THE DETERMINANTS OF BANK EFFICIENCY IN MALAYSIAN BANKING INDUSTRY

AINIE BINTI AZALLI

MASTER OF SCIENCE (FINANCE)
UNIVERSITI UTARA MALAYSIA
JUNE 2017

THE DETERMINANTS OF BANK EFFICIENCY IN MALAYSIAN BANKING INDUSTRY

By
AINIE BINTI AZALLI

Thesis Submitted to
School of Economics, Finance and Banking,
Universiti Utara Malaysia,
in Partial Fulfillment of the Requirement for the Master of Science (Finance)

Pusat Pengajian Ekonomi, Kewangan dan Perbankan

Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PENYELIDIKAN
(Certification of Research Paper)

Saya, mengaku bertandatangan, memperakukan bahawa
(I, the undersigned, certified that)
AINIE BINTI AZALLI (812938)

Calon untuk Ijazah Sarjana
(Candidate for the degree of)
MASTER OF SCIENCE (FINANCE)

Telah mengemukakan kertas penyelidikan yang bertajuk
(has presented his/her research paper of the following title)

THE DETERMINANTS OF BANK EFFICIENCY IN MALAYSIAN BANKING INDUSTRY

Seperti yang tercatat di muka surat tajuk dan kulit kertas penyelidikan
(as it appears on the title page and front cover of the research paper)

Bahawa kertas penyelidikan tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.
(that the research paper acceptable in the form and content and that a satisfactory knowledge of the field is covered by the dissertation).

Nama Penyelia : **Dr. Sharmilawati Sabki**
(Name of Supervisor)

Tandatangan : _____
(Signature)

Tarikh : **20 Jun 2017**

PERMISSION TO USE

In presenting this dissertation/project paper in partial fulfillment of the requirements for a Post Graduate degree from the Universiti Utara Malaysia (UUM), I agree that the Library of this university may make it freely available for inspection. I further agree that permission for copying this dissertation/project paper in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor(s) or in their absence, by the Dean of School of Economics, Finance and Banking where I did my dissertation/project paper. It is understood that any copying or publication or use of this dissertation/project paper parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the UUM in any scholarly use which may be made of any material in my dissertation/project paper.

Request for permission to copy or to make other use of materials in this dissertation/project paper in whole or in part should be addressed to:

Dean of School of Economics, Finance and Banking
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

It is noted that the study of bank efficiency and its determinants has become a focal point in the banking literature. Unexpected situation in the economy system such as the financial crisis is found to give a negative impact to the bank efficiency performance. In addition, the presence of foreign banks in the local banking system also affects the bank efficiency. For Islamic banks, the prohibited elements such as riba, gharar and maisir are the key for the increments of Islamic banks efficiency performance as compared to conventional banks. Hence, this study is aims to examine the impact of determinants of bank efficiency components; namely financial crisis, origins of bank ownership (foreign banks versus domestic banks) and types of bank (Islamic banks versus conventional banks); on three components of bank efficiency which are technical efficiency, pure technical efficiency and scale efficiency. This study covers 404 observations of commercial banks from the year 2004 to 2015. Thus, this study only analyzes one crisis which is the 2007-2008 U.S. financial crisis. This study employ the Data Envelopment Analysis (DEA) approach to find the bank efficiency followed by Tobit regression model to test the relationship between the financial crisis, origins of bank ownership (foreign banks versus domestic banks), types of bank (Islamic banks versus conventional banks) and bank efficiency. This study discovers that financial crisis has a significant and positive impact on bank efficiency (technical efficiency and pure technical efficiency). As for the origins of bank ownership, foreign banks with better skills, expertise and technology, outperformed the domestic banks in scale efficiency. In contrast, domestic banks perform better in technical and pure technical efficiencies as compared to their foreign counterparts. Finally, the findings highlight that Islamic banks are technically and scale efficient than conventional banks. Meanwhile conventional banks performed better in pure technical efficiency than their Islamic counterparts. Therefore, these findings provide some policy implications to the policy makers and the bank management in continuously assess the performance of Malaysian banks.

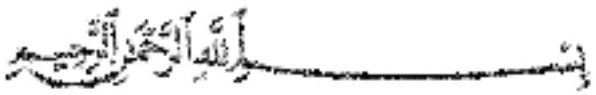
Keywords: Bank efficiency, data envelopment analysis, financial crisis, origins of bank ownership, types of bank.

ABSTRAK

Didapati bahawa kajian tentang tahap kecekapan bank dan faktor-faktor penentunya menjadi tumpuan kepada kesusasteraan perbankan. Walau bagaimanapun, kejadian yang tidak diduga dalam ekonomi seperti krisis sistem kewangan akan menjejaskan prestasi kecekapan bank. Seterusnya, kehadiran bank asing dalam sistem perbankan tempatan juga akan memberi kesan terhadap tahap kecekapan prestasi bank. Bagi bank-bank Islam, unsur-unsur larangan seperti riba, gharar dan maisir adalah kunci kepada peningkatan tahap kecekapan prestasi sesebuah bank Islam berbanding dengan bank konvensional. Justeru, kajian ini bertujuan untuk mengkaji kesan faktor-faktor penentu komponen tahap kecekapan bank; iaitu krisis kewangan, asal-usul pemilikan bank (bank asing berbanding dengan bank tempatan) dan jenis bank (bank Islam berbanding dengan bank konvensional); kepada tiga komponen kecekapan bank iaitu kecekapan teknikal, kecekapan teknikal tulen dan kecekapan skala. Kajian ini merangkumi 404 pemerhatian bank komersial dari tahun 2004 hingga 2015. Oleh itu, kajian ini hanya menganalisis satu krisis iaitu krisis kewangan AS 2007-2008. Kajian ini menggunakan DEA untuk mengukur tahap kecekapan bank dan menggunakan model regresi Tobit untuk menguji hubungan di antara krisis kewangan, asal-usul pemilikan bank (bank asing berbanding dengan bank tempatan), jenis bank (bank Islam berbanding dengan bank konvensional) dan tahap kecekapan bank. Kajian ini mendapati bahawa krisis kewangan memberi kesan yang signifikan dan positif kepada tahap kecekapan bank (kecekapan teknikal dan kecekapan teknikal tulen). Bagi asal usul pemilikan bank, bank-bank asing dengan kemahiran yang lebih baik, kepakaran dan teknologi, mengatasi bank-bank tempatan dalam kecekapan skala. Sebaliknya, bank-bank tempatan prestasi yang lebih baik dalam kecekapan teknikal teknikal dan tulen berbanding dengan negara-negara luar. Akhir sekali, hasil kajian juga mendapati bahawa bank-bank Islam secara teknikal dan skala lebih cekap berbanding dengan bank-bank konvensional. Sementara itu bank-bank konvensional yang lebih cekap dalam teknikal tulen berbanding dengan bank-bank Islan. Oleh itu, penemuan ini menyediakan beberapa implikasi dasar kepada pembuat dasar dan pengurusan bank untuk meneruskan penilaian prestasi terhadap bank-bank Malaysia.

Kata kunci: Tahap kecekapan bank, DEA, krisis kewangan, asal-usul pemilikan bank, jenis bank

ACKNOWLEDGEMENT



In the name of Allah, the most Gracious, the most Merciful

All praises and thanks to Allah, the Lord of the worlds, for all His bounties and blessings in giving a wellness, patience, strength and courage for me to accomplish this research paper with excellence. My humblest gratitude to the Holy prophet Muhammad (Peace Be Upon Him), his progeny and his companions.

Firstly, to fulfill my promise, I dedicate this research paper to my beloved late grandmother, Che Hawa binti Ahmad. Losing her due to the lung cancer on 4 March 2017 at 3.13 am was the biggest challenge for me in completing this research paper. Thank you tokwa for always encourage me to complete my Master study. Thank you for always guide me, be by my side, listen to all my story and always there for me when I need you. Thank you Allah for bring her in my life.

Special appreciation, respect, and thanks to Dr Sharmilawati binti Sabki, my supervisor who was always there to give advices, motivations, guide me with plenty of knowledge, encouragement and spend generous amount of time throughout the process of completing my research paper and finished my Master study. Thanks also to other lecturers who taught me a lot about finance study along my Master journey.

Special dedication to my dearest parents, Mr. Azalli bin Ab Razak and Mrs. Rozaida binti Saad who give support and motivate me to finish my Master study. Thanks to my lovely sister, Adliena binti Azalli who always cheer me along my journey. All the sacrifice, love, patience and motivation with continuous pray has made me become a stronger person with a strong will to succeed.

Special thanks also goes to all my friends; Nor Faizah Ahmad @ Mohammed Razikin, Ng Hui Chin, Nurhayati Faiszah binti Ismail and Nur Atiqah binti Jamaludin, who always there when I faced difficulties and challenges. They continuously support me, ever willing to share information and gave their best assistance in my journey all these years. I love you all. Finally, may Allah bless and reward all of us for this accomplishment.

Ainie binti Azalli
School of Economics, Finance and Banking
Universiti Utara Malaysia (UUM)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BCC Model	Banker, Charnes and Cooper (1984)'s model
BIMB	Bank Islam Malaysia Berhad
BNM	Bank Negara Malaysia
BOA	Bank of America
BOC	Bank of China
BOTM	Bank of Tokyo-Mitsubishi UFJ
CCR Model	Charnes, Cooper and Rhodes (1978)'s model
CPI	Consumer Price Index
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DMUs	Decision Making Units
FSMP	Financial Sector MasterPlan
GCC	Gulf Cooperation Council
GDP	Growth Domestic Products
HLEONG	Hong Leong Bank
HLEONG-I	Hong Leong Islamic
INCEIF	International Centre for Education in Islamic Finance
INDIAINTER	India International Bank
ICBC	Industrial and Commercial Bank of China
MYR	Malaysian Ringgit
NBAD	National Bank of Abu Dhabi
OCBC-I	OCBC Al-Amin Bank
OECD	Organization for Economic Cooperation and Development
OIC	Organisations of Islamic Conference
PWSBH	Perbadanan Wang Simpanan Bakal-Bakal Haji
ROA	Return on Assets
ROE	Return on Equity

STDCHARTERED	Standard Chartered Bank
SFA	Stochastic Frontier Analysis
VRS	Variable Return to Scale

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Banking institution is highly regulated because of their significant roles in the economic development (Freixas & Rochet, 2006; Kawai & Prasad, 2011). The important goal of the banking regulations is to safeguard the soundness of the banking system to ensure that the public interest is protected throughout the entire period. In addition, in the stable condition, the banks are able to operate efficiently by providing the products and services at the lower cost of productions (Berger, 2007; Berger, DeYoung, Genay, & Udell, 2000). Bank efficiency is the capacity of the banks to minimize the inputs and maximize the outputs is one of the important performance measurements of a bank (Sherman & Zhu, 2006). Due to that, the bank efficiency has become an important issue for the regulators since this measurement also indicates the bank success in providing their products and services at the competitive prices. Similarly, from the academic standpoint, the study of bank efficiency and its determinants has become a focal point in the banking literature (Alzubaidi & Bougheas, 2012; Anayiotos, Toroyan & Vamvakidis, 2010; Siddiquee, 2012). Hence, the information provided by the previous studies aid the understanding of the policy makers, banks' management and depositors on the bank efficiency's determinants.

The contents of the thesis is for internal user only

REFERENCES

Abbas, Azid, and Hj Besar. (2016). Efficiency, effectiveness and performance profile of Islamic and conventional banks in Pakistan. *Humanomics*, *32*(1), 2–18.

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2008). The efficiency and productivity of Malaysian banks : An output distance function approach, 1-38

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2011). The impact of Islamic banking on the cost efficiency and productivity change of Malaysian commercial banks. *Applied Economics*, *43*(16), 2033–2054. https://doi.org/10.1080/00036840902984381

Acharya, V. V., Philippon, T., Richardson, M., & Roubini, N. (2012). Prologue: A bird's-eye view: The financial crisis of 2007-2009: Causes and remedies. *Restoring Financial Stability: How to Repair a Failed System*, 1–56. https://doi.org/10.1002/9781118258163

Ahmad, S., & Abdul Rahman, A. R. (2012). The efficiency of Islamic and conventional commercial banks in Malaysia. *International Journal of Islamic and Middle Eastern Finance and Management*, *5*, 241–263. https://doi.org/10.1108/17538391211255223

Akhtar, M. H. (2013). After the financial crisis: a cost efficiency analysis of banks from Saudi Arabia. *International Journal of Islamic and Middle Eastern Finance and Management*, *6*(4), 322–332. https://doi.org/10.1108/IMEFM-05-2013-0059

Akin, A., Bayyurt, N., & Zaim, S. (2013). Managerial and technical inefficiencies of foreign and domestic banks in Turkey during the 2008 global crisis. *Emerging Markets Finance & Trade*, *49*(3), 48–63. https://doi.org/10.2753/REE1540-496X490304

Albayrak. A.S. (2009). Classification of domestic and foreign commercial banks in Turkey based on financial efficiency: a comparison of decision tree, logistic regression and discrimanant analysis models. *The Journal of Faculty of Economics and Administrative Sciences* 14(2): 113-139

Al-Suwailem, S. I. (2009). *Islamic Banking and Finance*. Charles University in Prague. https://doi.org/10.4337/9781843765318.00009

Allen, F., Babus, A., & Carletti, E. (2009). Financial crises: Theory and evidence. *Annual Review of Financial Economics*, *1*, 97–116. https://doi.org/10.1146/annurev.financial.050808.114321

Altaee, H. H. A., Talo, I. M. A., & Adam, M. H. M. (2013). Testing the financial stability of banks in GCC countries: Pre and post financial crisis. *International Journal of Business and Social Research*, *3*(4), 93–105.

Alzubaidi, H., & Bougheas, S. (2012). The impact of the global financial crisis on European banking efficiency. *Working Paper*, *44*(0), 0–31.

Anayiotos, G., Toroyan, H., & Vamvakidis, A. (2010). The efficiency of emerging Europe's banking sector before and after the recent economic crisis. *Financial Theory and Practice*, *34* (April 2010), 247–267. Retrieved from http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=94659

Ariff, M., & Can, L. (2009). IMF bank-restructuring efficiency outcomes: Evidence from east Asia. *Journal of Financial Services Research*, *35*(2), 167–187. https://doi.org/10.1007/s10693-008-0047-2

Association of Banks in Malaysia. (2015). *2015 Annual report*. Kuala Lumpur. ABM Malaysia

Ataullah, A., Cockerill, T., & Hang, L. (2004). Financial liberalization and bank efficiency: a comparative analysis of India and Pakistan. Applied Economics, 36(17), 1915-1924.

Avkiran, N. K. (1999). An application reference for data envelopment analysis in brank banking: helping the novice researcher. *International Journal of Bank Marketing*, *17*(5), 206–220. https://doi.org/10.1108/02652329910292675

Baily, M. N. & Elliott, D. J. (2009). The U.S. financial and economic crisis: Where does it stand and where do we go from here? *Business and Public Policy.* 2-24.

Bank Negara Malaysia. (1999). *The Central Bank And The Financial System In Malaysia: A Decade Of Change 1989-1999.* 1st Ed. Kuala Lumpur. Bank Negara Malaysia.

Bank Negara Malaysia, (2005). Operational flexibilities to the locally-incorporated foreign banking institutions operating in Malaysia. Retrieved on 10 May 2017

from http://www.bnm.gov.my/index.php?ch=en_press&pg=en_press&ac=854&lang=en

Bank Negara Malaysia, (2007). *2007 Annual report*. Kuala Lumpur. Bank Negara Malaysia.

Bank Negara Malaysia, (2008). *2008 Annual report*. Kuala Lumpur. Bank Negara Malaysia.

Bank Negara Malaysia, (2009). *2009 Annual report*. Kuala Lumpur. Bank Negara Malaysia.

Bank Negara Malaysia, (2015). *Commercial banks 2015.* Kuala Lumpur: Bank Negara Malaysia

Bank Negara Malaysia, (2015). *Islamic banks 2015.* Kuala Lumpur: Bank Negara Malaysia

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*. https://doi.org/10.1287/mnsc.30.9.1078

Berg, S. A., Førsund, F. R., Hjalmarsson, L., & Suominen, M. (1993). Banking efficiency in the Nordic countries. *Journal of Banking and Finance*, *17*(2–3), 371–388. https://doi.org/10.1016/0378-4266(93)90038-F

Berger, A. N. (2007). International comparisons of banking efficiency. *Financial Markets, Institutions & Instruments*, *16(3)*, 119-144.

Berger, an, & Humphrey, D. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, *98*(2), 175–212. https://doi.org/10.1017/S0266462310001182

Berger, DeYoung, Genay, & Udell. (2000). Globalization of financial institutions: evidence from cross-border banking performance. *Brookings-Wharton Papers on Financial Services*, *1*, 23–120.

BNP Paribas. (2007). BNP Paribas investment partners temporally suspends the calculation of the net asset value of the following funds: Parvest Dynamic ABS, BNP Paribas ABS EURIBOR and BNP Paribas ABS EONIA. Retrieved on 24 March 2017 from https://group.bnpparibas/en/press-release/bnp-paribas-

investment-partners-temporaly-suspends-calculation-net-asset-funds-parvest-dynamic-abs-bnp-paribas-abs-euribor-bnp-paribas-abs-eonia

Burki, A. A., & Niazi, G. S. K. (2009). Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. *Applied Economics*, *42*(*24*), 3147–3160. https://doi.org/10.1080/00036840802112315

Cardona, P., & Lawrence, B. S. (2013). The credit crunch and firm growth in the Euro area: 2005–2011. A quantile panel analysis. Bank of Greece*, Working Paper Series*. https://doi.org/10.1016/S1574

Casu, B., & Girardone, C. (2000). Bank competition, concentration and efficienciency in the single European market. *The Manchester School*, *74*(4), 441–468. https://doi.org/10.1111/j.1467-9957.2006.00503.x

Chansarn, S. (2005). Efficiency in Thai financial sector after the financial crisis. *Economic Analysis Working Papers (2002-2010)*. *Atlantic Review of Economics (2011-2016)*, 6, 1-31

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, *2*(6), 429–444. https://doi.org/10.1016/0377-2217(78)90138-8

Chen and Qian. (2009). MaxDEA Manual - Version 5.2, 86.

Chodnicka, P. (2014). Do institutional and political factors matter for the efficiency of banking sectors ? *Journal of Banking and Financial Economics*, *1*(1), 40–58. https://doi.org/10.7172/2353-6845.jbfe.2014.1.3

Chortareas, G. E., Girardone, C., & Ventouri, A. (2009). Efficiency and productivity of Greek banks in the EMU era. *Applied Financial Economics*, *19*(16), 1317–1328. https://doi.org/10.1080/09603100802599506

Crabtree, K., Dallwitz, M. J., Gibbs, A. J., & Watson, L. (2015). 16 Chapter 2. Economic bubbles pre-20th century (roughly in chronological order). *Boom & Bust: A Look at Economic Bubbles*, 15.

Chunhachinda, P., & Li, L. (2010). Efficiency of Thai commercial banks: Pre- vs. post-1997 financial crisis. *Review of Pacific Basin Financial Markets and Policies* (Vol. 13). https://doi.org/10.1142/S0219091510002013

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). An introduction to efficiency and productivity analysis. *Springer Science & Business Media.*

Delfino, M. E. (2007). Control changes and firm performance in banking. *International Journal of the Economics of Business*, *14*(2), 261–281. https://doi.org/10.1080/13571510701344061

Demyanyk, Y., & Van Hemert, O. (2011). Understanding the subprime mortgage crisis. *Review of financial Studies*, 24(6), 1848-1880.

Denizer, C. A., Dinc, M., & Tarimcilar, M. (2007). Financial liberalization and banking efficiency: Evidence from Turkey. *Journal of Productivity Analysis*, *27*(3), 177–195. https://doi.org/10.1007/s11123-007-0035-9

Duca. (2014) Subprime mortgage crisis. Retrieved on 7 June 2017 from https://www.federalreservehistory.org/essays/subprime_mortgage_crisis

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society. Series A (General)*, *120*(3), 253-290.

Fang, Y., Hasan, I., & Marton, K. (2011). Bank efficiency in South-Eastern Europe. economics of transition, 19(3), 495–520. https://doi.org/10.1111/j.1468-0351.2011.00420.x

Fatin Syazwani, S. (2014). Efficiency of Islamic and Conventional Banks during financial crisis*:* Empirical evidence from Malaysia. Universiti Utara Malaysia

Ferreira, C. (2012). Bank efficiency, market concentration and economic growth in the European Union.

Freixas, X., & Rochet, J.-C. (2006). Microeconomics of banking. The MIT press (2nd Edition). England. https://doi.org/10.1017/CBO9781107415324.004

Gardener, E., Molyneux, P., & Nguyen-Linh, H. (2011). Determinants of efficiency in South East Asian banking. *The Service Industries Journal*, *31*(16), 2693–2719. https://doi.org/10.1080/02642069.2010.512659

Garza-Garcia, J. G. (2011). Determinants of bank efficiency in Mexico : a two-stage analysis. *Center for Global Finance Working Paper Series*, 06–11. Retrieved

from http://www.uwe.ac.uk/bbs/research/cgf/

Golin J. (2001). The bank credit analysis handbook: A guide for analysts, bankers and investors. John. John Wiley & Sons, Asia.

Gup, B.E. & Kolari, J.W. (2005). *Commercial banking: The management of risk. 3rd ed. United States of America:* John Wiley & Sons Ltd.

Hasan, I., & Marton, K. (2003). Development and efficiency of the banking sector in a transitional economy: Hungarian experience. *Journal of Banking and Finance*, *27*(12), 2249–2271. https://doi.org/10.1016/S0378-4266(02)00328-X

Hassan, T., Mohamad, S., & Bader, M. K. I. (2009). Efficiency of conventional versus Islamic banks: evidence from the Middle East. *International Journal of Islamic and Middle Eastern Finance and Management*, *2*(1), 46–65. https://doi.org/10.1108/17538390910946267

Heffernan, S. (2005). *Modern banking*. England: John Wiley & Sons.

Hoque, H. A. A. B., Kim, J. H., & Pyun, C. S. (2007). A comparison of variance ratio tests of random walk: A case of Asian emerging stock markets. *International Review of Economics and Finance*, *16*(4), 488–502. https://doi.org/10.1016/j.iref.2006.01.001

Isik, I., & Hassan, M. K. (2002). Technical, scale and allocative efficiencies of Turkish banking industry. *Journal of Banking and Finance*, *26*(4), 719–766. https://doi.org/10.1016/S0378-4266(01)00167-4

Jagwani, B. (2012). Efficiency Measurement in the Indian banking industry: An application of data envelopment analysis. *Vision: The Journal of Business Perspective*, *16*(4), 315–331. https://doi.org/10.1177/0972262912460191

Jensen, R., & Szulanski, G. (2004). Stickiness and the adaptation of organizational practices in cross-border knowledge transfers. *Journal of International Business Studies*, *35*(6), 508–523. https://doi.org/10.1057/palgrave.jibs.8400107

Johnes, J., Izzeldin, M., & Pappas, V. (2014). A comparison of performance of Islamic and conventional banks (2004 – 2009). *Journal of Economic Behavior and Organization*, *103* (October), S93–S107. https://doi.org/10.1016/j.jebo.2013.07.016

Kasman, A., & Yildirim, C. (2006). Cost and profit efficiencies in transition banking:

the case of new EU members. *Applied Economics*, *38*(9), 1079–1090. https://doi.org/10.1080/00036840600639022

Kasman, A. (2005). Efficiency and scale economies in transition economies: Evidence from Poland and the Czech Republic. *Emerging Markets Finance and Trade*, *41*(2), 60–81. Retrieved from http://mesharpe.metapress.com/index/WXC7FLJYRUD873EP.pdf

Kasteren. (2012). Managing earnings before and after the financial crisis in the United States of America. (August) Faculty of Economics and Business, University of Amsterdam

Kawai, M., & Prasad, E. S. (2011). *Financial market regulation and reforms in emerging markets*. Washington: Brookings Institution Press. Retrieved from www.brookings.edu

Khoon, G. S., & Lim, M.-H. (2010). The impact of the global financial crisis: the case of Malaysia. *Third World Network*. https://doi.org/10.1016/j.gfj.2015.02.002

Kilic, O., Chelikani, S., & Coe, T. (2014). Financial Crisis and contagion : The Effects of the 2008 financial crisis on the Turkish Financial Sector, *11*(2), 19–37.

Kindleberger, C. P., & Aliber, R. Z. (2000). *Manias, Panics, and Crashes: A History of Financial Crises* (5th Ed). John Wiley & Sons, Inc.

Koopmans, T. CL. (1951). "Analysis of production as an efficient combination of activities". *Cap. III of Koopmans, TC (ed), Activity Analysis of Production and Allocation. Cowrles Commission Monograph*.

Košak, M., & Zajc, P. (2011). Accounting for heterogeneity in cross-country bank efficiency comparisons: The case of new EU member states. *Economics of Transition*, *19*(3), 473–494. https://doi.org/10.1111/j.1468-0351.2011.00419.x

Kumar, S., & Gulati, R. (2009). Did efficiency of Indian public sector banks converge with banking reforms? *International Review of Economics*, *56*(1), 47–84. https://doi.org/10.1007/s12232-008-0057-2

Kumbhakar, S. C., & Lovell, C. K. (2003). *Stochastic frontier analysis*. New York, USA: Cambridge University Press.

Laeven, L., & Valencia, F. (2008). *Systemic Banking Crises: A New Database* (No. WP/08/224).

Levine, R. (1996). Foreign banks, financial development, and economic growth. *International financial markets: Harmonization versus competition*, *7*, 224-54.

Li, Y., Hu, J. L., & Chiu, Y. H. (2004). Ownership and production efficiency: Evidence from Taiwanese banks. *Service Industries Journal*, *24*(4), 129–148. https://doi.org/10.1080/0264206042000275235

Mahesh, H. P., & Rajeev, M. (2008). Producing financial services: An efficiency analysis of Indian commercial banks. *Journal of Services Research*, *8*(2), 7–29. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=35344251&authtype=shib&site=ehost-live

Matkovskyy, R. (2016). A comparison of pre- and post-crisis efficiency of OECD countries : evidence from a model with temporal heterogeneity in time and unobservable individual effects. *The European Journal of Comparative Economics*, *13*(2), 135–167.

Matthews, K., & Ismail, M. (2006). *Efficiency and productivity growth of domestic and foreign commercial banks in Malaysia* (No. E2006/2 Efficiency). Aberconway Building Colum Drive Cardiff CF10 3EU United Kingdom.

McKinnon, R. I. (1973). *Money and capital in economic development.* Washington: Brookings Institution Press.

Miller, J. (2004). The contestability of markets. *Student Economic Review*, *18*, 211–223.

Mohamad, N. M., & Wahab, N. A. (2016). Examining the relationship between risks and efficiency, *1*(2), 90–116.

Mokhtar, H. S. A., AlHabshi, S. M., & Abdullah, N. (2006). A conceptual framework for and survey of banking efficiency study. *Unitar E-Journal*, *2*(2), 1–19.

Moradi-Motlagh, A., & Babacan, A. (2015). The impact of the global financial crisis on the efficiency of Australian banks. *Economic Modelling*, *46*, 397–406.

https://doi.org/10.1016/j.econmod.2014.12.044

Mukherjee, K., Ray, S. C., & Miller, S. M. (2001). Productivity growth in large US commercial banks: The initial post-deregulation experience. *Journal of Banking & Finance*, *25*(5), 913–939. https://doi.org/10.1016/S0378-4266(00)00103-5

Naaborg, I. J. (2007). Foreign bank entry and performance. Eburon Uitgeverij BV.

Papadakis, E. (2013). Determinants influencing bank profitability pre and post crisis in the Western-Eastern Region.

Pasiouras, F. (2008). Estimating the technical and scale efficiency of Greek commercial banks: The impact of credit risk, off-balance sheet activities, and international operations. *Research in International Business and Finance*, *22*(3), 301–318. https://doi.org/10.1016/j.ribaf.2007.09.002

Rezvanian, R., Ariss, R. T., & Mehdian, S. M. (2011). Cost efficiency, technological progress and productivity growth of Chinese banking pre- and post-WTO accession. *Applied Financial Economics*, *21*(7), 437–454. https://doi.org/10.1080/09603107.2010.532110

Rezvanian, R., Rao, N., & Mehdian, S. M. (2008). Efficiency change, technological progress and productivity growth of private, public and foreign banks in India: evidence from the post-liberalization era. *Applied Financial Economics*, *18*(9), 701–713. https://doi.org/10.1080/09603100701222317

Rizga, K. (2009). Untold stories: latvia: sobering lessons in unregulated lending. Retrieved on 20 February 2017 from https://web.archive.org/web/20090522105036/http://pulitzercenter.typepad.com/untold_stories/2009/05/latvia-sobering-lessons-in-unregulated-lending.html

Rosman, R., Wahab, N. A., & Zainol, Z. (2014). Efficiency of Islamic banks during the financial crisis: An analysis of Middle Eastern and Asian countries. *Pacific Basin Finance Journal*, *28*, 76–90. https://doi.org/10.1016/j.pacfin.2013.11.001

Saddique, A., Ahmad, M., Mumtaz, R., & Arif, M. (2016). The effect of financial variables on bank performance pre and post financial Crisis, *4*(6), 378–382. https://doi.org/10.11648/j.jfa.20160406.18

San, O. T., Theng, L. Y., & Heng, T. B. (2011). A comparison on efficiency of domestic and foreign banks in Malaysia : A DEA approach. *Business Management Dynamics*, *1*(4), 33–49.

Sathye, M. (2005). Technical efficiency of large bank production in Asia and the Pacific. *Multinational Finance Journal*, *9*(1), 1–22.

Shah, I. A., Shah, S., & Ahmad, H. (2012). Comparing the efficiency of Islamic versus conventional banking: through data envelopment analysis (DEA) model. *African Journal of Business Management*, *6*(3), 787–798. https://doi.org/10.5897/AJBM11.575

Shaw, E. S. (1973). *Financial deepening in economic development.* New York: Oxford University Press.

Sherman, H. D., & Zhu, J. (2006). *Service productivity management: Improving service performance using data envelopment analysis (DEA)*. Springer Science & Business Media.

Siddiquee, M. (2012). Measuring efficiency of the banking industry before and after the recent financial crisis: some international evidence. *International Journal of Accounting and Finance*, *4*(2), 143–167. Retrieved from http://inderscience.metapress.com/index/J22VK4NP33523L52.pdf

Sillah, B. M. S., & Harrathi, N. (2015). Bank efficiency analysis: Islamic Banks versus Conventional Banks in the Gulf Cooperation Council Countries 2006-2012. *International Journal of Financial Research*, *6*(4), p143. https://doi.org/10.5430/ijfr.v6n4p143

Sok-Gee, C., & Karim, M. Z. A. (2010). Bank efficiency, profitability and equity capital: evidence from developing countries. *American Journal of Finance and Accounting*, *2*(2), 181–195.

Spulbăr, C., Niţoi, M., & Anghel, L. (2015). Efficiency in cooperative banks and savings banks: A stochastic frontier approach. *Romanian Journal of Economic Forecasting*, *18*(1), 5–21.

Sturm, J. E., & Williams, B. (2004). Foreign bank entry, deregulation and bank efficiency: Lessons from the Australian experience. Journal of Banking & Finance, 28(7), 1775-1799.

Sufian, F. (2004). the Efficiency effects of bank mergers and acquisitions in a developing economy: Evidence from Malaysia. *The Efficiency Effects of Bank Mergers and Acquisitions in a Developing Economy: Evidence From Malaysia*, *1*(4), 53–74. https://doi.org/10.1016/S0378-4266(97)00053-8

Sufian, F. (2009a). Determinants of bank efficiency during unstable macroeconomic environment : Empirical evidence from Malaysia, *23*, 54–77. https://doi.org/10.1016/j.ribaf.2008.07.002

Sufian, F. (2009b). The determinants of efficiency of publicly listed Chinese banks: evidence from two-stage banking models. *Macroeconomics and Finance in Emerging Market Economies*, *2*(1), 93–133. https://doi.org/10.1080/17520840902726458

Sufian, F. (2010). Does foreign presence foster Islamic banks' performance? Empirical evidence from Malaysia. *Journal of Islamic Accounting and Business Research*, *1*(2), 128–147. https://doi.org/10.1108/17590811011086723

Sufian, F. (2011). Banks total factor productivity change in a developing economy: Does ownership and origins matter? *Journal of Asian Economics*, *22*(1), 84–98. https://doi.org/10.1016/j.asieco.2010.07.007

Sufian, F., & Abdul-Majid, M.-Z. (2008). Bank ownership , characteristics, and performance : A comparative analysis of domestic and foreign islamic banks in Malaysia. *JKAU: Islamic Econ*, *21*(2), 3–36. https://doi.org/10.1227/01.NEU.0000349921.14519.2A

Sufian, F., & Habibullah, M. S. (2010). Does foreign banks entry fosters bank efficiency? Empirical evidence from Malaysia. *Inzinerine Ekonomika-Engineering Economics*, *21*(5), 464–474.

Sufian, F., & Habibullah, M. S. (2012). Developments in the efficiency of the Malaysian banking sector: The impacts of financial disruptions and exchange rate regimes. *Progress in Development Studies*, *12*(1), 19–46. https://doi.org/10.1177/146499341101200102

Tahir, I. M., & Bakar, N. M. A. (2009). Evaluating efficiency of Malaysian banks using data envelopment analysis. *International Journal of Business and Management*, *4*(8), 96.

Tobin, B. Y. J. (1958). Estimation of relationships for limited dependent variables. *Econometrica: Journal of the Econometric Society*, *26*(1), 24–36.

Usman, M., Wang, Z., Mahmood, F., & Shahid, H. (2010). Scale Efficiency in banking sector of Pakistan. *International Journal of Business and Management*, *5*(4), 104–116.

Wahid, M. A. (2016). Comparing the efficiency of Islamic and conventional banks

based on the evidence from Malaysia, *13*(1), 35–65.

Williams, M. (2010). *Uncontrolled Risk*. McGraw-Hill Education. ISBN 978-0071638296.

Yudistra, D. (2003). Efficiency in Islamic Banking: an empirical analysis of 18 banks. *Islamic Financial Architecture - Risk Management and Financial Stability*, *44*(0), 479–496. https://doi.org/10.1080/09720529.2013.821361

APPENDICES

APPENDIX A

NUMBER OF COMMERCIAL BANKS IN MALAYSIA (2004-2015)

Origins of bank ownership	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Domestic banks	11	12	13	15	15	17	17	17	17	17	17	17
Foreign banks	14	14	14	15	17	18	18	18	22	23	23	23
Total	25	26	27	30	32	35	35	35	39	40	40	40

Types of bank	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Conventional banks	23	23	22	22	22	22	22	21	25	26	26	26
Islamic banks	2	3	5	8	10	13	13	14	14	14	14	14
Total	25	26	27	30	32	35	35	35	39	40	40	40

Sources: BNM Statistical Bulletin (2004-2015)

APPENDIX B

LIST OF COMMERCIAL BANKS IN MALAYSIA (2004-2015)

No	Conventional Banks	Origins of Bank Ownership
1	Affin Bank Bhd.	Domestic bank
2	Alliance Bank Bhd.	Domestic bank
3	AmBank Bhd.	Domestic bank
4	BNP Paribas Malaysia Bhd.	Foreign bank
5	Bangkok Bank (M) Bhd.	Foreign bank
6	Bank of America (M) Bhd.	Foreign bank
7	Bank of China (M) Bhd.	Foreign bank
8	Bank of Tokyo-Mitsubishi UFJ (M) Bhd.	Foreign bank
9	CIMB Bank Bhd.	Domestic bank
10	Citibank (M) Bhd.	Foreign bank
11	Deutsche Bank (M) Bhd.	Foreign bank
12	Hong Leong Bank Bhd.	Domestic bank
13	HSBC Bank (M) Bhd.	Foreign bank
14	India International Bank (M) Bhd.	Foreign bank
15	Industrial and Commercial Bank of China (M) Bhd.	Foreign bank
16	J.P. Morgan Chase Bank (M) Bhd.	Foreign bank
17	Malayan Banking Bhd.	Domestic bank
18	Mizuho Corporate Bank (M) Bhd.	Foreign bank
19	National Bank of Abu Dhabi (M) Bhd.	Foreign bank
20	OCBC Bank (M) Bhd.	Foreign bank
21	Public Bank Bhd.	Domestic bank
22	RHB Bank Bhd.	Domestic bank
23	Standard Chartered Bank (M) Bhd.	Foreign bank
24	Sumitomo Mitsui Banking Corporation (M) Bhd.	Foreign bank
25	The Bank of Nova Scotia (M) Bhd.	Foreign bank
26	The Royal Bank of Scotland (M) Bhd.	Foreign bank
27	United Overseas Bank (M) Bhd.	Foreign bank

(Source: BNM, 2015 retrieved on 1 Mac 2016)

No	Islamic Banks	Origins of Bank Ownership
1	Affin Islamic Bank Bhd.	Domestic bank
2	Al-Rajhi Banking & Investment Corporation (M) Bhd.	Foreign bank
3	Alliance Islamic Bank Bhd.	Domestic bank
4	AmIslamic Bank Bhd.	Domestic bank
5	Asian Finance Bank Bhd.	Foreign bank
6	Bank Islam Malaysia Bhd.	Domestic bank
7	Bank Muamamalat Malaysia Bhd.	Domestic bank
8	CIMB Islamic Bank Bhd.	Domestic bank
9	Hong Leong Islamic Bank Bhd.	Domestic bank
10	HSBC Amanah (M) Bhd.	Foreign bank
11	Kuwait Finance House (M) Bhd.	Foreign bank
12	Maybank Islamic Bhd.	Domestic bank
13	OCBC Al-Amin Bank Bhd.	Foreign bank
14	Public Islamic Bank Bhd.	Domestic bank
15	RHB Islamic Bank Bhd.	Domestic bank
16	Standard Chartered Saadiq Bhd.	Foreign bank

(Source: BNM, 2015 retrieved on 1 Mac 2016)

APPENDIX C

EFFFIENCY SCORES FROM YEAR 2004 TO 2015

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
Conventional Banks:					
2004	ABNAMRO	0.4158	0.4524	0.9190	F
2005	ABNAMRO	0.3962	0.4119	0.9619	F
2006	ABNAMRO	0.2343	0.2967	0.7895	F
2007	ABNAMRO	0.1198	0.1245	0.9623	F
2004	AFFIN	0.4197	0.6820	0.6153	D
2005	AFFIN	0.4676	0.7956	0.5877	D
2006	AFFIN	0.3784	0.6125	0.6178	D
2007	AFFIN	0.3539	0.5836	0.6064	D
2008	AFFIN	0.3958	0.6253	0.6329	D
2009	AFFIN	0.4571	0.6786	0.6736	D
2010	AFFIN	0.4413	0.6478	0.6812	D
2011	AFFIN	0.4821	0.6913	0.6974	D
2012	AFFIN	0.5127	0.7819	0.6558	D
2013	AFFIN	0.5134	0.7575	0.6778	D
2014	AFFIN	0.5642	0.8254	0.6836	D
2015	AFFIN	0.5832	0.8952	0.6515	D
2004	ALLIANCE	0.4755	0.7820	0.6080	D
2005	ALLIANCE	0.4852	0.8099	0.5991	D
2006	ALLIANCE	0.4209	0.7080	0.5946	D
2007	ALLIANCE	0.3683	0.6224	0.5917	D
2008	ALLIANCE	0.3677	0.6019	0.6109	D
2009	ALLIANCE	0.3645	0.6009	0.6067	D
2010	ALLIANCE	0.4150	0.6993	0.5934	D
2011	ALLIANCE	0.4921	0.8340	0.5901	D
2012	ALLIANCE	0.4797	0.8200	0.5849	D
2013	ALLIANCE	0.4922	0.8712	0.5649	D
2014	ALLIANCE	0.5023	0.8283	0.6064	D
2015	ALLIANCE	0.5291	0.8477	0.6242	D
2004	AMBANK	0.4444	0.5935	0.7488	D
2005	AMBANK	0.5982	0.8940	0.6690	D
2006	AMBANK	0.5399	0.8295	0.6509	D
2007	AMBANK	0.4675	0.7303	0.6402	D
2008	AMBANK	0.4648	0.7972	0.5830	D
2009	AMBANK	0.4353	0.7180	0.6063	D
2010	AMBANK	0.4642	0.8627	0.5381	D

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2011	AMBANK	0.4679	0.8644	0.5413	D
2012	AMBANK	0.5069	0.9586	0.5289	D
2013	AMBANK	0.4918	0.9826	0.5005	D
2014	AMBANK	0.4915	0.9951	0.4940	D
2015	AMBANK	0.4858	0.9805	0.4955	D
2004	BANGKOK	0.5432	0.6667	0.8148	F
2005	BANGKOK	0.5004	0.6453	0.7754	F
2006	BANGKOK	0.6535	0.8072	0.8095	F
2007	BANGKOK	0.3604	0.4471	0.8061	F
2008	BANGKOK	0.5421	0.6178	0.8774	F
2009	BANGKOK	0.5020	0.5664	0.8862	F
2010	BANGKOK	0.4504	0.4972	0.9057	F
2011	BANGKOK	0.4540	0.4998	0.9084	F
2012	BANGKOK	0.5321	0.5461	0.9743	F
2013	BANGKOK	0.5400	0.5478	0.9859	F
2014	BANGKOK	0.5369	0.5460	0.9833	F
2015	BANGKOK	0.6148	0.6223	0.9879	F
2004	BOA*	0.1338	0.6899	0.1940	F
2005	BOA	0.1409	0.8525	0.1652	F
2006	BOA	0.1170	1.0000	0.1170	F
2007	BOA	0.1201	0.5619	0.2137	F
2008	BOA	0.1031	0.6394	0.1612	F
2009	BOA	0.1226	0.8170	0.1501	F
2010	BOA	0.1373	0.4076	0.3369	F
2011	BOA	0.0681	0.2929	0.2326	F
2012	BOA	0.2701	0.3893	0.6938	F
2013	BOA	0.1406	0.2315	0.6073	F
2014	BOA	0.1425	0.2544	0.5603	F
2015	BOA	0.0916	0.3153	0.2906	F
2004	BOC*	0.2123	0.7698	0.2758	F
2005	BOC	0.2065	0.9742	0.2120	F
2006	BOC	0.2185	1.0000	0.2185	F
2007	BOC	0.2049	0.7260	0.2823	F
2008	BOC	0.3766	0.6762	0.5569	F
2009	BOC	0.2624	0.4188	0.6267	F
2010	BOC	0.2591	0.3727	0.6953	F
2011	BOC	0.3128	0.3923	0.7973	F
2012	BOC	0.2833	0.3316	0.8543	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2013	BOC	0.2135	0.2307	0.9253	F
2014	BOC	0.3661	0.3716	0.9853	F
2015	BOC	0.3798	0.3988	0.9523	F
2004	BOTM*	0.3575	0.3725	0.9597	F
2005	BOTM	0.3628	0.3793	0.9564	F
2006	BOTM	0.3371	0.3519	0.9582	F
2007	BOTM	0.3396	0.3530	0.9622	F
2008	BOTM	0.3561	0.3667	0.9710	F
2009	BOTM	0.3087	0.3159	0.9772	F
2010	BOTM	0.3649	0.3663	0.9962	F
2011	BOTM	0.3376	0.3449	0.9789	F
2012	BOTM	0.2982	0.3057	0.9754	F
2013	BOTM	0.3278	0.3516	0.9324	F
2014	BOTM	0.4827	0.6040	0.7991	F
2015	BOTM	0.8588	1.0000	0.8588	F
2004	CIMB	0.4380	0.7158	0.6120	D
2005	CIMB	0.4638	0.8125	0.5708	D
2006	CIMB	0.4213	0.8068	0.5222	D
2007	CIMB	0.3416	0.6618	0.5162	D
2008	CIMB	0.4196	0.7818	0.5367	D
2009	CIMB	0.3714	0.7434	0.4995	D
2010	CIMB	0.3860	0.7918	0.4875	D
2011	CIMB	0.3772	0.7495	0.5033	D
2012	CIMB	0.4001	0.9304	0.4300	D
2013	CIMB	0.4264	0.9040	0.4717	D
2014	CIMB	0.4475	1.0000	0.4475	D
2015	CIMB	0.4768	1.0000	0.4768	D
2004	CITI	0.4341	0.6847	0.6340	F
2005	CITI	0.3667	0.5802	0.6321	F
2006	CITI	0.3886	0.6867	0.5659	F
2007	CITI	0.2739	0.4141	0.6614	F
2008	CITI	0.3161	0.5166	0.6119	F
2009	CITI	0.3441	0.5377	0.6401	F
2010	CITI	0.3007	0.5040	0.5967	F
2011	CITI	0.2958	0.4729	0.6255	F
2012	CITI	0.3005	0.5134	0.5852	F
2013	CITI	0.2959	0.5077	0.5829	F
2014	CITI	0.3543	0.6473	0.5474	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2015	CITI	0.3407	0.6063	0.5619	F
2004	DEUTSCHE	0.2856	0.3079	0.9277	F
2005	DEUTSCHE	0.1469	0.2318	0.6339	F
2006	DEUTSCHE	0.1362	0.1727	0.7889	F
2007	DEUTSCHE	0.2968	0.2990	0.9926	F
2008	DEUTSCHE	0.1429	0.2129	0.6712	F
2009	DEUTSCHE	0.1535	0.2295	0.6688	F
2010	DEUTSCHE	0.1139	0.2166	0.5261	F
2011	DEUTSCHE	0.0975	0.2223	0.4386	F
2012	DEUTSCHE	0.2442	0.2952	0.8273	F
2013	DEUTSCHE	0.3121	0.3600	0.8667	F
2014	DEUTSCHE	0.1298	0.2744	0.4732	F
2015	DEUTSCHE	0.1120	0.2071	0.5406	F
2004	EON	0.5488	0.8127	0.6752	D
2005	EON	0.5006	0.8513	0.5881	D
2006	EON	0.4977	0.8205	0.6066	D
2007	EON	0.4266	0.7304	0.5840	D
2008	EON	0.3871	0.6797	0.5696	D
2009	EON	0.3976	0.7217	0.5509	D
2010	EON	0.3854	0.6737	0.5721	D
2004	HLEONG*	0.3589	0.5112	0.7021	D
2005	HLEONG	0.3833	0.5535	0.6925	D
2006	HLEONG	0.4353	0.6373	0.6831	D
2007	HLEONG	0.3474	0.4777	0.7274	D
2008	HLEONG	0.3475	0.5124	0.6782	D
2009	HLEONG	0.3891	0.7334	0.5305	D
2010	HLEONG	0.4191	0.8698	0.4818	D
2011	HLEONG	0.3965	0.6164	0.6431	D
2012	HLEONG	0.4476	0.8386	0.5337	D
2013	HLEONG	0.4977	0.8349	0.5961	D
2014	HLEONG	0.5512	0.9900	0.5568	D
2015	HLEONG	0.5779	1.0000	0.5779	D
2004	HSBC	0.3716	0.6373	0.5830	F
2005	HSBC	0.3446	0.6020	0.5724	F
2006	HSBC	0.3616	0.6572	0.5502	F
2007	HSBC	0.3077	0.5464	0.5631	F
2008	HSBC	0.3410	0.6111	0.5579	F
2009	HSBC	0.2796	0.4941	0.5659	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2010	HSBC	0.3140	0.5428	0.5785	F
2011	HSBC	0.2926	0.4541	0.6443	F
2012	HSBC	0.3441	0.5919	0.5813	F
2013	HSBC	0.3299	0.5623	0.5867	F
2014	HSBC	0.3881	0.7314	0.5307	F
2015	HSBC	0.3167	0.5688	0.5569	F
2013	INDIAINTER*	0.0715	1.0000	0.0715	F
2014	INDIAINTER	0.1090	1.0000	0.1090	F
2015	INDIAINTER	0.1093	1.0000	0.1093	F
2012	ICBC*	0.0682	0.2962	0.2303	F
2013	ICBC	0.2129	0.2571	0.8279	F
2014	ICBC	0.2750	0.3115	0.8829	F
2015	ICBC	0.3181	0.3375	0.9423	F
2004	JPMORGAN	0.0835	0.3982	0.2097	F
2005	JPMORGAN	0.1672	0.4396	0.3803	F
2006	JPMORGAN	0.4496	0.6127	0.7339	F
2007	JPMORGAN	0.4602	0.5219	0.8818	F
2008	JPMORGAN	0.0729	0.3764	0.1936	F
2009	JPMORGAN	0.0591	0.3748	0.1576	F
2010	JPMORGAN	0.1999	0.3804	0.5255	F
2011	JPMORGAN	0.2606	0.3591	0.7257	F
2012	JPMORGAN	0.1754	0.3162	0.5548	F
2013	JPMORGAN	0.0854	0.1389	0.6150	F
2014	JPMORGAN	0.0948	0.1499	0.6321	F
2015	JPMORGAN	0.0335	0.1090	0.3070	F
2004	MAYBANK	0.4676	0.8270	0.5654	D
2005	MAYBANK	0.4814	0.8541	0.5636	D
2006	MAYBANK	0.4663	0.8352	0.5583	D
2007	MAYBANK	0.4310	0.7432	0.5800	D
2008	MAYBANK	0.4701	0.7971	0.5898	D
2009	MAYBANK	0.4494	0.9350	0.4807	D
2010	MAYBANK	0.4499	0.9261	0.4858	D
2011	MAYBANK	0.4472	0.9069	0.4931	D
2012	MAYBANK	0.4555	0.9155	0.4975	D
2013	MAYBANK	0.4602	0.9536	0.4826	D
2014	MAYBANK	0.4872	1.0000	0.4872	D
2015	MAYBANK	0.4639	1.0000	0.4639	D
2012	MIZUHO	0.1188	0.4546	0.2614	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2013	MIZUHO	0.1277	0.2889	0.4422	F
2014	MIZUHO	0.1326	0.2807	0.4724	F
2015	MIZUHO	0.1956	0.2918	0.6705	F
2012	NBAD*	1.0000	1.0000	1.0000	F
2013	NBAD	0.2387	0.6208	0.3844	F
2014	NBAD	0.2062	0.4821	0.4276	F
2015	NBAD	0.3921	0.6869	0.5708	F
2004	OCBC	0.6228	0.9879	0.6304	F
2005	OCBC	0.6426	0.9587	0.6703	F
2006	OCBC	0.5750	0.8419	0.6830	F
2007	OCBC	0.5091	0.7544	0.6749	F
2008	OCBC	0.5001	0.7832	0.6386	F
2009	OCBC	0.4525	0.6398	0.7072	F
2010	OCBC	0.4565	0.6485	0.7040	F
2011	OCBC	0.4997	0.7443	0.6714	F
2012	OCBC	0.4620	0.6818	0.6776	F
2013	OCBC	0.5119	0.7594	0.6741	F
2014	OCBC	0.5330	0.7906	0.6742	F
2015	OCBC	0.5786	0.8949	0.6466	F
2004	PUBLICBANK	0.4509	0.6783	0.6647	D
2005	PUBLICBANK	0.4538	0.6993	0.6490	D
2006	PUBLICBANK	0.4582	0.6932	0.6610	D
2007	PUBLICBANK	0.4340	0.7034	0.6170	D
2008	PUBLICBANK	0.4642	0.7021	0.6611	D
2009	PUBLICBANK	0.4629	0.7119	0.6502	D
2010	PUBLICBANK	0.5014	0.7829	0.6405	D
2011	PUBLICBANK	0.5642	0.9110	0.6194	D
2012	PUBLICBANK	0.5789	0.9256	0.6254	D
2013	PUBLICBANK	0.5793	0.9248	0.6264	D
2014	PUBLICBANK	0.6264	1.0000	0.6264	D
2015	PUBLICBANK	0.6202	1.0000	0.6202	D
2004	RHB	0.3784	0.7600	0.4978	D
2005	RHB	0.4454	0.8279	0.5379	D
2006	RHB	0.4983	1.0000	0.4983	D
2007	RHB	0.3920	0.6868	0.5707	D
2008	RHB	0.4242	0.7839	0.5411	D
2009	RHB	0.4564	0.7828	0.5831	D
2010	RHB	0.4973	0.8676	0.5732	D

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2011	RHB	0.4586	0.8448	0.5428	D
2012	RHB	0.4545	0.7985	0.5692	D
2013	RHB	0.5068	0.9923	0.5107	D
2014	RHB	0.4773	0.9089	0.5251	D
2015	RHB	0.4787	0.9852	0.4858	D
2004	SOUTHERN	0.5251	0.9053	0.5800	F
2005	SOUTHERN	0.4778	0.8259	0.5784	F
2004	STDCHARTERED*	0.4594	0.6605	0.6955	F
2005	STDCHARTERED	0.4748	0.6888	0.6893	F
2006	STDCHARTERED	0.4054	0.6123	0.6621	F
2007	STDCHARTERED	0.3015	0.4374	0.6893	F
2008	STDCHARTERED	0.4230	0.8163	0.5181	F
2009	STDCHARTERED	0.3992	0.6179	0.6460	F
2010	STDCHARTERED	0.4896	0.8303	0.5897	F
2011	STDCHARTERED	0.4652	0.8040	0.5786	F
2012	STDCHARTERED	0.4591	0.8055	0.5699	F
2013	STDCHARTERED	0.4175	0.7346	0.5684	F
2014	STDCHARTERED	0.3838	0.7144	0.5372	F
2015	STDCHARTERED	0.3540	0.6160	0.5747	F
2012	SUMITUMOMITSUI	0.1419	0.3278	0.4327	F
2013	SUMITUMOMITSUI	0.2852	0.3815	0.7477	F
2014	SUMITUMOMITSUI	0.2788	0.3614	0.7714	F
2015	SUMITUMOMITSUI	0.2639	0.2830	0.9324	F
2004	NOVASCOTIA	0.6114	0.7018	0.8711	F
2005	NOVASCOTIA	0.5878	0.6825	0.8613	F
2006	NOVASCOTIA	0.6275	0.7913	0.7930	F
2007	NOVASCOTIA	0.5037	0.5431	0.9275	F
2008	NOVASCOTIA	0.7756	0.7843	0.9889	F
2009	NOVASCOTIA	0.8145	0.8199	0.9934	F
2010	NOVASCOTIA	0.8995	0.9164	0.9815	F
2011	NOVASCOTIA	0.9512	0.9650	0.9858	F
2012	NOVASCOTIA	1.0000	1.0000	1.0000	F
2013	NOVASCOTIA	0.8989	1.0000	0.8989	F
2014	NOVASCOTIA	0.6663	0.6966	0.9566	F
2015	NOVASCOTIA	1.0000	1.0000	1.0000	F
2008	ROYALBANK	0.2614	0.2779	0.9404	F
2009	ROYALBANK	0.1388	0.1497	0.9273	F
2010	ROYALBANK	0.1809	0.2018	0.8966	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2011	ROYALBANK	0.2717	0.3044	0.8924	F
2012	ROYALBANK	0.2043	0.2788	0.7328	F
2013	ROYALBANK	0.2067	0.3070	0.6734	F
2014	ROYALBANK	0.1973	0.2962	0.6662	F
2015	ROYALBANK	0.1151	0.2994	0.3845	F
2004	UNITEDOVERSEA	0.5648	0.8015	0.7046	F
2005	UNITEDOVERSEA	0.5602	0.8177	0.6851	F
2006	UNITEDOVERSEA	0.5476	0.8912	0.6144	F
2007	UNITEDOVERSEA	0.5358	0.8919	0.6008	F
2008	UNITEDOVERSEA	0.4639	0.6765	0.6858	F
2009	UNITEDOVERSEA	0.4879	0.7486	0.6518	F
2010	UNITEDOVERSEA	0.4757	0.7289	0.6526	F
2011	UNITEDOVERSEA	0.4874	0.7407	0.6581	F
2012	UNITEDOVERSEA	0.5675	0.8870	0.6398	F
2013	UNITEDOVERSEA	0.4923	0.7616	0.6465	F
2014	UNITEDOVERSEA	0.5066	0.8432	0.6007	F
2015	UNITEDOVERSEA	0.5187	0.8811	0.5887	F
Islamic Banks:					
2007	AFFIN-I	0.3536	1.0000	0.3536	D
2008	AFFIN-I	0.3137	0.3543	0.8853	D
2009	AFFIN-I	0.3422	0.3492	0.9802	D
2010	AFFIN-I	0.3611	0.3701	0.9758	D
2011	AFFIN-I	0.3017	0.3117	0.9681	D
2012	AFFIN-I	0.3421	0.3455	0.9902	D
2013	AFFIN-I	0.3691	0.3773	0.9782	D
2014	AFFIN-I	0.4450	0.4887	0.9105	D
2015	AFFIN-I	0.6291	0.7079	0.8887	D
2008	ALRAJHI-I	0.2948	0.2949	0.9999	F
2009	ALRAJHI-I	0.3470	0.4031	0.8608	F
2010	ALRAJHI-I	0.3746	0.4362	0.8588	F
2011	ALRAJHI-I	0.3504	0.3995	0.8773	F
2012	ALRAJHI-I	0.3381	0.3992	0.8469	F
2013	ALRAJHI-I	0.4518	0.5705	0.7920	F
2014	ALRAJHI-I	0.4646	0.5735	0.8101	F
2015	ALRAJHI-I	0.4994	0.6322	0.7899	F
2009	ALLIANCE-I	1.0000	1.0000	1.0000	D
2010	ALLIANCE-I	0.7048	0.7730	0.9117	D

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2011	ALLIANCE-I	0.8536	0.8858	0.9637	D
2012	ALLIANCE-I	0.9192	0.9533	0.9643	D
2013	ALLIANCE-I	0.9821	1.0000	0.9821	D
2014	ALLIANCE-I	1.0000	1.0000	1.0000	D
2015	ALLIANCE-I	0.9265	0.9451	0.9803	D
2007	AMBANK-I	0.8594	0.8853	0.9707	D
2008	AMBANK-I	1.0000	1.0000	1.0000	D
2009	AMBANK-I	0.8288	0.9145	0.9063	D
2010	AMBANK-I	0.8101	1.0000	0.8101	D
2011	AMBANK-I	0.7770	0.7770	1.0000	D
2012	AMBANK-I	0.9570	0.9652	0.9915	D
2013	AMBANK-I	0.9624	0.9666	0.9956	D
2014	AMBANK-I	1.0000	1.0000	1.0000	D
2015	AMBANK-I	1.0000	1.0000	1.0000	D
2007	ASIANFINANCE-I	0.0421	0.3303	0.1274	F
2008	ASIANFINANCE-I	0.0666	0.2672	0.2492	F
2009	ASIANFINANCE-I	0.1621	0.2740	0.5914	F
2010	ASIANFINANCE-I	0.1736	0.3042	0.5706	F
2011	ASIANFINANCE-I	0.2472	0.3421	0.7225	F
2012	ASIANFINANCE-I	0.3418	0.4116	0.8305	F
2013	ASIANFINANCE-I	0.4762	0.5806	0.8202	F
2014	ASIANFINANCE-I	0.6028	0.8079	0.7461	F
2015	ASIANFINANCE-I	0.4931	0.8789	0.5610	F
2004	BANKISLAM-I	0.4664	0.6159	0.7572	D
2005	BANKISLAM-I	0.3941	0.5472	0.7201	D
2006	BANKISLAM-I	0.3188	0.4711	0.6766	D
2007	BANKISLAM-I	0.2843	0.3819	0.7445	D
2008	BANKISLAM-I	0.2374	0.3001	0.7910	D
2009	BANKISLAM-I	0.3176	0.6554	0.4846	D
2010	BANKISLAM-I	0.3887	1.0000	0.3887	D
2011	BANKISLAM-I	0.3834	0.8593	0.4461	D
2012	BANKISLAM-I	0.4479	0.9844	0.4550	D
2013	BANKISLAM-I	0.4181	0.8467	0.4937	D
2014	BANKISLAM-I	0.4443	0.8212	0.5410	D
2015	BANKISLAM-I	0.4685	0.8485	0.5521	D
2004	BANKMUAMALAT-I	0.3041	0.3225	0.9431	D
2005	BANKMUAMALAT-I	0.2857	0.3030	0.9429	D
2006	BANKMUAMALAT-I	0.3159	0.3312	0.9540	D

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2007	BANKMUAMALAT-I	0.3378	0.3647	0.9263	D
2008	BANKMUAMALAT-I	0.3168	0.3483	0.9094	D
2009	BANKMUAMALAT-I	0.3616	0.4093	0.8834	D
2010	BANKMUAMALAT-I	0.2858	0.3371	0.8478	D
2011	BANKMUAMALAT-I	0.2926	0.3411	0.8579	D
2012	BANKMUAMALAT-I	0.3688	0.4800	0.7684	D
2013	BANKMUAMALAT-I	0.3835	0.5590	0.6861	D
2014	BANKMUAMALAT-I	0.4556	0.7248	0.6285	D
2015	BANKMUAMALAT-I	0.4537	0.7357	0.6167	D
2009	CIMB-I	0.6144	0.6904	0.8900	D
2010	CIMB-I	0.6542	0.6937	0.9431	D
2011	CIMB-I	0.6777	0.7824	0.8661	D
2012	CIMB-I	0.7005	1.0000	0.7005	D
2013	CIMB-I	0.7409	1.0000	0.7409	D
2014	CIMB-I	0.8082	0.9518	0.8491	D
2015	CIMB-I	0.8522	1.0000	0.8522	D
2006	HLEONG-I*	0.6903	0.7428	0.9293	D
2007	HLEONG-I	0.6766	0.7473	0.9053	D
2008	HLEONG-I	0.6778	0.7720	0.8779	D
2009	HLEONG-I	0.8555	0.8722	0.9808	D
2010	HLEONG-I	1.0000	1.0000	1.0000	D
2011	HLEONG-I	0.7106	0.7114	0.9988	D
2012	HLEONG-I	0.9172	0.9224	0.9944	D
2013	HLEONG-I	0.9335	0.9340	0.9995	D
2014	HLEONG-I	0.9639	0.9640	0.9999	D
2015	HLEONG-I	0.8926	0.9133	0.9773	D
2009	HSBC-I	0.6164	0.6279	0.9818	F
2010	HSBC-I	0.5761	0.5804	0.9925	F
2011	HSBC-I	0.6876	0.7175	0.9583	F
2012	HSBC-I	0.6684	0.7135	0.9367	F
2013	HSBC-I	0.5898	0.6167	0.9563	F
2014	HSBC-I	0.8151	0.8679	0.9392	F
2015	HSBC-I	0.6401	0.6906	0.9269	F
2006	KUWAITFINANCE-I	0.2170	0.2333	0.9301	F
2007	KUWAITFINANCE-I	0.3021	0.3429	0.8809	F
2008	KUWAITFINANCE-I	0.3772	0.5285	0.7136	F
2009	KUWAITFINANCE-I	0.4138	0.5229	0.7913	F
2010	KUWAITFINANCE-I	0.3570	0.4628	0.7714	F

continued…

Year	Banks	Technical Efficiency Score	Pure Technical Efficiency Score	Scale Efficiency Score	Origins of Bank Ownership
2011	KUWAITFINANCE-I	0.3264	0.4147	0.7871	F
2012	KUWAITFINANCE-I	0.3891	0.5201	0.7482	F
2013	KUWAITFINANCE-I	0.4123	0.5738	0.7186	F
2014	KUWAITFINANCE-I	0.4226	0.5753	0.7346	F
2015	KUWAITFINANCE-I	0.4524	0.5744	0.7876	F
2008	OCBC-I*	1.0000	1.0000	1.0000	F
2009	OCBC-I	0.4798	0.5139	0.9336	F
2010	OCBC-I	0.5310	0.5401	0.9830	F
2011	OCBC-I	0.5369	0.5396	0.9950	F
2012	OCBC-I	0.6700	0.6751	0.9923	F
2013	OCBC-I	0.6836	0.7002	0.9763	F
2014	OCBC-I	0.7274	0.7550	0.9634	F
2015	OCBC-I	0.7702	0.7962	0.9674	F
2011	PUBLICBANK-I	0.7092	0.7282	0.9738	D
2012	PUBLICBANK-I	0.8069	0.8237	0.9795	D
2013	PUBLICBANK-I	0.7667	0.7766	0.9872	D
2014	PUBLICBANK-I	1.0000	1.0000	1.0000	D
2015	PUBLICBANK-I	1.0000	1.0000	1.0000	D
2005	RHB-I	0.5268	0.5393	0.9768	D
2006	RHB-I	0.4806	0.4812	0.9988	D
2007	RHB-I	0.4767	0.4813	0.9906	D
2008	RHB-I	0.5364	0.5653	0.9489	D
2009	RHB-I	0.4537	0.4843	0.9368	D
2010	RHB-I	0.6226	0.7031	0.8856	D
2011	RHB-I	0.5183	0.5572	0.9301	D
2012	RHB-I	0.6460	0.7501	0.8611	D
2013	RHB-I	0.6819	0.8093	0.8426	D
2014	RHB-I	0.7834	0.8701	0.9004	D
2015	RHB-I	0.9052	1.0000	0.9052	D

*Note: BOA = Bank of America, BOC = Bank of China, BOTM = Bank of Tokyo-Mitsubishi UFJ, HLEONG = Hong Leong Banks, INDIAINTER = India International Bank, ICBC = Industrial and Commercial Bank of China, NBAD = National Bank of Abu Dhabi, STDCHARTERED = Standard Chartered Bank, HLEONG-I = Hong Leong Islamic Bank, OCBC-I = OCBC Al-Amin Bank.