

Post Asian Crisis Experience on Bank Efficiency and Competition

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Abstract: The transformation in Asian banking came with the aim to recover and improve the banking system performance and soundness. The structural changes in Asian economy has improved the region banking industry performances and brought significant effects through the regulatory changes as it spur a trend towards consolidation, resulting in the recent wave of mergers and acquisitions. This study investigates the impact of post crisis (1997 – 2005) banking reform on competition and performance of the banking system. Competition level is assessed by employing Panzar and Rosse methodology, while the efficiency is evaluated using Data Envelopment Analysis (DEA) that adjusted to allow slack or surpluses due to the environment variables. Our analysis shows that the region has successfully transformed the banking sectors as the efficiency indicates score displays positive changes. However the relation between efficiency and competition may not be a straightforward impact.

JEL Classification: G21; G28; D24

Key words: Efficiency • Competition • Post Asian Crisis

INTRODUCTION

The Asian crisis in 1997 is said to be different and remarkable in several ways. The crisis had hit the most rapidly growing economies in the world and cause the largest financial bailouts in history of developing world since the 1982 debt crisis. At the time, one common interpretation was that the crisis debunked the “Asian miracle”. Capitalism and globalization were repudiated and blamed for the busting of currency and property bubbles and the resultant difficulties. Asian and the western government, the private sectors and the International Monetary Fund (IMF) were among the organisations contribute a financial assistance to help countries ease balance of payments adjustments [1]. The financial crises severely undermine public finances in a number of Asian countries and prompted financial contribution particularly the IMF to organize a rescue package, involving Thailand, Korea, Indonesia and the Philippines. Due to this assistance, IMF has played a major role in changing the Southeast Asian economies mainly through restructuring the banking system. Asian 1997 financial crisis has also agreed to a proposal which allow global standards for banking regulation, enhancing the

quality of economic statistics and improving the levels of information available to investor in emerging market economies. However, Malaysia refused to liberalized and open its capital and financial markets and instead took capital control measures as the country believed it is the movement of short term money that caused the crisis [2].

This study investigates the impact of post crisis (1997 – 2005) banking reform on competition and performance of the banking system. This study is motivated by the gap in past literature which most has concentrated the study on the effects of concentration, competition and market structure of banking industry on developed markets [4, 5] and less attention given towards developing Asian and the crisis region. This search will contribute to the literature by looking into the behaviour of competition in the SEA during post crisis by investigating the most affected country. Secondly, this study provide cross country analysis on SEA bank competition by utilising non-structural approach, Panzar and Rosse H statistics. With the emerging of consolidation in the banking sectors through the restructuring planned, competition is an area that needed to look upon especially after the region crisis and recovery experienced.

While the performance based on the efficiency is evaluated using Data Envelopment Analysis (DEA) that adjusted to allow slack or surpluses due to the environment variables. We apply the four-stage methodology proposed by [6] Fried *et al.*, (1999), whereby we account for the impact of environmental variables in a DEA based study. The aim is to incorporate the influences of the external variables on South East Asian banking efficiency measurements. In doing so, we allowed slack or surpluses due to the environment variables and used it to calculate adjusted values for the primary inputs. In other words, the new radial efficiency measures incorporate the environmental variables (see appendix for further explanation). Our analysis shows that the region has successfully transformed the banking sectors as the efficiency indicates score displays positive changes. However the relation between efficiency and competition may not be a straightforward impact.

Methodology and Data: We estimated the *H* statistics using Panzar and Rosse (PR) approach following similar specification of dependent variables of [7] Luc Laeven (2006) and [9] Casu *et al.* (2006)¹. The *H* statistic abridges in a single figure the overall level of competition prevailing in the market under consideration [9] (Rozas, 2007) as explain in Table 1. This paper also explore the relationship between the efficiency (EFF) and competition in selected Asian countries using the Data envelopment analysis (DEA)².

Model Specification: We estimated the following reduced form revenue equations on pooled samples for each country³:

$$\ln TREV_{it} = \alpha + \beta_1 \ln P_{1,it} + \beta_2 \ln P_{2,it} + \beta_3 \ln P_{3,it} + \gamma_1 \ln ETA_{it} + \gamma_2 \ln AST_{it} + \gamma_3 \ln TLA_{it} + \gamma_4 \ln LLPL_{it} + \epsilon_{it} \quad (1)$$

For $t = 1 \dots T$, where T is the number of periods observed and $I = 1 \dots I$, where I is the total number of banks. Subscripts i and t refer to bank i at the time t . The dependent variable is $\ln TREV$, which is total revenue over total assets (proxy for output price for loans). [3] Molyneux *et al.* 1994 and [5] Bikker and Haaf, 2002, treat interest as dependent variable whereas following [8] Casu and Girardone (2006), [11] Nathan and Neave (1989) and

[12] De Bandt and Davies (2000), argues the differences between interest and non-interest income is becoming less significant in more competitive environment. Recent developments in banking industry have given great interest in accounting non-interest income along with non-interest income from fee-based products and off balance sheet activities to total revenue [9] (Casu and Girardone, 2006).

Output variables are treated as dependent variables and divided by total assets in order to account for the differences in the banks sizes. The analysis used three input under intermediation approach, $\ln P_1$ as the average labour cost (personnel expenses/total assets); $\ln P_2$ as the average cost of deposits (interest expenses/ total deposit and money market funding); and $\ln P_3$ as the ratio of other operating expenses and administrative expenses to total assets (proxy for input price of equipment/ fixed capital).

Bank specific factor were used to give an overall view on banking industry and act as the control variable at the individual bank level, we include (1) $\ln ETA$, the ratio of total equity to total assets (to control for different risk propensity); (2) $\ln AST$, logarithm of total assets (to control for potential size effects and considered as a proxy for scale economies); (3) $\ln TLA$, ratio of total loans to total assets (to show proportion of loan and revenue); and (4) $\ln LLPL$, ratio of loan loss provision over total loan. *H* statistics measures are calculated as the sum of the input prices coefficient.

An important feature of the *H* statistics is that the test must be undertaken on observations that are in the long-run equilibrium. [10] Nathan and Neave (1989) point out that this interpretation assumes that the test is undertaken on observations that are in long-run equilibrium. According to the past studies ([3] Molyneux *et al.*, 1994; [12] De Bandt and Davies, 2000; [5] Bikker and Haaf, 2002), the test is based on the proposition that in the competitive capital markets risk-adjusted rates of returns will be equalized across banks. We estimate the equilibrium test by recalculating the PR *H*-statistics by replacing the dependent variable total revenue over total assets with the natural log of return on assets (ROA),

$$\ln ROA_{it} = \alpha + \beta_1 \ln P_{1,it} + \beta_2 \ln P_{2,it} + \beta_3 \ln P_{3,it} + \gamma_1 \ln ETA_{it} + \gamma_2 \ln AST_{it} + \gamma_3 \ln TLA_{it} + \gamma_4 \ln LLPL_{it} + \epsilon_{it} \quad (2)$$

¹Further detail on the equation of the analysis is available upon request to the author.

²Further detail on DEA analysis can be given upon request to the author.

³We followed similar specification of dependent variables of [7] Luc Laeven (2006), [9] Casu *et al.* (2006) and [8] Claessens and Laeven (2003). The empirical application of the P-R approach usually assumes log-linearity in the specification of the marginal revenue and cost functions. denotes the natural logarithm. For estimation purposes, the log-specification is intended to avoid heteroskedasticity ([10] Rozas, 2007)

Table 1: Panzar-Rosse *H*-statistic

Value of H Index	Competitive Conditions
$H \leq 0$	Monopoly or conjectural variations short-term oligopoly. Each bank operates independently as under monopoly profit maximizing conditions. <i>H</i> is a decreasing function of the perceived demand elasticity.
$0 < H < 1$	Monopolistic competition Free entry (Chamberlain) equilibrium excess capacity. <i>H</i> is an increasing function of the perceived demand elasticity
$H = 1$	Perfect competition, or natural monopoly in a perfect contestable market, or sales maximizing firm subject to break even constraint. Free entry equilibrium with full (efficient) capacity utilization.
$H < 0$	Equilibrium Test Long Run Equilibrium
$H = 0$	Disequilibrium

Sources: Molyneux *et al.* 1994.

Table 2: Sample Used for Empirical Analysis

Countries	Average number of banks (1999-2005)	Total number of banks	Per cent of total	Average size of banks (millions US\$)
Indonesia	51	355	37.6%	2519.35
Korea	16	114	12.1%	46911.34
Malaysia	27	192	20.4%	7148.12
Philippines	24	171	18.2%	2197.47
Thailand	16	110	11.7%	11209.16
Total	134	942	100%	69985.44

It is important to realised the verification for the cases of perfect competition ($H=1$) and monopolistic competition ($H>0$), while $H<0$ is a long run condition for monopoly. If the sample is not in the long-run equilibrium, $H<0$ no longer establishes monopolistic market conditions, but will remains true that $H>0$ disproves monopoly or conjectural variation short run oligopoly [13] (Shaffer, 1982). Following [8] Claessens and Laeven (2004), the measure of ROA is $(1+ROA)$ which adjusted to any negative values due to losses in any year. The long-run equilibrium test measures the sum of the elasticity of return on assets with respect to input prices:

$$E = \sum_{j=1}^i \beta_j$$

is equal to zero again using the F- test. If rejected, the market is not in equilibrium and if accepted, then it indicates that in equilibrium prices of input are not related to banks return on assets.

Accounting for Bank Efficiency: Recent research testing for financial sector competition has expanded including more interest in the developing country. However, as highlighted earlier there is a lack of literature that investigates the relationship between competition and concentration in Asian especially after the experienced of 1997 financial crisis. In this section we aim to explore the

link between the efficiency (EFF) and competition in Asian crisis effected country. The frontier efficiency is estimated using the non-parametric techniques (DEA)⁴ and include such score in the reduced form equation (1).

$$\ln TREV = \alpha + \beta_1 \ln P_{1,it} + \beta_2 \ln P_{2,it} + \beta_3 \ln P_{3,it} + \gamma_1 \ln ETA_{it} + \gamma_2 \ln AST_{it} + \gamma_3 \ln TLA_{it} + \gamma_4 \ln LLPL_{it} + \gamma_5 EFF + \varepsilon_{it} \quad (3)$$

The equilibrium test has to be carried out again, recalculating the PR *H*-statistics replacing the dependent variable total revenue over assets with the natural log of return on assets (ROA) as shown in equation (2).

Data and Descriptive Analysis: Table 2 and Table 3 shows the data and the descriptive on the sample data selected for the period of analysis.

Analysis and Results: The Estimated *H* statistics for all selected country is 0.479, indicating a monopolistic competition (Table 4). Such results are confirmed by looking at the country level estimations. The results also imply that the banking sector earned their revenue in market condition of monopolistic competition and any form of conjectural variation oligopoly and monopoly can be clearly rejected during the period of study. Malaysia turns out to be the least competitive country whereas Korea are the most competitive followed by Indonesia, Philippines and Thailand.

⁴The efficiency estimation is estimated using the four stage analysis as in appendix. The results is upon request

Table 3: Descriptive Statistics of the Variables

Variable	Mean	Std. Dev.	Min	Max
Input and Output for DEA Analysis				
ix	365.096	842.977	0.300	7637.000
nix	121.679	281.104	-0.800	2645.800
ii	533.397	1381.590	0.300	14279.600
nii	154.369	488.554	0	5466.100
Environmental Variables				
TREV	0.096	0.073	-0.368	1.061
p1	0.011	0.007	0	0.123
p2	0.108	0.602	0.005	12.678
p3	0.030	0.073	-0.005	1.009
ETA	11.026	11.717	-129.210	99.720
AST	9791.377	21799.980	6.500	201215.100
TLA	51.666	18.599	0.620	89.820
LLPTL	0.014	0.270	-5.133	4.182
ROA	0.841	4.519	-30.440	66.960

ix (interest expenses); nix (non- interest expenses); ii (interest income); nii (non-interest); TREV (total revenue over total assets); p1 (the ratio of personnel expenses over total assets acted as average labour cost); p2 (the ratio of interest expense over total deposits and money market funding); p3 (the ratio of other operating expenses and administrative expenses over total assets); ETA (the ratio of total equity to total assets); AST (total assets); TLA (the ratio of loans to total assets); LLPTL (the ratio of loan loss provision to total loans); ROA (return on assets).

Table 4: H-Statistics Fixed Effects 1999-2005

	Indonesia	Korea	Malaysia	Philippine	Thailand	All
lnP ₁	0.080 (0.076)	0.084 (0.051)	-0.025 (0.862)	0.054 (0.164)	0.189 (0.119)	0.044 (0.416)
lnP ₂	0.424*** (0.383)	0.505*** (0.089)	-0.057 (0.078)	0.428*** (0.088)	0.180*** (0.060)	0.300*** (0.027)
lnP ₃	0.130** (0.056)	0.074** (0.037)	0.142*** (0.036)	0.160 (0.184)	-0.085 (0.084)	0.135*** (0.021)
lnETA	-0.082 (0.074)	0.222*** (0.058)	-0.273*** (0.075)	0.046 (0.119)	0.133* (0.071)	-0.020 (0.037)
lnAST	-0.224*** (0.067)	-0.018 (0.110)	-0.177** (0.088)	0.047 (0.137)	-0.547*** (0.128)	-0.110** (0.042)
lnTLA	0.253 (0.041)	-0.380* (0.194)	0.271* (0.137)	-0.015 (0.126)	0.348*** (0.097)	0.155*** (0.003)
lnLLPL	0.025* (0.015)	0.030 (0.018)	-0.020 (0.218)	0.046 (0.029)	0.011 (0.017)	0.014 (0.009)
Cons	0.641 (0.655)	1.356 (1.162)	-1.568 (1.005)	-0.548 (1.457)	1.556 (1.021)	-0.420 (0.390)
H statistics	0.633 (0.631)	0.663 (0.662)	0.060 (0.030)	0.642 (0.612)	0.283 (0.279)	0.470 (0.129)
F test (H stat = 0)	40.990	15.270	14.310	9.440	3.050	52.56
F test (H stat = 1)	249.040	285.070	548.140	50.790	212.770	910.84
Equilibrium test:						
F value for H = 0	1.36	3.45	1.46	1.56	1.96	0.600

Notes: * p<0.10, **p<0.05, ***p<0.01; Standard errors in parentheses.

The inclusion of efficiency as one of the independent bank specific variables in the calculation of the *H* statistics is motivated theoretically because it can be assumed to be one of the exogenous variables that shift the bank's cost. The crisis experiences and restructuring that effective during the process of recovery is significantly changed the way banking operated in the SEA region. The impact of these changes reflect the changes in the degree of efficiency level of each country

and as shown in Table 5, the inclusion of efficiency indicates significant changes to the competition measurement and reflect the successfulness of the recovery programmed in each country. Interestingly the degree of *H* is decreasing in the country highest efficiency level, Korea and followed by the Philippines for being the least effected country by the crisis. The overall results also show an increased in the degree of *H* statistics in Malaysia, Indonesia and Thailand.

Table 5: H-Statistics Fixed Effects 1999-2005 with DEA

	Indonesia	Korea	Malaysia	Philippine	Thailand	All
lnp1	0.131** (0.066)	0.083 (0.051)	0.037 (0.097)	0.181 (0.182)	0.285** (0.111)	0.106*** (2.66)
lnp2	0.435*** (0.033)	0.495*** (0.091)	-0.062 (0.078)	0.398*** (0.089)	0.269*** (0.059)	0.324*** (12.55)
lnp3	0.142*** (0.048)	0.062 (0.039)	0.137*** (0.022)	0.055 (0.195)	-0.034 (0.077)	0.140*** (6.940)
lneta	-0.095 (0.063)	0.225*** (0.058)	-0.268*** (0.074)	0.001 (0.123)	0.075 (0.066)	-0.052 (-1.490)
lnast	-0.166*** (0.058)	-0.015 (0.110)	-0.160* (0.088)	0.034 (0.146)	-0.465*** (0.118)	-0.093** (-2.310)
lntla	0.248*** (0.035)	-0.387* (0.194)	0.250* (0.137)	0.028 (0.129)	0.080 (0.112)	0.151*** (4.880)
lnllpl	0.240* (0.013)	0.033 (0.019)	-0.024 (0.022)	0.043 (0.030)	-0.002 (0.016)	0.010 (1.110)
lneff	0.457*** (0.059)	-0.109 (0.128)	0.196 (0.143)	0.331 (0.214)	0.536*** (0.137)	0.425*** (8.62)
cons	0.996* (0.567)	1.222 (1.175)	-1.298 (1.020)	0.311 (1.553)	3.171*** (1.014)	0.141 (0.380)
H statistics	0.708 (0.173)	0.640 (0.173)	0.112 (0.038)	0.633 (0.173)	0.520 (0.180)	0.570 (0.117)
F test ($H = 0$)	0.380	2.780	3.190	0.810	0.410	67.520
F test ($H = 1$)	0.120	1.080	2.630	0.070	0.240	965.270
Equilibrium test:						
F value for $H = 0$	1.31	3.82	2.33	1.87	1.64	0.45

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Standard errors in parentheses

To validate both of our analysis, we conducted the equilibrium test for all the banking markets and for the five selected country and found that the banking system are in long run equilibrium. The estimated yield of H value during the post crisis period studied has rejected the hypothesis of $H = 0$ even though the value of H is close to zero. It may be inferred from the findings that the selected Asian commercial banking was in long run equilibrium before the crisis and fell into disequilibrium during the crisis period. However, it made a rapid adjustment to a new equilibrium which similar to what [4] Molyneux *et al.*, (1996) found with Japanese commercial banking and [14] Park (2009) on Korean commercial banking.

CONCLUSIONS

For more than ten years there have been so many study analysing the 1997 financial crisis and have come out with many conclusion on the cause and consequences of the crisis. However, very few have concentrated on the relationship between competition and efficiency during the post crisis. Our intention is to look

upon the relationship between efficiency and competition in the selected 1997 Asian crisis worst effected countries and run a cross country analysis as there are almost none of past literature has done the analysis.

The structural changes in SEA has improved the region banking industry performances and brought significant effects through the regulatory changes as it spur a trend towards consolidation, resulting in the recent wave of mergers and acquisitions. An analysis on the efficiency using DEA indicate that the efficiency of the banking market has increased during the post crisis study period. To investigate the impact of increased efficiency on the competitive condition in SEA banking markets, we employed the non-structural Panzar and Rosse (PR) statistic. The estimated H -statistics for the five (5) selected SEA countries is 0.570, thus indicating monopolistic competition. Such results, confirm by the by country estimations, are consistent with the current literature. When the DEA efficiency score are included in the bank specific factors, we found that the overall results have decreased slightly almost not affected. Whereas, the values of H -statistics resulted for each country has increased with exceptions to Korea and the Philippines.

An analysis of the sign and significance of the regression coefficient indicates that the DEA efficiency scores are negative in Korea, whereas positive to all other selected countries and not significant to all (with exception to Indonesia and Thailand). This indicates as Korean banks efficiency estimated the highest scores, it's also generates the lowest total revenues. These results may be explained by the fact that banks that show the highest inefficiencies and incur higher cost might be able to generate greater profits than more cost efficient banks [9] (Girardone and Casu, 2005, pp. 16).

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