MEASURING BANKING EFFICIENCY POST CONSOLIDATION: THE CASE OF EGYPT

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1. INTRODUCTION

With increased globalization, banking productivity and efficiency are essential for the survival of banks. Over the past decade, the Egyptian banking sector was subject to several reforms aimed at increasing both its efficiency and competitiveness. One of the key legislative reforms was the issuance of banking law 88/2003, which mandated that banks raise their capital over a period of three years ending 2006. This requirement led to a massive wave of mergers and acquisitions and thus led to the reduction of the number of operating banks. Motivated by the catalytic role that banks play in the economy, the current study conducts a comparative assessment of the efficiency and profitability of Egyptian banks pre (2000-2003) and post consolidation (2008-2010).

To measure the efficiency of banks, we use data envelopment analysis (DEA), which is a non-parametric technique, to calculate overall banking sector efficiency pre and post consolidation. The study covers a homogenous set of units, namely the pool of commercial banks in Egypt.[1] Our hypothesis is that the wave of consolidations has led to greater overall banking efficiency. Following computation of managerial efficiency, Tobit regressions are used to identify key determinants of managerial efficiency. Moreover, the study uses traditional financial ratios to assess changes in other uncounted for factors, such as profitability change or profit efficiency. [2]

The study is organized as follows: Section 2 provides a brief review of the literature on banking efficiency; Section 3 presents key developments in the Egyptian banking sector over the past decade; Section 4 reviews the methodology; Section 5 presents the results; and Section 6 concludes.

2. LITERATURE REVIEW

The empirical literature analyzing the effects of mergers and acquisitions on bank performance follows two major approaches. The first approach follows the event study-type methodology, which is usually based on changes occurring in stock prices around the period of the announcement of a merger (Campa and Hernando 2008; Alexandridis, Dimitris and

[1] The study does not cover Islamic banks nor does it cover foreign banks' branches in Egypt. Islamic banks are not included as the inputs and outputs are different than those of traditional banks, i.e., they do not deal with interest rates.

[2] Yildirim and Philippatos (2007).

Travlos 2010; and Antoniou, Michael and Dimitris 2008). These studies examine the effect of a bank merger announcement on the creation of shareholder's value and the impact on the target, the bidder or the combined new entity.

The second strand of the literature, the operational performance approach, comprises studies that assess the link between mergers and acquisitions and the productive efficiency of the banks involved, either measured through accounting data or through the estimation of cost and profit functions. The increased interest in cost cutting and efficiency in the banking industry, particularly through mergers and acquisitions, has rendered this approach attractive.

Berger, Demsetz, and Strahan (1999) indicated that mergers and acquisitions may lead to changes in efficiency, market power, economies of scale and scope, availability of services to customers and payment systems' efficiency. Besides improvement in cost and profit efficiency, mergers and acquisitions may also lead to higher profits. Daley and Mathews (2009) explore the relationships between bank efficiency estimates, using accounting ratios and DEA in the case of Jamaican banks. Their findings suggest an advantage in favor of the DEA.

A growing number of studies used DEA to assess the impact of mergers and acquisitions (M&As). Allen and Boobal-Batchelor (2005) assessed the efficiency of the Malaysian banking sector pre and post mergers during the period 1996-2002, following the Asian financial crisis, using DEA. They found that acquiring banks were more technically efficient but less scale efficient than target banks at the time of a merger. Nevertheless, the acquiring banks did not maintain their pre-merger efficiency levels. Inefficiencies grew during the first post-merger year but the results were inconclusive during the subsequent post-merger years. Abd-Kadir, Selamat and Idros (2010) studied the effect of mergers and acquisitions on Malaysian banks' productivity over the period 2003-2007 using DEA. Yet, contrary to the finding of Allen and Boobal-Batchelor (2005), they found that the process of mergers and acquisitions has actually increased the efficiency and productivity growth of banks in Malaysia. That is, the consolidation has resulted in improved efficiency over a longer span of time.

Several studies were undertaken on the Egyptian banking system, each from a different angle, yet to our knowledge none has assessed the effect of mergers and acquisitions on the efficiency of the banking sector using DEA. Badrelin and Kalhoefer (2009) studied the effect

of mergers and acquisitions on banks' performance in Egypt. They measured the performance of Egyptian banks that have undergone mergers or acquisitions during the period 2002-2007 by calculating their return on equity. Their findings indicate that not all banks that have undergone deals of mergers or acquisitions have shown significant improvements in performance. They concluded that mergers and acquisitions have not had a clear effect on the profitability of banks in Egypt.

Nasr (2009) explored the role of banks in Egypt as a catalyst for economic development and found that although significant progress has been made in the implementation of financial sector reform in Egypt since mid-2004, challenges still remain. Moreover, various financial indicators put the Egyptian financial system at a moderate level in terms of financial intermediation over the period 2000-2008 as compared to other developing and developed countries. Moreover, concerns have surfaced that finance has been mainly going to privileged enterprises, while small and medium enterprises, as well as start-ups, have limited access to finance.

Ben Naceur and Kandil (2009) studied the impact of capital requirements on banks' cost of intermediation and performance in Egypt. The results of the study supported the efforts of the Central Bank of Egypt to enforce capital regulations as of 1991 towards improving the performance of the banking sector in Egypt.

Reda and Isik (2006) measured the efficiency and productivity change of Egyptian commercial banks during the period 1995-2003 using DEA and Malmiquist productivity index. They found that over the study period, productivity deteriorated on average by four percent annually. The study recommended that the government adopt policies that would foster competition and that the industry devises incentive schemes to improve managerial efficiency through greater investment in technology and skill enhancement.

3. DEVELOPMENTS IN THE EGYPTIAN BANKING SECTOR

Over the past decade, the Egyptian banking sector has gone through major reforms with the aim of raising its efficiency and soundness. The government developed specific banking restructuring reform programs to increase banking competition, reduce non-performing loans, raise capital adequacy and ensure adherence to prudential regulations. Key reforms included consolidation of the banking system through merger and acquisition of small and weak banks; operational and restructuring of state-owned banks; financial resolution of non-performing

loans (NPLs); privatization of one of the state-owned banks; divesting public sector shares in joint venture banks and strengthening the central bank's supervisory authority.

As of 2004, a non-performing loan monitoring unit was established in the central bank to help banks in making collective settlements with their major problem customers using moral suasion. From 2004 to 2010, the unit helped in settling more than 90 percent of NLPs (excluding the debts of the public business sector). With regards to the non-performing loans of public business sector enterprises to banks, about 62 percent was repaid in cash to the public commercial banks. As for the remaining 38 percent, they were supposed to be settled in kind in June 2010.[3]

The government aimed to consolidate banks so as to raise banks' competitiveness and eliminate low performers. An important factor contributing to the consolidation of the banking sector was the issuance of the unified banking law of 2003, which raised the minimum required paid-in capital of national banks from LE 100 million to LE 500 million. Also, the capital adequacy ratio requirement was increased to 10 percent as opposed to 8 percent for the risk-weighted assets. As a result, over the period 2004 to 2006, the Egyptian banking sector witnessed a major wave of consolidations.[4] Small banks and poor performers were easy acquisition targets, as they could not abide by the modified regulations. In contrast, foreign banks were involved in acquisition actions in an attempt to enter the Egyptian banking sector, especially after the government refrained from offering new banking licenses.[5] Foreign interest was evident by the participation of foreign players in the bids that took place to acquire stakes in Egyptian banks. These banks include BNP Paribas, Barclays, Piraeus, Credit Agricole, Societe Generale, BLOM and Audi among others. Table 1 portrays the structure of the banking sector over time, whereas Table A1 in the appendix reports key mergers and acquisitions that took place in the Egyptian banking sector.

The government also attempted to reduce public sector dominance in the banking sector by privatizing one state-owned bank, namely, Bank of Alexandria, which was acquired by the Italian Intesa San Paolo Bank in 2006. Banque du Caire, another state-owned bank, was also

[3] As per Central Bank of Egypt (CBE) annual report 2010/11.

[4] The exception is the acquisition that took place in January 2008, whereby the Societe Arabe Internationale De Banque acquired Port Said National Bank.

[5] Banking licensing is subject to economic needs, consequently no new licenses were offered over the past two decades.

about to be privatized in 2008, but the deal was cancelled as the bids did not match the value of the bank. Moreover, the government sold its stakes in bank joint ventures.

The lender of last resort has been a feature of the Egyptian banking system since the issuance of law 163 of 1957, which made the Central Bank of Egypt (CBE) responsible for providing troubled banks with emergency funds. Although a deposit insurance fund was allowed to be established by law 1992, it has yet to be implemented.

Table 1. The Structure of the Egyptian Banking Sector

End of June	Commercial state-owned banks	Commercial private & joint venture banks	Total commercial banks	Off-shore banks	Specialized banks	Total number of banks
2000	4	35	*39*	20	3	*62*
2001	4	35	*39*	20	3	*62*
2002	4	35	*39*	20	3	*62*
2003	4	35	*39*	20	3	*62*
2004	4	35	*39*	19	3	*61*
2005	4	34	*38*	18	3	*59*
2006	4	29	*33*	7	3	*43*
2007	3	28	*31*	7	3	*41*
2008	3	27	*30*	7	3	*40*
2009	2	27	*30*	7	3	*39*
2010	2	27	*30*	7	3	*39*
2011	2	27	*30*	7	3	*39*

Source: Central Bank of Egypt annual report, various issues.

Pressing forward with banking reform plan,[6] the Central Bank of Egypt (CBE) focused on several pillars during the period 2009-2011. Key reforms included financial and administrative restructuring of specialized state-owned banks;[7] applying Basel II standards in Egyptian banks with the aim of enhancing risk management practices; applying international governance rules and adopting an initiative promoting the development and growth of banking services and access to finance for various sectors, especially small and medium-sized enterprises (SMEs).

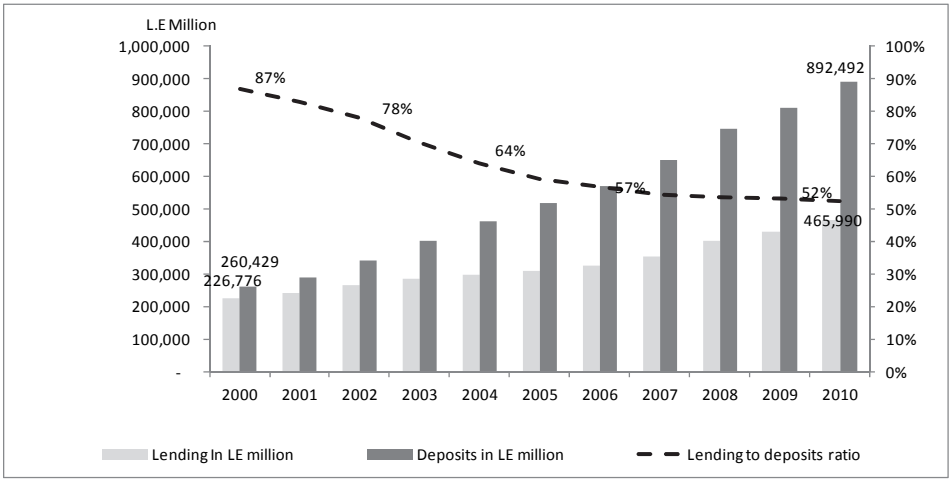
[6] The first stage of reforms focused on consolidation and privatization of the banking sector; financial and managerial restructuring of state-owned banks; addressing non-performing loans and upgrading of the supervision sector at the CBE. This stage was successfully implemented over the period 2004–2008.

[7] Specialized state-owned banks include the Principal Bank for Development and Agricultural Credit, Egyptian Arab Land Bank, and Industrial Development and Workers Bank of Egypt.

In this context, to encourage banking credit to small and medium-sized enterprises, the CBE exempted banks' deposits of the reserve requirement of 14 percent (for an amount equal to that granted to SMEs).[8] During the first half of 2009, finance extended to SMEs amounted to a mere LE 305 million, representing 3.5 percent of total credit. As stated in the CBE annual report 2009/10, the poor access to adequate, timely and reliable statistical data and information is one of the main obstacles to improving and financing SMEs. In this respect, the CBE and the Egyptian Banking Institute (EBI) collaborated with CAPMAS to establish a database that covers all SMEs in Egypt on a full count basis, which was launched in 2012. Moreover, the CBE has required banks in 2010 to obtain data and information from the Egyptian Credit Bureau (I-Score) on the credit history of natural persons and SMEs, as part of the process of assessing the creditworthiness of each customer.

Other reforms in place included setting up the rules and regulations governing the operation of payment orders via mobile phones (mobile-banking and money transfers); approvals for e-banking; and increased risk reserves and required security deposits when opening documentary credits. Moreover, banks' branching rules and guidelines were revised in a way that improves productivity and performance.

Figure 1. Key Banking Sector Indicators (Deposits and Loans, 2000-2010)



Source: Central Bank of Egypt annual reports and online data (http://www.cbe.org.eg).

[8] Recognizing the key role the banking sector plays in enhancing the national economy and developing and promoting firms, particularly SMEs that have difficulty accessing banking finance, the CBE Board of Directors decided in its session of 16th of December 2008 to exempt banks that extend loans and credit facilities to SMEs from the reserve requirement ratio (14 percent). The exemption is proportional to the volume of credit granted by banks to SMEs as of January 2009. It is worthy of note that in a latest development in March 2012, the CBE decided to reduce the required reserve ratio on domestic currency deposits to 12 percent to increase liquidity. In May 2012, this ratio was further decreased to 10 percent effective 26 June 2012.

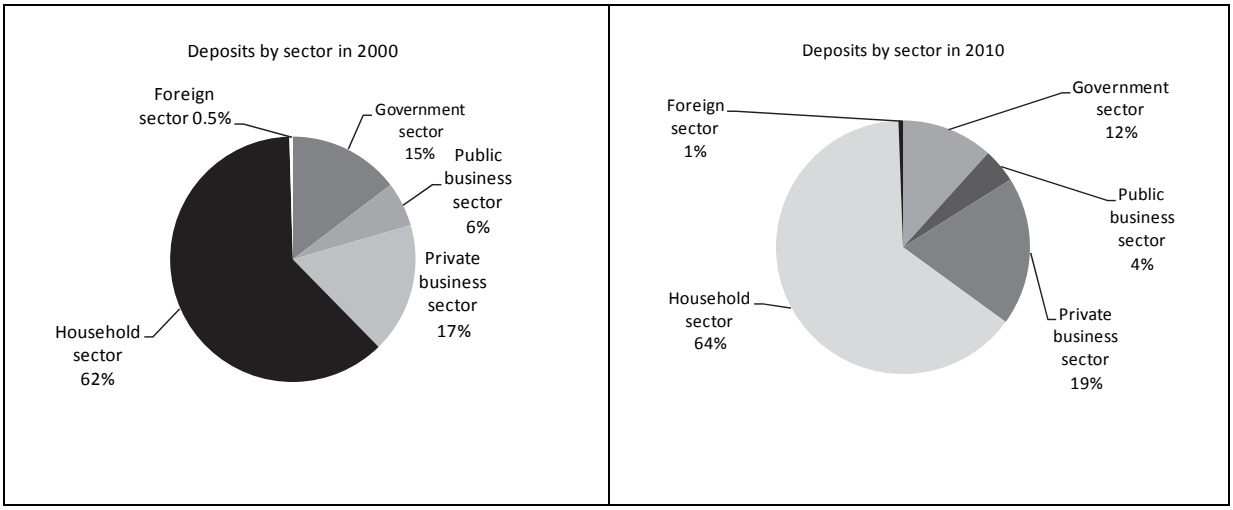
Figure 1 above shows aggregate deposits and lending in the Egyptian banking system over the period 2000-2010. In nominal terms, aggregate deposits quadrupled over the past decade while aggregate lending only doubled. During that period the lending to deposits ratio declined steadily from 87 percent in 2000 to a mere 52 percent in 2010, indicating weak intermediation function and weak demand for loans post the financial crisis in 2008. Moreover, if we look at the deposits structure at two points in time—years 2000 and 2010—as shown in Figure 2, we note that more than 75 percent of deposits come from the household and private business sectors and that the contribution of the government and public business sector to deposits declined from 21 percent in 2000 to 16 percent in 2010, which could be explained by lower profits after the financial crisis and slower economic growth. On the lending side, we note that lending to the private business sector slightly decreased on account of increased household lending. This could be due to banks trying to diversify their lending to corporate and individuals, which may have been reinforced by the effect of the financial crisis as of 2008, which decreased firms' appetite for undertaking new investments, and increased risk aversion by banks. As of 2004, the retail market started to flourish with new retail products made available in the market such as car loans, personal loans, and educational loans. Looking at the trend for retail lending over time (Figure A2 in the appendix) we note that it has been increasing over time since 2005. Household lending reached 19.9 percent of total lending in 2010 up from a low of 12.5 percent in 2004. Lending to government and public business sectors decreased from 20 percent of total lending in 2000 to 14 percent of total lending in 2010 (Figure 3).

The distribution of loans by economic activity shows that the manufacturing sector was a major recipient of loans over the past decade, with a share of 37 percent in 2010 of the total loans extended by banks, followed by unclassified sectors,[9] services, trade and finally agriculture (Figure 4 and Figure A3 in the appendix). Over the past decade, the share of lending directed to agriculture has been small, not exceeding the 2 percent of total loans offered by banks. Moreover, according to the CBE annual report 2009/10, small businesses receive only 3.5 percent of total credit, whereas large businesses receive around 85.4 percent and consumer credit 11.1 percent of total credit (Figure 5). Hence the need for Egyptian banks to play a bigger developmental role in the economy by further diversifying their portfolios and promoting vital economic sectors.

[9] Unclassified includes companies that are not easily classified such as craft shops.

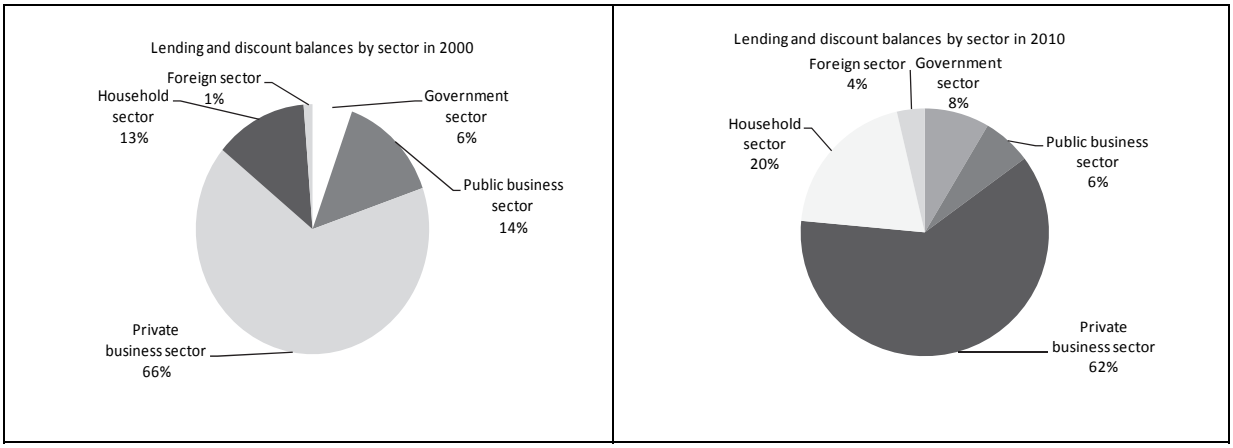
It is worth noting that despite the measures undertaken by the CBE to promote bank lending to SMEs, it remains limited. The underlying factors include constraints on the demand and supply sides of lending to SMEs. On the demand side, SMEs are not well informed about banks' paper requirements and regulations, and entrepreneurs often do not have the necessary skills or culture to borrow. On the supply side, banks often prefer less risky investments than risky and costly lending to SMEs, which requires intensive monitoring and overhead cost as well as market and client information that is often lacking. Moreover, banking intermediation is weak as it relates to lending to specific sectors such as agriculture or small-sized construction works. Over the past decade, lending to agricultural activity was small, standing at no more than 2 percent of total lending.

Figure 2. Deposits by Sector in 2000 and 2010



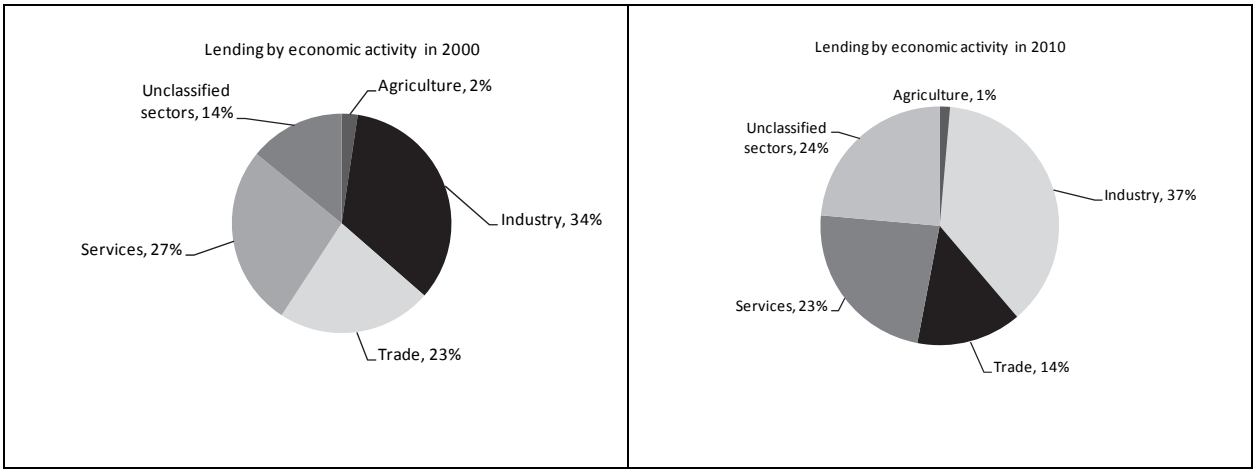
Source: Central Bank of Egypt data and author's calculations.

Figure 3. Lending and Discount Balances by Sector in 2000 and 2010



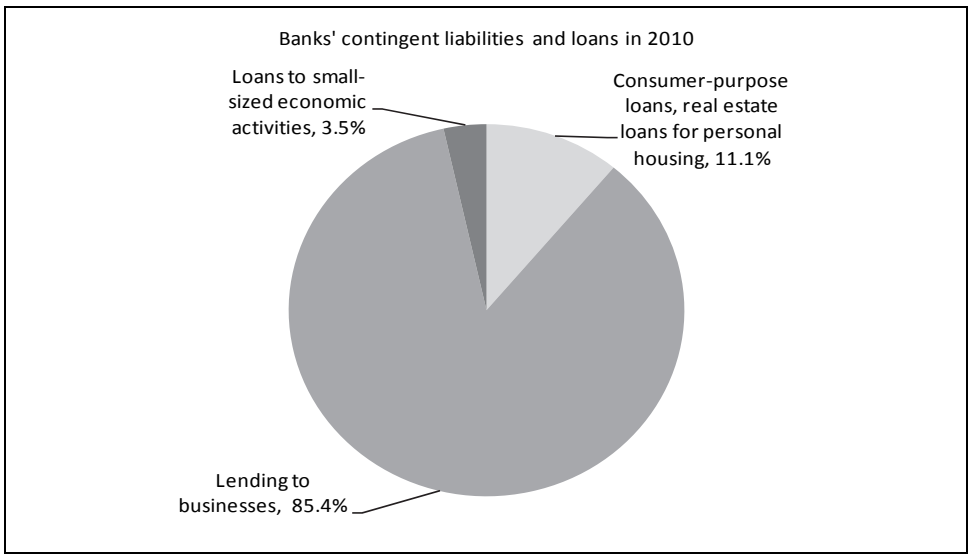
Source: Central Bank of Egypt data and author's calculations.

Figure 4. Lending by Economic Activity in 2000 and 2010



Source: Central Bank of Egypt data and author's calculations.

Figure 5. Credit Facility by Beneficiary, 2010



Source: Central Bank of Egypt annual report, 2009/10.

4. METHODOLOGY

The Concept of Efficiency

Efficiency relates to how well an organization transforms inputs into outputs. In order to measure efficiency, it is necessary to compare actual organizational production to some standard or benchmark that, if achieved, is considered efficient. Production functions generally serve as this benchmark, defined as a function, algorithm, or "black box" by which a given amount of inputs is converted into some maximal quantity of output. Frontier analysis is a sophisticated way by which one could "benchmark" the relative performance of production units. Frontier analysis provides an overall, objectively determined, numerical

efficiency value and ranking of firms (also called X-efficiency in the economics literature) that is not otherwise available. This attribute makes frontier analysis particularly valuable in assessing and informing government policy regarding financial institutions.

Following the terminology adopted by Reda and Isik (2006), the term technical efficiency is used to describe managerial efficiency in banking. *Managerial efficiency* (ME) consists of two mutually exclusive and exhaustive components: *pure technical efficiency* (PTE) and *scale efficiency* (SE). Pure technical efficiency is defined as managerial efficiency devoid of scale effects. When the scale issues are dismantled, managerial efficiency (ME) and pure technical efficiency (PTE) scores are the same, as the difference between them refers to scale inefficiency. Thus PTE refers to proportional reduction in input usage that can be obtained if the bank operates on the efficient frontier. As it results directly from management errors, it is considered one form of managerial inefficiency. Scale inefficiency refers to non-optimal choice of production scale in terms of cost control. A scale efficient firm will produce where there are constant returns to scale (CRS). Thus, when there are increasing returns to scale (IRS), efficiency gains could be obtained by expanding production levels. If decreasing returns to scale (DRS) exist, efficiency gains could be achieved by reducing production levels. As it involves the choice of an inefficient level by management, scale inefficiency is also considered a form of managerial inefficiency.

Efficiency and DEA

In order to measure managerial efficiency we use data envelopment analysis (DEA), with variable return to scale assumption to measure input-oriented managerial efficiency for each year 2000-2003 (pre-consolidation) and 2007-2010[10] (post consolidation). Our null hypothesis is that the Egyptian banking sector's efficiency improved post consolidation as banks are able to become more efficient, using fewer resources to produce the same amount of output (loans and services).

DEA has proven to be a popular technique for performance analysis in general and in the banking sector in particular. In this regard, the banking sector has a series of characteristics that make it particularly suitable for study through DEA: its multiple input and output nature, the non-linearity of its input-output relationships, the non-physical nature of

[10] Although a couple of merger and acquisition deals were concluded in 2007, they were deals of Islamic banks and are thus excluded from our study as we have a pool of homogenous traditional commercial banks.

some resources and products, and the impossibility of drawing on market price mechanism for some of them.

Broadly speaking, the DEA technique defines an efficiency measure of a production unit by its position relative to the frontier of the best performance established mathematically by the ratio of weighted sum of outputs to weighted sum of inputs. For a detailed description of the DEA technique, please refer to studies such as Coelli, Prasada and Battese (1998); Casu and Molyneux (1999); and Reda and Isik (2006).

Variables and Data Selection

The number of variables used in DEA is critical. Inclusion of many variables is not a viable option in DEA. As the number of variables in the model increases, more and more production units become efficient. On the other hand, when relevant variables are omitted, DEA underestimates efficiency and the effect of this is more severe than when irrelevant variables are included in the DEA model. Lack of a standard structured approach to variable selection in DEA makes the task of variable selection even more difficult. Berger and Humphrey (1997) commented on the difficulty of variable selection in performance appraisal of banks using the DEA technique as: there is no 'perfect approach' on the explicit definition and measurement of banks' inputs and outputs.

Definition of Commercial Bank's Function

The definition of a bank's function is one complication in bank efficiency studies that affects variable selection and the associated results. In order to provide guidelines for variable selection and application, it is useful to define the banking process.

One of the key approaches used in the literature to conceptualize the flow of services provided by banks in order to identify inputs and outputs is the intermediation approach. This approach describes banking activities as transforming the money borrowed from depositors into the money lent to borrowers. This transformation activity originates from the different characteristics of deposits and loans. Deposits are typically liquid and less risky, while loans, on the other hand, are regarded as illiquid and more risky. In this approach, the deposits collected and funds borrowed from financial markets constitute inputs while outputs are measured by the volume of outstanding loans and investments.

Similar to many studies on banking efficiency (e.g., Isik and Hassan 2002; Pasiouras, Sifodaskalatis and Zopunidis 2007; Sufian and Habibullah 2009), we adopt the intermediation approach. The use of the intermediation approach in bank productivity presents fewer data problems than the production approach. Literature suggests that it is the most appropriate approach for evaluating the entire banking industry, as it includes interest expenses, which account for 50-66 percent of total costs of banks as confirmed by Rao (2002). Accordingly, we will model commercial banks as multi-product firms, producing 3 outputs and using 2 inputs. Table 2 presents a summary of inputs and outputs used in the study.

Table 2. DEA Inputs and Outputs

Inputs	**Outputs**
- Operating expenses	- Net interest income
- Interest expenses	- Non-interest income*
	- Total amount of loans and advances

* Non-interest income includes fees and commissions, foreign exchange gains, stock dividends and investment sales gains.

The input vector includes:

(1) Operating expenses or non-interest expenses [OPE], which are expenses incurred for running the bank's operations that include personnel costs, establishment costs, marketing expenses and also administrative and general expenses. Personnel cost represents bank expenses for its regular activities and daily operations such as salaries and wages of the bank's operating staff. These expenses can indirectly reflect the efficiency of banks in management. If a bank's personnel costs increase, the operating expenses will also increase, and the results will mirror the bank management's efficiency in controlling the operating costs. Establishment costs are expenses contributed to the rental of premises, equipment, repair and maintenance of machines and premises and depreciation.

(2) Interest expenses [IE] represent expenses that the bank pays out in interest on deposits, the cost of the bank's loans or cost of borrowing money. They include deposits from customers and other financial institutions, and subordinated notes and bonds. It is important to keep track of the interest the bank pays out in relation to its revenue and earnings.

The output vector includes:

(1) Net interest income [NIE],

(2) Non-interest income (NONE) includes revenue from sundry services, fiduciary fees and deposit service charges. Non-interest income plays an important part in calculating the bank's earnings and management of risks. The bank's income is generated from only two sources, namely, the fee income and the non-interest income. With increasing inflation, the non-interest income must be monitored constantly; and

(3) Total amount of loans and advances [L&A], which includes overdraft, term loans or financing, bills receivable, trust receipts and claims on customers under acceptance credit.

In order to account for heterogeneous business operations among banks, such as additional overhead costs that may result from operating large branch networks, we normalized all production variables by the number of branch offices. This treatment is in accordance with Berger and Mester (1997) and Denizer, Dinc and Tarimcilar (2000). We also deflated all variables on a yearly basis according to the corresponding deflation rate (gross domestic product deflator). Deflating the figures of inputs and outputs aims to eliminate the adverse impact of inflation on real magnitudes.

Efficiency Correlates

It is also of considerable interest to explain the determinants of managerial efficiency scores derived from the DEA model. The DEA score ranges from 0 to 1. Hence, our dependent variable, efficiency scores, is a limited dependent variable. As stated by Sufian, Abdul Majid, and Haron (2007), the use of Tobit model can handle the characteristics of the distribution of efficiency measures and thus provide results that can guide policies to improve performance. The model is also known as truncated or censored regression model where expected errors are not equal to zero.

Given the changes in regulation and wave of consolidations we run the models once pre M&As and once post M&As. The potential determinants that were considered in the analysis include the following:

1. Bank size measured by the amount of **total assets** (LogTotalAssets).
2. Bank ownership: we compare the efficiency of public versus private banks (PublicVsPrivate) and foreign versus domestic banks (ForeignVsDomestic).
3. Market power measured by **loans to total assets** (LoansToAssets) and **deposits to total assets** (DepositsToAssets).

4. Profitability measured by **return on assets** (ROA)= net profit/assets and net **operating income to total assets** (NOIToAssets).
5. Risk measured by a proxy, namely, **provisions to loans** (PROVTLOANS).
6. Financial capital measured by **equity to assets** (EQTA).
7. Other bank specific characteristics that may have impact on efficiency performance such as the overhead cost, which is proxied by **total assets to the number of employees** (TATEMP).

Financial Ratios Analysis

We use traditional financial ratios to see the effect of mergers and acquisitions on other factors that may not have been captured by the data envelopment analysis, such as profitability change or profit efficiency. To achieve this we compare the average ratios of the overall commercial banks pre and post mergers and acquisitions. Moreover, we compare the average ratios of banks that were subject to mergers and acquisitions with those that were not subject to mergers and acquisitions, i.e., a control group. We note, however, that such comparison is only meant to give us insights into the variation in performance of the banks. Following Fauzias, Said, and Yahya (2006) and Sufian, Abdul Majid, and Haron (2007), the variables below were selected to analyze profitability, liquidity and risk:

a. Profitability indicators

- Return on Equity (ROE)= Net Profit/Equity: ROE measures accounting profitability from the shareholder's perspective as it illustrates the rate of return on shareholders' investments.
- Return on Assets (ROA)= Net Profit/Total Assets: is a comprehensive measure of overall profitability.
- Cost to Income Ratio= Total Expenses (Interest + Overheads)/Gross Income.

b. Liquidity ratios

- Net Interest Margin (NIM): NIM measures how wide the spread between interest revenues and interest costs that management have been able to achieve by close control over earning assets and the pursuit of the cheapest sources of funding.
- Net Loans/Total Assets

- Net Loans/Total Deposits, signifying the degree of effective intermediation.

- Loans to Deposits (LDR) ratio is a traditional measure of bank's liquidity. It indicates the extent to which deposits are used to meet loan demand. It is an important measure that signals how well banks are performing their key intermediation function, which is turning deposits into productive loans.

c. Risk indicators

- Total Capital Ratio= Capital/Total Assets

- Loan Loss Reserve/Gross Loans

- Provisions as a percentage of loans; this ratio and the loan loss reserve measure reflect on the loan portfolio quality. The higher the loan loss reserve or the provisions, the higher the risk of loans being unredeemed (abolished as non-performing loans).

5. RESULTS

Data Envelopment Analysis

In this section, we present DEA empirical results and analyze the performance and efficiency of banks by tracing their major sources. The first step of the analysis was to assess the banks' intermediation efficiency. According to the intermediation approach, the bank units collect funds in the form of deposits and intermediates them to loans and other income earning activities (Thanassoulis 1999). For this point of view, the basic input and output are the value of the deposit accounts and the value of the loan accounts, respectively.

Did the mergers and acquisitions result in a more efficient banking sector?

As shown in Table 3, the yearly frontier results demonstrate that the average managerial efficiency increased from 62.4 percent pre consolidation to 69.9 percent post consolidation. This indicates that consolidation and increased capitalization led to greater banking efficiency. A plausible reason could be the advantages that the large banks have in attracting a larger amount of deposits and providing larger amounts of loans, which in turn command larger interest rate spreads.[11] This is because large banks tend to be more secure from a depositors' point of view and are able to set the interest rate on loans they offer; being market

[11] The interest rate margins increased post mergers and acquisitions. Evidence is discussed in the section on financial ratios (liquidity ratios).

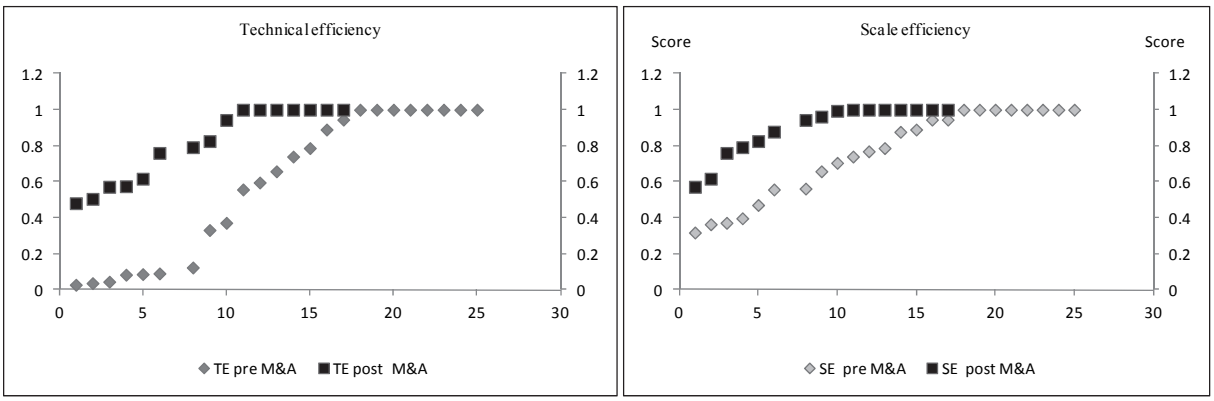
leaders. Additionally, large banks may offer more services and in the process derive substantial non-interest income from commissions, fees and other treasury activities.

Table 3. DEA Results

	Pre M&A (2000-2003)			Post M&A (2007-2010)		
	ME	**PTE**	**SE**	**ME**	**PTE**	**SE**
Grand frontier average score	0.599	0.709	0.765	0.817	0.916	0.897
Yearly frontier average score	*0.624*	*0.756*	*0.776*	*0.699*	*0.770*	*0.897*
Number of observations	24			16		

Source: Author's calculations.

Figure 6. Technical and Scale Efficiency Scores on a Bank-by-Bank Basis Pre and Post Mergers and Acquisitions



Source: Author's calculations.

* Number of banks before M&As= 24 and number of banks after M&As= 16. The number of banks decreased due to mergers and acquisitions. A detailed table in appendix includes all mergers and acquisitions that occurred.

To examine the difference in the efficiency of the Egyptian commercial banking sector between the two periods (before and after M&As), we perform a series of parametric (t-test) and non-parametric (Mann-Whitney [Wilcoxon] test) tests. The results are presented in Table 4. Both the results from the parametric t-test and non-parametric Wilcoxon test demonstrate that managerial efficiency improved post M&As significantly at the 5 percent level. The decomposition of the managerial efficiency changes into its two components, PTE (pure technical efficiency) and SE (Scale Efficiency) components suggests that the improvement in the Egyptian banking sector's managerial efficiency post M&As was mainly attributed to higher scale efficiency and is statistically significant at the 5 percent level; that is the increase in bank capitalization helped banks to become more scale efficient.

The empirical finding that managerial efficiency improved post mergers and acquisitions in the case of Egypt is similar to the findings of some other countries such as Malaysia during the period 1997-2003 (Sufian and Habibullah 2009).

The yearly frontier results also showed that the managerial inefficiency[12] has been as high as 61 percent pre M&As and that despite considerable decrease in inefficiency to 45 percent post M&As, there is considerable room for improvement as this figure implies that Egyptian banks could have produced the same output (loans and services) using less than half of the resources used (interest and operating expenses).

Looking at the difference between the average results obtained by the grand frontiers, pre and post M&As, we realize that managerial inefficiency was mainly due to pure technical inefficiency rather than scale inefficiency post M&As. That is the underperformance of Egyptian banks with respect to the frontier banks, which are operating under similar conditions, can be mainly attributed to internal problems and "poor" management practices. Whereas in case of pre M&As, the managerial inefficiency is driven by scale inefficiency.[13] That is, the inefficiency was attributed to lower level of output, banks producing loans and services. We also note that both pure technical and scale inefficiencies have decreased considerably post M&As implying better management and improved practices. The improvements in managerial and scale efficiencies are clearly observed as per Figure 6, which demonstrates the results on a bank by bank basis pre and post M&As.

Among the banks under investigation, there are seven banks that were not subject to mergers and acquisitions themselves (a control group) but of course they did abide by the new provision of raising their capital. One interesting thing to explore is the difference in efficiency and performance change for the control group and the other banks that were subject to M&As before and after M&As took place and discern if there is any difference between the two groups. As shown in Table 5, managerial efficiency increased for the two groups post M&As, yet the managerial efficiency was higher in the case of banks subject to M&As. This improvement stems mainly from improvement in pure technical efficiency. Coincidently, scale efficiency for the two groups post M&As was identical at 91 percent. We can infer from the above that the improvement in managerial efficiency post M&As for the banks that have

[12] The association between efficiency (Eff) and inefficiency (Ineff) is Ineff= (1-Eff)/Eff (Isik and Hassan 2002).

[13] Pre M&As, pure technical inefficiency was 41 percent and scale inefficiency was 31 percent, whereas post M&As they became 9 percent and 11 percent, respectively.

been consolidated was a result of improvement in input usage and the production of greater output (loans and services) using lesser inputs (interest and operating expenses)—neutralizing the scale efficiency, which increased considerably for both groups.

Table 4. Testing the Significance of Results pre and post Mergers and Acquisitions (M&As)

Individual tests	Test group			
	Parametric test		Non-parametric test	
	t-test		**Wilcoxon signed-rank test**	
Hypotheses	Median pre merger=Median post merger			
Test statistics	t(Prb>t)		z(Prb>z)	
	Mean	t	sum ranks	z
Managerial efficiency (ME)				
Pre M&As	0.599	-2.019**	27	-1.880**
Post M&As	0.817		99	
Pure technical efficiency (PTE)				
Pre M& As	0.709	-1.938	23	-1.293
Post M& As	0.916		68	
Scale efficiency (SE)				
Pre M&As	0.765	-1.939**	26	-1.933**
Post M&As	0.897		100	

Source: Author's calculations.

Table 5. Managerial Efficiency: Control Group versus Banks Subject to Mergers and Acquisitions

	Pre M&As (2000 to 2003)			**Post M&As (2007 to 2010)**		
	ME	**PTE**	**SE**	**ME**	**PTE**	**SE**
Average control group	0.59	0.74	0.74	0.70	0.76	0.91
Min.	0.20	0.33	0.52	0.22	0.24	0.85
Max.	0.98	1.00	0.98	1.00	1.00	1.00
Average others**	0.65	0.77	0.79	0.79	0.85	0.91
Min.	0.12	0.20	0.45	0.57	0.62	0.77
Max.	0.99	1.00	0.99	1.00	1.00	1.00

Source: Author's calculations.

* Control group of 7 banks; others include 15 banks pre M&As and 12 banks post M&As.
** By others we imply all banks that were subject to mergers and acquisitions.

Returns to Scale in the Egyptian Banking Sector

Scale inefficiency, i.e., functioning at the wrong size, appears to affect negatively the overall managerial inefficiency of Egyptian banks. It is worthwhile to examine returns to scale with

the increase in banks' size. The law of diminishing returns to scale indicates what happens to output when a bank changes only one input, say labor or capital, and holds all other inputs constant, whereas returns to scale (RTS) tell us what happens to a bank's output if it changes all inputs. Thus, we define RTS as the increases in output that result from increasing all inputs by the same percentage.

Increasing returns to scale (IRS) takes place in cases where increased output enables banks to increase the division of labor and equipment or to use more specialized labor and capital. In these circumstances, bank employees specialize in a small number of tasks at which they become highly proficient. Decreasing returns to scale (DRS) happen in all production and service technologies at some output rate, especially at a very large one. The larger the production and service levels of banks, the more complex are their management and organizational structure. The bigger the size of a bank, the more likely that many managerial layers will exist in its organizational structure, and therefore the more difficult and costly it becomes to operate, monitor and control the operations and marketing processes.

Table 6 displays the returns to scale of the Egyptian banks pre M&As (2000 to 2003) and post M&As (2007-2010) according to the intermediation model. As it appears from the table, pre mergers and acquisitions and the increase in banks capital as required by the regulation adopted in 2003, 37 percent of banks experienced increasing returns to scale, implying improvement in efficiency with size. IRS decreased considerably to 17 percent of banks post the implementation of the mandatory increase in capital and mergers and acquisitions during the period 2004-2006. That is, more banks were able to operate under constant returns to scale (CRS) (42 percent of banks). The results also show that decreasing returns to scale also increased post M&As to 41 percent. The scale inefficiency due to DRS might be related to established large banks, which transgressed the 'right' scale of operation. It is evident that despite improvements following the increase in required paid-in capital and the resulting wave of consolidations, there is still room for improvement. It is evident that absence of effective competition allows inefficient banks to continue with slackened efficiency and still remain in business. This implies that there is a need for policy makers to adopt policies that would foster competition. So far, new entry to the banking sector is subject to economic needs and no new licenses have been issued over the past decade. Furthermore, exit of the market is not allowed as banks are not allowed to fail with the Central Bank of Egypt acting as a lender of last resort.

Table 6. Returns to Scale in the Egyptian Banking Sector Pre and Post M&As

	Pre M&As (%)	Post M&As (%)
Increasing returns to scale (IRS)	37	17
Constant returns to scale (CRS)	33	42
Decreasing returns to scale (DRS)	30	41
All banks	100	100

Source: Author's calculations.

Tobit Model Results

To further investigate the determinants of the Egyptian banking sector efficiency pre and post mergers and acquisitions, we used the DEA efficiency results to run Tobit regression. Unlike a conventional ordinary least square (OLS) estimation, in case of limited dependent variables, the Tobit model is known to generate consistent estimates of regression coefficients. A positive coefficient implies an efficiency increase whereas a negative coefficient reflects the deterioration in efficiency. The model is as follows:

$$\varphi_{it} = \alpha + \beta_1 Size_{it} + \beta_2 Ownership_{it} + \beta_3 MarketPowe\ r_{it} + \beta_4 Risk_{it} + \beta_5 FinancialC\ apital_{it} + \beta_6 \Pr ofitabilit\ y_{it} + \varepsilon_i$$

where φ_{it} *is the efficiency score, and the explanatory variables include bank's size proxied by total assets; bank ownership; market power proxied by loans to assets; risk proxied by provisions to loans; financial capital measured by equity to assets and profitability measured by net operating income to total assets.*

Solving the model, where the dependent variable is bank's efficiency scores derived from DEA, and the explanatory variables include proxies for bank's size, type of ownership, market power, risk, financial capital and profitability, our findings are as follows:

- Bank's size has a positive effect on efficiency pre and post M&As, indicating that large banks tend to post higher efficiency scores. Size could have a positive impact via two channels: first, it relates positively to market power as large banks could pay less for their inputs. Second, there might be increasing returns to scale as a result of highly specialized workforce.
- Ownership did matter pre mergers and acquisitions. Public banks were more efficient than private banks. This could be a reflection of the fact that public banks were by far larger than private banks in terms of market power and capital. This has changed post

M&As as the private banks increased capitalization to adhere to the banking law of 2003.

- The results also suggest that equity to assets has a significantly positive effect on efficiency. That is, capitalization yields a positive effect on efficiency. This indicates that a strong capital structure is essential for banks' efficiency. Well capitalized banks are more likely to have better risk measures in place and to post lesser non-performing loans.

Table 7. TOBIT Regression Analysis of Technical Efficiency and Bank Characteristics

	Pre M&As		Post M&As	
VARIABLES	ME	SE	ME	SE
LogTotalAssets	0.652***	0.342***	0.477**	0.0607
	(0.134)	(0.0876)	(0.235)	(0.102)
PublicVsPrivate	-0.408***	-0.217**	-0.506	-0.0136
	(0.146)	(0.0961)	(0.366)	(0.147)
LoansToAssets	-0.332	-0.587	0.0700	0.0758
	(0.637)	(0.425)	(0.776)	(0.374)
PROVTLOANS	-1.907	-0.619	1.218	0.287
	(1.181)	(0.887)	(1.134)	(0.534)
EQTA	1.978	1.515*	2.943	2.581**
	(1.266)	(0.845)	(2.271)	(1.077)
NOIToAssets	7.800	4.393	-4.273	-0.329
	(5.275)	(3.780)	(3.839)	(2.015)
Constant	-3.659***	-1.336**	-2.762	0.289
	(0.929)	(0.609)	(1.824)	(0.806)
Observations	96	96	64	64
Number of id	24	24	16	16

Source: Author's estimation.

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Bank's size is proxied by total assets (LogTotalAssets); bank ownership (PublicVsPrivate); market power proxied by (LoansToAssets); risk proxied by provisions to loans (PROVTLOANS); financial capital measured by equity to assets (EQTA) and profitability measured by net operating income to total assets (NOIToAssets).

Financial Ratios Analysis

Table 8 presents the results of financial ratios for commercial banks before and after consolidation. Examining the most commonly used profitability ratios, namely ROA and ROE, we note that commercial banks posted lower ROA and ROE in the period post mergers and acquisitions (M&As) as compared to the pre M&As. The lower profitability could be due to the inability of banks to contain costs; this is confirmed by the slight increase in costs to income ratio post consolidation. The increase in costs to income led to lower profitability post mergers and acquisitions. Surprisingly, the results were not uniform across banks. The control

group posted improved return on equity during 2007-2010 as they were more successful in containing their costs. The average cost to income ratio for the control group decreased from an average of 51.3 percent to 47.3 percent in the two periods of comparison subsequently.

Liquidity indicators, such as net interest margin, increased significantly across all banks meaning that the consolidation did not result in strong competition between banks that would ideally result in lower interest rate margins. This draws attention to the importance of removing entry and exit barriers to expand the market with the aim of increasing competition among banks. This could lead to lower interest rate margins and expansion of novel and better banking services and products as suggested in the banking literature. Moreover, both loans to assets ratio and loans to deposits ratio have declined significantly, indicating deterioration in the banks' intermediation function. This is more acute in the case of banks that have been subject to mergers and acquisitions. This may be due to the fact that those banks were more focused on internal restructuring, reorganization and adopting tighter risk and supervisory measures that may have restrained them from focusing on the transformation of deposits into productive loans during the period 2007 to 2010, and low demand for loans post the financial crisis.

As for risk indicators, they witnessed improvement, particularly, the increased average capital ratio and the reduction in loan loss reserves and provisioning.

Summing up, the key financial ratios' results, comparison of average ratios of commercial banks pre and post M&As showed improvement in risk measures and increased capital ratio. Yet, no significant improvements were observed in profitability, liquidity or intermediation indicators providing further scope to improve the intermediation function of the banking system in Egypt.

Table 8. Financial Results Pre and Post M&As Based on Accounting Data

	Control group			Banks subject to M&As			Overall averages		
	Pre M&As (2000-2003)	**Post M&As (2007-2010)**	**t-test**	**Pre M&As (2000-2003)**	**Post M&As (2007-2010)**	**t-test**	**Pre M&As (2000-2003)**	**Post M&As (2007-2010)**	**t-test**
Profitability									
Return on equity (ROE)	4.9	5.69	1.7**	6.8	4.38	1.8**	5.85	5.035	-2.4***
Return on assets (ROA)	1	1	0.01	2	1.5	1.7**	1.5	1.25	-2.2**
Cost to income ratio	51.3	47.32	-0.6	55.52	60.19	0.2	53.41	53.755	0.11
Liquidity									
Net interest margin (NIM)	2.03	3	2.4***	2	2.68	2.1*	2.015	2.84	3.2***
Net Loans/total assets	37.8	34	-1.2	49.5	38.34	-2.6***	43.65	36.17	-2.7**
Net loans/total deposits	41.6	40	-0.2	53.2	43.81	-1.6**	47.4	41.905	-1.3*
Loans/deposits	0.58	0.42	-4.3***	0.7	0.47	-6.1***	0.64	0.445	-7.4***
Risk									
Total capital ratio	10.02	21.63	N/A	12.55	17.28	N/A	11.285	19.455	N/A
Loan loss res/gross loans	13.1	9.21	-1.9**	20.1	11.8	-1.8**	16.6	10.505	-2.3***
Provisions as % of loans	12 %	11%	0.08	9 %	8 %	-0.5	11%	10 %	-0.08

Source: Author's calculations.

6. SUMMARY AND CONCLUSION

The Egyptian banking sector was subject to reforms over the past decade. Perhaps one of the key legislative reforms that took place was the issuance of the unified banking law of 2003, which mandated that banks raise their capital considerably during the period 2004-2006. This study attempted to assess the effect of mergers and acquisitions that took place during the period 2004-2006 on overall banking efficiency in Egypt. We did this first by analyzing changes in managerial efficiency that reflects the sound and good practices adopted by banks to perform their key intermediation function pre and post mergers and acquisitions, using a non-parametric technique, namely data envelopment analysis. Secondly, we identified the determinants of efficiency and its potential correlates using Tobit regression model. Finally, traditional financial measures were used to capture changes in profitability and risk indicators that were not accounted for using the data envelopment technique.

The results suggest that mergers and acquisitions resulted in higher mean overall managerial efficiency of Egyptian banks. Decomposition of managerial efficiency to its key sources—technical (using the right operating and interest expenses to produce the right amount of loans and services) and scale efficiency (having the right size and the right level of capitalization)—showed that the higher managerial efficiency post M&As was mainly attributed to improvement in scale efficiency. Moreover, bank consolidation has led to more banks operating at the optimal operating scale, i.e., constant returns to scale, but it did not lead to exploitation of economies of scale by lowering the cost of intermediation as reflected by the increased interest rate margin post consolidation. To further promote banking efficiency, policies that would foster competition need to be put in place. Increased competition is likely to lead to lower costs for financial intermediation and would encourage banks to provide more and better quality services and to adopt novel technologies.

From the analysis of the financial ratios, the findings show that M&As did not result in higher average profitability for the Egyptian banks post M&As. The lower profitability could be the result of deterioration in cost efficiency, since overall banks' average cost to income increased slightly post M&As. Similarly, liquidity indicators such as net interest margin also deteriorated post M&As. However, the risk analysis measures indicated that all Egyptian banks experienced a positive effect on the quality of their loan portfolios. That is, the results suggest that the M&As resulted in more prudent risk management by Egyptian

banks. Perhaps the most striking result we obtained from the financial analysis is that both loans to assets and loans to deposits ratios have declined significantly indicating deterioration in overall banks' intermediation function. According to Rasmala[14] (2010) banking report, the low lending to deposits ratio is due to rigid credit policy implemented by the CBE to improve the quality of bank's balance sheets, the concentration of credit to blue chip corporations, reluctance of banks to aggressively penetrate retail and small and medium enterprises segment, and the attractive yields on government securities. Moreover, the low intermediation level could be a result of mixture of constraints from both the demand and the supply sides. Access to bank financial services is weak, and the number of bank branches and automated teller machines (ATMs) per capita is less than in countries with similar per capita income (Pearce 2011). Relative to the developing world, Egypt's branch density is low and its ATM coverage is less than $1/7^{th}$ that of a typical developing country.[15] Credit information and market information are poor. Limited credit information constrains bankers as it makes the credit decision very difficult and increases uncertainty. Private credit bureaus need to play an important role in providing the necessary credit information at reasonable cost and quality.

The explanation of efficiency scores using Tobit regression analysis offers useful economic insights. Banks' size and increased equity to assets ratio had a positive effect on efficiency. That is, increased capitalization has led to greater managerial efficiency. As banks become better capitalized, they tend to have better control over non-performing loans, and have a more diversified lending portfolio and better adherence to credit and risk measures.

However, our results show that despite the fact that banks' consolidation had a positive effect on managerial efficiency, capitalization and risk management practices, yet banks' intermediation function, as reflected by loans to deposits ratio, and banks profitability have weakened. The low level of loans to deposits ratio draws attention to the importance of designing policies and introducing instruments that would make banks more effective intermediaries towards mobilizing economic growth.

Our key recommendation is for policy makers to promote innovative financial tools and instruments that are well suited to the needs of the Egyptian market, and which are well suited for the needs of SMEs, especially in vital economic sectors and activities. Moreover,

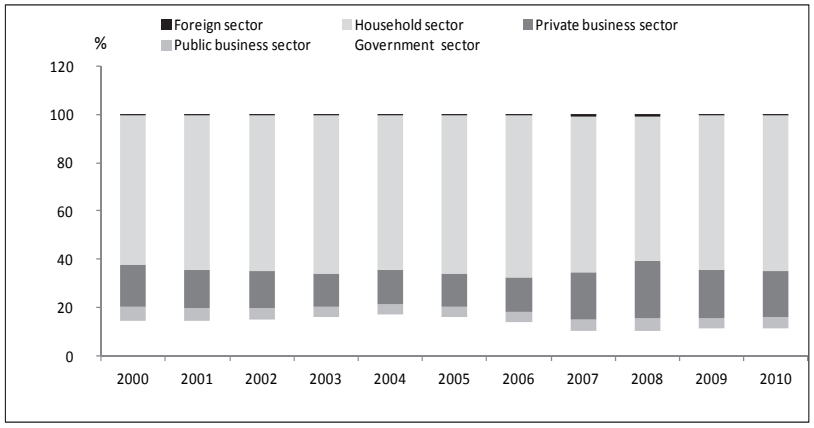
[14] Rasmala (2010).

[15] Pearce (2011). The number of bank branches in Egypt is 8 per 1000 adults and 4.5 per 1000 Km^2.

improving and promoting credit bureaus and credit scoring adapted to SMEs will help mitigate risk and encourage banks to be more aggressive in lending to SMEs. Promoting financial packages using multiple arrangements such as credit guarantees, export guarantees and well structured loan installments could also be among the instruments that banks can introduce, that is in addition to promoting equity finance and venture capital that are still limited in the Egyptian market. Banks could also establish a link between leasing and traditional credit facilities. Establishing a registrar for movable assets is crucial for the protection of leasing activities and to reduce fraud. Adopting sharia-compliant instruments may also be a way to promote lending for some Egyptian entrepreneurs that refrain from borrowing at interest rates. Measures leading to better intermediation along with prudential regulations are expected to lead to greater efficiency, profitability and economic growth.

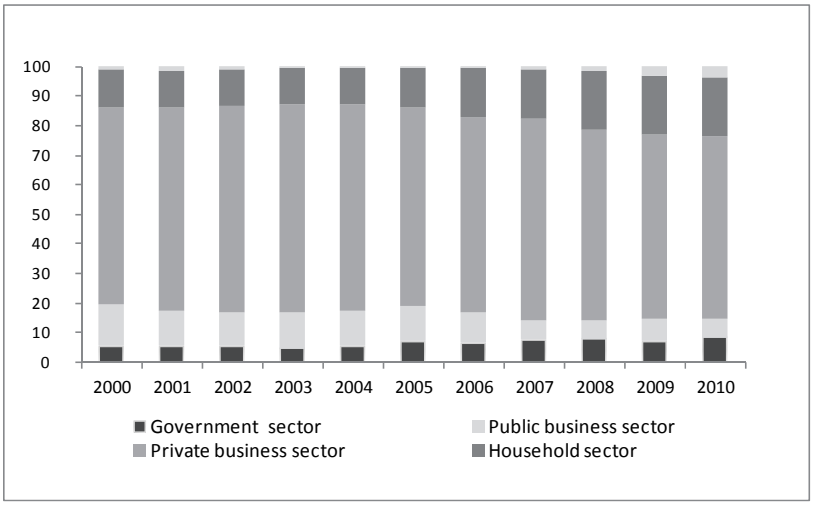
APPENDIX

Figure A1. Deposits by Sector (2000 to 2010)



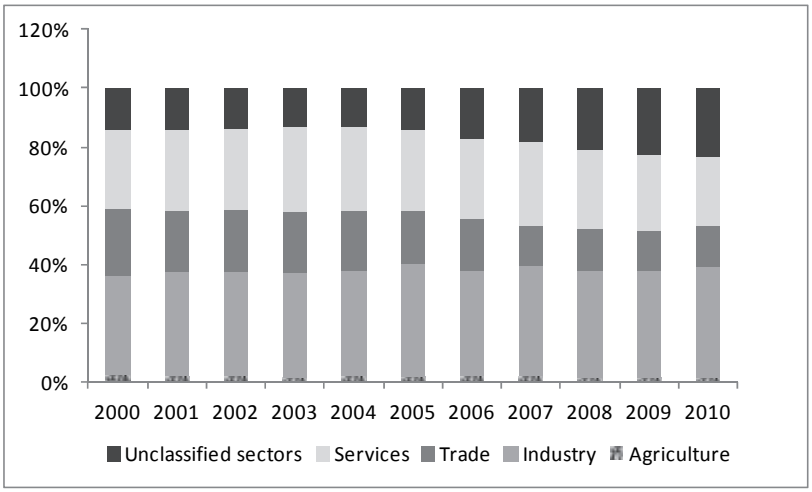
Source: Central Bank of Egypt annual reports (various issues).

Figure A2. Lending and Discount Balances by Sector (2000 to 2010)



Source: Central Bank of Egypt annual reports (various issues).

Figure A3. Lending by Economic Activity (2000 to 2010)



Source: Central Bank of Egypt annual reports (various issues).

Table A1. Key Banking Mergers and Acquisitions

(A) Mergers

First bank	Second bank	New entity	Date (Yr-month)
American Express Bank (Branches in Egypt)	Egyptian American Bank	Egyptian American Bank	2004-Sep
Misr Exterior Bank	Banque Misr	Banque Misr	2004-Sep
Credit Lyonnais Branch	Credit Agricole Indosuez	Calyon	2005-Mar
Misr America International Bank	Arab African International Bank	Arab African International Bank	2005-Sep
Mohandes Bank	National Bank of Egypt	National Bank of Egypt	2005-Oct
Bank of Commerce and Development	National Bank of Egypt	National Bank of Egypt	2005-Dec
Nile Bank with Islamic International Bank for Investment and Development	United Bank of Egypt	United Bank of Egypt	2006-Jun
Egyptian American Bank	Calyon	Credit Agricole Egypt	2006-Sep
Misr International Bank	National Societe Generale Bank	National Societe Generale Bank	2006-Nov
Banque du Caire	Banque Misr	Banque Misr	2007-Feb

(B): Acquisitions

Acquired bank	Acquirer	Acquisition date (Yr-month)
Misr America International Bank	Arab African International	2005-May
Egyptian Commercial Bank*	Piraeus	2005-Jun
Suez Canal Bank	Arab International Bank	2005-Aug
Misr International Bank	NSGB	2005-Sep
Misr Romania **	BLOM Bank	2005-Dec
Egyptian American Bank	Credit Agricole	2006-Feb
CIB	A consortium led by Ripplewood Holdings	2006-Feb
Cairo Far East	Audi Bank	2006-Mar
Misr Iran Development Bank	National Investment Bank	2006-Apr
Delta International Bank	A consortium led by Ahli United Bank	2006-Aug
Alexandria Commercial Maritime	Union National Bank	2006-Aug
Bank of Alexandria	San Paolo	2006-Dec
National Development Bank	Abu Dabi Islamic Bank	2007-Jul
Al Watany Bank of Egypt	A consortium led by National Bank of Kuwait	2007-Dec

Source: Global Research-Egypt, Banking Sector Report (2008), Global Investment House.

* In June 2005, Piraeus acquired around 69 percent of the Egyptian Commercial Bank, bringing its total stake to 88.0 percent.

** In December 2005, Blom Bank acquired around 84 percent of Misr Romania Bank, in which it originally owned 12.5 percent, bringing its total stake to 96.7 percent. Later on, it raised its stake to 99.4 percent.

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