

Growing Science™
PUBLISHERS OF DISTINGUISHED ACADEMIC, SCIENTIFIC AND PROFESSIONAL JOURNALS

Home About Us Contact Us Search: All Fields Advanced Search

Management Science Letters
ISSN 1923-9343 (Online) - ISSN 1923-9335 (Print)
Monthly publication

Welcome to the online submission and editorial system for *Management Science Letters*

| PRODUCTION ISSUE | ENVIRONMENT ISSUE | DESIGN ISSUE |
|---|--|---|
| Cheap car batteries | Car battery with environmentally friendly material | Ease of use |
| Car battery with lifetime is still > 2 years | | Car batteries are the same size and small |
| Car battery with large capacity | | |
| Car battery with large ampere | | |
| There is an electrical indicator on the battery | | |

Submit Article
Review Article
Volume 10 Issue 16
Archive
Twitter Instagram Facebook LinkedIn
Access to thousands of

For Readers
 • Volume 11 Number 4 (2021)
 • Volume 11 Number 3 (2021)
 • Volume 11 Number 2 (2021)
 • Volume 11 Number 1 (2021)
 • Volume 10 Number 17 (2020)
 • Volume 1.. Present
 • Online Issues
 • Editorial Board
 • Indexing/Abstracting
 • Statistics
 • Subscription

For Authors
 • Author Guidelines
 • Submit Manuscript
 • Author Fee
 • Review Process

website as soon as the review result becomes positive. The journal covers both empirical and theoretical aspects of management and gives the chance on sharing knowledge among practitioners.

Management Science Letters is dedicated for publishing in the following areas:

- Quality Management
- Production Management (Scheduling, Production management, etc.)
- Total Quality Management (TQM)
- Six Sigma
- Production Efficiency
- Just in Time Inventory
- Data Envelopment Analysis
- Balanced Score Card
- Activity Based Cost (ABC)
- Technology Acceptance Model
- Brand Image, Commitment, Emotional Intelligence
- Marketing planning and Customer Relationship Management
- Critical Success Factors, Corporate Social Responsibility
- e-learning, Innovation, Creativity, Talent Management
- Customer satisfaction, Job satisfaction, Job turnover,
- Organizational commitment, Employee Commitment
- Knowledge Management, Leadership
- Knowledge sharing
- Human Resources Management (Employee training, Employee Performance, Work achievements.)
- Empowerment, Workplace Spirituality, Turnover Intention
- Small and medium-sized enterprises (SMEs) issues and Economic development
- Innovation, Creativity, Productivity and Performance
- Multi-Criteria Decision Making Applications in Management Science (AHP, BWM, TOPSIS, ...)
- Education Management, Social development, Public Policy
- Tourism Industry, Tourism promotion, Tourism directorates
- Business performance and financial performance

- Empowerment, Workplace Spirituality, Turnover Intention
- Small and medium-sized enterprises (SMEs) issues and Economic development
- Innovation, Creativity, Productivity and Performance
- Multi-Criteria Decision Making Applications in Management Science (AHP, BWM, TOPSIS, ...)
- Education Management, Social development, Public Policy
- Tourism Industry, Tourism promotion, Tourism directorates
- Business performance and financial performance

Management Science Letters is an open access journal, which provides instant access to the full text of research papers without any need for a subscription to the journal where the papers are published. Therefore, anyone has the opportunity to copy, use, redistribute, transmit/display the work publicly and to distribute derivative works, in any sort of digital form for any responsible purpose, subject to appropriate attribution of authorship. Authors who publish their articles may also maintain the copyright of their articles.

Management Science Letters applies the Creative Commons Attribution (CC BY) license to works we publish (read the human-readable summary or the full license legal code). Under this license, authors keep ownership of the copyright for their content, but permit anyone to download, reuse, reprint, modify, distribute and/or copy the content as long as the original authors and source are cited. No permission is needed from the authors or the publishers. Appropriate attribution can be provided by simply citing the original article (e.g., Hajjiyan, H., Aminbeidokhti, A., & Hemmatian, H. (2015). The effect of customer relationship management on customer loyalty: Evidence from banking industry. *Management Science Letters*, 5(11), 993-998. doi: 10.5267/j.msl.2015.9.001). For any reuse or redistribution of a work, users have to also make clear the license terms under which the work was published. This broad license was developed to facilitate free access to, and unrestricted reuse of, original works of all kinds. Applying this standard license to your own work will ensure that it is freely and openly available in perpetuity.

For Readers

- Online Issues
- Editorial Board
- Journal Subscription

For Authors

- Author Guidelines
- Submit Manuscript
- Review process

Management Science Letters

ISSN 1923-9343 (Online) - ISSN 1923-9335 (Print)

Monthly publication

Editor in chief

S. J. Sadjadi Department of Industrial Engineering, Iran University of Science and Technology, Iran

Editorial Board Members

- Chien-Ho Ko National Pingtung University of Science and Technology, Taiwan
- Zélia Silva Serrasqueiro Management and Economics Department, Beira Interior University, Portugal
- Huyquan Vu, Deakin University, School of Information Technology, Geelong, Australia
- Nilsen Kundakci Pamukkale University, Department of Business Administration, Denizli, Turkey
- Mostafa Jafari Iran University of Technology, Iran
- Elyas Jazayeri University of Kentucky, USA
- Payman Akhavan Malek Ashtar University of Technology, Iran
- Nicola Miglietta Università degli Studi di Torino - Facoltà di Economia, Italy
- Tam Bang Vu University of Hawaii at Hilo, United States
- Leopoldo E. Cárdenas-Barrón Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico
- Yao-Ming Chan Dept. of Industrial Engineering and Management, Taiwan

Information menu

- Facts & Figures
- Open Access
- News
- Journal Subscription

growing-science.com/msl/EditorialBoard.html

Nicola Miglietta *Università degli Studi di Torino - Facoltà di Economia, Italy*
 Tam Bang Vu *University of Hawaii at Hilo, United States*
 Leopoldo E. Cárdenas-Barrón *Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico*
 Yee-Ming Chen *Dept. of Industrial Engineering and Management, Taiwan*
 Sanjay Sharma *National Institute of Industrial Engineering (NITIE), India*
 Bibhas C. Giri *Jadavpur University, India*
 Dinh Tran Ngoc Huy *Banking University - Ho Chi Minh Cit*
 Adekunle Ibrahim Musa *Moshood Abiola Polytechnic, Nigeria*
 Marcelo S. Nagano *University of São Paulo, Brazil*
 Morteza Yazdani *Universidad Europea de Madrid, Spain*
 Paulo S G De Mattos Neto *Universidade de Pernambuco, Escola Politécnica de Pernambuco, Recife, Brazil*
 Cao, Guangxi *Nanjing University of Information Science and Technology, Collaborative Innovation Center on Forecast and Evaluation of Meteorological Disasters, Nanjing, China*
 Abderrahim Taamouti *Durham University Business School, UK*
 Brian J. Galli *Assistant Professor in the School of Computer Science, Innovation, and Management Engineering in the College of Management, Long Island University (LIU), USA*
 Prabha Bhola *Indian Institute of Technology Kharagpur, 721302, West Bengal, India*
 Tehseen, Shehnaz *Sunway University, Selangor, Malaysia*
 Abbas Keramati *Ryerson University, Canada*
 Amin Mahmoudi *Southeast University, Nanjing, China*

Advisory Members
 Mojtaba Salehi *K. T. Toosi University of Technology, Iran*

© 2010-2021, Growing Science.

growing-science.com/msl/Vol9/Vol9Issue2.html

Growing Science™
 PUBLISHERS OF DISTINGUISHED ACADEMIC, SCIENTIFIC AND PROFESSIONAL JOURNALS

Home About Us

Information menu

- Facts & Figures
- Open Access
- News
- Journal Subscription

Volume 9 Issue 2 Pages 193 - 356 (2019)

Open Access Article

1. **Simulation-based optimization approach for vehicle allocation in a private transport service: A case study** *Pages: 193-204*
 Andrés Muñoz-Villamizar, Jairo R. Montoya-Torres and Carlos A. Moreno-Camacho *PDF (288 K)*

Abstract: Poor urban planning and traffic congestion lead to excessive delays in workers' transit times and decrease their quality of life, especially in emerging countries. Several medium and large companies have a need to hire a transport service for their staff. In this type of transportation system, there is a heterogeneous fleet of vehicles, which are assigned to a set of predefined routes. However, the total transport delay can be even greater if the private transportation system is inefficient or not controlled. The approach proposed in this study seeks to optimize the private transport service by defining the best allocation of its fleet to its routes. A mathematical model is proposed to minimize user wait times. This approach is validated using real data obtained from a transport company in Co-lombia. The results demonstrate the quantitative benefits that can be achieved when the proposed approach is implemented, represented by a considerable reduction in user wait times.

DOI: 10.5267/j.msl.2018.12.003
 Keywords: Optimization, Simulation, City logistics, Urban transport systems, Service level, Waiting time

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. *Creative Commons Attribution (CC-BY)*

2. **Fundamental factor of financial management in determining company values** Pages: 205-216
Yuniningsih Yuniningsih, Tri Kartika Pertiwi and Eko Purwanto PDF (288 K)
Abstract: Financial management faces 3 important decisions, namely funding, investment and dividends. The purpose of this study is to determine the effects of the fundamental factors such as leverage in financial management. Leverage is one of the factors of funding, investment and dividends that interdependently affect the value of the company. The method used in this study uses 2SLS (two-stage least square). There are 4 (four) equations in this study, namely the equation of leverage, investment, dividend and company value. Interdependence is shown based on leverage, investment and dividends. In the interdependence equation leverage, investment and dividends not only on one side act as endogenous variables but also act as exogenous variables on the equation of the company values. The results of the research on leverage equations show that investment affects leverage but dividends do not affect leverage. The investment equation shows the results of both leverage and dividend variables would not affect investment decision. Dividend equation also shows that leverage and investment variables also do not affect dividends. Moreover, the results of the company value equation show that the leverage variable would not affect the value of the company. But investment and dividend variables affect the value of the company. The conclusion of this study is that there was a mutually influential relationship between the three variables of financial management before influencing company value.

DOI: 10.5267/j.msl.2018.12.002
Keywords: Interdependence, Leverage, Investment, Dividend, Company Value

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

3. **An empirical study to identify and develop constructive model of e-supply chain risks based on Indian mechanical manufacturing industries** Pages: 217-228
Alok Kumar, Ramesh Kumar Garg and Dixit Garg PDF (288 K)
Abstract: Management towards control of risk issues appeared as an important area in E-supply chain for researchers in the present fast growing market. Extensive research has been accomplished in this area, but still there are several risks and uncertainties. The present research aims to identify and consolidate various e-supply risk factors for developing a constructive measurement model. The study also assesses the influence of risk factors over e-supply chain operation in Indian mechanical industries. Thus, after a thorough research and detailed discussion, 38 Risks factors are identified through literature to prepare the questionnaire. A questionnaire based survey is carried

3. **An empirical study to identify and develop constructive model of e-supply chain risks based on Indian mechanical manufacturing industries** Pages: 217-228
Alok Kumar, Ramesh Kumar Garg and Dixit Garg PDF (288 K)
Abstract: Management towards control of risk issues appeared as an important area in E-supply chain for researchers in the present fast growing market. Extensive research has been accomplished in this area, but still there are several risks and uncertainties. The present research aims to identify and consolidate various e-supply risk factors for developing a constructive measurement model. The study also assesses the influence of risk factors over e-supply chain operation in Indian mechanical industries. Thus, after a thorough research and detailed discussion, 38 Risks factors are identified through literature to prepare the questionnaire. A questionnaire based survey is carried out for collecting the primary data from 148 experts of mechanical manufacturing industries located in the national capital region of India. The research methodology is combined with descriptive statistics and factor analysis. SPSS 21 software tools is used for investigating the reliability and Amos Graphics 21 software is used for the fitment validation of the theoretical construct. The results suggest that all risk issues create significant negative influence e-supply chain process. The results also show negative effects of risks over e-supply chain performance. The current research outcome develops a stochastic model based on the e-supply chain risk factors used for reducing risks in e-supply chain operation.

DOI: 10.5267/j.msl.2018.12.001
Keywords: Risk issues, Risk management, e-supply chain, Exploratory factor analysis, Confirmatory factor analysis, Indian industries

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

4. **Can meaningful work really moderate the relationship between supervisor support, coworker support and work Engagement?** Pages: 229-242
Umair Ahmed, Abdul Halim Abdul Majid, La'aleh Al-Aali and Solesman Mozammel PDF (288 K)
Abstract: Work engagement has gained much prominence over the recent decades. With the aim of address-ing the global engagement crisis, the current study examined how prominent job resources such as supervisor support, coworker support and meaningful work perceptions can influence work engagement. The study also tested the moderation of meaningful work on these relationships. 537 questionnaires were distributed among the employees of six large banks of Pakistan. Structural equation modeling using Smart PLS 2.0

crisis, the current study examined how prominent job resources such as supervisor support, coworker support and meaningful work perceptions can influence work engagement. The study also tested the moderation of meaningful work on these relationships. 537 questionnaires were distributed among the employees of six large banks of Pakistan. Structural equation modeling using Smart PLS 2.0 resulted in strong positive relationship of supervisor support and coworker support with work engagement. The findings also concluded strong positive relationship between meaningful work and work engagement. Notably, the bootstrapping results also played significant moderation of meaningful work on the relationship between supervisor support and coworker support with work engagement. The study forwards theoretical and practical implications for future.

DOI: 10.5267/j.msl.2018.11.016

Keywords: Work Engagement, Supervisor Support, Coworker Support, Meaningful work, Moderation



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

5. **Effective human resource management strategy for hospital nursing organizations** Pages: 243-252

Ayana Matsumoto PDF (288 K)

Abstract: Human resource management (HRM) was first developed as a corporate business strategy that aimed to retain employees in the workplace and to develop personnel who generated results and whose capabilities could be effectively utilized. In recent years, human resource perspectives have been emphasized in personnel management by hospital nursing organizations. This study examined effective HRM strategies for creating an attractive nursing practice environment from the perspective of "magnetism." A questionnaire ("32 Items Regarding Effective Human Resource Management Policies") was developed. The Practice Environment Scale of the Nursing Work Index was employed to assess the type of environment in which nurses wished to continue working, and factors contributing to a desirable nursing practice environment were defined as "magnetic." Analysis of data obtained from nursing managers (n=305) yielded five factors that were effective HRM policies for hospital nursing organizations. It was also shown that the nursing practice environment was made more attractive by incorporating more of these policy elements. The following six strategies were identified: (1) enhancement of personal career development and organizational development; (2) goal management and personnel evaluations to assure the quality of patient care and promote team collaboration; (3) flexible hiring and transfer policies based on business execution; (4) promoting outside interactions to make the organization an open system; (5) ensuring support for career development; and (6) supporting a safe and healthy nursing practice environment by enhancement of manpower.

... promote team collaboration; (3) flexible hiring and transfer policies based on business execution; (4) promoting outside interactions to make the organization an open system; (5) ensuring support for career development; and (6) supporting a safe and healthy nursing practice environment by enhancement of manpower.

DOI: 10.5267/j.msl.2018.11.015

Keywords: Human resource management, Nursing, Staff development, Magnetism



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

6. **Defect reduction in a capacitor manufacturing process through Six Sigma concept: A case study** Pages: 253-260

Ravi Shankar Raman and Yadavalli Basavaraj PDF (288 K)

Abstract: In the present scenario, the Six Sigma tools and techniques are used by various manufacturing industries, exporting industries and even service organizations. It focuses on improving the quality of the products, cutting down the extra costs, reducing the variations and satisfying the customers. This case study follows the Six Sigma tools called DMAIC methodology to identify and analyze various root causes of the capacitors rejection problems, which influence the performance of the company and suggests solutions to counter with it. The issue not only causes financial loss to the company but also hinders future growth in form of customer dissatisfaction. The results of the implementation indicate significant improvement in the quality of the product and cost reduction.

DOI: 10.5267/j.msl.2018.11.014

Keywords: Six Sigma, DMAIC Methodology, Capacitor, Pareto chart, Cause and effect diagram



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

7. **Integration of supply chain management and tourism: An empirical study from the hotel industry of Indonesia** Pages: 201-210
Muhammad Arifin, Andi Ibrahim and Muhammad Nur PDF (288 K)

Abstract: The idea of supply chain management (SCM) is covering its perspective in the form of flow of material and information from the business to customers. Its application in the field of tourism is also very much significant. The objective of present study is to analyze the empirical association between the supply chain management and tourism industry from the context of hotel industry in Indonesia. For this purpose, a questionnaire-based approach is followed while taking the demographic factors regarding age, gender and qualification. A sample of 272 respondents is finally accepted for the empirical examination between supply chain and its implication in tourism industry. Both descriptive and regression analysis are conducted. To analyze the factor of supply chain, sixteen items are considered from the existing literature while considering the strategic supplier partnership, information sharing, and information quality as the key indicators. The factor of tourism is measured through four different proxies. The practical implications of the study are taken both the tourists and key policymakers while dealing with the SCM and its integration with those hotels dealing with the tourism and related services. This study contributes towards the future trends in the form of integration for SCM and tourism industry.

DOI: 10.5267/j.msl.2018.11.013

Keywords: Supply chain management, Tourism industry, Regression analysis, Indonesia



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

8. **The effect of board characteristics and audit committee characteristics on audit quality** Pages: 271-282
Dheyaa Zamil Khudhair, Firas Khudhair Abbas Al-Zubaidi and Ali Abdullhusein Raji PDF (288 K)

Abstract: The issues of audit quality and audit committee have received huge consideration from the auditing profession, the general public population and the government controllers particularly after the prominent corporate outrages in firms like Enron, Global Crossing, Tyco, and WorldCom. These concerns discourage investors to invest in foreign and local businesses. The primary objective of the current study is to explore the impact of internal and external governance mechanisms such as board size, audit committee independence, audit committee expertise, and audit committee meetings on the quality of audit in selected firms. The study is carried out on a sample of Iraqi non-financial firms. The dependent variable is the audit quality measured as a dummy variable and it receives 1 if a firm receives audit services of big five auditing firms and zero, otherwise. To achieve the research objectives the study uses logit regression technique. The results indicate that there was a positive relationship between audit quality and the percentage of non-executive directors in the audit

[Open Access](#) [Article](#)

9. **An evaluation of project management tools and techniques in Vietnam** Pages: 283-300
Quynh Le Hua Xuan, Massoud Moslehpour and Dat Tran Tien PDF (288 K)

Abstract: Project management tools and techniques provide the efficiency and effectiveness in managing and handling the projects. Many tools and techniques have been discovered and applied widely for a long period of time among project managers around the world with great contributions to the success of projects. Vietnam is a developing country and has become an attractive hub for national and international business opportunities. Consequently, there has been an increasing development and expansion of business projects in Vietnam. The purpose of this study is to analyze the use of project management tools and techniques in Vietnam. More specifically, this study aims at investigating: 1) the awareness of business people related to projects, 2) the application of project management tools and techniques within the organization and 3) the challenging obstacles that have prevented organizations in using the tools and techniques. The mixed-method methodology is employed to collect and analyze the data. This study uses interview and questionnaire techniques to collect the data for the study. Several companies in different industries in Vietnam participated in collection of the data. The findings of the study indicate lack of in-depth understanding and recognition of project and project management tools and techniques in Vietnamese businesses. The term "project" has not yet become popular in Vietnam. Hence, companies in Vietnam have been facing many obstacles with the application of project management tools and techniques affected on the performance of the projects. The study suggests that the definition and recognition of Project Management should go beyond the current assumption of the Vietnamese business people. Better exercises and practices of the concept of Project Management can benefit the local and international companies. Achieving higher awareness of projects and project management tools can significantly improve economic success of Vietnam.

DOI: 10.5267/j.msl.2018.11.011

Keywords: Project management tools and techniques, Challenges, Vietnam, Developing country



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

10. **Productivity and efficiency analysis using DEA: Evidence from financial companies listed in Bursa Malaysia** Pages: 301-312
Omar Sharif, Md Zobaer Hasan, Florentina Kurmasari, Atang Hermawan and Ardi Gunardi PDF (288 K)

10. **Productivity and efficiency analysis using DEA: Evidence from financial companies listed in Bursa Malaysia** Pages: 301-312
Omar Sharif, Md Zobaer Hasan, Florentina Kurniasari, Atang Hermawan and Ardi Gunardi PDF (288 K)

Abstract: This study evaluates the technical efficiency, productivity change of financial companies listed in the Malaysian stock exchange (Bursa Malaysia) and examines the effects of productivity change on efficiency over the period 2007–2016. Moreover, this study also concentrates on the ranking of financial companies according to their efficiency scores. Data Envelopment Analysis (DEA) is utilized on a Malmquist Productivity Index in order to calculate the financial companies' efficiency scores. The results of this study show that some firms were fully efficient. The results implied that these companies were in optimal control of their inputs or resources to generate the maximum outputs. Also, the results indicate a tremendous productivity gain was mostly because of a positive shift in frontier technology and positive shift in technical efficiency. This study is significant because it helps to identify the efficient companies from the financial sector in Malaysia based on multiple inputs and outputs by using the DEA model. Common misspecification problems observed that instability of efficiency scores over productivity.

DOI: 10.5267/j.msl.2018.11.010

Keywords: Bursa Malaysia, DEA, Efficiency, Financial Company, Malmquist productivity index



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

11. **Auditing financial statements in insurance enterprises: The case of Vietnam** Pages: 313-324
Thi Mai Anh Nguyen and Thi Tam Le PDF (288 K)

Abstract: This study is conducted to study the implementation of the audit techniques and procedures executed by auditors using risk-based approach. The study also determines factors affecting audit quality of financial statements in Vietnamese insurance enterprises. Quantitative method is used in the study where questionnaires are sent to 250 independent auditors and 186 valid questionnaires are encrypted, declared and entered into SPSS software version 22.0. The results show that in audit techniques, except for document testing and verification technique, there were significant differences in application level of material testing, observation, interview, calculation and analysis techniques between big 4 firms and non-big 4 firms. The analysis also confirms that the most significant difference was between the two audit groups. In audit procedures, while control testing is not performed singly, detailed testing can be performed alone at all three assurance levels and the analysis is performed alone in the assurance level of 1. It is possible to combine them in these procedures with the

Thi Mai Anh Nguyen and Thi Tam Le PDF (288 K)
Abstract: This study is conducted to study the implementation of the audit techniques and procedures executed by auditors using risk-based approach. The study also determines factors affecting audit quality of financial statements in Vietnamese insurance enterprises. Quantitative method is used in the study where questionnaires are sent to 250 independent auditors and 186 valid questionnaires are encrypted, declared and entered into SPSS software version 22.0. The results show that in audit techniques, except for document testing and verification technique, there were significant differences in application level of material testing, observation, interview, calculation and analysis techniques between big 4 firms and non-big 4 firms. The analysis also confirms that the most significant difference was between the two audit groups. In audit procedures, while control testing is not performed singly, detailed testing can be performed alone at all three assurance levels and the analysis is performed alone in the assurance level of 1. It is possible to combine them in these procedures with the assurance level of 2 and 3. On the other hand, the combination of these three procedures is only guaranteed at level 3. The results of the factor analysis and regression model test demonstrate that there were six factors influencing the audit quality of financial statements in insurance enterprises; namely audit method, auditors' quality, awareness of auditors and director board, characteristics of insurance enterprises, legal environment and position of the audit firm. In particular, audit method and auditors' quality are the strongest factors.

DOI: 10.5267/j.msl.2018.11.009

Keywords: Audit quality of financial statements, Audit procedures, Audit techniques, Insurance enterprises, Risk - based approaches



© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

[Open Access](#) [Article](#)

12. **A study on exchange rate risk through lagged predictors, market risk and financial sector indicators: Time series analysis from Kuwait** Pages: 325-338
Ahmed Nahar Al Hussaini PDF (288 K)

Abstract: This paper investigates the impact of lagged-exchange rate along with market risk and financial sector indicators on country risk in Kuwait. For this purpose, time series analyses both in aggregated and disaggregated approach are conducted along with the correlation and descriptive outcomes. Overall study sample is divided into fourth groups; namely the whole-time period, 1980 to 1990, 1991 to 2000, 1991-2005 and finally 1995-2005. To achieve this objective, regression equations are developed, indicating the set of lagged predictors along with market and financial sector indicators of exchange rate volatility. For the whole sample of the study, it is found that exchange rate lagged values are significant predictors of country risk from 1980 to 2005. Under the first subsample, lagged 1 and market risk through real interest rate are blamed for creating exchange rate (ER) volatility. For the 2nd disaggregated analysis, the factors like lagged 1 of ER

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

Open Access Article

13. **An inquisitive enquiry of work-life balance of employees: Evidences from Kingdom of Saudi Arabia** Pages: 339-346
Zafriul Allam PDF (288 K)

Abstract: This paper attempts to find out various facets of work-life balance (WLB) contribution and relationships with the employees' working in dairy company in the Kingdom of Saudi Arabia. The study considers 131 employees selected randomly from the Nadeq dairy company. Work-life balance Scale developed and standardized by Pareek et al. (2011) [Pareek, U., Purohit, S., & Joshi, A. (2011). *Training instruments in HRD and OD*. New Del-hi: Tata McGraw- Hills Publishing Company Limited. 287-289] was used to gather the information from the respondents. Both de-scriptive and inferential statistics are been used to analyze the data. The most prominent findings of the result are: (i) all the facets of work-life balance have positive relationships with each other except teamwork; (ii) married are scored high in terms of mean on time management and teamwork which statistically indicates an existence of significant difference in contrast to their counterparts and (iii) social needs a component of work-life balance appears as one of the most powerful predictors of personal needs within the employees' working in the dairy company. The current investigation is an eye-opener for HR professional in the Kingdom to design and implement the certain mechanism to improve the work-life balance of the employees to achieve the Saudi Vision 2030.

DOI: 10.5267/j.msl.2018.11.007
Keywords: Saudi Arabia, WLB, Performance, Personal life

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

Open Access Article

14. **Future earnings growth and dividend payout: Evidence from Malaysia** Pages: 347-356
Kamarun Nisham Taufil Mohd and Khairul Zharif Zaharudin PDF (288 K)

Abstract: This study investigates the effect of dividend payout on firms' future earnings growth (FEG) in Malaysia. We use panel data analysis methodology to determine the effect of dividend payout and other control variables on FEG in 1, 2, 3, 4, and 5 years. Our results

DOI: 10.5267/j.msl.2018.11.007
Keywords: Saudi Arabia, WLB, Performance, Personal life

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

Open Access Article

14. **Future earnings growth and dividend payout: Evidence from Malaysia** Pages: 347-356
Kamarun Nisham Taufil Mohd and Khairul Zharif Zaharudin PDF (288 K)

Abstract: This study investigates the effect of dividend payout on firms' future earnings growth (FEG) in Malaysia. We use panel data analysis methodology to determine the effect of dividend payout and other control variables on FEG in 1, 2, 3, 4, and 5 years. Our results show that firm size and payout ratio had significant positive relationship on four out of five dynamic models tested. The remaining factors except of debt ratio are significant at least four out of the five years used in dynamic models in this study. We find evidence that Malaysian firms show mean reversion pattern in their earnings; smaller firms would enjoy greater future earnings growth; increased monitoring from creditors leads to better earnings performance; firms with better investment prospect have greater future growth in earnings; and higher investment in assets leads to higher future earnings growth. The findings show that in Malaysia, managers use dividend as a tool to signal their positive private information about the firms' future prospect.

DOI: 10.5267/j.msl.2018.11.006
Keywords: Future earnings growth, Dividend payout, Dividend policy, Emerging markets, Panel data analysis

© 2010-2021 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the license. [Creative Commons Attribution \(CC-BY\)](#)

Most Accurate Contact Records
Seamlessly Integrated with Critical Mention's Media Monitoring Platform
Critical Mention OPEN

Management Science Letters

Country **Canada** - SCIMAGO INSTITUTIONS RANKINGS
Subject Area and Category **Business, Management and Accounting**
Business, Management and Accounting (miscellaneous)

13

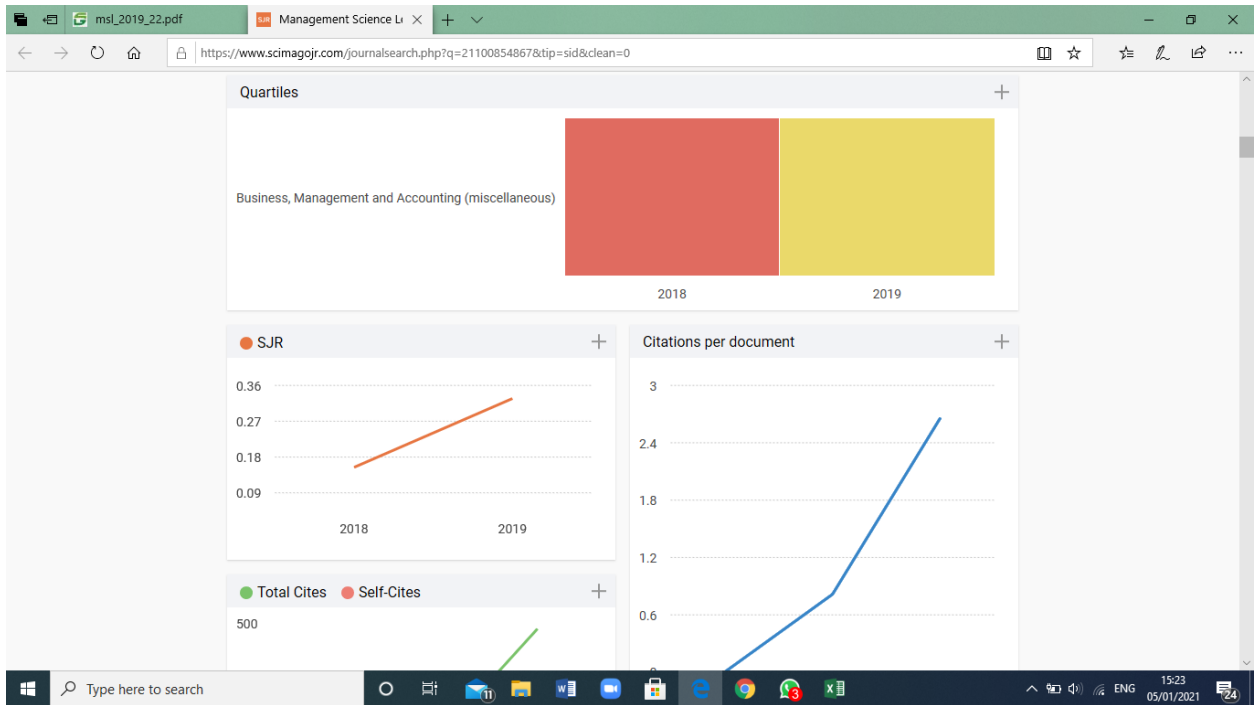
Management Science Letters

Country **Canada** - SCIMAGO INSTITUTIONS RANKINGS
Subject Area and Category **Business, Management and Accounting**
Business, Management and Accounting (miscellaneous)
Publisher **Growing Science**
Publication type **Journals**
ISSN **19239335, 19239343**
Coverage **2017-2020**
Scope **Information not localized**
[Join the conversation about this journal](#)

13

H Index

Easier. Faster. Scalable.



msl_2019_22.pdf Management Science L

https://www.scimagojr.com/journalsearch.php?q=21100854867&tip=sid&clean=0

Management Science Letters

Q2 Business, Management and Accounting... best quartile

SJR 2019 0.33

powered by scimagojr.com

Show this widget in your own website

Just copy the code below and paste within your html code:

```
<a href="https://www.scima
```

Journal of Management Research

A peer-reviewed quarterly outlet for multi-disciplinary research in management science.

Type here to search

15:23 05/01/2021

Productivity and efficiency analysis using DEA: Evidence from financial companies Listed in Bursa Malaysia

Omar Sharif^a, Md Zobaer Hasan^b, Florentina Kurniasari^c, Atang Hermawan^d and Ardi Gunardi^d

^aDaffodil International University, Dhaka, Bangladesh

^bMonash University Malaysia, Bandar Sunway, Malaysia

^cUniversitas Multimedia Nusantara, Tangerang, Indonesia

^dUniversitas Pasundan, Bandung, Indonesia

CHRONICLE

ABSTRACT

Article history:

Received: October 2, 2018

Received in revised format: November 15, 2018

Accepted: November 22, 2018

Available online: November 22, 2018

Keywords:

Bursa Malaysia

DEA

Efficiency

Financial Company

Malmquist productivity index

This study evaluates the technical efficiency, productivity change of financial companies listed in the Malaysian stock exchange (Bursa Malaysia) and examines the effects of productivity change on efficiency over the period 2007–2016. Moreover, this study also concentrates on the ranking of financial companies according to their efficiency scores. Data Envelopment Analysis (DEA) is utilized on a Malmquist Productivity Index in order to calculate the financial companies' efficiency scores. The results of this study show that some firms were fully efficient. The results implied that these companies were in optimal control of their inputs or resources to generate the maximum outputs. Also, the results indicate a tremendous productivity gain was mostly because of a positive shift in frontier technology and positive shift in technical efficiency. This study is significant because it helps to identify the efficient companies from the financial sector in Malaysia based on multiple inputs and outputs by using the DEA model. Common misspecification problems observed that instability of efficiency scores over productivity.

© 2019 by the authors, licensee Growing Science, Canada

1. Introduction

Bursa Malaysia, Malaysian capital market, has been increased very significantly especially after several financial crises (Ong & Ng, 2018). Stable and developing financial market can attract investors (Ali et al., 2018a). It is well established in investors' mind that investing in the stock market will give them satisfactory return, and it will contribute a major improvement for economic development (Ali et al., 2018b; John, 2018). Many techniques have been applied by investors to optimize their return and minimize the risk of their investment (Rossi & Gunardi, 2018; Rashid & Mehmood, 2018; Azizan & So-rooshian, 2014). By using non-parametric or parametric frontier techniques, a great deal of efforts have been devoted on the financial system in attaining the overall economic performance with changes within the regulatory environment. Additionally, the globalization of financial markets to research the efficiency of financial firms has been created by using different techniques (Vardar, 2013). Moreover, the efficiency of the financial company is more important for financial growth. In current years, the

* Corresponding author

E-mail address: omar.sharif.ges@diu.edu.bd (O. Sharif)

academic research on the performance of financial institutions has increasingly focused on frontier efficiency. In case of corporate process progress performance evaluation and benchmarking are extensively practiced methods (Beesky-Nagy & Fazekas, 2014). If there is no standard available for the evaluation then benchmarking can be notably imperative for the evaluation (Orbán, 2013). For performance evaluation, ample change has occurred during the past two decades. Presently, performance evaluation is critical gain factors and the corporate performance evaluation is more difficult as a large number of variables (input and output) are involved in the measurement (Herczeg, 2014). Performance analysis gives opportunities to investors, particularly private equity shareholders to find the extra value for their non-financial performance (Beesky-Nagy & Fazekas, 2014).

There are many methods in the frontier analysis to evaluate performance such as parametric and non-parametric, stochastic method (Fenyves et al., 2015). The present article introduces a non-parametric method, Data Envelopment Analysis (DEA), which is a non-parametric linear programming technique, and extends the idea of estimating efficiency by comparing each decision-making units with an efficient production frontier (Farrell, 1957). Fare et al. (1994) developed a DEA-based Malmquist productivity index (MPI). In non-parametric area, Malmquist index does not require the profit maximization or the cost minimization assumption. If the practitioner uses panel data, MPI allows the decomposition of changes in productivity (Noulas, 1997) into two components technical efficiency change and technological change. This is particularly interesting in cases of financial efficiency studies because the production frontier can shift upward or downward over time due to innovation, market structure, changes in regulatory policies, and shocks and severe financial disruptions. This explains the extensive application of total factor of productivity change in this strand of the literature (Portela & Thanassoulis, 2010; Duygun, et al., 2016; Casu et al., 2016, Fernandes et al., 2018; Soteriou & Zenios, 1999). This paper is structured as follows. The section 2 describes literature review. Section 3 describes methodology of DEA-MPI. The variables and data selection is presented in section 4. Result and discussion are explained in section 5. The final section offers some concluding remarks.

2. Literature review

Malmquist (1953) introduced the Malmquist productivity index that is a quantity index to apply in the analysis ratio of inputs and outputs. After that, Fare et al. (1994) jointed concept on the measurement of efficiency from Farrell (1957) to develop a MPI directly from input and output data by using DEA. The DEA method of measuring the technical efficiency does not allow a direct comparison of DMU's efficiency from one period to another. Therefore, this limitation does not allow the measurement of productivity growth over a period of time. The Malmquist productivity index can be defined as an index number that enables a productivity comparison of the same decision-making unit over two different periods (Zhu, 2003). Therefore, the MPI can be defined as an index number that enables a productivity comparison of the same firm over two different periods. Fare et al. (1994) considered any improvement in technical progress as evidence of innovation. Defining inputs, outputs and orientation is not a big issue in DEA (Cook et al., 2014) as many researchers preach "the input-oriented approach assuming that managers impose control over inputs variable rather than outputs variable" (Khodabakhshi et al., 2010; Tsolas & Charles, 2015). On the other hand, others believe it is more appropriate to answer how output quantities can be proportionally expanded without changing the underlying input quantities used over different time intervals (Fethi & Pasiouras, 2010). Although the literature was conflicting, many studies suggested that the choice of arrangement has less effect on the original finding scores. Accordingly, the orientation of DEA should not be a point of disagreement among the researchers' approaches (Fernandes et al., 2018).

Many researchers found efficiency, productivity, and benchmarking of state banking institutes, commercial banking institutes or both the banking institute. For instance, Canhoto and Dermine (2003), studied the magnitude of efficiency gains of Portuguese banks using DEA –MPI, found productivity improved by 59% in the banks. This improvement was contributed by technological change rather than efficiency change. Stavárek and Řepková (2012) analyzed the Czech commercial banking sector and its efficiency over the period 2001-2010, Wozniowska (2008) examined the efficiency of the Polish

banking sector from 2000 and 2007. Moreover, Fernandes et al. (2018) applied DEA-MPI to find efficiency in peripheral European domestic banks for the year 2007-2014. The majority of the studies, although, relied on both parametric and nonparametric methods to evaluate the bank performance in terms of efficiency but they did not rank the bank.

There are few studies on banking efficiency in Malaysia but they did not discuss productivity change and efficiency together. Siew et al. (2017) studied analyses efficiency of the financial sector of Bursa Malaysia using DEA and found the most efficient company in the financial sector of Bursa Malaysia. Some studies have based on DEA in banking sector: Sufian et al. (2016) found that banks from Asian countries to be relatively more efficient rather than foreign banks, and Davies (2017) postulated that technical efficiency of Malaysian commercial banks' technical efficiency was 71.33% and also found that domestic banks had been inefficient in controlling their costs due to their size. Doaei et al. (2013) found corporate diversification highly effective in financial performance in a study on manufacturing firms listed in Bursa Malaysia.

From the brief review we understand that there had been no study on the relationship between efficiency and productivity. The above background positions this work as an important topic in the respective literature and clarifies its motivation. First, DEA efficiency scores are calculated based on a Malmquist Productivity Index (MPI) on financial company listed in Bursa Malaysia. Then, the decomposition of the productivity changes into technological efficiency changes and technical efficiency changes. The third issue is productivity change over time and relationship between efficiency and productivity. Then the method of this paper ranks the companies according to their efficiency scores.

3. Methodology

DEA- MPI

The DEA method suggested by Charnes et al. (1978) and further developed to non-constant returns (NCR) by Banker et al. (1984) explained how to design the production possibility set without guessing a production function from given a set data of input, output variables. The first stage of this study utilises a DEA approach based on the Malmquist Productivity Index (MPI) to investigate how the productivity of each company changes through time. This is accomplished by following an output-oriented DEA approach described by Färe et al. (1994). If it is not possible to gain output without increasing or decreasing input usage then a firm is deemed to be technically efficient. Specifically, efficiency is measured as the distance between the point the firm lies in the input-output space and the production frontier (technology) that envelops the data. Let $u_n^t \in R^+$ and $v_n^t \in R^+$ the selected input and output variables (for $N \times 1$ input and $M \times 1$ output vectors) and n the total number of firms, then the production P_n^t in time t for the firm n can be expressed as:

$$P_n^t = \{(u_n^t, v_n^t) : v_n^t \text{ is produced by } u_n^t\}.$$

The output-oriented production function under the assumption of CRS (Constant Returns to Scale) can be defined as:

$$D_o^t(u_n^t, v_n^t) = \text{Min}\{\varphi | (u_n^t, v_n^t / \varphi) \in P^t\}, n = 1, 2, \dots, i \tag{1}$$

In Eq. (1), the '0' subscript denotes the output orientation of the model. The distance aims to gain in outputs, given the set of inputs but also making the outputs achievable. Particularly, it defines the technology at time t of firm n relative to the output technical efficiency at time t (Fare et al., 1994). Here, the technical efficiency (TE) is estimated relative to the technology as $D_o^t(u_n^t, v_n^t) \leq 1$. Only when the unit n is on the production frontier (i.e. technically efficient), can the equation be expressed in the form as $D_o^t(u_n^t, v_n^t) = 1$. Alternatively, as $D_o^t(u_n^t, v_n^t) < 1$ means that the unit below the frontier is technically inefficient. To define the MPI, a specification of distance functions with respect to two distinct time periods is needed. The efficiency of firm n relative to the technology at time $t + 1$ is expressed by:

$$D_o^t(u_n^{t+1}, v_n^{t+1}) = \text{Min}\{\varphi | (u_n^{t+1}, v_n^{t+1} / \varphi) \in P^t\}, n = 1, 2, \dots, i \tag{2}$$

In relation to technology at time t , this gap calculates the maximum comparative change in outputs required to make (u_n^{t+1}, v_n^{t+1}) worthwhile. By using DEA linear programming method distance functions are measured. The output oriented DEA (CRS) problem is defined as below:

$$D_o^t(u_n^t, v_n^t)^{-1} = \text{Max} \varphi_n \text{ s.t. } \left\{ \begin{array}{l} -\varphi_n v_n^t + Y_t \lambda \geq 0, u_n^t - X_t \lambda \geq 0, \lambda \geq 0 \end{array} \right\}. \quad (3)$$

Here, X_t and Y_t express the vector of inputs and outputs respectively and λ represents the weight vector, which is compared with any distinct observation in order to find the distance to the efficient frontier. Caves et al. (1982) defined MPI at two consecutive time periods (t, s) as:

$$M^t(u_n^{t+1}, v_n^{t+1}, u_n^t, v_n^t) = D_o^t(u_n^{t+1}, v_n^{t+1}) / D_o^t(u_n^t, v_n^t), \quad (4)$$

$$M^{t+1}(u_n^{t+1}, v_n^{t+1}, u_n^t, v_n^t) = D_o^{t+1}(u_n^{t+1}, v_n^{t+1}) / D_o^{t+1}(u_n^t, v_n^t). \quad (5)$$

To avoid the use of an arbitrary benchmark, the two continuous MPIs are combined into one by estimating its geometric mean, which provides the calculation of the Total Factor Productivity Change (TFPCH):

$$\begin{aligned} M_o(u_n^{t+1}, v_n^{t+1}, u_n^t, v_n^t) &= TFPCH = \left\{ \frac{D_o^{t+1}(u_n^{t+1}, v_n^{t+1})}{D_o^t(u_n^t, v_n^t)} \right\} \times \left\{ \left(\frac{D_o^t(u_n^{t+1}, v_n^{t+1})}{D_o^{t+1}(u_n^{t+1}, v_n^{t+1})} \times \frac{D_o^t(u_n^t, v_n^t)}{D_o^{t+1}(u_n^t, v_n^t)} \right)^{\frac{1}{2}} \right\} \\ &= \{EFFCH\} \times \{TECHCH\}. \end{aligned} \quad (6)$$

When TFPCH < 1 or > 1 , it is implied that there is a decrease or increase in productivity, while TFPCH = 1 refers to cases where productivity is unchanged. From Eq. (6), it is also shown that TFPCH is decomposed into the Efficiency Change (EFFCH) and Technology Change (TECHCH) sub-indices as explained by Färe et al. (1994). The EFFCH ratio measures the change in technical efficiency of a DMU relative to the best practice frontier. This shows whether unit n moves away from the production frontier or comes towards the production frontier between the period t and $t + 1$.

A firm is assumed to be technically efficient if it is impossible to increase output without altering input usage. Specifically, efficiency is measured as the distance between the point the firm lies in the input–output space and the production frontier (technology) that envelops the data. The Technological Change (TECHCH) component is due to the variation of the production frontier between two periods and hence, exerts improvement or deterioration of the unit's technology between the period t and $t + 1$. The EFFCH is further decomposed into improvements in management practices or movements toward an optimal size. As suggested by Färe et al. (1994), the first refers to a measure of Pure Technical Efficiency Change (PECH), while the latter to a measure of Scale Efficiency Change (SECH):

$$\begin{aligned} PECH^{t,t+1} &= \frac{D_{o,v}^{t+1}(u_n^{t+1}, v_n^{t+1})}{D_{o,v}^t(u_n^t, v_n^t)}, \\ SECH^{t,t+1} &= \frac{D_{o,c}^{t+1}(u_n^{t+1}, v_n^{t+1})}{D_{o,c}^t(u_n^t, v_n^t)} \times \frac{D_{o,v}^t(u_n^t, v_n^t)}{D_{o,v}^{t+1}(u_n^{t+1}, v_n^{t+1})}, \end{aligned} \quad (7)$$

$$EFFCH = PECH \times SECH.$$

Here, Variable Returns to Scale (VRS) technology is used to calculate PECH, while the components of SECH are measured as the deviations between the CRS and VRS technologies. Therefore, the above subscripts “o,c” and “o,v” represents CRS and VRS technologies applied respectively for this ‘enhanced decomposition’ (Casu et al., 2004; Berg et al., 1991).

3.1 Data and Variables

The data for this study is obtained from Bloomberg terminal. After excluding some companies because of lack of data, the data cover 26 financial companies of Bursa Malaysia during the period 2007-2016. Data were converted to US dollar. To construct dataset, this study uses market data for different input,

output variables. Table 1 and Table 2 below present listed companies name and the input, output variables, respectively. For some missing data, this study have used maximum likelihood estimation method by SPSS. When determining input and output variables of financial institutes, one should first select by the nature of financial approaches. There are three approaches frequently applied in financial institutes theory of literature such as intermediation, value added and production approaches (Sealey & Lindly, 1977). In this study, the production approach will be described because financial institutes are served as producers of services for the investor. The choice of inputs and outputs are guided by the choice made in previous studies. In this study, five outputs and three inputs are chosen. The selection of input and output variables are based on Ismail et al. (2012) and others major studies on the efficiency of financial sectors. The five input variables are market capital, total volume, dividend per share, financial leverage, price to book ratio. The three output variables are return on equity, return on assets and P/E ratio. The software package DEAP Version 2.1 is used to measure DEA estimations (Coelli, 1996, Coelli et al., 2005).

Table 1**Company Short Name**

| Company Name (DMUs) | Short term of companies |
|------------------------------|-------------------------|
| MALAYAN BANKING BHD | MAY |
| PUBLIC BANK BERHAD | PBK |
| CIMB GROUP HOLDINGS BHD | CIMB |
| HONG LEONG BANK BERHAD | HLBK |
| RHB BANK BHD | RHBBANK |
| HONG LEONG FINANCIAL GROUP | HLFG |
| AMMB HOLDINGS BHD | AMM |
| BIMB HOLDINGS BHD | BIMB |
| AFFIN HOLDINGS BERHAD | AHB |
| LPI CAPITAL BERHAD | LPI |
| SYARIKAT TAKAFUL MALAYSIA | STMB |
| ALLIANZ MALAYSIA BHD | ALLZ |
| MNRB HOLDINGS BHD | MNRB |
| MANULIFE HOLDINGS BHD | MHBS |
| PACIFIC & ORIENT BERHAD | PO |
| MALAYSIA BUILDING SOCIETY | MBS |
| BURSA MALAYSIA BHD | BURSA |
| AEON CREDIT SERVICE M BHD | ACSM |
| INSAS BHD | INS |
| RCE CAPITAL BHD | RCE |
| APEX EQUITY HOLDINGS BERHAD | APX |
| JOHAN HOLDINGS BHD | JOH |
| ECM LIBRA FINANCIAL GROUP BH | ECML |
| HONG LEONG CAPITAL BHD | HLG |
| TA ENTERPRISE BERHAD | TAE |
| MAA GROUP BHD | MAA |

Table 2**Descriptive Statistics and Variable Short Name**

| Name of Variables | Kind of variable | Minimum | Maximum | Mean | Std. Deviation |
|-------------------------------|------------------|----------|------------|-------------|----------------|
| Total Volume (TV) | Input | 770400.0 | 3761712400 | 459870978.7 | 726230640.93 |
| Dividends per share (DPS) | Input | 0.00 | 1.34 | .0481 | 0.09293 |
| Market capitalization(MC) | Input | 18.09 | 26844.15 | 2868.5974 | 5378.04424 |
| Price to Book Ratio(PB) | Input | 0.18 | 9.60 | 1.4813 | 1.23367 |
| Financial Leverage(FL) | Input | 1.01 | 32.19 | 8.4594 | 6.39369 |
| Return on Assets(ROA) | Output | -5.24 | 26.13 | 2.6349 | 3.31450 |
| Return on common Equity (ROE) | Output | -27.74 | 54.75 | 12.9440 | 10.27505 |
| Price earnings ratio(PE) | Output | 2.60 | 278.83 | 14.1755 | 19.37493 |

4. Result and Discussion

Before discussing the DEA results, the rule of thumb (DMUs should be three times of total inputs and output variables) was applied for the selection of sample variables (inputs and outputs) that is suggested by Cooper et al. (2002). Since in this study, the total number of financial companies is twenty six that is more than the number of input and output variables (e.g. $(3 \times 5 \text{ inputs} + 3 \times 3 \text{ outputs}) = 23$), so the

number of variables selection is justified since it satisfies the rule of thumb and allows the efficiencies of companies to be measured.

4.1 Technical efficiency and technical efficiency change

This study used the Malmquist index of Productivity (MIP) to measure the productivity change of financial company listed in Bursa Malaysia for the period 2007-2016. Table 3 and Table 4 present the technical efficiency and technical efficiency change for the 26 DMUs for each year. From the dataset of Table 3 it is obvious that the average technical efficiency was 0.935 which means companies were less than 7% inefficient to use their existing resources. On the other hand, Siew et al. (2017) found average efficiency score 0.5865 for the financial company of Malaysia. It is also seen that APX, JOH, ECML, MAA, BURSA, ACSM and LPI were fully efficient for all the time period. The results were approximately similar for most of the companies since Siew et al. (2017) also found similar results during the time period 2010-2015 where LPI, BURSA, ACSM, APX were reported to be fully efficient. The results also depict that AMM was the least efficient company as its efficiency was 79.45%. Moreover, the efficiency scores of STMB, ALLZ, MNRB, and MHBS were approximately the same as it was around 0.98.

The study would like to point out that TE change >1 only shows progress in technical efficiency (TE) changes. Average technical efficiency change shows that most of the companies made an increase in efficiency over the study period. From the average technical efficiency change it was seen that the highest technical efficiency change decreased for BIMB and increased for CIMB from 2007 to 2016. From the Table 4, it is seen that, all the financial companies' listed in Bursa Malaysia yearly technical efficiency declined 3 % from 2007 to 2008. Only the technical efficiency improved about 2.7% from 2008 to 2009. The average efficiency declined and improved vice versa from 2009 to 2013 for all the companies then continuously improved its efficiency from 2014 to 2015. After that efficiency was declined by 9.8% from 2015 to 2016. Overall, the average technical efficiency change was recorded 2.2 % decline in the financial companies. Fernandes et al. (2018) found technical efficiency increased more than 1% in peripheral European domestic banks.

Table 3
Technical Efficiency

| Company Short Name | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average |
|--------------------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| MAY | 0.854 | 1 | 0.833 | 0.826 | 0.65 | 0.832 | 0.763 | 0.865 | 0.892 | 0.658 | 0.8173 |
| PBK | 0.949 | 0.995 | 1 | 0.973 | 0.83 | 0.912 | 0.816 | 0.879 | 0.908 | 0.758 | 0.902 |
| CIMB | 0.919 | 0.809 | 1 | 0.87 | 0.7 | 0.867 | 0.77 | 0.894 | 0.900 | 0.616 | 0.8345 |
| HLBK | 0.86 | 0.869 | 0.861 | 0.851 | 0.793 | 0.852 | 0.863 | 0.91 | 0.878 | 0.673 | 0.841 |
| RHBBANK | 0.836 | 0.833 | 0.836 | 0.826 | 0.697 | 0.801 | 0.776 | 0.903 | 1 | 0.613 | 0.8121 |
| HLFG | 0.866 | 0.894 | 0.866 | 1 | 0.791 | 0.891 | 0.949 | 0.932 | 0.92 | 0.620 | 0.8729 |
| AMM | 0.824 | 0.793 | 0.865 | 0.823 | 0.676 | 0.821 | 0.781 | 0.863 | 0.911 | 0.588 | 0.7945 |
| BIMB | 1 | 0.915 | 0.924 | 0.918 | 0.958 | 0.842 | 0.778 | 0.905 | 0.996 | 0.694 | 0.893 |
| AHB | 0.814 | 0.816 | 0.86 | 0.773 | 0.716 | 0.816 | 0.875 | 0.938 | 1 | 0.661 | 0.8269 |
| LPI | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| STMB | 1 | 0.858 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.957 | 0.9815 |
| ALLZ | 1 | 1 | 1 | 1 | 1 | 0.89 | 1 | 1 | 1 | 0.983 | 0.9873 |
| MNRB | 1 | 1 | 1 | 1 | 0.952 | 0.864 | 1 | 1 | 1 | 1 | 0.9816 |
| MHBS | 1 | 0.981 | 0.871 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.9852 |
| PO | 1 | 1 | 1 | 1 | 1 | 0.978 | 1 | 1 | 1 | 0.695 | 0.9673 |
| MBS | 0.978 | 0.969 | 0.876 | 1 | 1 | 1 | 1 | 1 | 0.998 | 0.802 | 0.9623 |
| BURSA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ACSM | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| INS | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.989 | 1 | 1 | 0.9989 |
| RCE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.994 | 0.578 | 0.9572 |
| APX | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| JOH | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ECML | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HLG | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.952 | 0.9952 |
| TAE | 0.966 | 1 | 1 | 0.803 | 1 | 0.833 | 0.822 | 0.974 | 1 | 0.575 | 0.8973 |
| MAA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Average | 0.9563 | 0.95121 | 0.9535 | 0.9485 | 0.9139 | 0.9307 | 0.9305 | 0.9635 | 0.9768 | 0.8239 | 0.9349 |

Table 4
Technical Efficiency Change

| DMU | 2008/2007 | 2009/2008 | 2010/2009 | 2011/2010 | 2012/2011 | 2013/2012 | 2014/2013 | 2015/2015 | 2016/2015 | 2016/2007 |
|---------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| MAY | 2.281 | 0.517 | 0.778 | 0.869 | 0.901 | 1.393 | 1.129 | 1.144 | 0.785 | 1.002 |
| PBK | 0.702 | 1.366 | 1.026 | 1.137 | 0.762 | 1.150 | 1.061 | 1.318 | 0.692 | 0.994 |
| CIMB | 0.742 | 1.532 | 0.626 | 1.095 | 0.818 | 1.428 | 1.472 | 1.145 | 0.764 | 1.018 |
| HLBK | 0.780 | 1.129 | 1.139 | 0.889 | 0.826 | 1.465 | 0.980 | 1.245 | 0.757 | 1.000 |
| RHBBANK | 0.947 | 1.090 | 0.836 | 1.084 | 0.858 | 1.545 | 0.947 | 1.325 | 0.639 | 0.999 |
| HLFG | 1.026 | 0.768 | 1.413 | 0.668 | 1.064 | 1.434 | 0.897 | 1.188 | 0.766 | 0.991 |
| AMM | 0.846 | 1.304 | 0.630 | 1.116 | 0.738 | 1.571 | 1.025 | 1.523 | 0.689 | 0.996 |
| BIMB | 0.705 | 0.835 | 0.978 | 0.935 | 0.583 | 1.097 | 0.886 | 1.514 | 0.612 | 0.869 |
| AHB | 0.938 | 1.141 | 0.913 | 0.988 | 0.903 | 1.283 | 0.949 | 1.725 | 0.619 | 1.014 |
| LPI | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.824 | 1.213 | 1.000 | 1.000 |
| STMB | 0.626 | 1.598 | 1.000 | 1.000 | 0.335 | 1.025 | 0.023 | 1.168 | 0.889 | 0.894 |
| ALLZ | 1.000 | 1.000 | 1.000 | 1.000 | 0.864 | 1.157 | 1.000 | 1.000 | 0.981 | 0.998 |
| MNRB | 1.000 | 1.000 | 1.000 | 0.936 | 0.875 | 1.221 | 0.687 | 1.455 | 1.000 | 1.000 |
| MHBS | 0.795 | 0.815 | 1.257 | 1.258 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.003 |
| PO | 1.000 | 1.000 | 1.000 | 1.000 | 0.785 | 1.058 | 1.205 | 1.000 | 0.662 | 0.955 |
| MBS | 0.729 | 1.342 | 0.729 | 1.096 | 0.642 | 1.688 | 0.856 | 1.548 | 0.866 | 0.997 |
| BURSA | 1.000 | 1.000 | 1.000 | 0.986 | 0.897 | 0.831 | 1.361 | 0.812 | 0.721 | 0.942 |
| ACSM | 0.928 | 0.525 | 1.201 | 0.895 | 1.805 | 0.383 | 1.573 | 1.245 | 0.843 | 0.944 |
| INS | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.839 | 1.192 | 1.000 | 1.000 |
| RCE | 1.132 | 0.755 | 1.258 | 1.186 | 1.000 | 1.000 | 1.000 | 0.959 | 0.522 | 0.951 |
| APX | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| JOH | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| ECML | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| HLG | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.406 | 2.463 | 1.000 | 0.525 | 0.931 |
| TAE | 1.048 | 1.000 | 0.616 | 1.386 | 0.714 | 0.991 | 1.076 | 1.537 | 0.538 | 0.938 |
| MAA | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Average | 0.970 | 1.028 | 0.977 | 1.020 | 0.899 | 1.120 | 1.048 | 1.202 | 0.803 | 0.978 |

4.2 Malmquist Index Decomposition

The DEA-MPI estimates are summarized in the Table 5. The TFPCH was decomposed into its components EFFCH, TECHCH, PECH and SECH (Fare et al., 1994). This decomposition is valuable for empirical setting, since it provides insight on the sources of overall productivity change in the financial firm. Overall, 3.13% productivity was gained by financial companies listed in Bursa Malaysia for the period 2007-2016. Among the financial companies, the highest productivity was gained by the MHBS (24.8%) and the lowest productivity was declined by PO (17%). INS showed passive mode in productivity. From the decomposition of the MPI, the average TFPCH (3.13%) was driven by +5.38% in technological efficiency and -2.7% in technical efficiency. This means the growth was driven mostly from the technological component rather than the technical efficiency. Fernandes et al. (2018) and Casu et al. (2004) found the same conclusion when they analyzed efficiency in peripheral European domestic banks and European banking respectively. More generally, the TFPCH of MHBS was driven by +24.5% in technological efficiency and +0.3% in technical efficiency. In the same way, the TFPCH of PO was declined by -13.1% in technological efficiency and -4.5% in technical efficiency. Now, the decomposition into PECH and SECH shows similar trends, that financial firms were decreasing their technical efficiency through the pure technical efficiency changes rather than scale ones. For example, average 2.17% declined in EFFCH is driven by the 0.3% decrease in SECH (as PECH is decreasing by 0.2%). A large amount of improvement in technological or efficiency change can improve the total productivity. Thus, a tremendous productivity gain is mostly because of a positive shift in frontier technology and positive shift in technical efficiency. The line graph in Fig. 1 depicts the TECHCH, EFFCH and TFPCH evaluation for year between 2007 and 2016. In 2008, TECHCH and TFPCH were high but TFPCH was low. Again in 2009 the scenery was opposite of 2008. Similar results are also seen over the study period except 2015. From the line graph it can be inferred a tremendous productivity gain was mostly because of a positive shift in frontier technology and positive shift in technical efficiency.

Table 5
Malmquist Index Decomposition

| DMU | EFFCH | TECHCH | PECH | SECH | TFPCH |
|---------|--------|--------|--------|-------|--------|
| MAY | 1.002 | 1.001 | 0.972 | 1.031 | 1.002 |
| PBK | 0.994 | 1.035 | 0.975 | 1.019 | 1.029 |
| CIMB | 1.018 | 1.143 | 0.956 | 1.064 | 1.163 |
| HLBK | 1 | 1.055 | 0.973 | 1.027 | 1.054 |
| RHBBANK | 0.999 | 1.045 | 0.966 | 1.034 | 1.044 |
| HLFG | 0.991 | 1.057 | 0.964 | 1.029 | 1.048 |
| AMM | 0.996 | 1.113 | 0.963 | 1.034 | 1.109 |
| BIMB | 0.869 | 1.082 | 0.96 | 0.905 | 0.94 |
| AHB | 1.014 | 1.048 | 0.977 | 1.038 | 1.062 |
| LPI | 1 | 1.036 | 1 | 1 | 1.036 |
| STMB | 0.894 | 1.071 | 0.995 | 0.898 | 0.958 |
| ALLZ | 0.998 | 0.956 | 0.998 | 1 | 0.954 |
| MNRB | 1 | 1.064 | 1 | 1 | 1.064 |
| MHBS | 1.003 | 1.245 | 1 | 1.003 | 1.248 |
| PO | 0.955 | 0.869 | 0.96 | 0.995 | 0.83 |
| MBS | 0.997 | 1.029 | 0.978 | 1.019 | 1.026 |
| BURSA | 0.942 | 1.024 | 1 | 0.942 | 0.965 |
| ACSM | 0.944 | 1.026 | 1 | 0.944 | 0.969 |
| INS | 1 | 1 | 1 | 1 | 1 |
| RCE | 0.951 | 0.968 | 0.941 | 1.011 | 0.921 |
| APX | 1 | 1.133 | 1 | 1 | 1.133 |
| JOH | 1 | 1.086 | 1 | 1 | 1.086 |
| ECML | 1 | 0.968 | 1 | 1 | 0.968 |
| HLG | 0.931 | 1.089 | 0.994 | 0.936 | 1.014 |
| TAE | 0.938 | 1.052 | 0.944 | 0.994 | 0.987 |
| MAA | 1 | 1.204 | 1 | 1 | 1.204 |
| Average | 0.9783 | 1.0538 | 0.9814 | 0.997 | 1.0313 |

Notes: The table depicts the MPI decomposition ($EFFCH = SECH * PECH$ and $TFPCH = EFFCH * TECHCH$). The values < 1 depicts decline in efficiency, while values > 1 describes efficiency growth.

This study found that the average technical efficiency change was declined 2.17%, pure technical efficiency change was declined 1.86% and scale efficiency change was declined 0.3% but productivity was increased 3.13% due to increase of technological change 5.38%. These scores are in the range of what others have found (Ismail, 2005; Levine, 1998). The results indicate that the main source of inefficiency in financial sector of Bursa Malaysia was caused by technical inefficiency (failure to find the combination of inputs to produce optimal level of outputs). Based on pure technical efficiency change, the performance of the financial companies of Bursa Malaysia was relatively stable, with the score always remained close to 100% over the study period.

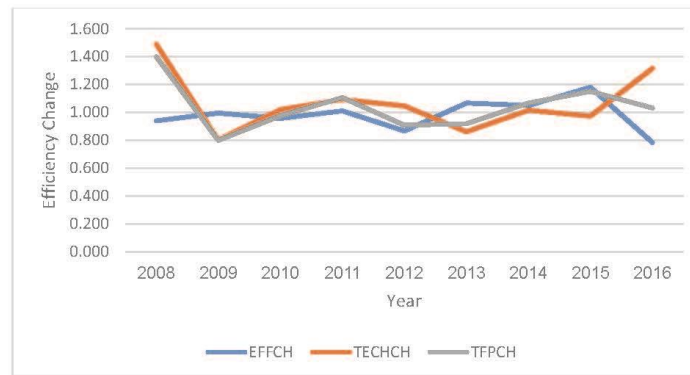


Fig. 1. Malmquist Index Summary of Annual Means

4.3 Efficiency scores stability over time and financial company type

Another very important, regulatory perspective, measure relates to the efficiency scores stability over time is shown in Fig. 2. The highest number of fully efficient (Score 1) company was 17 in the years 2009, 2010, 2015 and the least number of the fully efficient company was one in the year 2016. Doaei et al. (2013) found this kind of efficiency fluctuation in manufacturing firm of Bursa Malaysia. Even recognizing that some companies may go up or go down in their overall performance; except for fully efficient firm, it is unlikely that a very efficient firm in one year would become very inefficient in the following year. More generally it can be seen from Table 3 that TAE and RHBBANK were fully efficient in 2015 than in 2016 their efficiency decrease dramatically to 0.575 and 0.613, respectively. By Bauer et al. (1998) it was reported that there was more likely an efficient firm would maintain its efficiency in next year. However, this picture was different under the efficiency approach by DEA-MPI.

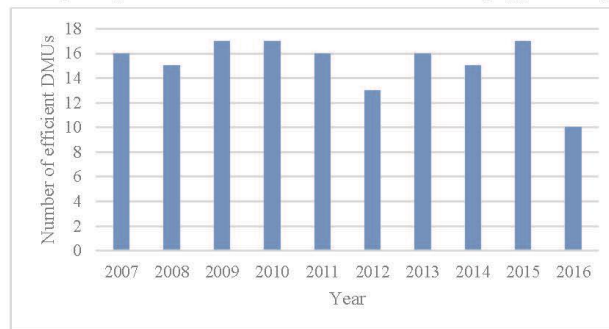


Fig. 2. Total Number of Efficient DMUs

4.4 Efficiency, productivity change and ranking

Fig. 3 shows the mean efficiency verses mean productivity. From the Fig. 3, it is seen that most of the companies' productivity were high, but their efficiency scores were low. Among the companies, productivity was highest in MHBS, CIMB, MAA. Almost all the companies' productivity greater than efficiency except PO, RCE, ALLZ. This kind of scenery also found by Fernandes et al. (2018) and Doaei et al. (2013) when they examined efficiency in peripheral European domestic banks and manufacturing firm of Bursa Malaysia respectively. Ranks, derived from DEA of the financial company listed in Bursa Malaysia, are shown in Table 6. Fully efficient company were LPI, BURSA, ACSM, APX, JOH, ECM, and MAA. The least efficient company was AMM but its productivity was relatively high.

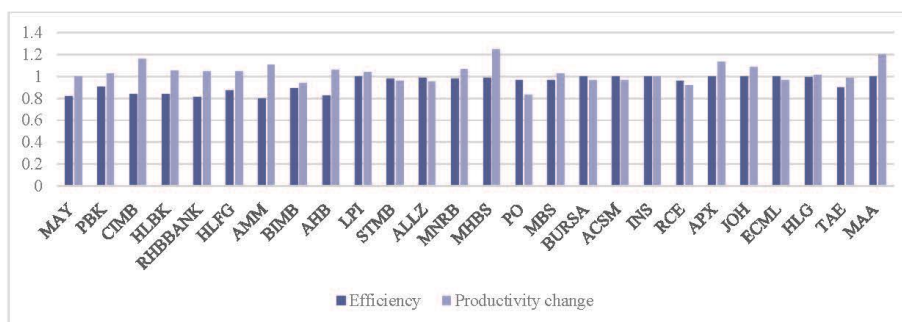


Fig. 3. Efficiency and Productivity Change

Table 6
Ranking of the Financial Company Listed in Bursa Malaysia

| Rank* (DEA) | Company Short name |
|-------------|--------------------|
| 1 | LPI |
| | BURSA |
| | ACSM |
| | APX |
| | JOH |
| | ECML |
| | MAA |
| 2 | INS |
| 3 | HLG |
| 4 | ALLZ |
| 5 | MHBS |
| 6 | MNRB |
| 7 | STMB |
| 8 | PO |
| 9 | MBS |
| 10 | RCE |
| 11 | PBK |
| 12 | TAE |
| 13 | BIMB |
| 14 | HLFG |
| 15 | HLBK |
| 16 | CIMB |
| 17 | AHB |
| 18 | MAY |
| 19 | RHBBANK |
| 20 | AMM |

*Rank by result derived from DEA.

5. Conclusion

Bursa Malaysia has increased very significantly. The investors should have adequate knowledge strategy in case of stocks investment to boost their investments to at maximum level. One of the ways is to use profit optimization. The present study has provided the first attempt to identify whether or not there is a relationship between productivity and efficiency in financial companies. In the first stage of the analysis, this study used DEA-MPI to obtain efficiency and productivity of 26 listed financial companies over the period 2007-2016. The results depicted that the number of the fully efficient company was seven. Additionally, the results have indicated a tremendous productivity gain was mostly because of a positive shift in frontier technology and positive shift in technical efficiency. Based on pure technical efficiency change, the performance of the financial companies of Bursa Malaysia was relatively stable, with the score always remained close to 100% over the study period. These kinds of analysis could provide important and useful information for management decision making and regulatory investigations. Ultimately, this study observed no evidence to support our measurement most significant as the selection of variable may change the ranking.

References

- Ali, M. M., Bakar, R. A., & Ghani, E. K. (2018a). The effect of firm internal and external characteristics on risk reporting practices among Malaysian listed firms. *Indonesian Journal of Sustainability Accounting and Management*, 2(2), 121–135.
- Ali, M., Sun, G., & Chowdhury, M. A. A. (2018b). Dynamic interaction between macroeconomic fundamentals and stock prices in Bangladesh. *Indonesian Journal of Management and Business Economics*, 1(1), 66–84.

- Azizan, N. A., & Sorooshian, S. (2014). Stock market performance and modern portfolio theory: Case on Malaysian stock market and Asian indices. *WSEAS Transactions on Business and Economics*, 11(303), 2224-2899.
- Banker, R.D., Charnes, A., & Cooper, W.W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30(9), 1078-1092.
- Bauer, P. W., Berger, A. N., Ferrier, G. D., & Humphrey, D. B. (1998). Consistency conditions for regulatory analysis of financial institutions: A comparison of frontier efficiency methods. *Journal of Economics and Business*, 50(2), 85-114.
- Becky-Nagy, P., Fazekas, B. (2014). Returns of private equity: comparative analyses of the returns of venture capital and buyout funds in Europe and in the US Annals of the University of Oradea. *Economic Science*, 2(2), 820-827.
- Berg, S. A., Forsund, F. R., & Jansen, E. S. (1991). Technical efficiency of Norwegian banks: The non-parametric approach to efficiency measurement. *Journal of Productivity Analysis*, 2(2), 127-142.
- Canhoto, A. and Dermine J. (2003). A note on banking efficiency in Portugal, New vs. Old banks. *Journal of Banking and Finance*, 27, 2087-2098.
- Casu, B., Ferrari, A., Girardone, C., & Wilson, J. O. (2016). Integration, productivity and technological spillovers: Evidence for Eurozone banking industries. *European Journal of Operational Research*, 255(3), 971-983.
- Casu, B., Girardone, C., & Molyneux, P. (2004). Productivity change in European banking: A comparison of parametric and non-parametric approaches. *Journal of Banking & Finance*, 28(10), 2521-2540.
- Caves, D. W., Christensen, L. R., & Diewert, W. E. (1982). The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica: Journal of the Econometric Society*, 50(6), 1393-1414.
- Charnes, A., Cooper, W. W., Rousseau, J., & Semple, J. (1987). Data Envelopment Analysis and Axiomatic Notions of Efficiency and Reference Sets. Research Report CCS 558. Centre for Cybernetic Studies. The University of Texas. Austin.
- Coelli, T.J. (1996). A Guide to DEAP Version 2.1 A Data Envelopment Analysis (Computer) Program. CEPA Working Paper 96/08. University of New England. Armidale.
- Coelli, T. J., Prasada Rao, D. S., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis* (2nd Ed.). Springer.
- Cook, W. D., Tone, K., & Zhu, J. (2014). Data envelopment analysis: Prior to choosing a model. *Omega*, 44, 1-4.
- Cooper, W. W., Seiford, L. M., & Tone, K. (2002). *Data envelopment analysis, a comprehensive text with models, applications, references and DEA-solver software*. Boston: Kluwer Academic Publishers.
- Doaei, M., & Shavazipour, B. (2013). Corporate diversification and efficiency of manufacturing firms listed in Bursa Malaysia. *International Journal of Business and Development Studies*, 8(1), 77-96.
- Duygun, M., Sena, V., & Shaban, M. (2016). Trademarking activities and total factor productivity: Some evidence for British commercial banks using a metafrontier approach. *Journal of Banking & Finance*, 72, S70-S80.
- Färe, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialized countries. *The American Economic Review*, 84(1), 66-83.
- Fenyves, V., Tarnóczy, T., & Zsidó, K. (2015). Financial performance evaluation of agricultural enterprises with DEA method. *Procedia Economics and Finance*, 32(15), 423-431.
- Fernandes, F. D. S., Stasinakis, C., & Bardarova, V. (2018). Two-stage DEA-Truncated Regression: Application in banking efficiency and financial development. *Expert Systems with Applications*, 96, 284-301.
- Fethi, M. D., & Pasiouras, F. (2010). Assessing bank efficiency and performance with operational research and artificial intelligence techniques: A survey. *European Journal of Operational Research*, 204(2), 189-198.

- Herczeg, A. (2014). *Financing Aspects of the Hungarian general manufacturers in 2010-2012: The Annals of the University of Oradea* (pp.905-91). Economic Sciences, Tom XXIII -2014 .
- Ismail, M. K. A., Rahman, N. M. N. A., Salamudin, N., & Kamaruddin, B. H. (2012, May). DEA portfolio selection in Malaysian stock market. In *Innovation Management and Technology Research (ICIMTR), 2012 International Conference on* (pp. 739-743). IEEE.
- Ismail, M., (2005). *A study of efficiency and competitive Behaviour of commercial Banks in Malaysia* (Doctoral thesis). Retrieved from UMI Dissertation Publishing, UMI Number U584012.
- John, E. I. (2018). Macroeconomic determinants of stock market performance in Nigeria: An econometric approach. *Indonesian Journal of Applied Business and Economic Research*, 1(1), 47–58.
- Khodabakhshi, M., Asgharian, M., & Gregoriou, G. N. (2010). An input-oriented super-efficiency measure in stochastic data envelopment analysis: Evaluating chief executive officers of US public banks and thrifts. *Expert Systems with Applications*, 37(3), 2092–2097.
- Levine, R. (1998). The legal environment, banks, and long run economic growth. *Journal of Money, Credit and Banking*, 30(3), 596–613.
- Malmquist, S. (1953). Index numbers and indifferent surfaces. *Trabajos de Estadica*, 4, 209-242.
- Noulas, A. G. (1997). Productivity growth in the Hellenic banking industry: State versus private banks. *Applied Financial Economics*, 7(3), 223–228.
- Ong, T. S., & Ng, P. S. (2018). The effects of share repurchase announcements on returns in the Malaysia stock market. *Indonesian Journal of Business Finance and Accounting*, 1(1), 1–19.
- Orbán, Mrs., & Tamás Dékán, I. (2013): Reporting companies' performance. *International Financial Reporting Standards (IFRS)*, 7(5), 107-112.
- Portela, M. C., & Thanassoulis, E. (2010). Malmquist-type indices in the presence of negative data: An application to bank branches. *Journal of Banking & Finance*, 34(7), 1472–1483.
- Rashid, A., & Mehmood, A. (2018). Downside risk analysis of returns of financial institutions in Pakistan. *Indonesian Journal of Management and Business Economics*, 1(1), 1–18.
- Rossi, M., & Gunardi, A. (2018). Efficient market hypothesis and stock market anomalies: Empirical evidence in four European countries. *Journal of Applied Business Research*, 34(1), 183–192.
- Sealey, C.W.J., & Lindley, J.T. (1977). Inputs, outputs, and a theory of production and cost at semi-parametric methodology. *Managerial Finance*, 35(3), 260–275.
- Siew, L. W., Fai, L. K., & Hoe, L. W. (2017). An empirical investigation on the efficiency of financial companies in Malaysia with data envelopment analysis model. *American Journal of Information Science and Computer Engineering*, 3(3), 32-38.
- Soteriou, A. C., & Zenios, S. A. (1999). Using data envelopment analysis for costing bank products. *European Journal of Operational Research*, 114(2), 234–248.
- Stavárek, D., & Řepková, I. (2013). Efficiency in the Czech banking industry: A non-parametric approach. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 60(2), 357-366.
- Sufian, F., Kamarudin, F., & Nassir, A. M. (2016). Determinants of efficiency in the Malaysian banking sector: Does bank origins matter? *Intellectual Economics*, 10(1), 38–54.
- Tsolas, I. E., & Charles, V. (2015). Incorporating risk into bank efficiency: A satisficing DEA approach to assess the Greek banking crisis. *Expert Systems with Applications*, 42(7), 3491–3500.
- Vardar, G. (2013). Efficiency and Stock Performance of Banks in Transition Countries: Is There A Relationship? *International Journal of Economics and Financial Issues*, 3(2), 355–369.
- Wozniowska, G. (2008). Methods of measuring the efficiency of commercial banks: an example of Polish banks, *Ekonomika*, 84, 81–91.
- Zhu, J. (2003). *Quantitative models for performance evaluation and benchmarking: Data envelopment analysis with spreadsheets*. Kluwer Academic Publishers, Boston.

