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The evolution of cost and profit efficiency of Philippine commercial banks

Santos José O. Dacanay III*
College of Social Sciences, University of the Philippines Baguio

The paper aims to analyse the evolution of cost and profit efficiency for Philippine commercial banks during the period 1992-2004. It has been observed that cost inefficiency increased after liberalization in 1994 and further shot up after the Asian financial crisis. Profit efficiency, on the other hand, is steadily declining, from above the 90 percent mark prior to liberalization to 84 percent in 2004. The evolution of efficiency scores clearly shows that Philippine banks experienced declining profit and cost efficiencies. Two hypotheses can be suggested to explain these evolutions, following Berger and Mester [1999]. First is the increasing quality of bank services hypothesis due to competitive pressures, which led to higher costs of production and lower profit margins. Second is the "quiet life" hypothesis. Threatened by new competitors, the banks have opted for defensive strategies instead of reducing their costs.

JEL classification: G21, G28
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1. Introduction

The paper examines the profit and cost X-efficiency of the Philippine commercial banking sector under periods of immense structural changes. Profit and cost X-efficiency, originally due to Leibenstein [1966], measure the extent to which a bank's profit and cost, respectively, approach a best-practice (least-cost and most profitable) firm under the *ceteris paribus* assumption [Clark and Siems 2002]. The study specifies a parametric form of translog profit and cost functions to characterize the efficient frontier using the intermediation approach for Philippine banks. The paper extends the literature in two directions. First, the paper tests whether banks perform differently through time, spanning liberalization, crisis, and consolidation periods. An empirical finding of substantial inefficiencies raises the question as to whether inefficiencies, which may have been brought about by regulatory limits to competition, will continue in the deregulated or less regulated future. It is posited that a more competitive banking landscape should encourage bank management to lower costs and raise revenue, that is, to become more efficient, which should foster an improvement in the allocation of resources. For competition and merger analysis, it is important to know the effects of market concentration on past mergers on banking efficiency, whether the acquired bank is less efficient, hence benefited from synergy, or not. Second, the two types of X-efficiency—cost and profit efficiency—are investigated in relation to bank type, ownership, size, provision for loan losses, returns on equity and assets, and market share in loans and deposit markets. In terms of governance and organizational form, it is interesting to know whether universal (expanded commercial) banks are more efficient than plain commercial banks, providing evidence for scope economies. In terms of ownership, it would be worthwhile to investigate if foreign banks are more efficient than domestic banks, or whether private domestic banks are more efficient than government banks, justifying liberalization and privatization. Correlations of other firm-specific, industry-level, and macroeconomic data with efficiency scores are likewise investigated.

The rest of the paper is structured as follows. Section 2 reviews the literature. Section 3 discusses the framework and hypotheses, followed by presentation of method and data in section 4. Section 5 presents the results, and section 6 concludes.

2. Literature review

The first part of the review presents cross- and in-country studies on liberalization and efficiency. The second part establishes the efficiency implication of the crisis on the banking sector. The last part reviews the literature on mergers and consolidation that includes the Philippine commercial banking industry.

Studies show that the impact of liberalization on efficiency has been mixed. Laeven [1999] studied the risk and efficiency of banks in five East Asian countries, including the Philippines, applying data envelopment analysis (DEA) for the pre-crisis period 1992-1996. The study pointed out that for all five East Asian countries, bank efficiency did not decrease significantly. There was also a substantial increase in efficiency of Philippine banks together with Indonesia and Thailand. Relative risk-taking across ownership groups was not significant for Philippine banks. Philippine and Indonesian banks took relatively more risk than banks from the other three countries. In terms of average technical efficiency scores, Philippine banks exhibited the second to the lowest—averaging 68 percent with 25 percent standard deviation (highest variability) for the study period 1992-1996. A two-factor fixed-effect model for changes in efficiency showed that the coefficient of the year 1994-1995 is negative and significant at 5 percent level, indicating a possible structural shift in the period due to foreign bank liberalization. In another study, Montinola and Moreno [2001] employed DEA to examine indicators of efficiency in the Philippines over the period 1992-1999. Their study showed that banking efficiency in the production of deposits for the intermediation of loans declined prior to the liberalization of foreign-bank entry. Further, there was no strong improvement in bank efficiency after said liberalization. Modest improvements in banking efficiency in 1995 suggested that foreign entry was too restrictive to generate a competitive environment to offset its adverse incentive effects.

Manlagñit and Lamberte [2004], on the other hand, examined the impact of competition policy reforms on the efficiency of the Philippine commercial banking system from 1990 to 2002, with 44 bank samples. Using stochastic frontier approach (SFA), they reported that Philippine banks have 85 percent average profit efficiency and 39 percent average cost inefficiency. Manlagñit and Lamberte [2004] also detailed improvements in banks' profit and cost efficiency after the liberalization in 1994, but such gains were halted when the crisis struck in 1997. In terms of bank size, the study noted that small

banks are found to be more profit and cost efficient than large banks. Karim [2001] studied bank efficiency across four Association of Southeast Asian Nation (ASEAN) countries for the period 1989-1996, including 27 sample banks from the Philippines, and found that, on average, the ASEAN banks enjoy increasing returns to scale. Karim [2001] found that scale economies decrease with asset size—larger banks tend to have higher cost efficiency than smaller banks.

The ASEAN region was badly affected by the Asian financial crisis, and there were cases of bank failures, hence the examined link between banking crisis and inefficiency. For cross-country comparison, the coefficient for the Philippines country dummy was positive. This implied that the inefficiency of input use for the Philippine banks tends to be higher than that for Indonesian banks, while those of Malaysia and Thailand are negative, indicating that the inefficiency of input use of both countries' banks tend to be smaller (with Indonesia as the controlled dummy variable). The cost inefficiency of input use of Philippine banks averaged 34.16 percent for the eight-year period, compared with 18.18 percent for Indonesia, 4.35 percent for Malaysia, and 1.87 percent for Thailand. The cost inefficiency of input use of Philippine banks shot up to 69.5 percent in 1995—the year ten new foreign banks entered the industry—but went down to 26.47 percent in 1996 or near the 1991 level of 25.81 percent. The results also showed that if the ASEAN banks were free to move within the region, the Philippine and Indonesian banks would be at a disadvantage compared with their Thai and Malaysian counterparts.

In contrast, Kwan [2003] noted that operating efficiency is found to be unrelated to the degree of openness of the banking sector, and in the case of the Philippines, the country is more open in practice than what the law demands [Claessens and Glaessner 1998]. Unite and Sullivan [2003] investigated how the relaxation of foreign-entry regulations affected domestic banks. Specifically, they found evidence that foreign bank entry and penetration reduced interest rate spreads but did not affect bank profits due to corresponding improvements in operating efficiencies. Operating expenses, which measure the impact of liberalization on bank efficiency, declined with foreign bank entry and foreign bank penetration. However, the gains in efficiency were found to be lower for banks with high group ownership. The findings suggested that an increased foreign presence resulted in greater efficiency, but such is tempered when insiders feel immune to potential threats from outsiders due to their high ownership levels.

Manzano and Neri [2001], on one hand, focused on deconcentration, bank spread, and macroeconomic implications of liberalization. They found that there appears to be no systematic reduction of bank spreads, and offered an alternative explanation to the puzzle. They argued that prevailing macroeconomic incentives matter in determining the outcome of liberalization measures.

Studies on the impact of the 1997 Asian financial crisis were unanimous in their finding that the Philippines was the least affected [Zhuang and Dowling 2002], with only four distressed institutions: two banks and two nonbank financial institutions, with only the latter closed [Bongini, Claessens, and Ferri 2000]. According to Canlas [2000], only 23 banks failed in the Philippines as of November 1998, and only one was a commercial bank; the rest were thrift and rural banks. These failed banks accounted for a small portion of the total banking resources, hence they did not pose a serious threat to the financial system. Claessens, Djankov, and Klapper [1999] likewise confirmed that the Philippines reported the smallest number of bankruptcies during the crisis.

According to Gochoco and Reside [2000], the Philippine financial system managed to survive the Asian financial crisis due to two main factors. First, three years prior to the crisis, the Bangko Sentral ng Pilipinas (BSP) implemented improved prudential measures such as the imposition of increased capital requirements, tightening of provisioning requirements, and stricter loan classification subject to loan-loss provisioning. Second, the low level of financial intermediation in the Philippines, with a loan-to-GDP ratio of 65 percent, insulated the financial system from greater damage.

The aftermath of the crisis saw the consolidation of the sector with BSP-encouraged mergers. Under existing Philippine banking regulations, merger is defined as the absorption of one or more corporation by another existing corporation, which retains its identity and takes over the rights, privileges, franchises, and properties, and assumes all the liabilities and obligations of the absorbed corporation(s). The absorbing corporation continues its existence while the life or lives of the other corporation(s) is/are terminated. Consolidation, on the other hand, is the union of two or more corporations into a single new corporation, and all the constituent corporations cease to exist as separate entities. The BSP continues to promote the policy of mergers and consolidation as a means of developing larger and stronger financial institutions.

To encourage mergers, the BSP gives a generous incentive package: temporary relief from prescribed net-worth-to-risk-assets ratio; rediscounting of up to 150 percent of adjusted capital accounts for one year; grace period of one year to merged or consolidated entity, which exceeds the 20 percent limit of real estate loans; restructuring of payment of past due obligations with the BSP over a period up to ten years; amortization of goodwill up to 40 years if warranted, and others.[1] For the study period 1992-2004, the BSP approved 20 mergers. Before the crisis, there was only one merger in 1993 while three mergers were reported in 1996. The aftermath of the crisis witnessed an accelerated pace of mergers, with 17 mergers from 1997 to 2004. Mergers took place not only among small and big banks but also among the bigger banks, hence the motivation seems to be to protect market share in response to competition [Milo 2000] and the need to project themselves as significant players in the global arena [Manlagñit and Lamberte 2004].

Cetorelli and Gambera [2001] also showed that the average 3-firm and 5-firm deposit concentration ratio for the Philippines from 1989 to 1996 is 0.40 and 0.56, respectively—relatively low in a cross-country panel of 42 with 0.70 considered high. The average and relatively stable Hirschman-Herfindhal indices (HHI) from 1992 to 2004 for loans and deposits stood at 614 and 686, respectively. Hence, the industry can be characterized as being of low concentration, with a HHI of 1,800 considered as highly concentrated. Karim [2001] also observed consolidation in the aftermath of the Asian financial crisis, which was expected to improve resource utilization in the industry. On average, cost inefficiencies of the ASEAN banks increased over the years preceding the Asian banking crisis in 1997, suggesting that the problem of bank failures may have had something to do with inefficiency. Manlagñit and Lamberte [2004] reported that profit efficiency of merged banks dropped more sharply than nonmerged banks after 1998, but eventually recovered and approximated that of nonmerged banks in 2002. The study noted that the merger and consolidation incentives granted by the BSP appear to be a complementary policy for improving profit and cost efficiencies of banks.

In Williams and Nguyen [2005], Philippine banks selected for domestic mergers and acquisitions (M&As) were characterized with relatively low

[1]BSP Circular 237 dated 19 April 2000 consolidated the various BSP issuances on incentive package for mergers and consolidation.

profit efficiency before the governance change, which improved in the short term but deteriorated in the long term, implying temporary efficiency gain. The results implied that benefits associated with domestic M&As were realized in terms of technical developments that determine productivity rather than managerial performance (efficiency). There was considerable improvement in rank-order technical change and productivity in the short term after M&A, which was maintained in the long term.

3. Framework and hypotheses

3.1. Cost efficiency

Cost efficiency measures the extent to which a firm's cost approaches the cost of a "best practice" or least-cost firm under the *ceteris paribus* assumption [Clark and Siems 2002]. Cost efficiency is measured by estimating a cost function in which cost is the dependent variable and the independent variables include variable output(s), input prices, fixed inputs, variables capturing differences in the economic environment, random error, and inefficiency. A general version of this cost function can be written as

$$C = C(w, y, z, v, u_c, \varepsilon_c) \tag{1}$$

where C denotes costs; w is the vector of variable input prices; y is the vector of quantities of variable outputs; z indicates the quantities of any fixed netputs (inputs or outputs), which are included to account for the effects of these on variable costs owing to substitutability or complementarity with variable netputs; v is the set of economic and environmental variables that may impact cost performance; u_c denotes an inefficiency factor that pushes the firm's cost above those of the most efficient firm; and ε_c denotes random error that incorporates measurement error and luck. It is generally assumed that the inefficiency and random error terms can be separated from the remainder of the cost function, and both sides of equation 1 are represented in natural logs, hence

$$\ln C = f(w, y, z, v) + \ln u_c + \ln \varepsilon_c \tag{2}$$

where f denotes a particular functional form for the cost function and the terms ($ln\, u_c + ln\, \varepsilon_c$) are treated as a composite error term comprising random

error (ε_c) and an inefficiency factor (u_c) that pushes the firm's cost above those of a best-practice or most cost-efficient firm.

From equations 1 and 2, cost efficiency of bank b is defined as the estimated cost needed to produce bank b's output vector if the bank were as efficient as the best-practice bank in the sample facing the same exogenous variables (w,y,z,v) divided by the actual cost of bank b, adjusted for random error. Hence, using the parameter estimates from the cost function of equation 2, a firm-specific measure of relative cost efficiency is calculated as follows:

$$CostEff^b = \frac{\hat{C}^{\min}}{\hat{C}^b} = \frac{\exp[\hat{f}(w^b, y^b, z^b, v^b)] \times \exp(\ln \hat{u}_c^{\min})}{\exp[\hat{f}(w^b, y^b, z^b, v^b)] \times \exp(\ln \hat{u}_c^b)} = \frac{\hat{u}_c^{\min}}{\hat{u}_c^b} \qquad (3)$$

where $\hat{u}_c^{\min}$ is the minimum of the $\hat{u}_c^b$ across all sample firms. This relative cost-efficiency measure should be interpreted as bank b is X percent as efficient as the best-practice or most efficient firm, and can theoretically fall in the interval (0,1].

3.2. Profit efficiency

In contrast to the concept of cost efficiency, standard profit efficiency measures how close a bank is to producing the maximum possible profit given a particular level of input and output prices. The standard profit function takes variable output prices as given rather than holding all output quantities statistically fixed at their observed levels. This means that the profit-dependent variable allows for consideration of revenues that can be earned by varying outputs as well as inputs. Output prices are taken as exogenous, allowing for inefficiencies in the choice of outputs when responding to these prices or to other variables in the profit function. The standard profit efficiency may not be appropriate to use as banks may influence output prices. Berger and Mester [1997] thus advance an alternative profit-efficiency measure. The alternative profit function holds that variable output is held constant as in the cost function while output prices are free to vary and affect profits. Alternative profit efficiency may provide useful information when one or more of the following conditions hold: (a) there are substantial unmeasured differences in the quality of banking services; (b) outputs are not completely variable, so that a bank cannot achieve every output scale and product mix; (c) output markets are not perfectly

competitive, so that banks have some market power over the prices they charge; and (d) output prices are not accurately measured, so they do not provide accurate guides to opportunities to earn revenues and profits in the standard profit function.

Manlagñit and Lamberte [2004] contend that there are reasons that one or more of these conditions hold in the case of the Philippines and use the alternative profit function in their specifications. Other empirical studies justify the use of the alternative over the standard profit function. First, Claessens and Laeven [2003], applying the Panzar and Rosse [1987] methodology for estimating the degree of competition in 50 countries' banking systems, found that the Philippine banking industry has a H-statistic of 0.59, estimated using pooled ordinary least squares (OLS), where a number close to 1 means a perfectly competitive market. This score is far from 0.86 of Hong Kong, the bastion of free market in Asia. Second, Claessens and Glaessner [1998] as cited in Kwan [2003] noted that Philippine banking industry is more open than what the law requires. The degree of openness index, with a score of 1 meaning most closed and 5 most open, the Philippines' commitment is 2.80 while in practice it is 3.35. Although this is a positive observation, the degree of openness in terms of practice is still far from Hong Kong's 4.75, the highest in Asia. These two studies justify the use of the alternative profit specification, which is adopted in this study. Henceforth, profit efficiency in this paper refers to alternative profit X-efficiency. It employs the same independent variables as the cost function. Equation 4 gives the profit function in log form.

$$\ln(\pi + \theta) = f(w, y, z, v) + \ln u_{\pi} + \ln \varepsilon_{\pi} \tag{4}$$

where π is the variable profits of the firm, which includes all the interest, security and fee income earned on the variable outputs minus costs, *C*, used in the cost function; θ is a constant added to every firm's profit so that the natural log is taken of a positive number (absolute value of the lowest, negative profit plus 1). The variables *w*, *y*, *z*, *v* are defined as in the cost function, and *ln* u_{π} and *ln* ε_{π} represent the inefficiency and random error terms, respectively. Hence, the profit efficiency is the ratio of predicted actual profits to the predicted maximum profits for a best-practice bank:

$$ProfitEff^{\,b} = \frac{\hat{\pi}^{b}}{\hat{\pi}^{\max}} = \frac{\left\{\exp[\hat{f}(w^{b}, y^{b}, z^{b}, v^{b})] \times \exp(\ln \hat{u}_{\pi}^{b})\right\} - \theta}{\left\{\exp[\hat{f}(w^{b}, y^{b}, z^{b}, v^{b})] \times \exp(\ln \hat{u}_{\pi}^{\max})\right\} - \theta} \tag{5}$$

In equation 5, efficiency values are allowed to vary in an important way with output prices, but errors in choosing output quantities do not affect profit efficiency except through the point of evaluation $\hat{f}(w^b, y^b, z^b, v^b)$ to the extent that the best-practice bank is not operating at the same (w, y, z, v) as bank b [Berger and Mester 1997].

3.3. Hypotheses

The translog cost and profit estimations test the following hypotheses:

Hypothesis 1: Financial liberalization increased bank industry efficiency.

The literature considers the effects of financial deregulation and liberalization on bank efficiency and productivity [Berger and Humphrey 1997] but the empirical evidence is mixed. Financial deregulation has been associated with rising bank costs, which offset potential productivity gains (Berger and Humphrey [1997]; Humphrey and Pulley [1997]); higher productivity but declining efficiency [Kumbhakar et al. 2001]; increases and declines in productivity growth [Alam 2001]. It is conjectured in this study that financial liberalization increases and improves efficiency.

Hypothesis 2: The Asian financial crisis increased the inefficiency of the banking sector.

Exogenous shocks such as the Asian financial crisis may boost operating costs as additional resources may be needed to deal with the piling up of problem loans [Kwan 2003], which decrease profit and cost efficiency. Although researchers are unanimous in their assessment that the Philippines is the least affected by the Asian crisis (Claessens, Djankov, and Klapper [1999]; Bongini, Claessens, and Ferri [2000]; Canlas [2000]; Gochoco-Bautista and Reside [2000]; Zhuang and Dowling [2002]), it is hypothesized that the crisis nevertheless exposed the inefficiency of the banking sector, which led to decreased post-crisis efficiency levels.

Hypothesis 3: Efficiency of merged banks increased after the merger.

The empirical literature on mergers drawing from the US experience (Berger, Hunter, and Timme [1993]; Clark [1996]; Clark and Speaker [1994]; Evanoff and Israilevich [1991]; Gilbert [1984]; Humphrey [1990]; Mitchell and Onvural [1996]) shows that, overall, the average cost curve is relatively

flat with some evidence of efficiency gains for small banks. Results on scope economies are even more controversial since the literature provides little consensus on the existence and extent of product mix efficiency [Berger and Humphrey 1991, 1994]. Empirical papers on the European experience have mainly focused on cost functions using data from a single bank or country, and show that the average cost curve tends to be U-shaped and, to a lesser extent, scope economies exist (Athanassopoulos [1998]; Berg et al. [1993]; Drake and Howcroft [1994]; Drake and Simper [2002]; Glass and McKillop [1992]; Parisio [1992]; Simper [1999]; Zardkoohi and Kolaris [1994]). It is posited that mergers and consolidation aim at reaping profitability, reducing cost inefficiency, increasing market power, and exploiting scale and scope economies [Maggi and Rossi 2003].

4. Method and data

4.1. Functional forms of the preferred specifications

According to Greene [1980], the translog function, originally due to Christensen, Jorgenson, and Lau [1971], is the most frequently selected model to measure bank efficiency because it is a flexible functional form and it accommodates multiple outputs without necessarily violating curvature conditions. The translog form of the cost and profit functions adopted in this study is consistent with the concept of economic optimization. The absence of *a priori* restrictions on substitution possibilities among the factors of production allows both economies and diseconomies of scale at different output levels. Equation 6 gives the translog cost frontier of the banks.

$$\begin{aligned}\ln C_{it} = {} & \beta_0 + \sum_{j=1}^{2} \beta_1 \ln w_{jit} + \frac{1}{2} \sum_{j=1}^{2} \sum_{k=1}^{3} \beta_2 \ln w_{jit} \ln w_{kit} + \sum_{l=1}^{3} \beta_3 \ln y_{lit} \\ & + \frac{1}{2} \sum_{l=1}^{3} \sum_{m=1}^{3} \beta_4 \ln y_{lit} \ln y_{mit} + \sum_{n=1}^{2} \beta_5 \ln z_{nit} + \frac{1}{2} \sum_{n=1}^{2} \sum_{p=1}^{2} \beta_6 \ln z_{nit} \ln z_{pit} \\ & + \sum_{j=1}^{2} \sum_{l=1}^{3} \beta_7 \ln w_{jit} \ln y_{lit} + \frac{1}{2} \sum_{j=1}^{2} \sum_{p=1}^{2} \beta_8 \ln w_{jit} \ln z_{nit} \\ & + \sum_{l=1}^{3} \sum_{p=1}^{2} \beta_9 \ln y_{lit} \ln z_{nit} + \ln u_c + \ln \varepsilon_c \end{aligned} \tag{6}$$

where $ln\ C_{it}$ is the natural logarithm of the total cost; $ln\ w$ is the natural logarithm of the j^{th} input price given $j<k$; $ln\ y$ is the natural logarithm of the l^{th} output given $l<m$; $ln\ z$ is the natural logarithm of the n^{th} netput with the restriction that $n<p$ (the subscript o is skipped so as to be not confused with the subscript of the intercept). The second and third subscripts of the variables i and t pertain to bank number and time of the observation, respectively. βs are the coefficients to be estimated. The term $ln\ u_c$ is non-negative random variable associated with inefficiency of input use, given the levels of outputs and the quasi-fixed inputs. The $ln\ u_c$ implies that the observed cost for the given level of outputs and quasi-fixed inputs are not as small as would be possible if the banks were fully efficient in their use of input. $ln\ \varepsilon_c$ is random variable associated with measurement errors in the input variable or the effect of unspecified explanatory variables in the model.

Scale economies (SC) can be calculated from equation 6. Banking scale economies are measured by the reciprocal of the elasticity of cost with respect to output. For the translog cost frontier function that is applied in this study, the SC can be computed by taking the inverse of the cost elasticities of the outputs:

$$SC(y,w)=\left[\sum_{j=1}^{n}\frac{\partial \ln C(y,w)}{\partial \ln y_i}\right]^{-1} \tag{7}$$

Increasing, constant, and decreasing returns to scale or economies of scale are present if SC is greater than, equal, and less than 1, respectively.

To specify the profit-efficiency function, this study uses essentially the same cost-efficiency specification, with few changes in equation 6. First, the dependent variable for the cost function replaces $ln\ C$ with $ln\ (\pi+\theta)$ as in equation 4. Second, all other terms and variables are the same except the terms $ln\ u_c$ and $ln\ \varepsilon_c$, which are relabeled to $ln\ u_\pi$ and $ln\ \varepsilon_\pi$, respectively.

4.2. Preferred estimation method

The study employs the parametric stochastic frontier approach to estimate the translog cost and profit functions given in equation 6. In using the SFA, the inefficiency and random error components of the composite error term are disentangled by making explicit assumptions about their distributions. The random error, $ln\ \varepsilon$, is assumed to be two-sided, normally distributed, and the inefficiency term, $ln\ u$, is assumed to be one-sided, half-normally distributed. The parameters of the cost and profit specifications

are estimated using Coelli's [1996] Frontier Version 4.1 using maximum likelihood estimation technique.

The cost- and profit-efficiency scores are regressed with bank-specific and environmental variables as a second-stage procedure. The exogenous variables influence performance not by influencing efficiency, with which they are assumed to be uncorrelated, but by influencing the structure of the profit and cost frontier [Dietsch and Lozano-Vivas 2000].

4.3. Data

The data set is constructed from the BankScope Fitch IBCA database, an internationally recognized source of information for financial institutions. The database generated 39 banks spanning the 13-year period 1992-2004, yielding an unbalanced panel of 306 observations. The figures reported in the BankScope database are in nominal thousand US dollar values. The variables are deflated using the Philippine Consumer Price Index (CPI). The sample accounts for an average of 82.4 percent, 59.1 percent, and 90.3 percent of the total assets, loan, and deposit portfolio of the entire commercial banking sector from 1992 to 2004 using the published banks' statements of condition from the BSP as reference.

The period of the study takes into consideration a government policy shift that has hypothesized effects on the dependent variable. Structural changes are posited after the foreign bank liberalization act came into effect in 1995. Another historical occurrence that has a profound effect on the industry in particular and the economy in general is the Asian financial crisis in 1997, whose impact during the last quarter of 1997 and the succeeding years led the BSP to implement stricter prudential regulations. Thus, the period of the study is set along these circumstances, starting in 1992, or three years before foreign-bank entry (liberalization) in 1995, post-liberalization from 1995 to 1997, and ending seven years after the Asian financial crisis or in 2004.

4.4. Variable selection and definition

It is commonly acknowledged that the choice of variables in efficiency studies significantly affects results. A number of studies present results that differ due to variable selection (Favero and Pappi [1995]; Hunter and Timme [1995]). This case is unlikely, as this study deals only with the Philippine

commercial banks under one reportorial regime. The variable selection for this study relied mainly on classical banking theory.

For the dependent variables, cost is defined as operating plus interest costs, which includes interest paid on deposits, labor cost, and cost of purchased funds. Profit includes revenues from loans, securities, and services, less costs as defined above, before tax. The price of labor and deposits are the two input variables considered in the profit and cost functions. Total costs associated with these inputs are, respectively, total personnel expenses and total interest expenses. The price of labor is calculated as the total personnel cost including fringe benefits divided by total assets following Altunbas et al. [2000] and Manlagñit and Lamberte [2004], as the data on the number of employees are not complete. Price of deposits is computed by dividing the total interest expenses by the total amount on deposits and purchased funds.

The expected signs of the costs of labor and deposits are both positive. Following the intermediary approach, the cost function for Philippine banks is shaped using three outputs: (a) loans, (b) other earning assets, and (c) services, all expressed in constant 2000 prices. Only three outputs are included in the model to provide parsimonious estimation of the parameters and to promote tractability. This study employs the intermediation approach, hence deposits are considered as input and the interest paid on deposits is included in the specification as an input price. The loans variable includes all forms of retail and commercial loans to customers. Other earning assets include securities and equity investments of the banks in allied and non-allied undertakings. The services variable is constructed as the total value of services income, which comprises fee-based income, net revenues from security and currency trading, and income from off-balance sheet transactions.

The three output variables are expected to positively affect cost and profit. The treatment of physical capital as quasi-fixed input is relatively standard in efficiency estimation, but financial equity capital is not. Physical capital includes bank's investment in home and branch offices, equipment, furniture, and fixture, which generally show little variability in the short run [Hunter and Timme 1995]. Physical capital is measured by the number of bank branches. Financial equity capital includes shareholders' equity and accounts for the different risk preferences on the part of banks, as financial capital availability is used to absorb portfolio losses and portfolio risk as raising equity typically involves higher costs than raising deposits [Berger and Mester 1997]. Hence, the two netput variables are expected to positively affect costs but negatively affect profits.

Dietsch and Lozano-Vivas [2000] give three categories of environmental variables that influence cost efficiency as guide for cross-country studies: (a) those that describe the main macroeconomic conditions, which determine the banking product demand characteristics; (b) variables that describe the structure and regulation of the banking industry; and (c) those that characterize the accessibility of banking services. In this study, the cost- and profit-efficiency scores are regressed with the following exogenous variables: log of total assets (lnTA) as a proxy for size effects; equity ratio (EQUI_TA) or the degree of leverage of the bank; net interest margin (NIM) or the contribution of interest income to operating income representing the traditional income base of banks; return on average assets (ROAA) and equity (ROAE), the traditional accounting measures of performance; dummy variables OWN for foreign-owned, 0 otherwise; and dummy variable EKB for banks with expanded commercial banking status, 0 otherwise.

A second regression is done with the same independent variables (lnTA, EQUI_TA, NIM, ROAA, ROAE) plus cross-section invariant but time-varying macroeconomic variables. The dummy variables are dropped when the macroeconomic variables are added to avoid the dummy variable trap [Suits 1984]. These macroeconomic variables are as follows: real GNP and GDP growth rates as general measures of macroeconomic performance; real financial sector growth rate (from the GDP industrial origin) to measure sector-specific growth; real market deposit and loan growth rates to account for the sector's aggregate deposit and loan portfolios; and loan-to-GNP ratio as a measure of the degree of financial intermediation in the economy.

5. Results

5.1. SFA estimates of variables

The results of the maximum likelihood estimation (MLE) for the translog profit and cost functions are presented in Table 1. Out of the 34 regressors, the profit and cost estimates report 7 and 22 regressors as statistically significant, respectively. Five variables are significant for both estimates. The estimation results also include the profit- and cost-efficiency scores of individual banks per year, hence changes are tracked and analysed as well.

Among the outputs, other earning assets (securities and equity investments) and services are significant for the cost function while only loans are significant and positive for the profit function. Services are found to be cost-absorbing with a coefficient of 1.67 (β_3) while other earning assets

Table 1. Maximum likelihood estimation for the profit and cost functions

Regressors†		Profit		Cost	
Betas	Notation	Coefficient	t-ratio‡	Coefficient	t-ratio‡
β_0	Constant	29.65	1.51	10.33	3.25***
β_1	(y_1)	6.06	1.65*	0.45	0.85
β_2	(y_2)	2.08	0.74	-0.99	-2.31**
β_3	(y_3)	1.40	0.46	1.67	3.83***
β_4	(w_1)	-2.31	-0.54	-3.36	-5.23***
β_5	(w_2)	0.91	0.26	-0.95	-1.97**
β_6	(z_1)	-12.86	-3.86***	-1.01	-2.12**
β_7	(z_2)	0.06	0.05	0.48	2.50**
β_8	$(y_1)(y_1)$	-0.10	-0.57	0.07	2.96***
β_9	$(y_2)(y_2)$	0.12	0.67	0.15	5.84***
β_{10}	$(y_3)(y_3)$	0.11	0.83	0.06	3.42***
β_{11}	$(w_1)(w_1)$	0.17	0.45	0.26	4.74***
β_{12}	$(w_2)(w_2)$	0.02	0.10	0.04	1.25
β_{13}	$(y_1)(y_2)$	-0.68	-2.21**	-0.27	-5.98***
β_{14}	$(y_1)(y_3)$	0.01	0.03	0.03	0.73
β_{15}	$(y_2)(y_3)$	-0.13	-0.61	-0.71	-2.23**
β_{16}	$(w_1)(w_2)$	-0.12	-0.28	0.07	1.23
β_{17}	$(y_1)(w_1)$	-0.81	-2.01**	0.08	1.34
β_{18}	$(y_2)(w_1)$	-0.01	-0.03	-0.02	-0.37
β_{19}	$(y_3)(w_1)$	-0.13	-0.35	-0.18	-3.46***
β_{20}	$(y_1)(w_2)$	-0.47	-1.59	0.03	0.73
β_{21}	$(y_2)(w_2)$	-0.15	-0.47	0.21	4.76***
β_{22}	$(y_3)(w_2)$	0.10	0.39	-0.17	-5.04***
β_{23}	$(y_1)(z_1)$	0.74	2.05**	0.08	1.67*
β_{24}	$(y_2)(z_1)$	0.47	1.53	0.09	1.93**
β_{25}	$(y_3)(z_1)$	-0.19	-0.65	-0.09	-2.33**
β_{26}	$(w_1)(z_1)$	1.20	2.77***	0.29	4.66***
β_{27}	$(w_2)(z_1)$	0.52	1.37	-0.04	-0.71
β_{28}	$(z_1)(z_1)$	-0.24	-0.90	-0.04	-1.14
β_{29}	$(y_1)(z_2)$	0.03	0.16	0.01	0.43
β_{30}	$(y_2)(z_2)$	0.02	0.17	-0.05	-2.53**
β_{31}	$(y_3)(z_2)$	0.00	0.03	-0.01	-0.43
β_{32}	$(w_1)(z_2)$	-0.07	-0.34	-0.11	-3.64***
β_{33}	$(w_2)(z_2)$	-0.01	-0.04	0.02	0.78
β_{34}	$(z_2)(z_2)$	-0.10	-2.19**	0.06	8.60***
sigma squared		0.49	7.48	0.03	3.79
gamma		0.10	0.82	0.72	9.41
eta		-0.06	-0.82	0.00	0.03
Log likelihood function		-313.42		286.36	
LR test of one-sided error		0.92		56.06	

†Variable notation: Loans (y_1); Other earning assets (y_2); Services (y_3); Price of labor (w_1); Price of funds (w_2); Financial equity capital (z_1); and Number of branches (z_2).

‡ t-ratio superscripts ***, **, * denote significance at 1 percent, 5 percent, and 10 percent, respectively.

are not (negative coefficient of β_2 at -0.99). This result is not surprising considering that fee- and commission-based services, including other off-balance sheet transactions, have high associated costs in terms of personnel expenses, branch network, and physical capital. Moreover, services income account for as much as 36 percent on average of the sources of operating income. The sharp reduction of the bank's main profit source (interest income) is forcing banks to find new income alternatives to deal in, implying a larger impact on the cost function. Therefore, it seems plausible to expect higher cost connected to the production of services as it requires high investments in financial and payment system technology such as software and telecommunications, and human capital. Other earning assets ($\beta_2 = -0.99$) are cost-transferring because they are less dependent on the bank's physical capital and ride-on the joint production of bank services. Loans ($\beta_1 = 6.06$) still imply a high and significant contribution to the firm's profit.

The results of the translog cost function are also used to compute for specific output returns to scale. The two outputs, other earning assets and services, have significant t-ratios, and the inverse of their elasticities yields constant returns to scale for other earning asset [$(|\varepsilon = -0.99|)^{-1} = 1$] and decreasing returns for services [$(\varepsilon = 1.67)^{-1} = 0.60$]. This can be explained by the fact that other earning assets or the securities and investments output of a bank benefits from scope economies with the usual banking operations. The provision of services requires additional personnel and branch infrastructure that are costly. The sum of the elasticities of the two significant variables, other earning assets and services, is 1.60, suggesting increasing returns to scale for the bank production of these two outputs.

The negative but significant elasticities of the price of labor (w_1) and price of funds (w_2) seem to suggest the nonpositive influence of the wage and deposit rates to the bank's cost function. This is surprising considering that input prices are generally expected to significantly and positively influence operating cost. In an efficiency study involving seven countries, Kwan [2003] found out that the Philippines' labor cost to total operating cost is highly statistically significant and has a negative sign. Kwan [2003] interprets the negative coefficient of labor cost as evidence that Philippine banks use relatively more labor because it is cheap. From the BankScope database used in the study, the unit price of labor, defined as the personnel and fringe-benefit expenses of the banks divided by the number of employees, has been steadily declining from as high as US$ 13,813 in 1995 to US$ 7,000

in 2004 in constant 2000 prices.[2] The 1994-2004 data show that unit labor cost is decreasing by an annual average rate of 5.94 percent, although Kwan [2003] notes that the average wage rate grew by 1.5 percent in the Philippines, the lowest in the seven-country study for the period 1992-1999.

The other input price, the cost of funds, likewise nonpositively influences cost as it is often below the registered inflation rate.[3] The elasticity of the price of labor (β_4=-3.36) is smaller than the elasticity of the price of funds (β_5=-0.95). This suggests that banks can control more personnel expenses than interest expenses when prices rise. A likely explanation is that, at least in the short run, it seems more difficult to cut interest expenses than personnel expenses as the former is partly determined by the market, and an already low interest rate on deposits (cheap funds) is difficult to reduce further. The notion that banks tend to control personnel expense more than interest expenses when prices increase is also consistent with the ongoing tendency among banks to restructure through mergers and acquisitions.[4] The wave of mergers is also consistent with the significant level of inefficiency detected by the cost estimates in other studies (Karim [2001]; Manlagñit and Lamberte [2004]).

The quasi-fixed netput equity capital (z_1) is inversely related to both the profit and cost dependent variables at 1 percent and 5 percent, respectively.

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[2]The data on the number of employees in the Bankscope database are only available for 91 out of the 306 observations starting in 1995. The mean unit price of labor is US$ 8,528 while the maximum is US$ 17,497 and the minimum is US$ 4,210, all in constant 2000 prices. The drop in the real unit cost of labor is greatest during the aftermath of the Asian financial crisis at 28.78 percent and during the consolidation period 1999-2000, which registered a decrease of 34.13 percent. For samples with available number of employees, a general decline in the real price of labor is observed such that at an exchange rate of Php 50 to US$ 1 (base year 2000), the unit price of labor is Php 690,000 in 1994 and only Php 350,000 in 2004.

[3]Inflation rate for the years 1992-2004 is on average 6.47 percent while the cost of funds is only 6.21 percent on average for the 306 observations. Alternatively, annual deposit rates are on average 32 basis points lower than inflation rate for the 1992-2004 period.

[4]During the period of consolidation in the sector from 2000 to 2002, the total number of employees in the commercial banking industry decreased by 6.62 percent. In 2000, there were 72,599 employees for the entire sector and by end of 2005, the number is down to 71,967, or a decrease of 0.13 percent. The employees affected generally belong to the rank and file as the ratio of officers to the rank and file is 30.7:69.3 in 2000; by 2005 it has become 33.7:66.3. (Data are taken from the Philippine Deposit Insurance Corporation.)

Equity capital, put up by shareholders to acquire banking licenses, is also used for investments in head and branch offices, furniture and fixture, equipment, etc., which generally show little variability in the short run. The cost of equity capital is more expensive than the cost of funds (deposits), thus the opportunity cost associated with it reduces profits. On the other hand, besides the capital required to maintain the bank's infrastructure, part of equity capital is the so-called free capital, the one set aside to protect depositors against losses. This capital used for prudential concerns reduces costs in the long run.

Two mixed-product terms involving equity capital are also found to be significant for both profit and cost functions. The interaction term loans and equity capital (β_{23}) is significant and positively related to both profit and cost functions. Bank capital directly affects costs by providing an alternative to deposits as a source of funding for loans. A likely explanation for the positive influence of the interaction term on profits is that interest paid on debt counts as cost while dividends issued are not. On the other hand, the slightly significant but nevertheless positive effect of the interaction term on cost can be partly explained by the fact that raising equity involves higher costs compared to raising deposits, hence costs will be higher for banks using a higher proportion of equity financing. The interaction term wage rate and equity capital (β_{26}) is positive and highly significant for both profit and cost functions. The intensity of risk management activities by banks as represented by the magnitude of equity capital deployed for insolvency risk management as well as the salaries of risk management professionals may increase cost. The long-run effect of these risk management activities that reduce portfolio losses may increase profits.

The other netput is bank branches, and its quasi-fixed nature follows from the significant adjustment costs and time required to dismantle or significantly alter branching networks. The variable is significant and positively impacts the bank's cost ($\beta_7 = 0.48$). Its square term (β_{34}) is highly statistically significant, positively and negatively influencing the cost and profit functions, respectively. This finding suggests that the collective products and services offered by banks require a wide network of bank branches which may cause a rise in total cost, thereby depressing profits.

The product of the two outputs, loans and other earning assets (β_{13}), is likewise significant for both profit and cost estimates. The negative sign suggests substitutability rather than complementarity between the two bank outputs. This is because the source of funds of the two outputs (assets side) is basically the same bank deposit base (liabilities side). Separately, loans

($\beta_1 = 6.06$) is found to positively influence profit levels at $p < 0.10$ while other earning assets ($\beta_2 = -0.99$) is found to be negatively related to cost at $p < 0.05$, suggesting that securities and equity investment in allied and non-allied undertakings do not exert much pressure on the banks' cost structure. Another product of two outputs, other earning assets and services, has a negative sign ($\beta_{15} = -0.07$), suggesting substitutability between the two as engagement in securities and equity investments reduces resources needed in other (nonbanking, nonsecurity, and non-investment related) services.

In terms of goodness-of-fit test of the model, the log likelihood functions of the profit and cost estimates are reported at –313.42 and 286.36, respectively. Evaluated using the chi-square statistic at 33 degrees of freedom and at 1 percent level of significance, there is no reason to reject the null hypothesis that the parameters are not significantly different from other fixed values. The log likelihood ratios (λ) of 0.92 and 56.06 for the profit and cost functions, respectively, seem to point that a reduced model provides the same fit as a full model for the cost function (significant at 1 percent level) but not for the profit model. This is because for the profit model, only two variables are significant among the seven first-order regressors while for the cost model, only one is not significant. Sigma squared or the square of the error terms (σ^2), at $p < 0.01$ level for both profit and cost functions, indicates highly significant profit efficiency and cost inefficiency parameter estimates. The t-ratio of the gamma (γ) for the profit function is not significant while that of the cost function is significant, indicating that sigma squared term is zero (close to zero in fact at 0.03), hence the model can be estimated using OLS, which Frontier 4.1 generates as well. Mu (μ) is restricted to zero since the model assumes a half-normal distribution. The next section presents the efficiency estimates across time and cross-sections, and tests the hypotheses on the effects of the three episodes of liberalization, crisis, and mergers on industry efficiency.

5.2. Effects of liberalization, crisis, and mergers on efficiency

Table 2 presents the annual profit- and cost-efficiency scores for the data set and is illustrated in Figure 2. For the unbalanced panel data, the average profit efficiency is 88.52 percent and the average cost inefficiency is 12.60 percent, with a standard deviation of 4.6 percent and 7.89 percent, respectively, for the period 1992-2004. The trend for profit efficiency is that it is steadily declining—from a high of 92 percent in 1992 to 84 percent

in 2004. The trend for cost inefficiency likewise increases, from 10-12 percent in 1992-1998 to 14-15 percent in 1999-2004. Karim [2001] reports an average of 34.1 percent cost inefficiency from 1989 to 1996 while Manlagñit and Lamberte [2004] account a mean cost inefficiency of 39 percent from 1990 to 2002. Eta (η) for both profit and cost estimates are not significant at any level, indicating the absence of cross-section (bank-level) time-varying efficiencies.

Table 2. Average profit- and cost-efficiency scores

Year	No. of obs.	Profit		Cost	
(t=13)	(n=306)	Efficiency	Inefficiency	Efficiency	Inefficiency
1992	16	0.92	0.08	0.89	1.11
1993	19	0.92	0.08	0.90	1.10
1994	23	0.91	0.09	0.89	1.11
1995	25	0.91	0.09	0.88	1.12
1996	27	0.90	0.10	0.88	1.12
1997	31	0.89	0.11	0.88	1.12
1998	27	0.89	0.11	0.89	1.11
1999	27	0.88	0.12	0.85	1.15
2000	21	0.87	0.13	0.85	1.15
2001	20	0.87	0.13	0.86	1.14
2002	24	0.86	0.14	0.86	1.14
2003	24	0.85	0.15	0.86	1.14
2004	22	0.84	0.16	0.86	1.14
Descriptive statistics					
Mean		0.89	0.11	0.87	1.13
Median		0.89	0.11	0.89	1.11
Maximum		0.95	0.37	0.99	1.34
Minimum		0.63	0.05	0.66	1.01
Standard deviation		0.05	0.05	0.08	0.08

The SFA models for the translog profit and cost functions are run on different subsets of the original data to allow for hypotheses testing. For the first hypothesis that tests whether liberalization increased the profit and cost efficiency of the banking sector or not, the 306 observations are divided into two: 58 observations for the pre-liberalization period 1992-1994 and 248 observations for the post-liberalization period 1995-2004. The two data subsets are run using the original SFA profit and cost specifications. The log

likelihood ratios of the two subsets are then compared.[5] The log likelihood ratio (LR) is greater than 6.635 (x^2 at 1 percent level) for both the profit and cost specifications at 221.28 and 201.26, respectively, as shown in Table 3. This is sufficient reason to reject the null hypothesis that the pre-liberalization profit and cost functions are not significantly different from their post-liberalization counterparts, respectively. Although the average profit-efficiency scores for the pre- and post-liberalization periods are not disparate at 99.69 percent and 98.37 percent, respectively, the number of significant variables varies. Only the constant term and financial equity capital are significant for both periods.

But for the post-liberalization result, the three output variables and six second-order variables—loans and other earning assets, loans and cost of funds, loans and financial equity capital, other earning assets and financial equity capital, wage rate and financial equity capital, and cost of funds and financial equity capital—significantly affected profit. The interaction terms loans with other earning assets and loans with cost of funds registered negative impact on profits while the interaction terms financial equity capital with loans, other earning assets, wage rate, and cost of funds positively affected profit. This seems to suggest the poor quality of the loan portfolio prior to

Table 3. Log likelihood ratio test of hypotheses

	Pre-liberalization (n_1= 58)	Post-liberalization (n_2=248)	LR	Null Hypothesis
Profit	.59E+02	-2.70E+02	221.28***	Reject
Cost	1.23E+02	2.23E+02	201.26***	Reject
	Pre-crisis (n_1= 110)	Post-crisis (n_2=196)	LR	Null Hypothesis
Profit	2.43E+02	-2.27E+02	30.94***	Reject
Cost	1.71E+02	1.85E+02	28.00***	Reject
	Nonmerged (n_1= 185)	Merged banks (n_2=121)	LR	Null Hypothesis
Profit	-2.14E+02	1.85E+02	58.44***	Reject
Cost	1.65E+02	1.64E+02	2.00	Accept

*** Significant at 1 percent level.

[5]The difference between the two likelihoods is multiplied by two for technical reasons so that the quantity is distributed as the familiar chi-square (x^2) statistic. Log likelihood ratio (LR) is given by $LR = 2(|LL_A| - |LL_O|)$ where LL stands for log likelihoods. The subscripts $_A$ and $_O$ denote alternate and null hypotheses, respectively. The number of degrees of freedom is 1 since both specifications under the null and alternate models have the same number of parameters.

liberalization and the importance of financial equity capital due to increased competition brought about by liberalization.[6] The gap between cost efficiency in the pre- and post-liberalization periods, however, is wide at 99.47 percent and 87.99 percent, respectively, accounting for the rejection of the null hypothesis of no difference. This seems to suggest that liberalization or the entry of foreign banks exposed the sources or the variables influencing cost inefficiencies of the domestic banks, with 19 other variables aside from the four variables significant to both pre- and post-liberalization, cost functions being statistically significant.

For the pre- and post-Asian financial crisis profit and cost models, the log likelihood ratio is greater than x^2 at 1 percent significance level, leading to the rejection of the null hypothesis of no difference. Profit-efficiency scores before and after the crisis are 98.19 percent and 87.34 percent, respectively. The difference between the cost efficiencies before (87.33 percent) and after (89.48 percent) the crisis, however, is small, but the difference lies in the number of significant variables aside from the nine that are significant to both specifications—four in the pre-crisis era and eleven in the post-crisis period. Loans and price of funds, together with the interaction term financial equity capital with the prices of labor and funds, are significant for the pre-crisis cost function. For the post-crisis cost function, the significant variables are other earning assets, services, wage rate, the square terms of services, wage rate and cost of funds, services and wage rate; interaction term loans with cost of labor; interaction term cost of funds with other earning assets and services; and interaction term wage rate and financial equity capital. Although there are similar variables in the interaction terms of both pre- and post-crisis cost specifications, their partner-variables are different. A noticeable difference is the significant effect of other earning assets and services in the post-crisis model, suggesting the impact of these non-intermediary banking outputs on the cost structure, which is not readily discernible in the pre-crisis period.

The third hypothesis for testing involves the efficiency implications of mergers and acquisitions. The BSP reports 20 mergers from 1992 to 2004.

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[6]The minimum capital requirements for universal banks increased from Php 1 billion in 1990 to Php 2.5 billion in 1995, the year ten new foreign banks were allowed entry, and then to Php 4.95 billion in 1999, two years after the Asian financial crisis. For plain commercial banks, the corresponding figures are Php 0.5 billion in 1990, Php 1.25 billion in 1995, and Php 2.4 billion in 1999.

For the nonmerged and merged banks comparison, the profit-efficiency estimate is rejected while that of the cost function is not rejected at 1 percent significance level. Although the average profit efficiencies of nonmerged and merged banks are 97.90 percent and 99.06 percent, respectively, the difference actually lies in the number of variables that is significant—13 for nonmerged banks against one for the merged group—which led to the rejection of the null hypothesis. On the other hand, the relatively huge difference between the average cost efficiency of nonmerged bank and that of merged banks—86.11 percent and 97.09 percent, respectively—did not lead to the rejection of the null hypothesis as eight variables are common to both nonmerged and merged banks cost specifications, the highest number for the three hypothesis-testing exercises.

An examination of the merged banks' efficiency levels before and after the merger would lend support to the acceptance of the null hypothesis of no difference. Acquired banks, in most cases, have higher profit- and cost-efficiency scores than the surviving or acquiring banks. Vela and Paradi [2002] recommend that to test for synergy gains, the efficiency of both acquiring and acquired banks should be weighted based on total assets before the merger and compared with the efficiency scores after the merger. As a robustness check, the suggestion of Vela and Paradi [2002] is applied for the eight pairs of merged banks in the sample. This is based on comparing the weighted efficiency scores at least three years before the merger whenever data permit, and the efficiency scores three or more years after the merger date. No significant profit- and cost-efficiency improvements after the merger are found. The changes were 1 percent or less in magnitude. Sherman and Rupert [2006] note that merger benefits may not be realized until four years after the merger, and banks may forego or defer realizing these benefits because of political pressures, personnel-integration issues, system-integration issues, and financial components of the merger.

There were other mergers after the study period. In 2005, Prudential Bank, with mean profit and cost efficiency of 91 percent and 98 percent, respectively, was acquired by the Bank of Philippine Islands (BPI) with mean profit and cost efficiency of 91 percent and 92 percent, respectively. International Exchange Bank (iBank), with a mean profit and cost efficiency of 85 percent and 70 percent, respectively, was acquired by Union Bank with a mean profit and cost efficiency of 87 percent and 99 percent, respectively. In 2006, Equitable PCI, with a mean profit and cost efficiency

Table 4. Average profit-efficiency and cost-inefficiency scores of banks

Bank name	No. of obs.	Ownership†	Merged‡	Profit efficiency	Cost inefficiency
ABN-AMRO	1	F	N	88.14%	13.26%
Allied Bank	12	D	N	91.07	1.98
AsianBank	4	D	A	89.49	11.36
Asia United	5	F	N	87.86	8.52
Bank of Commerce	12	D	N	89.26	10.94
Banco de Oro	10	D	S	88.12	6.47
Bank of PI	13	D	S	91.29	7.53
China Bank	13	D	N	88.89	17.98
Chinatrust	9	F	N	84.94	18.66
Citytrust	4	F	A	91.68	8.49
Dao Heng	5	F	N	87.90	2.91
DBS Bank	3	F	A	88.59	22.46
East West	10	D	N	88.65	9.60
Equitable PCI	13	D	S	87.10	20.24
Export & Industry	5	D	N	83.99	4.08
Far East	8	D	A	91.09	10.18
Global Business	3	D	S	89.33	5.80
HSBC	1	F	N	86.81	17.61
iBank	9	D	A	85.36	29.92
Land Bank	6	D	N	90.02	34.42
Maybank	5	F	N	85.77	21.33
Metrobank	13	D	S	91.08	10.28
PB Comm	13	D	N	87.41	16.38
PCI Bank	7	D	A	90.30	2.89
Pilipinas	7	D	A	91.52	5.98
PNB	13	D	N	71.74	18.60
Prudential	11	D	A	91.33	1.65
RCBC	13	D	N	92.54	21.17
Santander	5	F	A	89.51	5.69
Security	11	D	N	88.84	17.55
Solid Bank	7	D	A	93.38	4.24
TA Bank	1	F	A	90.28	7.78
Bank of Tokyo	2	F	N	87.20	4.34
Traders	6	D	A	91.80	10.61
UCPB	10	D	N	91.53	14.38
Union	13	D	S	87.11	1.40
United Overseas	9	F	N	89.05	23.14
Urban	4	D	N	90.32	10.14
Veterans	10	D	N	88.10	15.63

† Pertains to foreign- (F) or domestic- (D) owned;

‡ Pertains to not engaged in merger (N); acquired (A) or surviving (S) bank in a merger.

of 87 percent and 80 percent, respectively, was acquired by Banco de Oro with a mean profit and cost efficiency of 88 percent and 94 percent, respectively. These empirical data seemed to contradict the notion put forward by Focarelli, Panetta, and Salleo [2002] that banks picked for acquisition are less efficient. The literature on the efficiency gains of mergers were mixed (Rhoades [1993]; Peristiani [1997]; Fixler and Zieschang [1993]).

The mean profit- and cost-efficiency scores of the 39-bank sample were computed for cross-sections with more than two observations as shown in Table 4. For the study period 1992-2004, there were two commercial bank closures—Orient Commercial Banking Corporation in 1997 and Urban Bank in 2000, with the latter included in the sample. Urban Bank was 90 percent profit and cost efficient on average from 1994 to 1997, which is above the sample mean.[7] The top-five profit-efficient banks were Solid Bank, Rizal Commercial Banking Corporation (RCBC), Traders, Citytrust, and United Coconut Planters Bank (UCPB). Solid, Traders, and Citytrust were all absorbed in mergers, and so were other profit-efficient banks like Far East and Prudential. UCPB was financially rehabilitated while RCBC was one of the banks with lowest cost efficiency, canceling out its relatively high profit efficiency. The laggards in terms of profit efficiency were Philippine National Bank (PNB), Export and Industry Bank, iBank (acquired by Union Bank in 2006), Chinatrust, and Maybank. The most cost-efficient banks were Union, Prudential (acquired by BPI in 2005), Allied, Philippine Commercial International Bank (PCI) (before it was acquired by Equitable), and Dao Heng while the laggards were Maybank, DBS Bank, United Overseas, iBank, and Land Bank of the Philippines (LBP).

Potential correlates of profit and cost efficiency are also examined. Table 5 shows that profit efficiency increases with asset size up to Php 170 billion, then drops precipitously to 84.7 percent in the asset size range of Php 170-400 billion. The megabanks, those with asset size of Php 400 billion and above, have relatively high profit-efficiency levels of 89.75 percent. Cost inefficiency registers at 12.34 percent for banks with asset size below the Php 50 billion mark, improves a bit at 11.28 percent for those in the Php 50-100 billion range, and surges to 15.76 percent for the Php 170-400 billion asset-size range. Figure 1 shows the profit-efficiency and cost-inefficiency scores for the first four categories, exhibiting a U-shaped curve with a left

[7]Profit- and cost-efficiency scores are poor signals for bank closures especially if these are due to corporate governance failures. See Echanis [2006] for cases.

tail.[8] The asset size category of Php 400 billion and above has the lowest cost inefficiency score of 9.66 percent.

Table 5. Average profit efficiency and cost inefficiency per asset size category

Asset size*	Average size*	No. of Obs.	Profit efficiency (%)	Cost inefficiency (%)
< 50	22.35	156	88.75	12.34
50 to <100	71.58	52	89.34	11.28
100 to <170	132.10	42	90.68	12.33
170 to <400	257.88	47	84.68	15.76
400 and above	453.41	9	89.75	9.66

*In constant 2000 Philippine billion pesos.

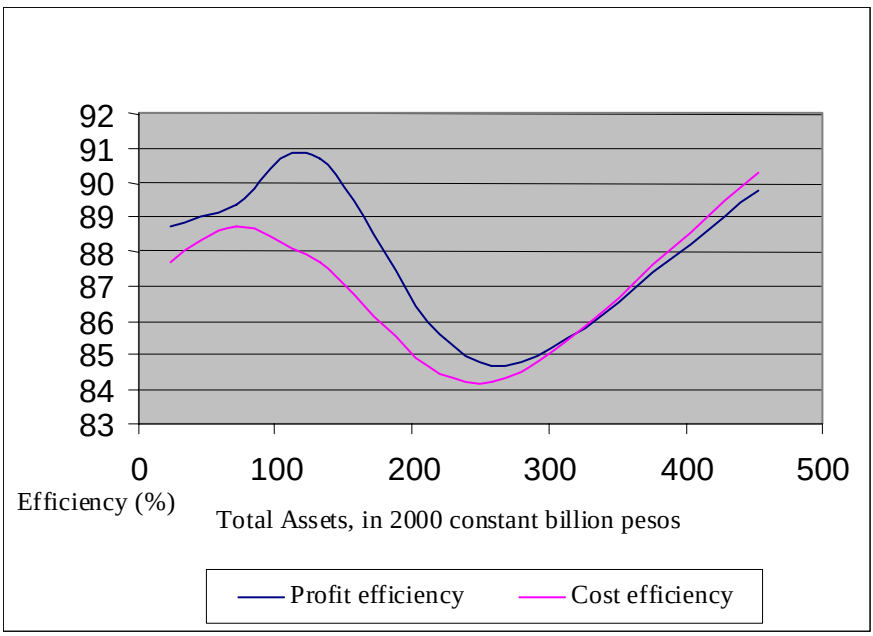

Figure 1. Profit and cost efficiency with asset size

[8]Nearly similar average efficiency scores of the banks every interval of Php 200 million of total assets were collapsed into categories, hence the five asset range groupings. Dividing the sample into quintiles would average out data differences for boundary observations.

Regressing the potential correlates of efficiency scores is due to Berger and Mester [1997] and is applied in this study with results shown in Table 6. Foreign-bank status is found to be significantly correlated with cost inefficiency. A plausible reason is that foreign banks incur higher salaries and operating expenditures.[9] Another reason why foreign banks performed badly in terms of cost efficiency is that they are really small fractions of their parent entities, which operate globally. Foreign banks in the Philippines are mostly branch offices of the parent bank, and are not subsidiaries.[10] This finding is similar to the case of India wherein foreign banks fared poorly compared to domestic banks [Sensarma 2006].

The second set of regressions involves the same bank-characteristic variables, with the dummy variables dropped and replaced with time-varying but cross-section invariant macroeconomic variables. The results are presented in the second profit-efficiency column in Table 6. The macroeconomic variables are not significantly correlated with the cost inefficiency estimates, and hence are not presented. Only two macroeconomic variables are found to be significantly correlated with profit efficiency. First is the finance-sector growth rate culled from the GDP industrial-origin accounts. This sector-specific measure is negatively correlated with profit efficiency. A plausible explanation is that finance-industry growth brought about by liberalization (entry of more banks)

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[9]Only 91 observations are available out of the 306 sample used from the BankScope database for the unit personnel cost. For foreign banks, unit personnel cost averaged US$ 9,750 while that of domestic banks is only US$ 8,250. Owing to the limited number of data for unit personnel cost from BankScope, the Philippine Deposit Insurance Corporation (PDIC) statistics on per capita other operating expenses are a better metric considering that they are based on all banks. The PDIC statistics from 2000 to 2005 reports the following other operating expenses per full-time equivalent employee for all banks in the following categories in 2000 constant prices: Php 1.13 billion for expanded commercial banks, Php 1.091 billion for plain commercial banks, Php 2.566 billion for foreign banks, and Php 1.385 billion for government banks.

[10]Of the 18 foreign banks that operate in the Philippines in 2004, 14 are foreign-bank branches while only four are subsidiaries. The criteria used in allowing a foreign bank to operate in the Philippines are as follows: it should be among the top five in its country of origin, and its country of origin should have substantial trade and investment relations with the Philippines as per Republic Act 7721. The parent banks of the subsidiaries are small compared to the parent banks of the foreign-bank branches.

Table 6. Regression of potential correlates with profit efficiency and cost inefficiency scores

	Profit efficiency†	Profit efficiency‡	Cost inefficiency
Constant	1.040 (19.53)***	0.923 (23.36)***	1.076 (10.68)***
Equity ratio	-0.001 (-2.16)**	-0.001 (-1.56)	-0.002 (-3.20)***
ln of total assets	-0.014 (-3.62)***	-0.006 (-2.46)**	0.004 (0.59)
Net interest margin	0.009 (5.21)***	0.007 (3.88)***	0.007 (2.08)**
ROAA	-0.012 (-3.45)***	-0.010 (-2.95)***	-0.002 (-0.30)
ROAE	0.002 (5.67)***	0.002 (4.80)***	-0.001 (-1.50)
Foreign-owned=1; 0 other	-0.010 (-1.14)		0.051 (3.09)***
Universal bank=1; 0 other	0.013 (1.74)*		0.008 (0.05)
Real GNP growth		0.002 (0.36)	
Real GDP growth		-0.005 (-0.88)	
Finance sector growth		-0.002 (-2.44)**	
Market deposit growth		0.001 (0.88)	
Market loan growth		0.001 (1.18)	
Loans/GNP ratio		0.001 (1.71)*	
R-squared	0.2849	0.3347	0.1260
Adjusted R-squared	0.2680	0.3097	0.1054
Durbin-Watson stat	0.4607	2.1210	0.2516
F-statistic	16.9020	13.3979	6.1191

† Profit efficiency with dummy variable regressors;

‡ Profit efficiency with macroeconomic variable regressors;

t-statistics in parentheses; ***, **, * denote significance at 1 percent, 5 percent, and 10 percent, respectively.

leads to more intense competition affecting profitability. The second significant variable is the loans-to-GNP ratio, which is a measure of the degree of financial intermediation in the macroeconomy. Loans-to-GNP ratio is positively related to profit efficiency as increases in the intensity of intermediation activity means improved profitability for the banks and the industry as a whole. Figure 2 shows the trend of the two macroeconomic variables with the profit- and cost-efficiency estimates.

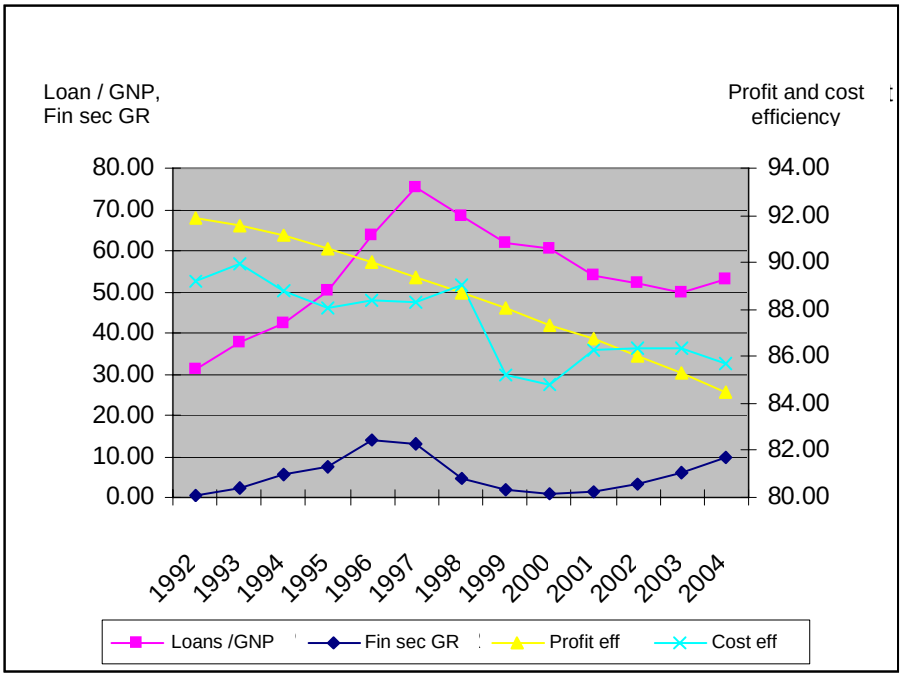

Figure 2. Profit and cost efficiency with loan/GNP ratio and finance sector growth rate

6. Conclusion

The paper tracks the profit-efficiency and cost-inefficiency scores of Philippine commercial banks for the period 1994-2004. It has been observed that cost inefficiency increased after liberalization in 1994 and further shot up after the Asian financial crisis, averaging 13 percent for the entire period. Profit efficiency, on the other hand, is steadily declining, from above the 90 percent mark before liberalization to 84 percent in 2004. The evolution of efficiency scores clearly shows that Philippine banks experienced declining profit and cost efficiencies, although the inefficiencies are not substantial. Karim [2001] reports an average of 34.1 percent cost inefficiency from 1989 to 1996. Manlagñit and Lamberte [2004] report an average profit efficiency of 85 percent and cost inefficiency of 39 percent from 1990 to 2002.

Two hypotheses can be suggested to explain these evolutions, following Berger and Mester [1999]. First is the increasing quality of bank services hypothesis to explain this phenomenon. Increasing quality of bank services due to competitive pressures led to higher costs of production and lower

profit margins. The actual entry of foreign banks into the banking-industry landscape after 1994 exposed and increased the inefficiency of the domestic-bank-dominated banking sector. Foreign-bank status is found to be correlated with cost inefficiency due to higher personnel and other operating costs. These findings are consistent with Sensarma [2006] who posits that foreign banks are not necessarily the best in local-banking markets. The paper also finds support in Laeven [1999] insofar as the effect of liberalization is concerned for the Philippines. The negative coefficient of the year 1994-1995 for the Philippines indicates a possible structural shift, which augurs well with the statistically significant decline in profit and cost efficiency after the opening up of the banking market in 1994. This is also consistent with Montinola and Moreno [2001] who showed that banking efficiency in the production of deposits for the intermediation of loans declined prior to the liberalization of foreign-bank entry, and noted a further slide in bank efficiency after liberalization. The seemingly conflicting result of liberalization from Laeven [1999] and Montinola and Moreno [2001] with Unite and Sullivan's [2003] finding that liberalization led to the decline in interest spreads can be resolved by the fact that performance is not confined to the narrowing of spreads. Bank outputs have moved beyond traditional balance sheet items like loans and deposits to include equities and investments and off-balance sheet services that could mean increasing and expanding quality services that capture more fully the characteristics of a modern banking firm.

Second is the "quiet life" hypothesis. Facing threat from new competitors, the banks could have opted for defensive strategies instead of reducing their costs. Defensive-strategy tools include the following: banks try to extend or reinforce their market shares through mergers and acquisitions, they increase the switching costs by exploiting their relationship with customers, and they maintain their nationwide branch network as a barrier to entry. Foreign banks definitely exert pressure on the domestic banks by forcing the latter to narrow the interest-rate spread [Unite and Sullivan 2003] but in terms of concentration ratios (C3, C4, C5, and HHI), these dropped after the liberalization but have since recovered and even exceeded their pre-liberalization levels due to consolidation in the industry after the Asian financial crisis.

Mergers and the consolidation of the banking sector altered the rankings and market share of the players, but the data on profit and cost efficiency showed that the weighted scores of the acquired and surviving banks before

the merger have not improved three years after the merger. Synergy gains from the merger needed a longer time to be realized. Williams and Nguyen [2005] noted that the benefits associated with domestic M&As are realized in terms of technical developments, which determine productivity rather than managerial performance (efficiency). Unite and Sullivan's [2003] assertion that high-ownership correlation deters entry further lends support to the study's explanation of increasing quality of banking services, which is used to explain the declines in profit and cost efficiency for the 13-year period. The observed buildup of the automated teller machine (ATM) and branch network infrastructure of the domestic banks as entry deterrent further supports the "quiet life" hypothesis. Of the 33 banks with e-banking licenses in 2005, 20 had been granted to domestic banks. Foreign banks' e-banking operations are mostly internet-based and proprietary while domestic banks' e-banking operations also include mobile- and landline-based banking as well as a wide network of on-site and off-site ATMs numbering 5,476 against foreign banks' 130 by end of 2005. Foreign banks are also limited to six branches while the top-five domestic banks have branches numbering more than 500.

In the area of policy, the findings of the study point to the following implications. First, in terms of the policy of the BSP, mergers should continue to be encouraged but merging banks should be subjected to stress testing to determine whether the merged entities remain viable even without incentives. It has been found that the medium-sized firms are the least profit and cost efficient, hence there are more efficiency or synergy gains that can be realized from encouraging mergers between huge and medium-sized banks rather than between the large banks. The latter type of mergers is simply motivated by increase and protection of market shares and positional advantages.

Second, plain commercial banks should be encouraged to upgrade themselves into universal or expanded commercial banks. The study finds that universal banks have significantly higher profit-efficiency scores than ordinary commercial banks. The economies of scope that can be exploited from having an expanded commercial banking license should be a sufficient incentive for banks to aim for such. Medium- and small-sized non-expanded commercial banks should be encouraged to merge with large universal banks to exploit scale and scope economies.

Third, the government should review its commercial banking operations. Land Bank of the Philippines is shown to be the most cost inefficient of all banks in the sample. While the state-owned bank has a specific and socially

relevant mandate, its venture into purely commercial banking services to subsidize its social mission is efficiency depleting. An in-depth study is needed to examine whether the difference is due to the fact that state-owned banks have a development mandate mixed with commercial banking operations or whether politics or corruption plays a role. The key challenge for future research is to understand if, and under what conditions, the potential benefits of the development mandate can balance if not outweigh the inefficiencies due to multiple if not conflicting objectives. It is hoped that these policy prescriptions would improve industry efficiency.

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