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THE STUDY OF EFFECT OF M&A ON THE REAL ESTATE INDUSTRY FIRMS' PERFORMANCE

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ABSTRACT

This paper proposes to adopt data envelopment analysis (DEA) based Malmquist total factor productivity (TFP) indices methods to evaluate the effect of mergers and acquisitions (M&As) on acquirers in short-term and long-term window. Based on analyzing 32 M&A deals conducted by Chinese real estate firms from 2000-2011, the study result demonstrate that the effect of M&A on developers' performance is positive. Through M&A, the developers' Malmquist TFP experienced a steady growth; their technology has got noticeable progress immediately after acquisition; and their technical efficiency has suffered a slight decrease in short-term after acquisition, but then achieved marked increase in the long-term when realization of integration and synergy. However, there is no evidence that the real estate firms have achieved scale efficiency improvement after M&A in either short-term or long-term.

KEYWORDS

Mergers and acquisitions, real estate industry, efficiency and total factor productivity, China

INTRODUCTION

Real estate is the fastest-growing industry since its formation and development in 1980's following with the China's policies of reform and opening up

(Choi, 1998) Due to the Chinese government enacted a series of macro-economic regulatory policy to mitigate the risk of real estate bubble since 2004, the real estate industry is experiencing a wave of M&As to survive and remain competitive. And now real estate industry is one of the most active industries involved in the M&As activities in China. According to the record of Zdatabase, both of the deals number and volume of M&As transaction are increasing sharply since 2006. However, It is not clear yet whether M&A strategy adopted by real estate industry is value enhancement or not. The purpose of this study is to identify whether M&As deals conducted by Chinese real estate developers make economic sense from the perspective of firm's performance.

In spite of various methods are proposed to evaluate the performance of the M&As in business domain, the commonly used methods include such three categories as event studies, cash flow analysis, and market value frontiers (Franks and Harris, 1989; Healy et al., 1992; Sudarsanam et al., 1996; Mitchell et al., 2004;). However, as Antoniou et al (2011) stated, these methods are inability to reflect the meaningful insight and usable information regarding the core question of whether M&As create value. Therefore, to overcome the failure of these commonly used methods and measure the reality value creation of M&As, this study adopts a Data envelopment analysis (DEA) based Malmquist total factor productivity (TFP) Index to analyze the effect of M&As on the performance of acquirers.

DEA was originally established by Charnes et al (1978) based on the work of Farrell (1957), which is a powerful methodology for assessing the relative efficiencies of multi-input and multi-output production units. The major advantages of DEA over other methods like cost-benefit analysis or regression include that it no need to select a particular functional form, to establish a distributional assumption and to set up the relative weights of the variables, it is very convenient to detect the efficiency and productivity changes of each firm due to its result is individual firm based, and it has good statistical characters (Charnes et al, 1978; Cooper, et al, 2007).

The Malmquist (1953) index was first adopted to analyze productivity by Caves et al. (1982). Since then, most of studies adopted the Malmquist index to evaluate the TFP change for a particular organization between two periods, s and t , although Malmquist index could be applied in other areas equally well (Färe et al 1994; Cooper et al, 2007; Kortelainen, 2008). Malmquist indexes have several desirable features and properties over other indices, such as they no need to make behavioral assumptions like cost minimization or profit maximization, which make them useful when producer's objectives differ, or are unknown or are unachieved; they no need to provide price information which make them practicable when either prices do not exist, distorted or have little economic meaning; and they can be easily calculated by the DEA methodology (Caves et al. 1982; Färe et al, 1994). Therefore, DEA-based Malmquist TFP Index is appropriate to evaluate the firm's performance change during M&A.

The remainder of the paper is organized as follows. Section 2 explains research methodology. Section 3 presents the research results of performance evaluation, and Section 4 concludes.

EVALUATION METHODOLOGY

Data sources and sample selection:

The M&A deals are identified through Thomson Financial Securities Data's SDC and Bloomberg database. For Chinese real estate industry, specially, its M&A deal information can be complemented by (1) China Real Estate Industry Research Database, (2) China-listed Firm's Merger & Acquisition Dataset. The sample of this study will be selected according to the following criteria. In line with M&A theories, an M&A deal completed where there must be a transfer of ownership between acquirers and targets, which means that M&A deals with pending, terminated, or non-binding, and acquisition of minority interest will be excluded from the sample. As to investigate the performance of real estate firms as acquirers, acquirers are required to belong to real estate industry while targets have no such limitation. Furthermore, data available is another primarily requirement for the sample selection, which means that only listed developers will be selected as their operation and financial data are public disclosure. Finally, 32 M&A cases in Chinese real estate industry are selected as sample for this study.

Evaluation indicators

To reflect the real estate industry's operational characteristic, this study adopts the representative evaluation indicators following the study of Chiu and Wang (2011). Finally, eight indicators are selected in this study. There are three input indicators comprising stockholder's equity ratio, Inventory turnover, and Receivable Turnover Ratio, and five output indicators including Return of equity, Return on sales, quick ratio, cash flow ratio, and return of assets. These indicators are summarized in Table 1.

DEA-Based Malmquist analysis for productivity

Malmquist index approach is adopted to measure the total factor productivity (TFP) change of Decision Making Unit (DMUs) over time in this study. The description below draws primarily upon the work of Fare et al (1994) and recaps some of the discussion from Coelli et al (2005). The Malmquist TFP change index (output-orientated) between period s (the start period) and period t can be calculated by (Caves et al ,1982):

$$M_0(x_s, y_s, x_t, y_t) = \left[\frac{D_0^s(x_t, y_t)}{D_0^s(x_s, y_s)} \times \frac{D_0^t(x_t, y_t)}{D_0^t(x_s, y_s)} \right]^{1/2} \quad (1)$$

The distance function $D_0^s(x_s, y_s) = \inf\{\phi: (x^s, y^s/\phi) \in S^s\}$ is defined as reciprocal of the “maximum” proportional expansion of the output vector y_s in given inputs x_s . Similarly, the distance function $D_0^s(x_t, y_t) = \inf\{\phi: (x^t, y^t/\phi) \in S^s\}$ represents the distance from period t to the period s technology. If the value of M_0 is larger than one, it means that the TFP growth from period s to period t , or else it indicates the TFP decline.

Through rearranging the function 1, The TFP index can be decomposed into the product of the technical change index and the technical efficiency change index as:

$$M_0(x_s, y_s, x_t, y_t) = \frac{D_0^t(x_t, y_t)}{D_0^s(x_s, y_s)} \left[\frac{D_0^s(x_t, y_t)}{D_0^t(x_t, y_t)} \times \frac{D_0^s(x_s, y_s)}{D_0^t(x_s, y_s)} \right]^{1/2} \quad (2)$$

In equation 2, the ratio outside the square brackets is actually the efficiency change (EC), which evaluates the change in the output-oriented measure of Farrell technical efficiency between periods s and t .

$$EC = \frac{D_0^t(x_t, y_t)}{D_0^s(x_s, y_s)} \quad (3)$$

The remaining part in the equation 2 is the technical change (TC), which measures the geometric mean of the shift in technology between the two periods s and t .

$$TC = \left[\frac{D_0^s(x_t, y_t)}{D_0^t(x_t, y_t)} \times \frac{D_0^s(x_s, y_s)}{D_0^t(x_s, y_s)} \right]^{1/2} \quad (4)$$

Furthermore, Fare et al (1994) decomposed technical efficiency change into "pure" technical efficiency change and scale efficiency change. The pure efficiency change (PEC) is defined as (5):

$$PEC = \frac{D_{0v}^t(x_t, y_t)}{D_{0v}^s(x_s, y_s)} \quad (5)$$

And, the scale efficiency change (SEC) is written as:

$$SEC = \left[\frac{D_{0v}^t(x_t, y_t)/D_{0c}^t(x_t, y_t)}{D_{0v}^s(x_s, y_s)/D_{0c}^s(x_s, y_s)} \times \frac{D_{0v}^s(x_t, y_t)/D_{0c}^s(x_t, y_t)}{D_{0v}^s(x_s, y_s)/D_{0c}^s(x_s, y_s)} \right]^{1/2} \quad (6)$$

The SEC is actually the geometric mean of two SEC measures relative to period t and s technology respectively.

According the Fare et al (1994), the Malmquist TFP index (distance measures) in equation 4 can be calculated by using DEA-like linear programming methodology. For the firm i-th, four distance functions need to be calculated to measure the TFP change between two periods. These four distances can be computed by the following four linear programming problems (7-10):

$$\begin{aligned} [D_0^t(x_t, y_t)]^{-1} &= \max_{\theta, \lambda} \theta, \\ \text{st } -\theta x_{it} + X_T \lambda &\geq 0, \\ y_{it} - Y_t \lambda &\geq 0, \\ \lambda &\geq 0, \end{aligned} \quad (7)$$

$$\begin{aligned} [D_0^s(x_s, y_s)]^{-1} &= \max_{\theta, \lambda} \theta, \\ \text{st } -\theta x_{is} + X_S \lambda &\geq 0, \\ y_{is} - Y_s \lambda &\geq 0, \\ \lambda &\geq 0, \end{aligned} \quad (8)$$

$$\begin{aligned} [D_0^t(x_s, y_t)]^{-1} &= \max_{\theta, \lambda} \theta, \\ \text{st } -\theta x_{is} + X_T \lambda &\geq 0, \\ y_{is} - Y_t \lambda &\geq 0, \\ \lambda &\geq 0, \end{aligned} \quad (9)$$

and

$$\begin{aligned} [D_0^s(x_t, y_t)]^{-1} &= \max_{\theta, \lambda} \theta, \\ \text{st } -\theta x_{it} + X_S \lambda &\geq 0, \\ y_{it} - Y_s \lambda &\geq 0, \\ \lambda &\geq 0, \end{aligned} \quad (10)$$

where θ is a scalar and λ is a $I \times 1$ vector of constants. The value of θ is the efficiency score for the i-th firm. To calculate the PEC index (equation 5) and the SEC index (equation 6), two additional LPs are required on basis of the LPs 7 and 8 respectively, only with the convexity restriction ($\Pi \lambda = 1$) added to each. This study adopts DEAP version 2.1 to evaluate the DEA and Malmquist index. The valuable instruction of DEAP version 2.1 can refer to Coelli (1996).

Estimation window

To compare the value of Malmquist TFP index change between prior and post-acquisition, three estimation windows are set up in this study, which include four time point like one year prior to acquisition (t-1), acquisition announcement (t+0), one year after acquisition (t+1) and three years after acquisition (t+3). The two windows (1) from (t-1) to (t+1); and (2) (t-1) to (t+3) represent the short-term window and relatively long-term window of M&As respectively.

EVALUATION RESULT

Summary statistics

The information of input and output indicators are summarized in Table 2. On the part of input indicators, the equity ratio is increased slightly from 0.36 in t-1 to 0.38 in t+3. It indicates that the acquirers' capital commitment increased after acquisition. The acquirers' average inventory turnover decreased significantly from 0.94 in period t-1 to 0.44 in period t+3. Receivables turnover ratio decreased dramatically from 227 to 117 from t-1 to t+1, but then increased slightly to 241 in t+3. In terms of out-put indicators, both ROE and ROS increased significantly from pre-acquisition to post-acquisition. The acquirer's average quick ratio has experienced little fluctuation from t-1 to t+3. Reversely, cash flow ratio has great volatility during the same period. Finally, it has been a substantial rise in the acquirers' return of assets on average from t-1 to t+3. Specially, the short term increasing at mean 0.06 is larger than that of long-term at 0.04 on average.

Productivity measuring result analysis

Each acquirer's Malmquist TFP index is provided in Table 3. In terms of average value of each acquirer during t-1 to t+3, there are such 17 firms as 1,2,...,29 and 32 have TFP growth, while the remaining 15 firms like 4,6,...,28 and 31 have experienced productivity decline. Firm 29 is the most productivity growth one with TFP index 2.24. According to the above discussion, TFP index of firm 29 = $TEC * TC = 1 * 2.24 = 2.24$, and $TEC = PEC * SEC = 1 * 1 = 1$. Therefore, it can be interpreted that the productivity growth of firm 29 are induced by the considerable technical improvement after acquisition, while other index like TEC, PEC and SEC with no change. Oppositely, the worst performance firm in the productivity decline group is goes to firm 8 and 4 with 0.66. Both of two firms have experienced dramatically technical efficiency and technology decrease during acquisition. Similarly, the remaining firms' average TFP change index can be understood in the same way. On the part of the TFP change index in each period say t+0, t+1 and t+3, it can be seen

from Table 3 that there are 15, 20 and 16 firms experienced TFP progress respectively. Obviously, there are 5 more acquirers realized the productivity advance in t+1 than that of in t+0. It can be interpreted that most of the acquirers has achieved productivity growth through the M&A in short-term, but the growth are reduced in the long-term. The each firms of TFP change in these periods can be analyzed by using some method as above discussed. Therefore, its growth of productivity is mainly promoted by the tremendous improvement of technology and the slight increase of technical efficiency. Simultaneously, $TEC=PEC*SEC: 1.32=1.12*1.17$, both of its pure technical efficiency and scale efficiency show some progress.

Compared comprehensively, regarding to the mean of Malmquist TFP index of each period, the TFP have experienced the greatest progress with 1.26 in the year of deal making (t+0), but it decreased significantly to 0.81 in the one year after acquisition (t-1). In terms of relative long-term period after acquisition (t+3), the acquirers' mean TFP have slight improvement to 1.02. The reason behind of the TFP change can be identified from the perspectives of TEC and TC. The acquirers' technology has got the largest upgrade due to the M&A making in t+0, and achieved slight increase at t+1, but it suffered a slight decrease in t+3. In contrast, the mean technical efficiency of acquirers have marked decline in both t+0 (0.96) and t+1 (0.79), but get rise in t+3 (1.03). It is reasonable to interpret that the technology of acquirers are improved obviously through M&A in short-term due to the more commitment of resource, but its growth began to slow down in long-term as the effect of M&A on resource investment is weakened. However, the technical efficiency has decreased in t+0 and t+1 because of organization transition in short-term, but as realization of synergy and integration in long-term, then the technical efficiency got increased. Similarly, PEC can be interpreted in the same way like the TEC. In surprise, the scale efficiency didn't realize increase during the M&A in either short-term or long-term for developers. That is consistent with the above discussed scale efficiency analysis result, the reason behind of which might depends on the unique feature of localization and products unmovable in real estate industry.

CONCLUSION

This study investigates the efficiency and productivity change of acquirers during M&As by using DEA based Malmquist index methods. And then, 32 M&A cases from Chinese real estate industry were selected as analysis sample. By adopting the DEA based Malmquist TFP change of acquires, the conclusions of Malmquist TFP change include: the developers' TFP realizes growth through M&A; Developers' technology has got increase after acquisition in short-term, but gradually reduce in long-term; Their technical efficiency suffer slight drop after M&A in short-term, but picked up in long-term; and the scale efficiency of developers didn't realize improvement during M&A in either short-term or long-term. Overall, this

conclusion reflects the characters of real estate industry, and identifies that M&A made value-enhancing for developers, but not support the economic scale of M&A in real estate industry.

One point should be mentioned here is that the analysis result of the study depends on the specific inputs and outputs selected in this paper. To sum up, the analysis method proposed in this study are very useful and valid to measure the M&A performance from efficiency and productivity prospective. Valuable and reasonable analysis result can be achieved by applying this approach with special tailored indicators.

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APPENDICES

Table 1 Summary of inputs and outputs indicators

Input ratios	Output ratios
Equity ratio	Return of equity
Inventory turnover	Return on sales
Receivable Turnover Ratio	Quick ratio
	Cash flow ratio
	Return of assets
	Return on sales

Table 2. Summary on the input and output indicators (32 samples)

Items	t-1			t+0			t+1			t+3		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Equity ratio	0.36	-0.79	0.89	0.36	-0.74	0.75	0.39	0.21	0.75	0.38	0.18	0.71
Inventory turnover	0.94	0.03	6.55	0.67	0.14	3.48	0.49	0.02	2.31	0.44	0	3.76
Receivables turnover Ratio	227	1	5270	139	4	1990	117	2	1098	241	3	2141
Return of equity	-0.06	-1.5	0.33	0.12	0	0.44	0.12	0	0.55	0.11	-0.02	0.38
Return on sales	0.23	-0.44	0.51	0.26	0.09	0.44	0.32	0.07	0.71	0.3	0.08	0.56
Quick ratio	0.69	0.08	2.11	0.58	0.1	1.45	0.72	0.09	2.33	0.68	0.22	1.79
Cash flow ratio	-0.04	-1.37	0.78	0.04	-0.89	1.79	-0.13	-1.19	0.75	-0.1	-0.45	0.45
Return of assets	0.02	-0.23	0.15	0.06	0	0.36	0.05	0	0.31	0.04	-0.01	0.1

Table 3. Malmquist Productivity Index of acquirers

Firm	Technical Efficiency Change (TEC)				Technical Change (TC)				Pure Technical Efficiency Change (PEC)				Scale Efficiency Change (SEC)				TFP Change (total factor productivity)			
	t+0	t+1	t+3	Ave.	t+0	t+1	t+3	Ave.	t+0	t+1	t+3	Ave.	t+0	t+1	t+3	Ave.	t+0	t+1	t+3	Ave.
	1	0.88	0.75	0.86	0.83	0.97	1.53	1.25	1.23	0.93	0.72	1.06	0.89	0.94	1.04	0.81	0.93	0.85	1.15	1.07
2	1.12	0.65	0.73	0.81	0.89	2.52	1.22	1.40	1.10	0.69	0.94	0.89	1.02	0.95	0.78	0.91	1.00	1.65	0.90	1.14
3	0.62	0.99	1.23	0.91	1.17	1.67	1.20	1.33	1.00	0.81	1.23	1.00	0.62	1.22	1.00	0.91	0.72	1.65	1.47	1.20
4	1.12	0.50	0.84	0.78	0.81	0.78	0.97	0.85	1.03	0.52	1.13	0.84	1.09	0.97	0.75	0.93	0.91	0.39	0.81	0.66
5	1.00	0.58	1.35	0.92	0.89	2.31	0.72	1.14	1.00	0.59	1.45	0.95	1.00	0.99	0.94	0.97	0.89	1.34	0.98	1.05
6	0.72	1.48	1.00	1.02	0.92	1.14	0.58	0.85	0.81	1.28	1.00	1.01	0.89	1.16	1.00	1.01	0.66	1.69	0.58	0.87
7	0.77	1.30	0.36	0.71	0.87	1.43	0.91	1.04	1.00	1.00	0.82	0.94	0.77	1.30	0.44	0.76	0.67	1.86	0.33	0.74
8	1.00	1.00	0.59	0.84	1.29	0.64	0.58	0.79	1.00	1.00	0.83	0.94	1.00	1.00	0.71	0.89	1.29	0.64	0.34	0.66

9	1.00	1.00	1.00	1.00	1.07	1.13	1.70	1.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.13	1.70	1.27
10	1.00	0.76	0.64	0.79	1.30	1.13	1.34	1.25	1.00	0.78	0.74	0.83	1.00	0.97	0.87	0.94	1.30	0.85	0.86	0.98
11	1.20	0.86	0.78	0.93	0.92	1.22	0.93	1.01	1.20	0.87	1.02	1.02	1.00	0.98	0.76	0.91	1.09	1.05	0.72	0.94
12	1.06	0.84	0.74	0.87	1.13	0.98	1.24	1.11	1.05	0.81	0.98	0.94	1.01	1.03	0.75	0.92	1.19	0.82	0.91	0.96
13	0.89	0.88	1.29	1.00	0.98	1.75	0.63	1.03	1.00	1.00	1.00	1.00	0.89	0.88	1.29	1.00	0.87	1.54	0.82	1.03
14	1.00	0.64	0.97	0.85	1.81	1.27	1.21	1.41	1.00	0.86	1.17	1.00	1.00	0.75	0.83	0.85	1.81	0.82	1.17	1.20
15	0.97	0.42	2.44	1.00	0.86	2.47	0.61	1.09	1.00	0.45	2.21	1.00	0.97	0.94	1.10	1.00	0.83	1.04	1.49	1.09
16	1.00	1.00	0.85	0.95	11.15	0.00	0.58	0.74	1.00	1.00	0.98	0.99	1.00	1.00	0.86	0.95	9.87	0.00	0.49	0.70
17	1.00	0.70	1.42	1.00	0.70	1.66	1.23	1.13	1.00	0.88	1.14	1.00	1.00	0.80	1.25	1.00	0.70	1.17	1.75	1.13
18	1.07	0.80	0.84	0.90	0.96	1.38	1.36	1.22	1.07	0.92	0.81	0.93	1.01	0.87	1.04	0.97	1.04	1.11	1.14	1.09
19	1.12	0.64	0.79	0.83	1.11	1.49	0.93	1.15	1.17	0.80	0.99	0.97	0.96	0.81	0.80	0.85	1.24	0.96	0.74	0.95
20	1.00	0.98	0.56	0.82	0.86	1.76	1.08	1.18	1.00	1.00	0.68	0.88	1.00	0.98	0.83	0.94	0.86	1.72	0.61	0.97
21	1.00	0.60	1.67	1.00	0.63	1.30	0.98	0.93	1.00	0.62	1.62	1.00	1.00	0.97	1.03	1.00	0.63	0.78	1.65	0.93
22	0.73	0.79	1.27	0.90	0.48	1.25	0.90	0.81	1.00	0.66	1.14	0.91	0.73	1.19	1.11	0.99	0.35	0.98	1.15	0.73
23	1.00	0.91	1.05	0.99	0.88	1.27	1.22	1.11	1.00	1.00	1.00	1.00	1.00	0.91	1.05	0.99	0.88	1.16	1.28	1.09
24	1.41	0.68	1.20	1.05	0.93	1.34	1.06	1.10	1.35	0.69	1.19	1.04	1.04	0.98	1.01	1.01	1.31	0.91	1.28	1.15
25	1.00	1.00	1.00	1.00	0.84	4.22	0.57	1.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	4.22	0.57	1.27
26	0.52	1.02	1.75	0.98	0.47	1.88	0.63	0.83	0.82	1.09	1.09	0.99	0.64	0.93	1.60	0.98	0.25	1.91	1.11	0.81
27	1.01	0.61	2.91	1.21	0.86	1.95	0.49	0.94	1.09	0.88	1.67	1.17	0.92	0.69	1.75	1.03	0.87	1.19	1.43	1.14
28	1.00	0.62	1.04	0.87	1.16	0.88	1.12	1.05	1.00	0.92	0.89	0.94	1.00	0.68	1.16	0.92	1.16	0.55	1.16	0.91
29	1.00	0.76	1.32	1.00	1.87	0.83	7.23	2.24	1.00	0.89	1.12	1.00	1.00	0.85	1.17	1.00	1.87	0.63	9.51	2.24
30	1.17	1.00	1.00	1.05	1.08	1.19	0.94	1.06	1.15	1.00	1.00	1.05	1.01	1.00	1.00	1.00	1.26	1.19	0.94	1.12
31	0.83	1.01	0.86	0.90	0.98	1.20	1.10	1.09	0.81	1.24	0.85	0.95	1.02	0.82	1.01	0.95	0.81	1.22	0.94	0.98
32	1.00	0.44	1.55	0.88	1.12	3.05	0.93	1.47	1.00	0.50	1.85	0.97	1.00	0.89	0.84	0.91	1.12	1.34	1.44	1.29
Mean	<i>0.96</i>	<i>0.79</i>	<i>1.03</i>	<i>0.92</i>	<i>1.31</i>	<i>1.03</i>	<i>0.99</i>	<i>1.10</i>	<i>1.01</i>	<i>0.83</i>	<i>1.07</i>	<i>0.97</i>	<i>0.95</i>	<i>0.95</i>	<i>0.96</i>	<i>0.95</i>	<i>1.26</i>	<i>0.81</i>	<i>1.02</i>	<i>1.01</i>

Note: If TFP change index is large than 1, it means the firms' productivity progress, or else, it implies their productivity decline;
Index in t+0 is based on comparing with t-1, t+1 is based on t+0, and so on; Ave. means the average value of index during t-1 to t+3 periods. Mean represents the average value of the entire sample in the same period.