Productivity, Technology and Efficiency Change of Islamic and Conventional REITs in Malaysia

Nor Nazihah Chuweni∗
Department of Estate Management, Faculty of Architecture, Planning and Surveying
Universiti Teknologi Mara, Perak Branch, Seri Iskandar Campus, 32610 Seri Iskandar, Malaysia

Ihsan Isik
Department of Accounting and Finance William G. Rohrer College of Business, Rowan University, Glassboro, NJ, USA

Ahmad Shazrin Mohamed Azmi
Department of Estate Management, Faculty of Architecture, Planning and Surveying
Universiti Teknologi Mara Shah Alam, Selangor, Malaysia

Abstract

Problem/Purpose – The paper examined total factor productivity changes namely Malmquist Productivity Index (MPI) for the Malaysian Real Estate Investment Trust (M-REITs) by drawing attention to the Islamic and conventional REITs Design/methodology/approach – Data was attained from annual reports for the period of 2007 to 2015. The non-parametric approach of MPI-DEA examined the productivity, technological and efficiency change indices. Findings – The result suggested both Islamic and conventional REITs have exhibited productivity regress of 18.09% and 11.51% respectively during the period of study. These productivity regress could mainly due to the regress in technological rather than efficiency change. One possible reason for this technological regress is likely due to REIT requirement in which the REIT managers could not retain their earning and reinvest their income for the following year. The REIT managers need to have access to external capital for purchasing new asset, which could lead to a higher cost of capital than the retained earnings. On the other hand, both conventional and Islamic REITs exhibited an increase of 28.33% and 61.54% respectively for efficiency change, mainly due to an increase in managerial rather than scale, implying that both REITs have been managerially efficient in managing the operating costs but operating at the non-optimum scale of operations. Research limitations/implications – This study provide empirical evidence on the source of productivity regress for M-REITs and insights on the comparative analysis of Islamic and conventional REITs. Future research suggested to be undertaken include the identification of key determinants for the productivity changes of M-REITs using the parametric approach. Originality/value – This paper is the first analysis on the productivity changes of Islamic REITs vis-à-vis conventional REITs. By examining these values, the identification of main sources of Malaysian Islamic REITs productivity regress assist M-REIT managers to develop strategies in improving their REIT productivity and provide competitive edge in the market.

Keywords: Malmquist index; Islamic REITs; Productivity; Malaysia; Real estate investment.

1. Introduction

Formerly known as property trust fund, real estate investment trusts can be defined as money pooled in a unit trust managed by a fund manager, in which investments are primarily based on income producing real estate or other real estate related assets investment (Securities Commission Malaysia, 2012). REIT investors benefit from stable income distributions, because REIT managers are required to distribute at least 90 percent of the income to investors. Apart from benefiting from the steady income and capital gains from a REIT properties portfolio, REITs investors also enjoy the liquidity that direct ownership real estate investment fails to offer.

The existing research in Malaysian REIT has focused primarily on performance based on the Capital Asset Pricing Model or Modern Portfolio Theory; there is a lack of studies that directly assess the impact of Sharia compliance on productivity growth, efficiency change, and the technological progress of REITs. Since Malaysia maintains its lead in the global Sharia-compliant investment, with the lion’s share for Sharia-compliant REITs (Chuweni et al., 2017), this study will be the first empirical investigation to examine and estimate the total factor productivity (TFP) for Islamic vis-à-vis conventional REITs, using the non-parametric approach of Malmquist data envelopment analysis (DEA) from 2007 to 2015. Although productivity and efficiency are often used interchangeably, they are not precisely the same, as there is the difference in terms of production performance. For instance, a fully efficient firm may not be fully productive; it can improve its productivity by exploiting economies of scale (Coelli T. J. et al., 2005). Therefore, previous studies suggested that the productivity concept is superior to the efficiency concept in order to investigate the performance of an industry (Isik I. and Hassan, 2003a, 2003b; Topuz and Isik, 2009).

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 Islamic REITs and the respective productivity and efficiency sources. Section 5 concludes the article and provides suggestions for future research.

2. Literature Review

Previous works have applied various frontier techniques of estimation for the REIT efficiency (Anderson et al., 2002; Anderson and Springer, 2003) and productivity, which mainly focus in a mature market such as US REITs. Isik I. and Topuz (2017) examined the performance of US equity REITs particularly the de novo REITs using non-parametric approach of DEA. Despite being new in the REIT market, these de novo REITs outperform the established REIT as they are relatively innovative, large, focused on property sector and geographical.

Topuz and Prather (2007) employed the Malmquist Index to measure the equity REIT efficiency and productivity change of US REIT 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. Extending this study, Topuz and Isik (2009) explored the impact of structural changes on the productivity growth, efficiency change and technological progress of REITs using the Malmquist index. Their results indicated that REIT efficiency significantly increased over the 1989 to 1999 period, but average productivity declined and technology regressed, suggesting a failure of REITs to improve technically. They caution that REIT might over-extended themselves, suffering from diseconomies of scale.

In the case of emerging market of Malaysia, Chuweni and Eves (2017) provide review of efficiency for REITs and their specific application for Malaysian Islamic REITs. They identified and examined the appropriate methods and instrument which include non-parametric approach of data envelopment analysis. Chuweni et al. (2017) examined the efficiency performance of Islamic and conventional REITs in Malaysia. They found that Islamic REITs higher efficiency scores than their conventional counterparts, indicating that the Sharia-compliant effect is positive. Their findings suggest improvement through governance, capitalisation and diversification. Different approaches, data and focus are used in this study bridge the gap in the under-researched studies on productivity change of Islamic REITs. This present study addressed the Sharia requirements of Islamic REITs and the productivity performance in the REIT industry, particularly in the emerging market of Malaysia during two different periods: during and post global financial crisis.

3. Methodology

For this study, productivity change is measured using the input-oriented Malmquist Productivity Index (MPI). MPI, which was developed by Fare et al. (1994), differentiates the shift production frontier (technological change) and the movement of REIT towards the frontier (efficiency change). The Malmquist index is constructed using the DEA software of DEAP version 2.1 by Coelli T. (1996). 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). The decomposition allows us to identify the sources of productivity change in M-REIT. 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 a constant return to scale. Therefore, we applied the variable return to scale (VRS) assumption, which allows the efficiency change to further decompose into pure technical efficiency change (PECH) and scale efficiency change (SECH). The TECHCH index will take a value of greater than unity in the case of improvement in technology. Contrary, technological regress is reflected in the value of the index less than unity between period $t+1$ and period $t$. In other words, the MPI score of higher (lower) than 1.000 in the subsequent year indicates a progress (regress), which could be interpreted as catching up to the frontier (EFFCH) and innovation (TECHCH) Cummins et al. (1999). To summarise, the input-oriented Malmquist index used to measure the REIT productivity of a REIT j, $j = 1, …, L$ between consecutive time periods of $t$ and $t+1$ is the combination of three indices, namely pure technical efficiency change, scale efficiency change and technical change (Equation 1).

$$M_{j,t+1} = PECH_{j,t+1} \times SECH_{j,t+1} \times TECHCH_{j,t+1} $$  \hspace{1cm} \text{Equation 1}$$

4. Data and Empirical Design

We collect our data from annual reports of M-REITs for the years 2007 to 2015. Following previous works on REIT efficiency and productivity, total asset (Y1) are selected as output variables, while interest expense (X1), property operating expense (X2) and administrative and management expense (X3) as the input variables (Anderson et al., 2002; Chuweni et al., 2017; Topuz et al., 2005; Topuz and Isik, 2009).

5. Results and Discussions

In this section, the sources of productivity changes of the M-REITs are discussed with 2007 as the reference year. The MPI score of higher (lower) than 1.000 in the subsequent year indicate a progress (regress) which could be interpreted as catching up to the frontier (EFFCH) and innovation (TECHCH) Cummins et al. (1999). The summary of geometric mean for the Malaysian Islamic and conventional REIT TFPCH and its decomposition of TECHCH, EFFCH, PECH and SECH for the year 2007-2015 are exhibited in Table 1. Average mean is used for three periods of 2007-2009, 2010-2015 and 2007-2015 to capture the impact of the global financial crisis on the productivity changes of M-REITs particularly during and post global financial crisis. Panel A and B of Table 1 depict the results
of changes for MPI for Islamic and conventional REITs. The findings suggested that both Malaysian Islamic and conventional REITs exhibited TFPCH regress of 18.09% and 11.51% respectively. The TFPCH regress could mainly attribute by the regress in TECHCH of 30.51% and 33.33% respectively.

Table 1. Summary of Malmquist Productivity Index of Malaysian REITs (2007-2015)

| Panel A: Islamic REITs | EFFCH | TECHCH | PECH | SECH | TFPCH |
|------------------------|-------|--------|------|------|-------|
| 2007-2008              | 1.8770| 0.5430 | 1.4830| 1.2660| 1.0200 |
| 2008-2009              | 1.0835| 0.5518 | 1.0807| 1.0027| 0.5980 |
| 2009-2010              | 1.0359| 0.4571 | 0.8904| 1.1636| 0.4732 |
| 2010-2011              | 0.8336| 1.1657 | 0.7678| 1.0864| 0.9720 |
| 2011-2012              | 2.0685| 0.4418 | 1.6265| 0.9130|       |
| 2012-2013              | 1.3885| 0.6833 | 1.4426| 0.9485|       |
| 2013-2014              | 1.2800| 0.6630 | 1.2340| 0.8487|       |
| 2014-2015              | 0.7394| 1.0536 | 0.7999| 0.7792|       |
| 2007-2009              | 1.4803| 0.5474 | 1.2818| 1.1343| 0.8090 |
| 2010-2015              | 1.2243| 0.7441 | 1.1269| 1.0743| 0.8224 |
| 2007-2015              | 1.2883| 0.6949 | 1.1656| 1.0893| 0.8191 |

| Panel B: Conventional REITs | EFFCH | TECHCH | PECH | SECH | TFPCH |
|-----------------------------|-------|--------|------|------|-------|
| 2007-2008                   | 1.4240| 0.4897 | 1.3777| 1.0334| 0.6974 |
| 2008-2009                   | 1.1794| 0.8882 | 1.1238| 1.0496| 1.0476 |
| 2009-2010                   | 2.8907| 0.3124 | 1.5051| 1.9206| 0.9033 |
| 2010-2011                   | 0.9334| 0.9812 | 0.9448| 0.9881| 0.9159 |
| 2011-2012                   | 2.7587| 0.2489 | 1.6582| 1.6636| 0.6864 |
| 2012-2013                   | 1.4640| 0.5965 | 1.2977| 1.1279| 0.8733 |
| 2013-2014                   | 1.3966| 0.6952 | 1.2416| 1.1248| 0.9710 |
| 2014-2015                   | 0.8763| 1.1237 | 0.9734| 0.9004| 0.9847 |
| 2007-2009                   | 1.3017| 0.6889 | 1.2507| 1.0415| 0.8725 |
| 2010-2015                   | 1.7199| 0.6597 | 1.2701| 1.2876| 0.8891 |
| 2007-2015                   | 1.6154| 0.6670 | 1.2653| 1.2260| 0.8849 |

On the other hand, during the period under study, both conventional and Islamic REITs exhibited an increase of 28.33% and 61.54% respectively for EFFCH. The decomposition of EFFCH increase for both Islamic and conventional REITs could further be examined in Figure 1. The increase in EFFCH for both Islamic REIT and conventional could mainly be the result of an increase in PECH rather than SECH. The increase in PECH of 16.56% for Islamic REITs and 26.53% for conventional REIT suggests both REITs exhibited higher pure technical than scale efficiency. The result implies that both REITs have been managerially efficient in managing the operating costs but operating at the non-optimum scale of operations. The development of MPI and its components are illustrated in Figure 2 which shows a consistency in EFFCH and SECH for 20007 – 2015 in the case of Islamic REITs.

Figure 1. Geometric mean of MPI for M-REITs (Islamic and conventional) for 2007-2015
6. Development in the Number of Malaysian REIs with Productivity Gain (Loss) or Efficiency Increase (Decrease)

Analysis based on the number of M-REIs with productivity gain (loss) or efficiency increase (decrease) was performed to address the issue of possible outliers. The results are tabulated in Panel A and B in Table 2. Panel A of Table 2 exhibits the result analysis for Islamic REIs that have experience productivity progress and/or regress. The result indicates that 16.67% of Islamic REIs have experienced productivity loss in 2007-2015 before increasing substantially to reach 66.67% of Islamic REIs by the year 2010-2015. Therefore, the average of numbers of Islamic REIs experiencing TFP loss is 54.17%. On the other hand, Islamic REIs exhibited a decline in TFP growth from 83.34% in 2002-2009 to 33.33% by the year 2010-2015. The average of the number of Islamic REIs with TFPCH growth is therefore 45.83% for the period of 2007 – 2015. The majority of Islamic REIs with 66.67% of them operate at increasing EFFCH, PECH, and SECH during the global financial crisis of 2007-2009. However, the situation change post financial crisis of 2010-2015. 41.67% of Islamic REIs experience an increase in EFFCH and PECH. However, in the case of PECH, 41.67% of Islamic REIs exhibited stagnation in PECH.

The developments in the number of conventional REIs are depicted in Panel B of Table 2. For the period of GFC (2007-2009), the number of conventional REIs that exhibit productivity growth (loss) increased (declined) from 31.25% (68.75%) to 39.64% (60.36%) for 2010-2015. On a similar note, the empirical result implies that the number of conventional REIs experiencing technological progress (regress) increased (decreased) from 12.50% (87.50%) prior financial crisis of 2007-2009 to 24.10% (75.90%) post financial crisis of the period of 2010-2015. On the average, for the period of conventional REIT operate at EFFCH increase, PECH increase and SECH increase with the percentage of 70.09%, 50.26% and 63.83% of conventional REIs respectively.

7. Sources of Productivity of M-Reits

Table 3 represents the sources of productivity (growth) and efficiency increase (decrease) for Islamic and conventional REIs during the period of 2001-2015. Panel A of Table 3 exhibits the result analysis for major sources of productivity progress (regress) and efficiency increase (decrease) for Islamic REIs. For instance, as depicted in Panel A of Table 3, 100% of Islamic REIT experience TFP growth. This TFP growth could mainly attribute to an increase in EFFCH rather than technological progress, evidenced by 100% of Islamic REIs experiencing an increase in EFFCH in Panel A of Table 3. Of that 100% of EFFCH increase, the result could also identify the sources of the EFFCH increase. The result in Panel A of Table 3 indicates that 100% of EFFCH increase mainly due to PTE increase and not SE increase. On a similar note, as indicated in Panel A of Table 3, 83.34% of Islamic REIs have experienced productivity growth for the period of 2007-2009, of which could mainly be the result of an increase in EFFCH rather than technological progress. From this result, the sources of EFFCH increase could further be examined as Panel A of Table 4 indicates 66.67% of EFFCH increase could mainly due to the increase in PTE than SE. Likewise, the sources of EFFCH increase (decrease) for Islamic REIs could be the result of PTE increase (decrease) for both periods of prior and post financial crisis. The result suggests that the sources of EFFCH for Islamic REIs are likely due to the PTE if which requires managerial focus. 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).

Panel B of Table 3 shows the result analysis for major sources of productivity progress (regress) and efficiency increase (decrease) for conventional REIs. As in Panel B of Table 3 for the period of 2007-2009, the numbers of conventional REIs which exhibit productivity growth is 31.25%. The productivity growth of conventional REIT could mainly attributed by EFFCH increase. The balance of 68.75% for conventional REIs (as in Panel B of Table 3) experience productivity regress. This result is likely due to regress in TECHCH. On a similar note, the source of TFP growth (loss) of 39.64% (60.36%) of conventional REIT post financial crisis for the period of 2010-2015 could also mainly attributed by the same sources of EFF increase (TECH regress). On the other hand, the source of EFF...
increase (decrease) of conventional REITs for 2007-2009 could mainly attributed by PTE increase (decrease). However, post financial crisis of 2010-2015, the source of EFF increase (decrease) of conventional REIT could mainly due to the SE increase (decrease).

9. Robustness Test: Univariate Test Results

As previous studies in productivity growth, Islamic and conventional REITs were assumed coming from the same environment (population). However, it may be questionable to pool these two REITs into a same frontier. Therefore, as robustness tests were carried out to determine whether there is significant difference between the Islamic and conventional REITs. To achieve this, following the methodology Isik and Hassan (2002); Sufian and Kamarudin (2014) among others, we employ a parametric t-test and non-parametric (Mann-Whitney [Wilcoxon Rank-Sum], Kruskal Wallis and Kolmogrov-Smirnov) tests to test the null hypothesis of the frontier between Islamic and conventional REITs. The result indicates that conventional REIT is slightly more productive (0.9219>0.8637) than Islamic REIT mainly attributed by greater efficiency change (1.7378>1.3035). Contrary, Islamic REIT have higher technological change (0.7557>0.6998). The t-test result indicates there is no significant difference in the mean of productivity index between Islamic and conventional REITs. The results from the non-parametric tests of Mann-Whitney [Wilcoxon Rank-Sum], Kruskal Wallis and Kolmogrov-Smirnov further confirm this. Since there is no statistically difference between Islamic and conventional REITs, the null hypothesis was failed to reject at the 5% level of significance, suggesting that Islamic and conventional REITs are drawn from the same environment (population). Therefore, it appropriate to pool Islamic and conventional REITs in the same frontier.

10. Conclusion

The empirical result in this study discussed REIT productivity, technology and efficiency change since 2007 to 2015. In terms of productivity, the result indicates that both Islamic and conventional REITs have exhibited productivity regress of 18.09% and 11.51% respectively during the period of study. These productivity regress could mainly due to the regress in technological rather than efficiency change. One possible reason for this technological regress is likely due to REIT requirement in which the REIT managers could not retain their earning and reinvest their income for the following year. The REIT managers need to have access to external capital for purchasing new asset, which could lead to a higher cost of capital than the retained earnings.

On the other hand, both conventional and Islamic REITs exhibited an increase of 28.33% and 61.54% respectively for efficiency change. Further decomposition of efficiency change into pure technical efficiency change and scale efficiency change indicate the main sources for efficiency change is likely due to pure technical efficiency change. Likewise, the sources of efficiency increase (decrease) for Islamic REITs could be the result of pure technical efficiency increase (decrease) during the period of study. The results imply that both REITs have been managerially efficient in managing the operating costs but operating at the non-optimum scale of operations. Empirical findings from this study provide insight for Islamic REIT managers to facilitate sustainable competitiveness of Islamic REITs in achieving the optimum utilisation of resources, improvement in managerial skills and the optimum scale of operation for Islamic REITs. Moving forward, it is reasonable to expect that policy makers and regulatory bodies to develop policies and measures in enhancing the Malaysian REIT productivity, stimulating the robustness and growth of the REIT industry. Future research on examination of Islamic REIT productivity in the global context would produce a more robust result and provide validation of the productivity performance of Islamic REITs. The evolution of capital and corporate structure by REIT age is another avenue to test. Last but not least, the REIT productivity could be more deeply studies within specific property sector, regions and organisational structure.
Table 2: Developments in the number of M-REITs with productivity gain (loss) or efficiency increase (decrease)

| Period       | Panels A: Islamic REITs | Panels B: Conventional REITs |
|--------------|-------------------------|-------------------------------|
|              | Growth | Loss | No Δ | Progress | Regress | No Δ | Inc. | Dec. | No Δ | Inc. | Dec. | No Δ | Inc. | Dec. | No Δ |
| 2007-2008    | 100    | 0    | 0    | 0       | 0       | 100  | 0    | 0    | 0    | 100  | 0    | 0    | 100  | 0    | 0    |
| 2008-2009    | 66.67  | 33.33| 0    | 33.33   | 66.67   | 0    | 33.33| 0    | 66.67| 33.33| 0    | 66.67| 33.33| 0    | 66.67|
| 2009-2010    | 33.33  | 66.67| 0    | 100     | 0       | 0    | 66.67| 33.33| 0    | 0    | 33.33| 66.67| 66.67| 33.33| 0    |
| 2010-2011    | 66.67  | 33.33| 0    | 100     | 0       | 0    | 66.67| 33.33| 0    | 66.67| 33.33| 0    | 66.67| 33.33| 33.33|
| 2011-2012    | 33.33  | 66.67| 0    | 100     | 0       | 0    | 100  | 0    | 0    | 100  | 0    | 0    | 100  | 0    | 0    |
| 2012-2013    | 0      | 100  | 0    | 0       | 100     | 0    | 50   | 0    | 50   | 50   | 0    | 50   | 50   | 0    | 50   |
| 2013-2014    | 33.33  | 66.67| 0    | 100     | 0       | 0    | 33.33| 66.67| 33.33| 0    | 66.67| 33.33| 0    | 66.67| 33.33|
| 2014-2015    | 33.33  | 66.67| 0    | 66.67   | 33.33   | 0    | 0    | 66.67| 33.33| 0    | 66.67| 33.33| 0    | 66.67| 33.33|
| Mean         | 83.34  | 16.67| 0    | 16.67   | 83.34   | 0    | 66.67| 0.00 | 33.34| 66.67| 0.00 | 33.34| 66.67| 0.00 | 33.34|
| 2010-2015    | 33.33  | 66.67| 0    | 27.78   | 72.22   | 0    | 41.67| 27.78| 30.56| 30.56| 27.78| 41.67| 38.89| 30.56| 30.56|
| 2012-2015    | 45.83  | 54.17| 0    | 25.00   | 75.00   | 0    | 47.92| 20.83| 31.25| 39.58| 20.83| 39.58| 45.83| 22.92| 31.25|

Notes: 
1. TFCH: Total factor change
2. TFPCH: Total factor productivity change
3. TECHCH: Technology change
4. EFFCH: Efficiency change
5. PECH: Pure efficiency change
6. SECH: Scale efficiency change
Table 3: Sources of productivity of M-REITs

| Panel A: Islamic REITs | 2007-2008 | 2008-2009 | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 |
|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Eff. Inc. | 100.00 | 33.33 | 33.33 | 0.00 | 33.33 | 33.33 | 0.00 | 33.33 |
| Tech. Progress | 0.00 | 33.33 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eff. Decr. | 0.00 | 0.00 | 66.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tech. Regress | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| No Prod. (%) ∆ | 100.00 | 33.33 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Efficiency increase (%) mainly due to: | 100.00 | 33.33 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Efficiency increase (%) mainly due to: | 0.00 | 0.00 | 33.33 | 33.33 | 33.33 | 33.33 | 33.33 | 33.33 |
| PTE Incr. | 100.00 | 33.33 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SE Inc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PTE Decr. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SE Decr. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Panel B: Conventional REITs

| 2007-2008 | 2008-2009 | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Eff. Inc. | 0.00 | 12.50 | 12.50 | 25.00 | 0.00 | 25.00 | 0.00 | 25.00 |
| Tech. Progress | 0.00 | 0.00 | 0.00 | 75.00 | 0.00 | 75.00 | 0.00 | 75.00 |
| Eff. Decr. | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tech. Regress | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| No Prod. (%) ∆ | 55.56 | 6.25 | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Efficiency increase (%) mainly due to: | 55.56 | 6.25 | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Efficiency increase (%) mainly due to: | 12.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PTE Incr. | 55.56 | 6.25 | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SE Inc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PTE Decr. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SE Decr. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

References
Anderson, R. I. and Springer, T. M. (2003). REIT selection and portfolio construction, Using operating efficiency as an indicator of performance. Journal of Real Estate Portfolio Management, 9(1): 17–28.
Anderson, R. I., Fok, R., Springer, T. and Webb, J. (2002). Technical efficiency and economies of scale: A non-parametric analysis of REIT operating efficiency. European Journal of Operational Research, 139: 598–612. Available: https://doi.org/10.1016/j.ejor.2005.00121.x
Chuweni, N. N. and Eves, C. (2017). A review of efficiency measures for REITS and their specific application for Malaysian Islamic REITS. Journal of Islamic Accounting and Business Research, 8(1): 41–53. Available: https://doi.org/10.1108/JIABR-03-2015-0007
Chuweni, N. N., Eves, C., Hoang, V. N., Isik, I. and Hassan, M. K. (2017). How efficient are alternative financial institutions? An empirical investigation of Islamic REITs in Malaysia. *Journal of Real Estate Literature*, 25(1): 109–39.

Coelli, T. (1996). A guide to deap version 2.1, A Data Envelopment Analysis (Computer) Program. CEPA Working Paper 96/08: Available: [http://www.une.edu.au/econometrics/cepa.htm](http://www.une.edu.au/econometrics/cepa.htm)

Coelli, T. J., Prasada Rao, D. S., O'Donnell, C. J. and Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. 2nd edn: United States of America. https://doi.org/10.1007/b136381

Cummins, J. D., Weiss, M. A. and Zi, H. (1999). Organizational form and efficiency, The coexistence of stock and mutual property-liability insurers. *Management Science*, 45: 1254-69. Available: [https://doi.org/10.1287/mnsc.45.9.1254](https://doi.org/10.1287/mnsc.45.9.1254)

Coelli, T. J., Prasada Rao, D. S., O'Donnell, C. J. and Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. 2nd edn: Springer: United States of America. https://doi.org/10.1007/b136381

Cummins, J. D., Weiss, M. A. and Zi, H. (1999). Organizational form and efficiency, The coexistence of stock and mutual property-liability insurers. *Management Science*, 45: 1254-69. Available: [https://doi.org/10.1287/mnsc.45.9.1254](https://doi.org/10.1287/mnsc.45.9.1254)

Securities Commission Malaysia (2012). Guidelines on real estate investment trusts. Securities commission malaysia.: Available: [https://www.sc.com.my/wp-content/uploads/eng/html/resources/guidelines/2013/REITGuidelines_Dec2012.pdf](https://www.sc.com.my/wp-content/uploads/eng/html/resources/guidelines/2013/REITGuidelines_Dec2012.pdf)

Sufian and Kamarudin (2014). Efficiency and returns to scale in the Bangladesh banking sector, Empirical evidence from the slack-based dea method. *Engineering Economics*, 25(5): 549–57.

Topuz, J. C. and Prather, L. J. (2007). Firm size and productivity, The case of REITs. *Journal of Academy of Business and Economics*, VII((1)): 213–24.

Topuz, J. C. and Isik, I. (2009). Structural changes, market growth and productivity gains of the US real estate investment trusts in the 1990s. *Journal of Economics and Finance*, 33: 288–315. Available: [https://doi.org/10.1007/s12197-008-9026-6](https://doi.org/10.1007/s12197-008-9026-6)

Topuz, J. C., Darrat, A. F. and Shelor, R. M. (2005). Technical, Allocative and Scale Efficiencies of REITs, An Empirical Inquiry. *Journal of Business Finance & Accounting*, 32(9 & 10): 1961–94. Available: [https://doi.org/10.1111/j.0306-686X.2005.00653.x](https://doi.org/10.1111/j.0306-686X.2005.00653.x)