

International Conference
Recent Developments in Asian Trade Policy and Integration
Centre for Research on Globalisation and Economic Policy
(GEP)
University of Nottingham

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Financial Institutions in Selected Asian Countries

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20-21 February 2013

Kuala Lumpur Teaching Centre for the University of Nottingham Malaysia Campus,
Malaysia

Bank Efficiency, Regulation and Response to Crisis of Financial Institutions in Selected Asian Countries*

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Abstract

This paper studies the determinants of efficiency of banks in the Southeast Asian countries of Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The study, which covers nearly 600 banks from 1994 to 2008, adopts the two-stage least square fixed-effects (FE2SLS) and two-stage least square random-effects estimators (RE2SLS) as provided by Baltagi (2001) to address individual bank heterogeneity and endogeneity issues related to bank efficiency. It focuses on three key areas: (1) bank-specific activities such as off-balance sheet activities of banks, (2) financial liberalization through foreign participation and ownership, and (3) impact of bank regulation and supervision. The results of the paper indicate that off-balance sheet activities tend to reduce bank efficiency. The foreign participation and ownership in the financial markets tend to increase bank efficiency. The results of the paper indicate that bank regulation and supervision will be crucial to improve the efficiency of the banks and stability in the financial markets in the Southeast Asia.

JEL codes: G18, G21, G28

Keywords: banking efficiency, regulation, supervision, off-balance sheet

* We would like to thank, first, Guo Jaijing and Xu Kaixian for their excellent research assistance and, second, ERIA for the financial support for the project that generated these papers. The paper was presented at the ERIA Workshop Program, "Linkages between Real and Financial Aspects of Economic Integration in East Asia", Singapore, 28 February 2010. We would like to thank Shujiro Urata, Jenny Corbett, Tony Cavoli, Victor Pontines, Friska Parulian, Kazuki Onji and Reza Siregar for their helpful comments on an earlier draft

Introduction

With the pace of financial market liberalization, financial institutions are facing increasing competition and greater volatility from external shocks. In such an environment, efficient banks and financial institutions will have greater competitive advantage. Banking efficiency is also important to maintain the stability of the financial markets (Berger et al., 1993; Schaeck et al., 2009). Efficient banks are, in addition, better able to diversify their activities and channel funds effectively to economically viable activities in the economy, thereby providing greater stability for the economy.

A competitive environment is a spur to efficiency but it may also increase risk-taking activities as banks are forced to adopt non-traditional banking activities to maintain their share in the financial markets (Edwards and Mishkin, 1993). The regulatory concern is that competition in the financial market could lead to excessive risk-taking behaviour leading to instability in the financial markets. The 2007 global crisis provides examples of excessive off-balance sheet activities of banks. The traditional banking model was replaced by the “originate and distribute” banking model where loans are pooled, tranced and then resold via securitization (Brunnermeier, 2009). Financial innovation that had supposedly made the banking system more stable by transferring risk to those most able to bear it had an unprecedented credit expansion. To offload the risk, banks repackaged the loans and passed them on to other financial investors through structured products often referred to as collateralized debt obligations (CDOs). Financial market regulation plays an important role in maintaining a balance between competition and risk-taking activities in the financial sector, but in the process it may affect the efficiency of the financial institutions.

The determinants of efficiency of banks in the Southeast Asian countries of Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam are discussed in this paper, which covers nearly 600 banks from 1994 to 2008. The study is expected to help improve the institutional, regulatory and supervisory framework of financial institutions in the region by identifying factors that could contribute to their efficiency.

There are four key aspects of the paper. First, it studies the impact of financial market regulation on bank efficiency. One of the objectives of bank regulation is to manage competition and risk-taking activities in the financial sector. In this case, bank regulation tends to retard competition and innovative activities of financial institutions, thereby affecting the efficiency of financial institutions. Recent studies highlight the positive impact of regulation on banking activities in terms of increased market monitoring and a better-quality contracting environment, which has a positive impact on bank efficiency (Gonzales, 2009). In this paper, we study the impact of bank regulation and supervision on bank efficiency in terms of the regulation of the activities that generate non-interest income, the intensity of monitoring of banks by private sector organizations, and the extent of official supervision by the central bank. To our knowledge, this is the first paper to address the impact of bank regulation and supervision on bank efficiency for Southeast Asian banks.

The paper also studies the impact of financial market liberalization, in terms of opening up the financial sector to foreign participation and foreign ownership, on the efficiency of financial institutions. Foreign banks are generally restricted in entry and operations in Asia, and the penetration of foreign banks in Asia is much lower than in Central Europe and Latin America (Montgomery, 2003). Foreign banks in Asia are restricted in commercial lending activities and limited to a few branches in comparison to the local banks. For example, in Indonesia, foreign banks are restricted geographically in lending activities in the Jakarta region and in taking time deposits. In most Asian countries, foreign banks are restricted in access to the Central Bank discount window and to subsidized trade credit facilities. In Korea, foreign banks are allowed to operate only restricted branches within the city area, thereby restricting their access to local currency deposits; and the total amount of deposit they can accept is also restricted (Montgomery, 2003).

The impact of financial market liberalization is an important talking point following the experience of the Asian Crisis in 1997. Following the Crisis, Singapore liberalized its financial sector by increasing the foreign ownership and participation of foreign banks in the domestic economy. In contrast, Malaysia adopted capital controls that limited the flow of capital and the role of foreign participation in the financial and domestic markets. Malaysian policies are argued by some to have led in the short run to a faster economic recovery, smaller decline in unemployment and wages, and a more rapid turnaround of the stock market (Kaplan and Rodrik, 2001). However, there is no clear evidence of the impact of capital controls in the long run on bank efficiency. An understanding of the impact of foreign participation on the productive performance of banks in the long term is valuable. A recent study by Kose et al. (2009) also shows that financial openness has a robust positive impact on TFP growth in the domestic economy. A study by Xu (2010) provides strong empirical evidence that foreign entry led to a more competitive and efficient banking industry in China. However, Obstfeld (2009) says that there is little evidence of a direct positive impact of financial openness on the economic welfare of developing countries. The paper studies the impact of foreign ownership and participation in the financial markets on individual bank efficiency.

Our study further examines the impact of the off-balance sheet activities of banks on their efficiency. Increasingly, banks are using off-balance sheet activities in pursuit of higher profits and to satisfy the rising consumer demand for non-banking products. These off-balance sheet activities could be associated with excessive risk taking, which subsequently affects efficiency. There is little research that examines financial innovation in terms of the off-balance sheet activities of Southeast Asian banks and this study fills this gap. Finally, this work contributes to the understanding of the risk of the misallocation of funds by banks arising from the moral hazard issues associated with state influence and guarantees (Radelet and Sachs, 1998). We used a bank's equity-to-asset ratios and its corporate linkages, via its own ownership structure or its links to subsidiaries, to capture the impact of the related moral hazard issues on productive performance.

The chapter is organized as follows. Section 2 discusses the methodology, and the construction of the data is presented in Section 3. The results are presented in Section

4 and the conclusion in Section 5.

Empirical Methodology

The paper adopts panel data framework to study the determinants of bank efficiency. The regression equation is given as:

$$\text{Bank-Efficient}_{it} = \alpha_0 + \alpha_1 \text{Fin}_{it} + \alpha_2 \text{Reg}_{it} + \alpha_3 \text{Types}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (1)$$

where $\text{Bank-Efficient}_{it}$ is the bank efficiency measure of bank i in year t ; Fin_{it} is the set of specific characteristics of Bank i in year t ; Reg_{it} is the set of bank regulatory and supervision variables; Types_{it} captures the bank types; θ_t are dummies to capture any unobserved bank-invariant time effects not included in the regression; μ_i are unobservable bank-specific effects that vary across the banks but are constant over time; and ε_{it} are white-noise error terms.

We adopt fixed-effects and random-effects to estimate Equation (1). It is very likely that there are endogeneity problems in Equation (1) in terms of reverse causation, whereby bank regulation and supervision might be responding to the efficiencies of the bank. Thus, failure to account for the simultaneity problems might lead to biased estimation and coefficients.² To address this problem we adopt the two-stage least square fixed-effects (FE2SLS) and two-stage least square random-effects estimators (RE2SLS) as provided by Baltagi (2001). Both FE2SLS and RE2SLS are expected to control for the presence of unobservable bank-specific effects and potential endogeneity of bank efficiency.

Data and Construction of Variables

3.1. Data

The main bank level data for the study is obtained from BankScope Database. Bank-level information to estimate bank efficiency is taken from BankScope Database. All data used are expressed in 1996 US dollar terms and consolidated bank balance sheet and income statement data will be used whenever available. The construction of regulatory and supervisory variables is based on Barth, Caprio, and Levine (2004, 2006) and the World Bank's Bank Regulation and Supervision Database. The full description of the data is given in Table A1 in the Appendix.

² The FE2SLS and RE2LS estimations are expected to correct for the key endogeneity problems in the estimation such as those related to bank regulation and supervision and also any endogeneity effects from the TE-TA ratio.

3.2. Variables

3.2.1. Bank efficiency measure

To measure bank efficiency, we adopted the DEA (data envelopment analysis) analysis. This framework has been extensively used to study the efficiency of financial institutions as in Casu et.al (2004), Gonzales (2009), Isik and Kabir (2003), Leightner and Lovell (1998), Strum and Williams (2004) and Wheelock and Wilson (1999).³ A recent paper by Gonzales (2009) used DEA to measure the bank efficiency of commercial banks in 69 countries to study the impact of political economy variables on bank efficiency. Isik and Kabir (2003) utilized DEA analysis to examine productivity growth and technical progress in Turkish commercial banks during the deregulation of financial markets in Turkey. Strum and Williams (2004) adopted the DEA framework to study the efficiency of banking in Australia during the post-deregulation period 1988 to 2001. Casu et al. (2005) examined the efficiency of European banks for the period 1994 to 2000 using the DEA framework and found Italian and Spanish banks have higher productivity increases compared to German, French and English banks.

Data envelopment analysis (DEA) is a nonparametric method to estimate production functions, particularly the productive efficiency of decision-making units. DEA employs mathematical programming to estimate the tradeoffs inherent in the empirical efficient frontier. The efficient frontier identified by DEA is the benchmark against which other decision-making units will be compared (see Gonzales, 2009). Two alternative approaches can be employed in the determination of the efficient frontier: input-oriented and output-oriented approaches. In the input-oriented approach, the outputs of each decision-making unit are held at the current levels and the minimal amount of inputs required by an efficient producer to produce those specific levels of outputs will be estimated. A comparison between this optimal level of inputs required and the actual level of inputs each producer uses will yield an efficiency measure for each decision-making unit. The output-oriented approach is similar, except that the inputs are kept fixed at the current levels and the maximum amount of outputs that can be produced at those levels of inputs will be estimated and compared against the actual levels of outputs of each producer. In the estimation of the efficient frontier, either constant returns to scale (CRTS) or variable returns to scale (VRTS) can be assumed. DEA efficiency scores ranges between 0 and 1, with 1 being fully efficient.

DEA has several advantages in terms of its application to the financial sector. It does not require knowledge of the explicit functional form or assumptions with regard to its stochastic error terms, which is particularly important as it is difficult to define the functional forms of bank production. Nor does it require a large sample size to implement. In this study we adopt the input orientation to measure the efficiency of each bank with the assumptions of constant (Input CRS). As in Berger and Mester (1997), DeYoung and Nolle (1998) and Gonzales (2009), we used three inputs – personnel expenses, book value of fixed assets and loanable funds (sum of deposits and

³ See Berger and Humphrey (1997) for an application of DEA analysis in the financial sector.

non-deposit funds) – and two outputs – total loans and non-interest income. In this approach, a frontier is calculated for each individual country and a bank's efficiency is measured relative to its country's own frontier (banks are equally weighted).

The average bank efficiency measure using DEA for the selected Southeast Asian countries is given in Table A2 in the Appendix. Indonesia, Malaysia and Vietnam have experienced low levels of bank efficiency among the countries in the sample. In fact, the bank efficiency for Vietnam is lowest among the six Southeast Asian countries while Singapore and the Philippines have the highest. It is interesting to notice that the banking efficiency of Malaysia is lower than that of Indonesia and Thailand, and is a declining trend over time except for 1999–2003. It will be interesting to examine if this result is due to the capital controls and restrictions on foreign participation imposed by Malaysia since 1998 after the Asian Crisis. We also notice that banking efficiency is declining for all Southeast Asian banks except for Vietnam. Although the bank efficiency measures for the Philippines, Singapore and Thailand are relatively high, they also declined in recent years.

In this paper, we adopt the two-stage framework to study the determinants of bank efficiency. The efficiency measure derived from DEA in the first stage is used as an independent variable in the second stage. Recent studies by Banker and Natarajan (2008), Simar and Wilson (2007) and Souza and Staub (2007) highlight that the two-stage analysis using DEA is viable and under certain conditions can even capture the nonparametric stochastic efficiency results.

Our measure of efficiency is based on activity, particularly loans and other banking activities that earn a fee, and might better be described as a productivity or technical efficiency measure. A more complete measure of efficiency would be based on profits or margins, and that extension is a topic for further work, which may also involve the application of other estimation methods, such as a stochastic frontier.

3.2.2. Bank regulation and supervision

The study used three key regulatory and supervisory variables. The variable RESTRICT measures the extent of bank regulations that restrict activities that generate non-interest income. This variable indicates if bank activities in the securities, insurance, and real estate markets and bank ownership and control of nonfinancial firms are unrestricted, permitted, restricted or prohibited. Higher values indicate a higher level of restrictions.

The bank supervision variables are represented by the intensity of private monitoring (MONITOR) and official supervision of banks (OFFICIAL). Both variables were derived as given in Barth, Caprio and Levine (2004, 2006). The MONITOR index contains information regarding the external auditing of banks, ratings by international agencies, the availability of an explicit deposit insurance scheme, and the disclosure of risk-management procedures to the public. The OFFICIAL index provides information regarding the extent to which regulators have the authority to take regulatory actions. Higher values for MONITOR and OFFICIAL indicate greater

private oversight and more official supervisory power, respectively.

3.2.3 Specific Characteristics of Financial Institutions

We used several variables to capture specific banking activities that could directly affect the productive performance of banks. Several studies have highlighted the importance of capital requirements. Higher capital requirements will have a direct impact on the risk-taking activities of the owners of the bank. To capture this effect, we introduced the total equity to total assets ratio (TE_TA). To capture the liquidity effects of the banks we used loan loss reserve to total loans ratio (LOANLR_GL), liquid assets to total assets ratio (LA_TA), and non-earning assets to total assets ratio (NEA_A). To account for the off-balance sheet activities of banks, we used off-balance sheet to total assets ratio (OFFBAL_A).

The impact of foreign ownership and partnership on bank performance is given by a dummy variable, FOREIGN, which represents majority foreign ownership of more than 50 percent equity ownership of the banks. We also show whether the bank is a public bank (PUBLIC), wherein the government has more than 25 percent ownership. To capture the moral hazard issues related to banks taking ownership of banks and private companies taking ownership of banks, we introduce the dummy variable SUBSIDIARY that indicates if the bank is a subsidiary or if it has a subsidiary. We also introduce dummy variables to capture the types of banking activities of the bank.

Results: Determinants of Bank Efficiency

The key trends of TE_TA (ratio of total equity to total assets ratio), LOANLR_GL (loan loss reserve to total loans ratio), LA_TA (liquid assets to total assets ratio), NEA_A (non-earning assets to total assets ratio) and OFFBAL_A (off-balance sheet to total assets ratio) are given in Table A3 in the Appendix. We also present the plots of TE_TA, LOANLR_GL, LA_TA, and NEA_A in Figures A1 to A5. In Figure A1, TE_TA tends to fall in the Asian crisis period of 1997–1999 and then increase during the post-crisis period of 2000–2008. Singapore and Thailand increase their total equity to total assets ratio by nearly 20 percent in 2000–2008. The other selected ASEAN countries of Malaysia, Indonesia, The Philippines and Vietnam also increase their TE_TA ratio by nearly 15 percent. In particular, Indonesia experienced a TE_TA ratio of less than 5 percent in 1997–1999, which increased to nearly 15 percent in 2000–2008.

The LOANLR_GL ratio tends to increase during an economic crisis, which is shown clearly among the ASEAN countries in Table A2. Most ASEAN countries increased their LOANLR_GL ratio in 2000–2008 by nearly 10 percent except Vietnam. The higher LOANLR_GL indicates that the financial institutions are holding higher liquidity reserves to ride volatility in output in the post-Asian crisis period. The higher liquidity assets holding is also reflected by the liquidity assets to total assets ratio (LA_TA ratio) for Malaysia in Figure A3, which shows that it is holding more than 25 percent of liquid assets to total assets. In comparison, the other countries are holding more than 15

percent of liquid assets to total assets

In Figure A4, the non-earning assets to total assets (NE_A) are nearly 30 percent for Malaysia in 2000–2008, indicating the vulnerability of the Malaysian financial markets relative to other ASEAN countries. The vulnerability of Malaysian financial markets is also indicated in Figure A5, the off-balance sheet to total assets ratio (OFFBAL_A). Although the off-balance sheet to total assets ratio declined in 2000–2008, it remained nearly 25 percent for Malaysia. The other ASEAN countries experienced around 15 percent of OFFBAL_A ratio.

The results of the panel study are given in Tables 1 to 2. Table 1 report the estimations based on the bank efficiency measurement using constant returns to scale (CRS) using fixed- (FE) and random-effects (RE) specifications, respectively. To account for bank-specific effects and endogeneity issues in our estimation, we adopted the two-stage least square estimation for fixed- (FE2SLS) and random-effects (RE2SLS) specifications proposed by Baltagi (2001). We used the liquid assets to total bank deposits and borrowing ratio, the sample size for DEA estimation, and types of banks as instrumental variables in the estimation. The results of FE2SLS and RE2SLS estimation are reported in Table 2. The results of our study are very consistent across both the fixed- (FE) and random-effects (RE) specifications.

[Insert Table 1 here]

[Insert Table 2 here]

4.1. Specific Bank Characteristic

It is interesting to note that bank-specific characteristics have an important impact on the efficiency of banks. TE_TA, the capital requirement variable, is positive and statistically significant, which indicates that an increase in capital requirements of banks tends to improve their efficiency. This suggests that banks might experience better risk management if they assume greater ownership of their activities. This result is in line with the recent recommendation by the Basel II Accord to increase capital requirements to manage the risk-taking activities of banks (BIS, 2006). The estimation based on FE2SLS and RE2SLS indicate that the impact of TE_TA on bank efficiency is much stronger and more robust (see Table 2). Our results are also consistent with the recent study on the Brazilian banks by Staub et al. (2009) that indicates that higher bank equity ratio reduces the moral hazards of bankers and thus reduces the allocative inefficiencies of banks.

The variables to capture the bank liquidity effects are not statistically significant in FE and RE estimations as given in Table 1 using the constant returns-to-scale measure. We also notice that the loan loss reserve to gross loans ratio (LOANLR_GL) and non-earning assets to total assets ratio (NEA_A) variables are statistically significant in FE2SLS and RE2SIS estimations as indicated in Table 2. The provisions for more reserves to protect loan losses and more liquid assets tend to improve the overall productive performance of banks.

The off-balance sheet effect of banks (OFFBAL_A) is negative and statistically significant at the 1 percent level to both the FE and RE estimation specifications. It is also robust to the FE2SLS and RE2SLS estimations. The negative coefficient of off-balance sheet activities indicates that constraining the non-traditional activities of banks will have a positive outcome on the efficiency of banks.

Foreign participation and ownership in the financial sector have positive effects on banking efficiency (see the positive and statistically significant coefficient for the FOREIGN variable).

There is a negative coefficient on the SUBSIDIARY variable. This result is statistically significant at the 1 percent level and robust to FE2SLS and RE2SLS estimations. This indicates that there are moral hazard issues if banks take ownership of companies and if they are bought by corporations.

The results indicate that the types of banking activities have different impacts on the efficiency of banks in Southeast Asia and thus diversification of banking activities is important to maintain banking performance and efficiency.

4.2. Bank Regulation and Supervision

The results for the banking regulation and supervision variables of RESTRICT (restrictions on activities that generate non-interest income), MONITOR (intensity of private monitoring) and OFFICIAL (index of official supervision) are statistically significant and robust to the FE2SLS and RE2SLS estimations.

The MONITOR variable in our study is negative and statistically significant at the 1 percent level. This result is very robust in our FE2SLS and RE2SLS specifications. It is supported by the recent study by Gonzales (2009) that indicated a negative coefficient for intensity of private monitoring of financial markets. The negative coefficient in our study indicates that private monitoring does not yield a positive outcome for the financial markets in Southeast Asia. It is likely that more developed and well-diversified financial markets will rely heavily on the private sector to provide information on the activities of the banks for depositors and potential investors. However, given the stage of growth of the financial markets in Southeast Asia and developing countries, private monitoring might not produce a positive impact in these countries as compared to those hosting well-developed financial markets. This result supports the views expressed during both the recent Global Financial Crisis and the Asian Crisis concerning the moral hazard issues related to weak private sector monitoring of the financial markets by rating agencies and private investors.

In contrast, the supervisory and regulatory role of the central bank seems to produce a positive outcome in terms of improvements in the bank efficiency of the financial institutions in Southeast Asia. The RESTRICT variable that captures the restrictions on activities that generate non-interest income is positive and statistically significant. This suggests that the regulatory role of central banks in the region is crucial to bank efficiency. Monitoring and regulating the balance sheet activities of banks tends to improve the productive performance of the banks in our sample. The coefficient on

the bank supervisory variable (OFFICIAL) is also positive and statistically significant in our estimations. The transparency of the supervisory function and the official authority of the supervisory activities of the central bank improve banking efficiency. In comparison, the variable on the restriction of activities of non-interest income (RESTRICT) tends to have a higher coefficient in our estimation, indicating that restrictions on bank activities are associated with higher increments to bank efficiency compared to the OFFICIAL variable.

Conclusion

This paper studied the determinants of the technical efficiency of banks in Southeast Asia using individual bank data from 1994 to 2008. The study controlled for bank heterogeneity and endogeneity issues by adopting the two-stage least square estimation of fixed and random effects as provided by Baltagi (2001).

The results highlight certain key activities that could be valuable to policy makers to improve banking efficiency and thereby stability in financial markets. More extensive non-traditional banking activities, in terms of off-balance sheet activities, are associated with lower levels of efficiency. More extensive corporate linkages to a bank also tend to reduce efficiency. There are further implications of these linkages that may also have a direct impact on system stability. Based on the experience from the Asian Crisis, linkages with corporations that may induce moral hazard have to be monitored and the transparency of such relationships will be very important for the stability of the financial system.

Given the different stages of financial and economic development, a greater concentration on traditional banking activities such as government savings banks and Islamic banking has a positive impact on efficiency..

Compared with private sector monitoring of financial activities, the role of banking regulation and supervision is important for the efficiency of banks in Southeast Asia. Our results highlight the importance of bank regulation and supervision for improving bank efficiency in the region compared with private sector monitoring of banking activities. In particular, restrictions on risky activities of banks tend to produce more efficient banks. Thus, central banks in the region gain from a better system of monitoring and supervising the risk-sensitive activities of the banks.

The results of the paper have important implications for liberalizing the financial sector in terms of increasing foreign ownership and participation as they show that there are positive impacts on bank efficiency from foreign ownership and participation. The financial openness of the financial markets will be important for their development and regional integration.

Bank regulation and supervision is important for the efficiency of banks and for stability in the financial markets in the Southeast Asia. However, different types of bank regulation and supervision produce different results and recognition of the impact of different policies will be important to achieve the desired outcomes. The right balance

between creating a competitive market, including foreign participation, alongside prudent banking regulation and supervision will be important for banking efficiency and for stability in financial markets.

References

- Baltagi, Badi H. (2001). *Econometric Analysis of Panel Data*. New York: John Wiley and Sons.
- Banker, R.D., and R. Natarajan (2008). “Evaluating Contextual Variables Affecting Productivity Using Data Envelopment Analysis.” *Journal of Operations Research* 56, no. 1: 48-58.
- Barth, James R., Gerald Caprio Jr., and Ross Levine (2004). “The Regulation and Supervision: What Works Best?” *Journal of Financial Intermediation* 13: 205-48.
- Barth, James R., Gerald Caprio Jr., and Ross Levine (2006). *Rethinking Bank Supervision and Regulation: Until Angels Govern*. Cambridge, UK: Cambridge University Press.
- Berger, A.N., D. Hancock, and D.B. Humphrey (1993). “Bank Efficiency Derived from the Profit Function.” *Journal of Banking and Finance* 17: 317–47.
- Berger, Allen, and David B. Humphrey (1997). “Efficiency of Financial Institutions: International Survey and Directions for Future Research.” *European Journal of Operational Research* 98: 175–212.
- Berger, Allen N. and Loretta J. Mester (1997). “Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions.” *Journal of Banking and Finance* 21: 895–947.
- BIS, 2006. “International Convergence of Capital Measurement and Capital Standards”, Basel Committee on Banking Supervision, CH-4200 Basel, Switzerland.
- Brunnermeier, Mark, 2009. “Deciphering the Liquidity and Credit Crunch 2007–2008.” *Journal of Economic Perspective*. 23, no. 1: 77–100.
- Casu, B., C. Girardone, and P. Molyneux (2004). “Productivity Change in European Banking: A Comparison of Parametric and Non-Parametric Approaches.” *Journal of Banking and Finance* 28, no. 10: 2521–40.

DeYoung, Robert, and Daniel E. Nolle (1998). "Foreign-Owned Banks in the US: Earning Market Share or Buying It?" *Journal of Money, Credit and Banking* 28: 622–36.

Edwards, Franklin, and Frederic S. Mishkin (1993). "The Decline in the Traditional Role of Banks: Implications for Financial Stability and Regulatory Policy." NBER Working Paper No. 4993.

Gonzalez, Francisco (2009). "Determinants of Bank-Market Structure: Efficiency and Political Economy Variables", *Journal of Money, Credit and Banking* 41, no. 4: 736–54.

Isik, Ihsan, and Kabir Hassan (2003). "Financial Deregulation and Total Factor Productivity Change: An Empirical Study of Turkish Commercial Banks." *Journal of Banking and Finance* 27, no. 8: 1455–85.

Kaplan, Ethan, and Dani Rodrik (2001). "Did the Malaysian Capital Controls Work?" NBER Working Paper No. 8142.

Kose, Ayhan, Eswar S. Prasad, and Marco E. Terrones (2009). "Does Openness to International Financial Flows Raise Productivity Growth?" *Journal of International Money and Finance* 28, no. 4: 554–80.

Leightner, Jonathan E., and Knox Lovell (1998). "The Impact of Financial Liberalization on the Performance of Thai Banks." *Journal of Economics and Business* 50: 115–31.

Montgomery, Heather (2003). "The Role of Foreign Banks in Post-Crisis Asia: The Importance of Method of Entry." ADB Institute Research Paper No. 51, ADB Institute, Tokyo.

Obstfeld, Maurice, 2009. "International Finance and Growth in Developing Countries: What have we learned?" NBER Working Paper No. 14691.

Radelet, Steven, and Jeffrey Sachs (1998). "The Onset of the East Asian Financial Crisis." NBER Working Paper No. 6680.

Schaeck, Klaus, Martin Cihak, and Simon Wolfe (2009). "Are Competitive Banking

Systems More Stable?” *Journal of Money, Credit and Banking* 41, no. 4: 711–34.

Simar, L., and P. Wilson (2007). “Estimation and Inference in Two-stage, Semi-parametric Models of Production Process.” *Journal of Econometrics* 136: 31–64.

Souza, G., and R. Staub (2007). “Two-stage Inference Using Data Envelopment Analysis Efficiency Measurements in Univariate Production Models.” *Transactions in Operations Research* 14: 245–58.

Staub, R., Geraldo da Silva e Souza, and Benjamin Miranda Tabak (2009). “Evolution of Bank Efficiency in Brazil: A DEA Approach.” *Pesquisa Operacional na Gestão do Conhecimento*, XLI SBPO 1616–28.

Strum, Jan-Egbert, and Berry William (2004). “Foreign Banks Entry, Deregulation and Bank Efficiency: Lessons from Australian Experience.” *Journal of Banking and Finance* 28, no. 7: 1775–97.

Wheelock, David C., and Paul W. Wilson (1999). “Technical Progress, Inefficiency, and Productivity Change in US Banking, 1984–1993.” *Journal of Money, Credit and Banking* 31: 212–34.

Xu, Ying (2010). “Towards a more accurate measure of foreign bank entry and its impact on domestic banking performance: A case of China.” Crawford School of Economics and Government, Australian National University.

Appendix

Table A2. Description of Variables

| | |
|---|------------------------------------|
| • Period | 1994–2008 |
| • | |
| • Country | Coverage of Number of banks |
| • Indonesia | 129 |
| • Malaysia | 131 |
| • Singapore | 110 |
| • Thailand | 73 |
| • The Philippines | 83 |
| • Vietnam | 43 |
| • | |
| • Description | Variables |
| • Total Equity/Total Assets | TE_TA |
| • Loan Loss Reserve/Gross Loans | LOANLR_GL |
| • Liquid Assets/Total Assets | LA_TA |
| • Non Earning Assets/Assets | NEA_A |
| • Off Balance Sheets/Assets | OFFBAL_A |
| • Majority foreign owned | FOREIGN |
| • Public bank (>25% Govt ownership) | PUBLIC |
| • Subsidiary or has Subsidiary | SUBSIDIARY |
| • Bank Regulation & Supervision | |
| • Bank Regulation: Restrictions on activities that generate non-interest income | RESTRICT |
| • Bank Supervision: Intensity of private monitoring | MONITOR |
| • Bank Supervision: Official Supervision | OFFICIAL |
| • Bank Efficiency | |
| • DEA efficiency, input CRS method | Input CRS |
| • | |
| • Sample size for DEA estimation for country year | DEAsize |

Table A2. Average Bank Efficiency for the Years 1994–2008

| | Input CRS |
|------------------|--------------|
| Indonesia | |
| 1994–2008 | 0.269 |
| 1994–1998 | 0.210 |
| 1999–2003 | 0.430 |
| 2004–2008 | 0.170 |
| 2007–2008 | 0.184 |
| Malaysia | |
| 1994–2008 | 0.185 |
| 1994–1998 | 0.150 |
| 1999–2003 | 0.231 |
| 2004–2008 | 0.175 |
| 2007–2008 | 0.187 |
| Singapore | |
| 1994–2008 | 0.761 |
| 1994–1998 | 0.908 |
| 1999–2003 | 0.778 |
| 2004–2008 | 0.616 |
| 2007–2008 | 0.650 |
| Thailand | |
| 1994–2008 | 0.698 |
| 1994–1998 | 0.752 |
| 1999–2003 | 0.621 |
| 2004–2008 | 0.721 |
| 2007–2008 | 0.714 |
| Philippines | |
| 1994–2008 | 0.860 |
| 1994–1998 | 0.920 |
| 1999–2003 | 0.921 |
| 2004–2008 | 0.740 |
| 2007–2008 | 0.830 |
| Vietnam | |
| 1994–2008 | 0.060 |
| 1994–1998 | 0.025 |
| 1999–2003 | 0.048 |
| 2004–2008 | 0.105 |
| 2007–2008 | 0.120 |

Table A3. The Trends of Key Bank Variables from 1994–2008 (%)

| | Year | TE_TA | LOANLR_GL | LA_TA | NEA_A | OFFBAL_A |
|-----------------|-----------|-------|-----------|-------|-------|----------|
| Indonesia | 1994-1996 | 10.4 | 1.8 | 23.1 | 5.3 | 11.8 |
| | 1997-1999 | 2.9 | 17.0 | 32.2 | 11.3 | 8.1 |
| | 2000-2008 | 14.5 | 7.1 | 32.6 | 9.9 | 15.0 |
| Malaysia | 1994-1996 | 8.8 | 3.2 | 23.9 | 18.5 | 38.1 |
| | 1997-1999 | 9.8 | 6.5 | 19.9 | 17.9 | 36.5 |
| | 2000-2008 | 16.0 | 8.3 | 29.2 | 20.4 | 24.7 |
| The Philippines | 1994-1996 | 17.2 | 2.0 | 25.2 | 8.4 | 29.0 |
| | 1997-1999 | 20.6 | 5.0 | 23.0 | 10.9 | 11.5 |
| | 2000-2008 | 15.4 | 9.6 | 22.5 | 13.5 | 10.0 |
| Singapore | 1994-1996 | 27.3 | 3.7 | 19.7 | 8.5 | 11.7 |
| | 1997-1999 | 14.9 | 10.9 | 19.5 | 7.8 | 15.1 |
| | 2000-2008 | 23.1 | 9.4 | 27.1 | 13.7 | 15.3 |
| Thailand | 1994-1996 | 9.3 | 1.5 | 9.5 | 3.7 | 14.3 |
| | 1997-1999 | 8.6 | 11.7 | 11.8 | 4.9 | 16.1 |
| | 2000-2008 | 19.0 | 8.4 | 15.4 | 10.4 | 19.2 |
| Vietnam | 1994-1996 | 18.0 | 6.5 | 25.7 | 8.9 | 16.3 |
| | 1997-1999 | 14.9 | 1.3 | 40.0 | 7.7 | 12.8 |
| | 2000-2008 | 13.0 | 1.2 | 37.5 | 9.3 | 10.0 |

Figure A1: Total Equity to Total Assets (TE_TA) for Selected Asian Countries

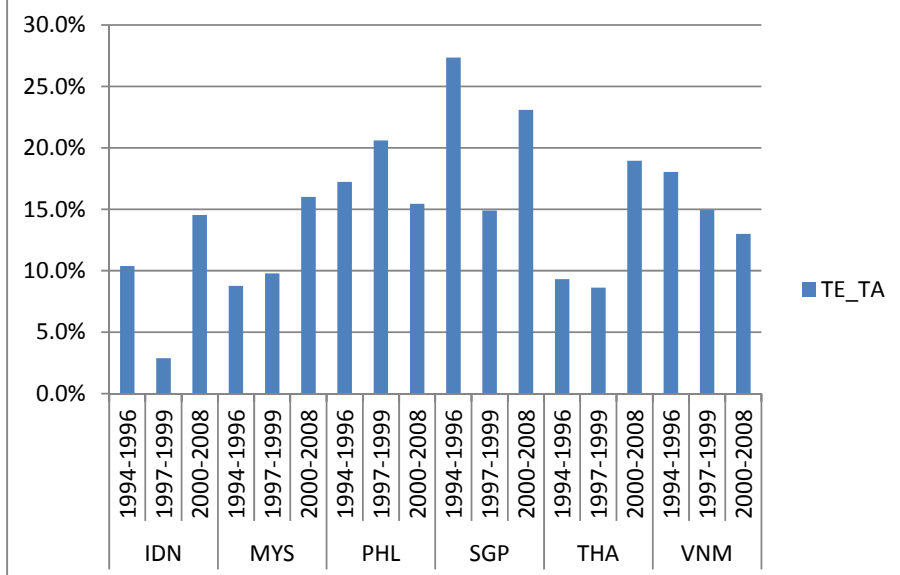


Figure A2: Loan Loss Reserve to Total Assets (LOANLR_GL)

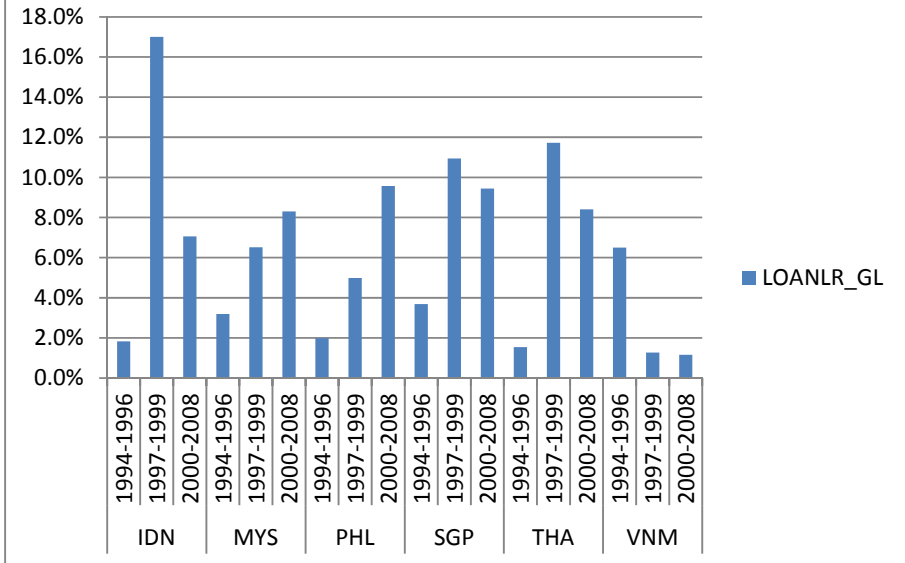


Figure A3: Liquid Assets to Total Assets (LA_TA)

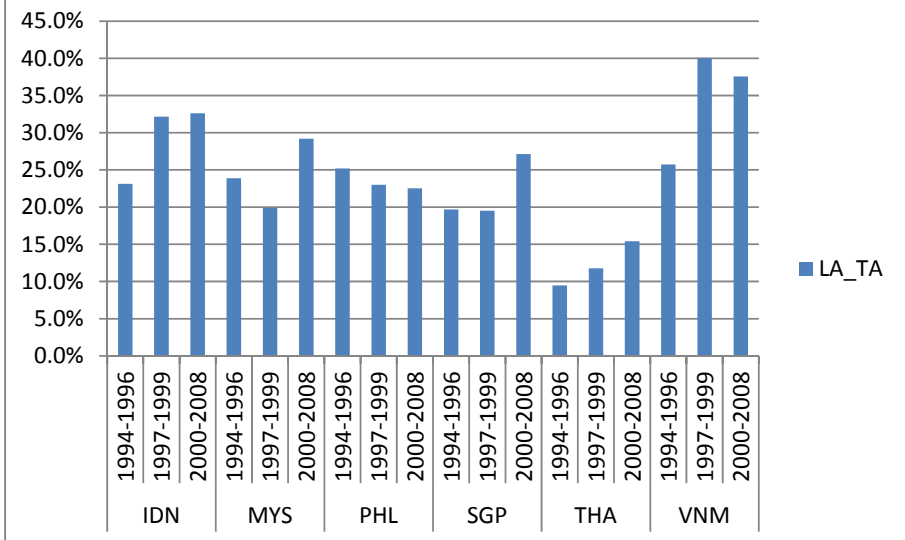


Figure A4: Total Non-Earning Assets to Total Assets (NEA_A) for Selected Asian Countries

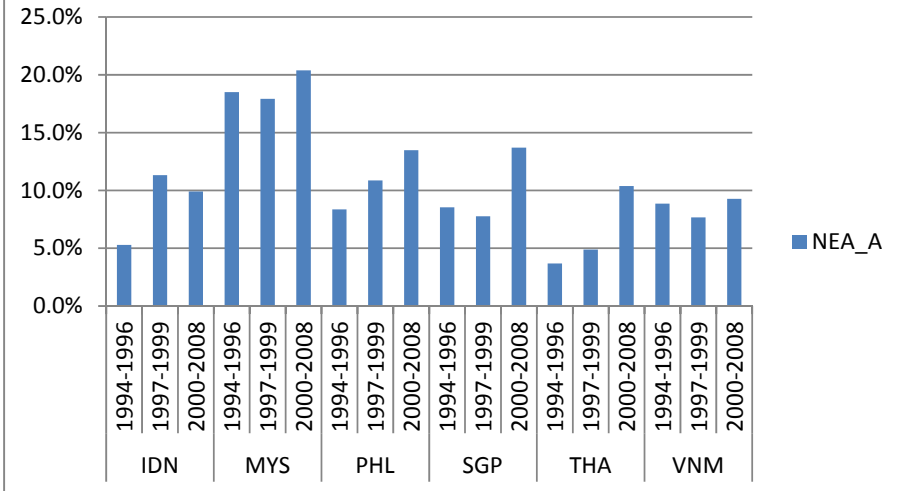


Figure A5: Off-Balance Sheet Activities to Total Assets (OFFBAL_A) of Selected Asian countries

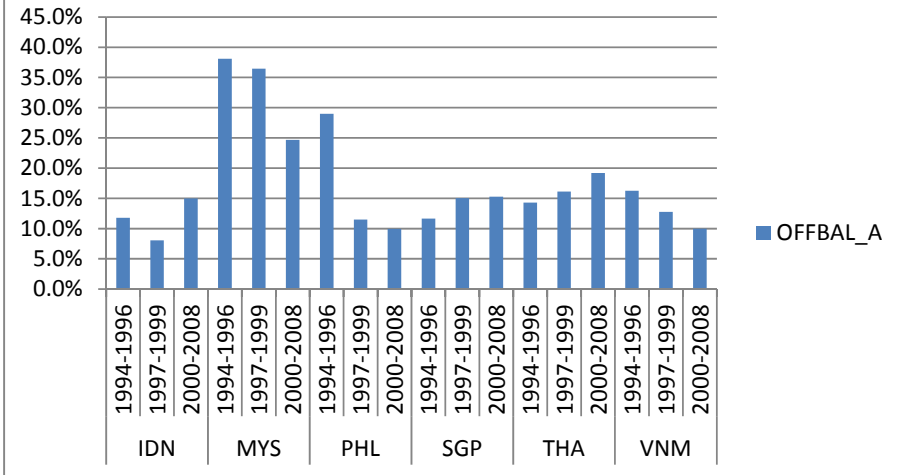


Table 1. Determinants of Bank Efficiency Based on Constant Returns-to-Scale Measure (CRS DEA–Input CRS) in Selected Southeast Asian Banks

| | FE(1) | FE(2) | RE(1) | RE(2) |
|--------------------------------|------------------------|------------------------|------------------------|------------------------|
| TE_TA | 0.257** (2.280) | 0.283** (2.490) | 0.243** (2.540) | 0.242** (2.150) |
| LOANLR_GL | 0.074 (0.820) | 0.078 (0.843) | 0.099 (0.790) | 0.035 (0.401) |
| LA_TA | 0.009 (0.140) | 0.051 (0.701) | –0.066 (–1.140) | 0.019 (0.390) |
| NEA_A | 0.135* (1.710) | – | 0.116 (1.500) | – |
| OFFBAL_A | –0.011*** (–7.220) | –0.013*** (–7.424) | –0.010*** (–5.300) | –0.014*** (–7.820) |
| FOREIGN | 0.029*** (3.531) | 0.032*** (3.805) | 0.053*** (5.660) | 0.023*** (2.730) |
| PUBLIC | 0.015 (0.962) | 0.014 (0.930) | 0.023 (1.550) | 0.004 (0.320) |
| SUBSIDIARY | –0.089*** (–4.063) | –0.090*** (–4.071) | –0.117*** (–6.600) | –0.103*** (4.800) |
| RESTRICT | 0.107*** (5.040) | 0.099*** (5.210) | 0.097*** (4.630) | 0.096*** (4.530) |
| MONITOR | –0.495*** (–15.500) | –0.478*** (–15.750) | –0.464*** (–15.350) | –0.464*** (–15.350) |
| OFFICIAL | 0.088** (2.875) | 0.078** (2.780) | 0.077** (2.580) | 0.073** (2.460) |
| Commercial Banks | 0.097*** (3.975) | 0.106*** (4.302) | 0.077 (0.160) | 0.023 (0.520) |
| Investment Banks | 0.192*** (6.330) | 0.199*** (6.550) | 0.114** (2.260) | 0.125** (2.600) |
| Finance & Securities Companies | 0.202*** (5.280) | 0.208*** (5.260) | 0.101* (1.610) | 0.205** (2.355) |
| Savings Banks | 0.072 (1.306) | 0.073 (1.290) | –0.069 (–0.710) | –0.044 (–0.650) |
| Holding Finance Companies | 0.069** (2.510) | 0.074** (2.680) | –0.023 (–0.480) | –0.011 (–0.220) |
| Government Savings Banks | 0.228*** (5.510) | 0.232*** (5.710) | 0.129** (2.170) | 0.147** (2.631) |
| Islamic Banks | 0.222*** (5.090) | 0.231*** (5.320) | 0.100* (1.650) | 0.122** (1.920) |
| Others | 0.089** (2.020) | 0.094*** (5.080) | –0.015 (–0.260) | –0.086* (–1.690) |
| Constant | 1.710*** (4.450) | 1.791*** (5.080) | 1.851*** (4.420) | 1.874*** (4.650) |
| Country Dummies | Yes | Yes | Yes | Yes |
| Time Dummies | Yes | Yes | Yes | Yes |
| R-Square | 0.550 | 0.549 | 0.556 | 0.551 |
| Obs | 1359 | 1359 | 1359 | 1359 |

* 10 percent level of significance; ** 5 percent level of significance; *** 1 percent level of significance;

t-Statistics in parenthesis; FE – Fixed Effects; RE – Random Effects

Table 2. Determinants of Bank Efficiency Based on Constant Returns-to-Scale Measure (Input CRS) Using IV Estimation in Selected Southeast Asian Banks

| | FE2SLS | | RE2SLS | |
|--------------------------------|------------------------|-----------------------|------------------------|------------------------|
| | (1) | (2) | (3) | (4) |
| TE_TA | 0.606*** (6.240) | 0.591*** (8.260) | 0.567*** (5.460) | 0.564*** (5.560) |
| LOANLR_GL | 0.117 (0.820) | 0.113 (0.640) | 0.060 (0.340) | 0.060 (0.430) |
| LA_TA | 0.052 (0.76) | 0.038 (0.480) | 0.022 (0.360) | 0.020 (0.330) |
| NEA_A | – | 0.049 (0.330) | – | 0.008 (0.070) |
| OFFBAL_A | –0.013*** (–3.840) | –0.013*** (–3.230) | –0.015*** (–4.750) | –0.015*** (–4.130) |
| FOREIGN | 0.028** (2.630) | 0.026** (2.550) | 0.019** (1.940) | 0.018* (1.670) |
| PUBLIC | 0.011 (0.710) | 0.012 (0.790) | 0.001 (0.120) | 0.002 (0.110) |
| SUBSIDIARY | –0.091*** (–3.580) | –0.081*** (–3.360) | –0.094*** (4.760) | –0.095*** (–4.020) |
| RESTRICT | 0.112*** (5.360) | 0.115*** (4.260) | 0.179*** (17.660) | 0.180*** (15.750) |
| MONITOR | –0.502*** (–16.080) | –0.508 (–11.700) | –0.488*** (–13.310) | –0.490*** (–12.530) |
| OFFICIAL | 0.094*** (3.110) | 0.098** (2.540) | 0.159*** (7.900) | 0.160*** (7.760) |
| Commercial Banks | 0.089** (3.700) | 0.086*** (3.160) | 0.103** (2.960) | 0.103** (2.990) |
| Investment Banks | 0.164** (6.730) | 0.160*** (5.780) | 0.184*** (4.860) | 0.183*** (5.180) |
| Finance & Securities Companies | 0.201*** (5.280) | 0.207*** (5.071) | 0.220*** (4.310) | 0.220*** (4.810) |
| Savings Banks | 0.263*** (4.320) | 0.262*** (3.870) | 0.250*** (4.040) | 0.250*** (4.250) |
| Holding Finance Companies | 0.051** (1.980) | 0.048* (1.750) | 0.059 (1.600) | 0.058* (1.710) |
| Government Savings Banks | 0.207*** (4.450) | 0.205*** (4.940) | 0.215*** (4.970) | 0.218*** (3.890) |
| Islamic Banks | 0.225*** (3.050) | 0.220** (2.550) | 0.215** (2.430) | 0.214** (2.660) |
| Others | 0.126** (2.310) | 0.123** (2.14) | 0.129* (1.830) | 0.128* (1.650) |
| Constant | 1.621*** (4.610) | 1.589*** (3.530) | 1.680** (2.840) | 1.675** (2.010) |
| Country Dummies | Yes | Yes | Yes | Yes |
| Time Dummies | Yes | Yes | Yes | Yes |
| R-Square | 0.590 | 0.589 | 0.591 | 0.590 |
| Obs | 1220 | 1220 | 1220 | 1220 |

* 10 percent level of significance; ** 5 percent level of significance; *** 1 percent level of significance.

t-Statistics in parenthesis; FE2SLS – Two-Stage Least Square Fixed Effects; RE2SLS – Two-Stage Least Square Random Effects (Baltagi, 2001)