2018). Equation (1) represent the mathematical program to compute the efficiency score for the Indian real estate firms is as follows:

- 1) minimize Theta (objective Function),
- 2) subject to the following constraints:

$$\sum_{j=1}^n w_j x_i^j \leq \theta x_i^t; i = 1, 2, 3 \dots, m$$

$$\sum_{j=1}^n w_j y_r^j \geq y_r^t; r = 1, 2, 3 \dots, s \quad (1)$$

$$\sum_{j=1}^n w_j = 1$$

$$w_j \geq 0 (j = 1, 2, 3 \dots, n),$$

where

w_j is the weight of j^{th} DMU;
 x_i^j is the i^{th} input for j^{th} DMU;
 y_r^j is the r^{th} output for j^{th} DMU;
 x_i^t is the i^{th} input for t^{th} DMU;

y_r^t is the r^{th} output for t^{th} DMU;

θ is the efficiency, m and s for inputs and outputs, respectively.

Decision-making units, inputs and outputs are described in the next subchapter.

2.3. Decision-Making Units, Inputs and Outputs

DEA considers a DMU as a separate unit for transforming inputs into outputs. In order to identify DMUs, eight real estate firms in India have been considered based on Bombay stock exchange 500 index as per their turnover. The inputs and outputs to evaluate efficiency of real estate firms is depicted in Fig.1. The current study has been carried out by considering two outputs and two inputs. The outputs are sales turnover and profit (rupees in crores). Earnings before depreciation, interest, taxes and amortization (EBDITA) have been considered as a proxy for profit. The two inputs considered are manufacturing & selling and administrative & personal expenses (rupees in crores). The secondary data related to the inputs and outputs for the eight Indian real estate firms have been collected from the profit and loss account of the respective firms (The Economic Times, 2019).

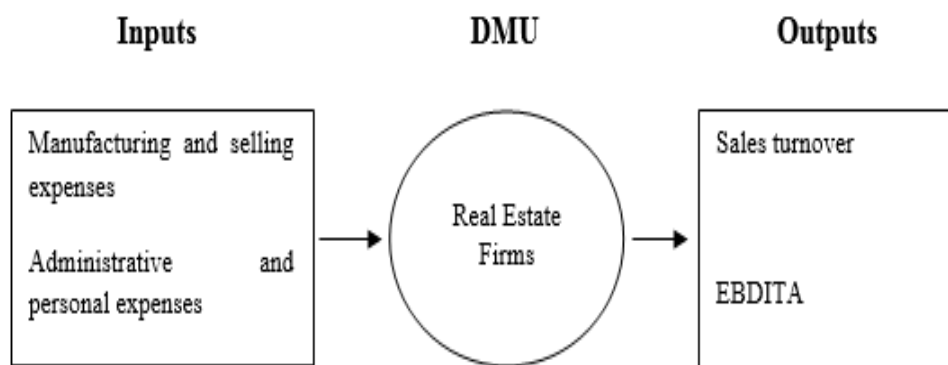


Fig.1. Inputs and outputs (developed by the author).

Information related to the data collection is provided in the next subpart.

2.4. Data Collection

The study has been organized in two sections that is pre-demonetization period (2014–2015 and 2015–2016) and post-demonetization period (2016–2017 and 2017–2018) so as to evaluate the efficiency changes of the Indian real estate firms. The mean of the inputs and outputs during pre- and post-demonetization period is reflected in Table 1 and 2 respectively.

Table 1. Data related to Pre-demonetization 2014–2016
(The Economic Times, 2019)

Decision-making unit	Sales turnover (Rs in crores)	EBDITA (Rs in crores)	Manufacturing & selling expenses (Rs in crores)	Administrative & personal expenses (Rs in crores)
DMU 1	3319	2689	1303	445
DMU 2	429	272	281	88
DMU 3	564	265	324	91
DMU 4	940	580	380	82
DMU 5	336	319	5	109
DMU 6	2515	742	1690	239
DMU 7	2105	492	1275	343
DMU 8	128	117	6	115

Table 2. Data related to Post-demonetization 2016–2018
(The Economic Times, 2019)

Decision-making unit	Sales turnover (Rs in crores)	EBDITA (Rs in crores)	Manufacturing & selling expenses (Rs in crores)	Administrative & personal expenses (Rs in crores)
DMU 1	3379	2040	1629	437
DMU 2	977	508	650	178
DMU 3	578	113	450	93
DMU 4	532	577	350	90
DMU 5	387	307	15	119
DMU 6	2585	548	1892	263
DMU 7	2429	480	1693	254
DMU 8	187	160	29	18

Results and discussion are provided further.

3. RESULTS AND DISCUSSION

“Data envelopment analysis is basically a non-parametric approach of linear programming” (Arindam, 2018). Linear program (LP) has been formulated to evaluate the efficiency score of the eight DMUs considered in the current study. Input oriented variable return to scale model has been applied in the analysis with an objective to minimize the theta. The formulated LP was run in Lingo 13.0 to measure the efficiencies of real estate firms.

3.1. Pre-demonetization Period (2014–2016)

An example of LP formulated for DMU1 is shown in Figure 2.

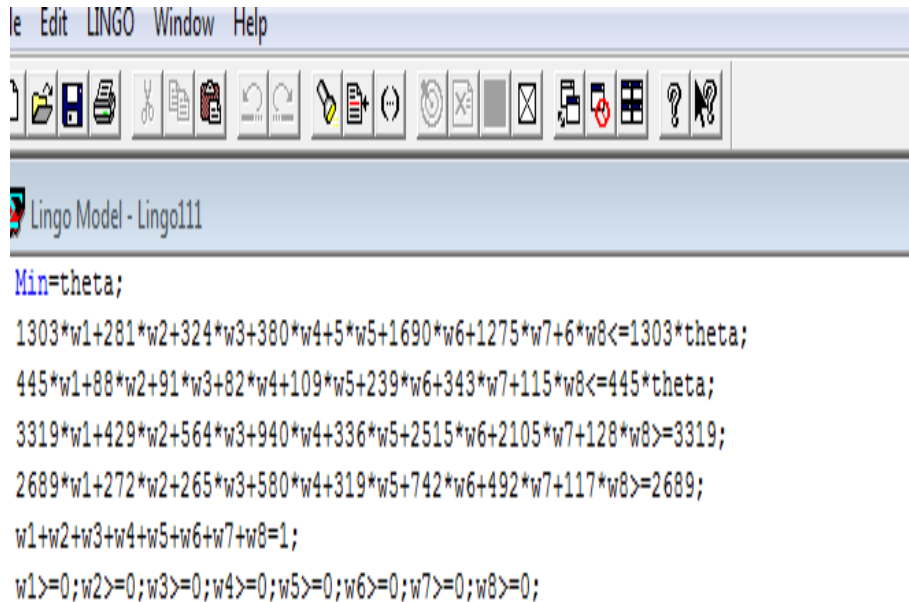


Fig. 2. LP to measure efficiency of DMU1 (developed by the author).

The LP was run in Lingo 13.0 and the output of DMU 1 was depicted in Figure 3.

Lingo 13.0 - [Solution Report - Lingo111]			
File Edit LINGO Window Help			
Global optimal solution found.			
Objective value:		1.000000	
Infeasibilities:		0.000000	
Total solver iterations:		2	
Variable	Value	Reduced Cost	
THETA	1.000000	0.000000	
W1	1.000000	0.000000	
W2	0.000000	0.1059793	
W3	0.000000	0.1290809	
W4	0.000000	0.2482314E-01	
W5	0.000000	0.000000	
W6	0.000000	0.6592555	
W7	0.000000	0.6966429	
W8	0.000000	0.8194244E-01	
Row	Slack or Surplus	Dual Price	
1	1.000000	-1.000000	
2	0.000000	0.4020615E-03	
3	0.000000	0.1069919E-02	
4	0.000000	0.000000	
5	0.000000	-0.3718855E-03	
6	0.000000	0.000000	
7	1.000000	0.000000	
8	0.000000	0.000000	
9	0.000000	0.000000	
10	0.000000	0.000000	
11	0.000000	0.000000	
12	0.000000	0.000000	
13	0.000000	0.000000	
14	0.000000	0.000000	

Fig. 3. Output of Lingo software of DMU1 during pre-demonetization (developed by the author).

Similarly, LP was formulated for other DMUs and the program was run in the software. The efficiency score based on the output is reflected in Table 3. The DMUs with an efficiency score of one are treated as efficient, and the inefficient units required to identify their weaknesses so as to become efficient. Finally, ranking was given to the real estate firms based on their efficiency score.

Table 3. Efficiency Scores of Real Estate Firms during the Pre-demonetization Period (developed by the author)

Decision-making unit	Efficiency score	Rank
DMU 1	1	3
DMU 2	1	3
DMU 3	0.949	6
DMU 4	1	3
DMU 5	1	3
DMU 6	1	3
DMU 7	0.725	8
DMU 8	0.947	7

The next subchapter is related to the post-demonetization period.

3.2. Post-demonetization period (2016–2018)

Similar to the pre-demonetization period, DEA has been applied by formulating the LP to measure the efficiency scores of eight real estate firm by using the data available in Table 2. The efficiency scores thus computed were presented in Table 4 after running the LP in Lingo 13.0. Finally, the real estate firms were ranked as per efficiency scores.

Table 4. Efficiency Scores and Ranks of Real Estate Firms in the Post- demonetization Period (developed by author)

Decision-making unit	Efficiency score	Rank
DMU 1	1	3.5
DMU 2	0.675	7
DMU 3	0.661	8
DMU 4	1	3.5
DMU 5	1	3.5
DMU 6	1	3.5
DMU 7	1	3.5
DMU 8	1	3.5

To ascertain the correlation among the ranks obtained by real estate firms during the pre- and post-demonetization period, the Spearman's rank correlation coefficient was computed. The objective of computing the rank correlation coefficient was to interpret the outcome of demonetization on the performance of the Indian real estate firms. The Spearman's rank correlation coefficient was calculated for the ranks obtained during the pre- and post-demonetization period and the value was 0.3631.

It is observed from Table 3 and Table 4 that five out of eight real estate firms are performing with an efficiency of one during the pre-demonetization period where as six firms are efficient during post-demonetization. It is also observed that DMU 3 was not efficient in both periods. The number of efficient units increased by one during post-demonetization compared to pre-demonetization. The rank correlation coefficient is weak (0.3631) and it suggests that there is a significant difference between the ranks obtained by the Indian real estate firms during pre- and post-demonetization. Thus, it can be interpreted that demonetization had an impact on the performance of the Indian real estate firms. The efficiency scores of two inefficient DMUs during the post-demonetization period that is DMU 2 and DMU 3 are far below the efficiency scores of inefficient firms during pre-demonetization

CONCLUSION

From the results of the analysis, it is noticed that demonetization had an impact on the performance of the Indian real estate firms. Based on the efficiency scores, it can be inferred that the real estate firms performed well during the pre-demonetization compared to the post-demonetization period. Though there are more inefficient DMUs during pre-demonetization compared to post-demonetization, the efficiency scores of two inefficient firms (0.949 and 0.947) are close to one and little effort would have made the firms efficient. On the contrary, the efficiency scores of inefficient units during post-demonetization are very low. The value of rank correlation coefficient also guides to the same direction. It can be concluded from the results of the analysis that demonetization had an impact on the performance of the Indian real estate firms.

Inefficient real estate firms are suggested to consider the potential improvements needed and learn from the efficient units in order to obtain more regulatory, correction actions and business insights for managers in making resources planning decisions. Government support is needed for sustainability of the real estate sector by lowering interest rates substantially to give a solid thrust for boosting purchases. Real estate segment is known for huge involvement of undisclosed cash which will be controlled in the long run owing to the demonetization initiative.

One of the limitations of the study is that the efficiency scores will be affected by increasing or decreasing the number of inputs and outputs. The period of the study is considered as two years in both cases due to the fact that the demonetization policy in India was implemented during 2016 only. The results of the analysis may change, if the period for the study is increased in future.

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