



**PLANNING MALAYSIA:**

*Journal of the Malaysian Institute of Planners*

**VOLUME 17 ISSUE 1 (2019), Page 149 – 159**

## **TOTAL FACTOR PRODUCTIVITY CHANGE IN THE REIT INDUSTRY: THE CASE OF MALAYSIAN REITS DURING AND POST GLOBAL FINANCIAL CRISIS**

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### **Abstract**

The paper examined productivity changes for the Malaysian Real Estate Investment Trust (M-REITs) using a non-parametric approach of Malmquist Productivity Index (MPI) of Data Envelopment Analysis (MPI-DEA). Data was attained from M-REIT annual reports, Thomson Reuters Datastream and Osiris via Bureau Van Dijk for 2007-2015. The non-parametric approach of MPI-DEA examined the Total Factor Productivity Change (TFPCH), Technological Change (TECHCH), Efficiency Change (EFFCH), Pure Technical Efficiency Change (PEFFCH) and Scale Efficiency Change (SECH) indices. On average, the M-REIT industry has faced 14.91% of productivity regress during 2007-2015 period, comprising 49.90% of efficiency increase and 33.40% technological regress. The decomposition of the productivity change index suggests that Malaysian REIT productivity changes were mainly due to efficiency change rather than technological change. These findings could help M-REIT managers to formulate ways to enhance their REIT productivity. The findings are also applicable to similar *Shariah* compliant real estate investment or socially responsible investment.

**Keyword:** Malmquist index; productivity, technology, efficiency, Malaysian REITs

## **INTRODUCTION**

Global financial crisis began in 2007 with a crisis in the US subprime mortgage market and the situation getting worse with the bankruptcy of Lehman Brothers in 2008. While the collapse of large financial institutions was prevented by the interventions of national governments to bail out distress banks, stock markets still dropped worldwide. Malaysia was not an exception. Along with other countries, the impact of the crisis on Malaysia has been felt largely through contraction in demand of exports particularly when the economies of its major trading partners fell. The Kuala Lumpur Composite Index, which is the main index and market indicator in Malaysia, has experience a 45% drop in its value within the period of January to September 2008 (Angabini & Wasiuzzaman, 2011). However, despite its severity on the economics, the financial crisis has not been studied yet in terms of its impact on the productivity growth, efficiency change, and the technological progress of REITs.

If confidence in the REIT industry is shaken, both local and global investors may leave the industry and the country, increasing the vulnerability of the real estate industry to subsequent shock. This study will be the first empirical investigation to examine and estimate the total factor productivity (TFP) for Malaysian REITs, using the non-parametric approach of Malmquist data envelopment analysis (DEA) from 2007 to 2015. The remainder of the paper unfolds as follows. Section 2 provides an overview of the review of the literature, followed by methodology and empirical design. Section 4 discusses the empirical findings, which highlight the productivity change of Malaysian REITs and the respective productivity and efficiency sources. Section 5 concludes the article and provides suggestions for future research.

## **LITERATURE REVIEW**

While there has been extensive literature examining the efficiency and productivity in the mature market of the USA, the works on emerging market of Malaysian REITs are still under-researched. Previous works have applied various frontier techniques of estimation for the efficiency and productivity of these REITs. Topuz, Darrat and Shelor (2005) measured the technical, allocative and scale efficiency of US REIT from 1989 to 1999 with results showing that inefficiency was caused by a high level of input use instead of the choice of input mix. Similar approach of estimation of Malaysian Islamic REITs are conducted by Chuweni, Eves, Hoang, Isik and Hassan (2017). Their findings revealed that Malaysian REITs can reduce their input consumption by 35.8% without reducing output, implying significant potential for improvement. Isik and Topuz (2017) employed non-parametric approach of DEA approach on eleven-year dataset from the 1990s. The de novo REITs outperform the established REITs in all form of efficiency scores. The result suggest that these new REITs are ‘born efficient’ which are likely due to the REIT size, accessibility to finance and are rich with congenital experience. In another study, Topuz and Prather (2007) employed the Malmquist Index to measure the equity REIT efficiency and productivity change

for 1989 to 1999. Regardless of their size, REITs experienced increases in technical efficiency during 1994-1999 due to both managerial and scale efficiency. However, a significant level of technological regress leads to REIT productivity losses. However, none of these studies have critically addressed the productivity performance in the REIT industry, particularly in the emerging market of Malaysia during two different periods: during and post global financial crisis. This present study differs with the above studies in terms of data (Malaysian REITs from 2007 to 2015), approach (use of input/output variables) and foci (productivity change of Malaysian REITs).

### **METHODOLOGY**

For this study, productivity change was measured using the input-oriented Malmquist Productivity Index (MPI). MPI, which was developed by Fare, Grosskopf and Lovell (1994), differentiates the shift production frontier (technological change) and the movement of REIT towards the frontier (efficiency change). The Malmquist index was constructed using the DEA software of DEAP version 2.1 by Coelli (1996). Grifell-Tatjé and Lovell (1996) highlighted three advantages of MPI over Fischer and Tornqvist indices. Firstly, MPI does not require price information for input and output prices. Secondly, MPI does not require restricted assumption (profit maximisation or cost minimisation) in its calculation. Thirdly, panel data allow the decomposition of productivity changes as a product of the effect of catch up to the frontier (efficiency change) and the frontier-shift effect (technological change). The main drawback is the need of a distance functions measurement, which could be resolved by using the DEA. Furthermore, Translog and Cobb-Dougllass functions are prone to model sensitivity and functional stability (Topuz & Isik, 2009).

MPI allows us to isolate the effect of catching up or falling behind to the frontier effect (efficiency change) from the effect of outward shift or regress in REIT technological frontier (technological change). In other words, Malmquist total factor productivity change index (TFPCH) is the product of efficiency change (EFFCH) and technological change (TECHCH) under the assumption of constant returns to scale (CRS). This decomposition allows us to identify the sources of productivity change in M-REIT. However, due to the imperfect market competition and regulatory restraints, REITs may operate at increasing return to scale (IRS) or decreasing return to scale (DRS), instead of operating at CRS. Therefore, when we relaxed the assumption of CRS and applied the variable return to scale (VRS) assumption, we were able to further decompose efficiency change into pure technical efficiency change (PECH) and scale efficiency change (SECH). The PECH measures the proximity of REIT to the frontier, devoid of scale effects. The SECH, on the other hand, captures the deviations between the VRS and CRS technology at observed inputs, indicating the changes in efficiency due to movement toward or away from the frontier. In essences,  $TFPCH =$

$TECHCH \times EFFCH$  and  $EFFCH = PECH \times SECH$ . Further discussion on the MPI follows.

### Data and Empirical Design

We collected our data from annual reports of M-REITs, Thomson Reuters Datastream and Osiris via Bureau Van Dijk for the years 2007 to 2015. Following previous works on REIT efficiency and productivity, total asset (Y1) were selected as output variables, while interest expense (X1), property operating expense (X2) and administrative and management expense (X3) as the input variables (Anderson, Fok, Springer, & Webb, 2002; Chuweni et al., 2017; Topuz et al., 2005; Topuz & Isik, 2009). Table 1 displays the summary of statistics of data used.

**Table 1:** Descriptive statistics for inputs and output variables

	Y1: Total Asset (RM million)	X1: Interest Expense (RM million)	X2: Property Operating Expense (RM million)	X3: Administrative & Management Expense (RM million)
Min	171.151	0.21638	1.065	0.9215
Mean	1,700.716	21.378	26.692	11.963
Max	9,568.582	100.361	122.397	76.534
S.D	1,779.108	20.710	32.044	15.939

Source: M-REITs' annual reports

### RESULTS AND DISCUSSIONS

In this section, we analyse the performance of M-REITs during (2007-2009) and after the crisis (2010-2015). With reference to Table 2, the Malmquist Productivity Index results indicate that the Malaysian REIT industry has an average geometric mean of TFPCH regress of 14.91%. The result of TFPCH of M-REITs seems to imply that M-REITs exhibited TFPCH regress during all years mainly attributed by 33.40% of TECHCH regress. Our findings were corroborated with the findings by Topuz and Isik (2009) where REIT has failed to improve technically but applied significant effort to catch up with the best practice by depending on aggressive growth strategies. The decomposition of EFFCH into PECH and SECH indicate that the main sources for M-REITs' EFFCH is due to pure technical efficiency (PECH) rather than scale efficiency. The results suggest that M-REITs are more managerial efficient in controlling the operational expenses but not operating at the optimum scale of operations. Table 3 depicts the summary of geometric means of Malmquist Productivity Index for each Malaysian REIT for the period under study. The results indicate that 2 REITs have exhibited TFP progress namely REIT 4 and REIT 12 with an increase of 2.66% and 2.36% for TFPCH progress respectively. The sources for TFPCH growth could mainly be attributed to the EFF increase rather than technological change.

**Table 2: Summary of Malmquist Productivity Index of Malaysian REITs (2007-2015)**

	EFFCH	TECHCH	PECH	SECH	TFPCH
2007-2008	1.4640	0.4950	1.3880	1.0550	0.7240
2008-2009	1.1530	0.7800	1.1120	1.0370	0.8990
2009-2010	2.1850	0.3470	1.3040	1.6750	0.7570
2010-2011	0.9090	1.0210	0.9000	1.0100	0.9280
2011-2012	2.6040	0.2790	1.6520	1.5770	0.7270
2012-2013	1.4540	0.6070	1.3160	1.1040	0.8830
2013-2014	1.3740	0.6890	1.2400	1.1080	0.9470
2014-2015	0.8490	1.1100	0.9380	0.9050	0.9420
<i>Mean</i>					
2007-2009	1.3085	0.6375	1.2500	1.0460	0.8115
2010-2015	1.5625	0.6755	1.2250	1.2298	0.8640
<b>2007-2015</b>	<b>1.4990</b>	<b>0.6660</b>	<b>1.2313</b>	<b>1.1839</b>	<b>0.8509</b>

**Table 3: Summary of MPI for Malaysian REIT 2007-2015 (by firm)**

REIT/ Index	EFFCH	TECHCH	PECH	SECH	TFP
REIT 1	1.2563	0.6007	1.2247	1.0260	0.7546
REIT 2	1.3321	0.6996	1.1549	1.1534	0.9319
REIT 3	1.7545	0.5529	1.3867	1.2651	0.9702
REIT 4	1.8134	0.5660	1.3549	1.3381	1.0266*
REIT 5	1.2246	0.7195	1.0797	1.1344	0.8810
REIT 6	1.7294	0.5537	1.3843	1.2493	0.9579
REIT 7	1.6382	0.5131	1.3611	1.2037	0.8407
REIT 8	1.6063	0.5817	1.3168	1.2197	0.9344
REIT 9	0.9733	0.8682	0.9587	1.0153	0.8450
REIT 10	1.5345	0.6256	1.0000	1.5345	0.9600
REIT 11	1.0193	0.5696	1.0000	1.0193	0.5807
REIT 12	1.7824	0.5743	1.3560	1.3147	1.0236*
REIT 13	1.5153	0.5973	1.7741	0.8541	0.9043
REIT 14	1.0726	0.5170	1.1353	0.9450	0.5539
REIT 15	0.9434	0.6791	1.0416	0.9055	0.6405
REIT 16	1.0000	0.8369	1.0000	1.0000	0.8369
REIT 17	1.0624	0.5851	0.9999	1.0626	0.6217

**Note:** grey shades indicate M-REITs with TFPCH growth; EFFCH = Technical Efficiency Change; TECHCH = Technological Change; PECH= Pure Technical Efficiency Change; SECH= Scale Efficiency Change; TFPCH= Total Factor Productivity Change.

### **Development in the Number of Malaysian REITs with Productivity Gain (Loss) or Efficiency Increase (Decrease)**

Analysis based on the number of M-REITs with productivity gain (loss) or efficiency increase (decrease) was performed to address the issue of possible outliers. The results are tabulated in Panel A-C in Table 4. As the results in Panel A of Table 4 indicate, 63% M-REITs have experienced productivity loss for the period of 2007-2015. The number of M-REITs with TFPCH loss is seen to

decrease from 63.18% during financial crisis to 60.86% for 2010-2015. Similar trend could also be observed from the number of M-REITs which experienced technological regress has decreased from 86.37% for 2007-2009 to 74.85% in 2009-2015. It is also interesting to note there is a mix result of EFFCH increase (decrease) and productivity stagnant of M-REITs for the period under study.

### **Sources of Productivity of M-REITs**

Table 5 represents the sources of productivity (growth) and efficiency increase (decrease) for M-REITs during the period of 2007-2015. Table 5 is the decomposition from the results in Table 4. For instance, in 2007-2008, of the majority of 90% of M-REITs which have experienced productivity loss as depicted in Table 5 could mainly be attributed by technological regress, while 10% of M-REITs which have experienced productivity growth were the result of efficiency increase. Apart from that, the results exhibit productivity regress due to technological regress rather than efficiency change for Malaysian REITs. The results are also consistent with other market sectors since Md Saad, Abd. Majid, Kassim, Hamid and Yusof (2010) also found that on average, Malaysian unit trust which experienced productivity regress were likely due to technological regress. Therefore, it is important to investigate on the reasons for this technological regress which have adverse impact on Malaysian REIT productivity.

One possible reason for this technological regress is likely due to the income distribution requirement Topuz (2002). Under the Malaysian REIT guideline (Securities Commission Malaysia, 2012), REIT managers need to distribute 90% of their taxable income and therefore could not retain their earning and reinvest their income for the following year. Since the funding for purchasing new assets are lacking, the managers need to have access to external capital. Raising the fund through debt and equity are costly than the retained earnings, resulting to a higher cost of capital. This higher cost of capital might be the reason for the technological regress throughout the studied period. Further investigation into the input revealed that the increase in total expenses are likely due to the managers controllable expenses (the combination of the administrative/ management and property operating expenses) rather than the market driven expenses (interest expenses). The findings validate earlier efficiency results when the dominant sources for technical inefficiency are due to pure technical inefficiency (managerial inefficiency).

**Table 4:** Developments in the number of M-REITs with productivity gain (loss) or efficiency increase (decrease) <sup>i</sup>

Period	Productivity change (%) (TFPCH)		Technology change (%) (TECHCH)			Efficiency change (%) (EFFCH)			Pure efficiency change (%) (PECH)			Scale efficiency change (%) (SECH)		
	Growth	Loss Δ	Pgrs	Rgrss	No Δ	Inc.	Dec.	No Δ	Inc.	Dec.	No Δ	Inc.	Dec.	No Δ
2007-														
2008	10	90	0	100	0	80	10	10	60	10	30	40	50	10
2008-														
2009	63.64	36.36	0	72.73	0	63.64	9.09	27.27	45.45	9.09	45.45	45.45	27.27	27.27
2009-														
2010	27.27	72.73	0	100	0	90.91	9.09	0	54.55	9.09	36.36	90.91	9.09	0
2010-														
2011	53.85	46.15	0	69.23	30.77	30.77	53.85	15.38	7.69	53.85	38.46	53.85	30.77	15.38
2011-														
2012	20	80	0	100	0	86.67	6.67	6.67	60	6.67	33.33	80	13.33	6.67
2012-														
2013	40	60	0	93.33	0	66.67	6.67	26.67	60	0	40	60	13.33	26.67
2013-														
2014	43.75	56.25	0	100	0	81.25	0	18.75	68.75	0	31.25	81.25	0	18.75
2014-														
2015	50	50	0	75	25	18.75	62.5	18.75	18.75	43.75	37.5	25	56.25	18.75
<i>Mean</i>														
2007-														
2009	36.82	63.18	0	13.64	86.37	0	71.82	9.55	52.73	9.55	37.73	42.73	38.64	18.64
2010-														
2015	39.15	60.86	0	25.15	74.85	0	62.50	23.13	44.96	18.89	36.15	65.17	20.46	14.37
2007-														
2015	38.56	61.44	0	22.27	77.73	0	64.83	19.73	46.90	16.56	36.54	59.56	25.01	15.44

**Table 5:** Sources of productivity of M-REITs <sup>ii</sup>

	Productivity growth (%) mainly due to:		Productivity loss (%) mainly due to		No Prod. (%) $\Delta$	Efficiency increase (%) mainly due to:		Efficiency decrease (%) mainly due to:		No Eff (%) $\Delta$
	Eff. Inc.	Tech. Progress	Eff. Decr.	Tech. Regress		PTE Incr.	SE Inc.	PTE Decr.	SE Decr.	
2007-2008	10.00	0.00	0.00	90.00	0	60.00	20.00	0.00	10.00	10.00
2008-2009	45.45	18.18	9.09	27.27	0	45.45	18.18	9.09	0.00	27.27
2009-2010	27.27	0.00	0.00	72.73	0	18.18	72.73	0.00	9.09	0.00
2010-2011	15.38	38.46	30.77	15.38	0	0.00	30.77	23.08	30.77	15.38
2011-2012	20.00	0.00	0.00	80.00	0	33.33	53.33	0.00	6.67	6.67
2012-2013	33.33	6.67	0.00	60.00	0	53.33	13.33	0.00	6.67	26.67
2013-2014	43.75	0.00	0.00	56.25	0	50.00	31.25	0.00	0.00	18.75
2014-2015	12.50	37.50	43.75	6.25	0	12.50	6.25	31.25	31.25	18.75
<i>Mean</i>										
2007-2009	27.73	9.09	4.55	58.64	0	52.73	19.09	4.55	5.00	18.64
2010-2015	25.37	13.77	12.42	48.44	0	27.89	34.61	9.05	14.07	14.37
2007-2015	25.96	12.60	10.45	50.99	0	34.10	30.73	7.93	11.81	15.44



## **CONCLUSION**

This study discusses productivity changes for the M-REITs using a non-parametric approach of Malmquist Productivity Index (MPI) of Data Envelopment Analysis (MPI-DEA) between 2007 and 2015. The methodology has allowed us to isolate the efforts to catch up to the frontier (EFFCH) from the frontier shift (TECHCH). Furthermore, Malmquist index has enabled us to explore the sources of efficiency change, whether there is a need in improvements in management practice (PECH) or improvement towards optimal size (SECH). Our study was confined to Malaysian REITs listed in Bursa Malaysia between 2007 to 2015. This paper also aimed to fill a gap in the real estate efficiency and productivity through the establishment of recent evidence on the productivity changes of M-REITs. Our results suggested that the impact of the global financial crisis on the productivity, technology and efficiency of the M-REITs was dramatic. On average, M-REIT industry faced an 18.85% productivity loss, comprising 36.25% of technological regress and 30.85% of efficiency increase during 2007-2009 period, implying that the major source of productivity decline was shock to the REIT industry technology rather than an increase in efficiency.

On average, the M-REIT industry has faced 14.91% of productivity regress during 2007-2015 period, comprising 49.90% of efficiency increase and 33.40% technological regress. These decomposition of the productivity change index suggest that Malaysian REIT productivity changes were mainly due to efficiency change rather than technological change. One possible reason for this technological regress is likely due to the income distribution requirement in which the REIT managers could not retain their earning and reinvest their income for the following year. Since the funding for purchasing new assets are lacking, the REIT managers need to have access to external capital. Raising the fund through debt and equity are costly than the retained earnings, resulting in a higher cost of capital.

We have also explored the sources of efficiency change when the results indicate that the main sources for efficiency change is likely due to management practice (pure technical efficiency change). This establishes the need for improvement in management practice rather than scale adjustment.

Empirical findings from this study provide insight for the policy maker in attaining the optimum utilisation of resources, improvement in managerial skills and the optimum scale of operation for M-REITs. This helps to establish the need to facilitate sustainable competitiveness of M-REIT operations in the future. Moving forward, it is reasonable to expect that regulatory policy measures will be geared towards enhancing the efficiency and productivity of REIT operating in the Malaysian real estate investment industry, with the aim of intensifying the robustness and growth of the industry. A different approach to measuring REIT efficiency and productivity over a longer period for M-REITs will produce a more robust result. This includes estimating the efficiency and

productivity using the bootstrap DEA and parametric approach, which falls outside the scope of the current study.

## ACKNOWLEDGEMENT

The authors would like to acknowledge the sponsors and the anonymous referees for the feedback received in improving this research paper.

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<sup>i</sup> M-REITs are classified into the following categories: Productivity growth:  $TFPCH > 1$ , productivity loss:  $TFPCH < 1$ , productivity stagnant:  $TFPCH = 1$ , Technological progress:  $TECHCH > 1$ , Technological regress:  $TECHCH < 1$ , Technological stagnant:  $TECHCH = 1$ , technical, pure technical and scale efficiency increase:  $EFFCH, PECH, SECH > 1$ , technical, pure technical and scale efficiency decrease:  $EFFCH, PECH, SECH < 1$ , No change in technical, pure technical and scale efficiency:  $EFFCH, PECH, SECH = 1$ .

<sup>ii</sup> M-REITs are classified into the following categories: Productivity growth due to technological progress (efficiency increase):  $TFPCH > 1$  and  $TECHCH > 1$  and  $EFFCH$  ( $TFPCH > 1$ , and  $EFFCH > 1$  and  $TECHCH$ ); productivity loss due to technological regress (efficiency decrease):  $TFPCH < 1$ ,  $TECHCH < 1$  and  $EFFCH$  ( $TFPCH < 1$ , and  $EFFCH < 1$  and  $TECHCH$ ); efficiency increase due to PTE increase (SE increase):  $EFFCH > 1$  and  $PECH > 1$  and  $SECH$  ( $EFFCH > 1$  and  $SECH > 1$  and  $PECH$ ); Efficiency decrease due to PTE decrease (SE decrease):  $EFFCH < 1$ , and  $PECH < 1$  and  $SECH$  ( $EFFCH < 1$ , and  $SECH < 1$  and  $PECH$ ).

Received: 28<sup>th</sup> October 2018. Accepted: 1<sup>st</sup> March 2019