Measuring the Performance of Working Banks in Egypt

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Abstract

Purpose: Paper aims to evaluate the performance of working banks in Egypt.

Design/methodology/approach – This is done via total factor productivity (TFP) and technical efficiency(TE) through Malmquist index and data envelopment analysis (DEA). Data incorporate annual statements from 2010 to 2021 for 26 different sorts of banks. TE and TFP are regressed against bank's size, age, number of branches, and ATMs to detect their impact on TE and TFP.

Findings – Results reveal discrepancy on TE and TFP among banks. Productivity gains are mainly derived from technical progress than efficiency improvements. Moreover, TE scores for net profits and investment indicators have poor performance for all banks. Provided loans' performance is not as hoped relative to collected deposits. Public banks perform better than Arab and foreign banks for size and age. Islamic banks perform better than conventional banks since they have wide range of diversified products that suit clients' preferences. Thus, banks have to set policies that aim to manage deposits and investments efficiently to enhance performance and profits. Moreover, conventional banks have to diversify products to improve performance. Small and less-productive banks have to merge with large ones to enhance performance.

Originality/value – The paper aims to fill the gap for the lack of papers that measure banking performance in Egypt as a case of developing countries via TFP. Moreover, propose ways to enhance the performance of less-productive and inefficient banks.

Keywords: TE and TFP; Deposits; Loans; Investments; Net profits; Earning assets

JEL Classifications: C20 ; C51 ; D24 ; G21

1. Introduction

The banking sector at any country is considered the core of the financial system in which it has a major task in enhancing economic growth and achieving economic stability. The role of the banking industry is not restricted to the nature of economic regime. Indeed, the strength and solidity of the banking system are a guarantee for achieving economic stability, especially for developing and emerging countries. Hence, it is a prerequisite for conventional banks to be operated efficiently along with fulfilling higher levels of performance to obtain sustainable economic growth.

The aim of efficiency is to measure the success of a firm in resource allocation. It is a necessity for firms to survive in competitive markets. Similarly, total TFP is used to benchmark the performance of the firms in their business. From this perspective, the efficiency or optimal output can be obtained through the use of limited resources to achieve a desired level of output.

Alternatively, TFP is a measure of productive efficiency in which it measures the amount of produced output from a given amount of inputs. For relatively small percentage changes, the rate of TFP growth is estimated by subtracting growth rates of labor and capital inputs from the growth rate of output. TFP measures residual growth in total output of a firm, industry or national economy that cannot be explained by the accumulation of traditional inputs such as labor and capital. TFP is mainly decomposed into technical change (TC) and technical efficiency change (TEC). Undoubtedly, competition motivates firms to be efficient as it is crucial for surviving. Thus, the existence of a variety of banks; domestic, Arab and foreign along with Islamic banks will contribute to consolidate the banking system. Enhancing the efficiency and productivity of banks is a prerequisite to improve the possibilities of banks to survive and succeed and to achieve optimal use of their resources.

The aim of this study is to fill the gap in the banking literature related to TFP estimation by measuring the performance of the working banks in Egypt at various categories – domestic, Arab and foreign, and Islamic banks – using microeconomic theory. Despite there is a wide range of literature relating TFP for economic sectors, unfortunately there is only one paper covered TFP for a sample of 14 Egyptian banks from 1997 to 2013. Moreover, There a lack of TFP banking papers covers developing countries relative developed world. The performance can be achieved via applying the Malmquist index to estimate TFP growth for 26 working

banks in Egypt from 2010 to 2021. Furthermore, the paper covers a variety of banks public, private, Arab, foreign, and Islamic banks. The collected data is obtained from authenticated annual financial statements which are confirmed by the central bank of Egypt.

Owing to fluctuations in Egyptian pound during the study period, all financial statements are converted from Egyptian pound into U.S. dollar according to applied exchange rates for each period to avoid any misleading results. The production efficiency approach is employed in which factors of production are used to produce different bank products. Thus, the objective of this paper is to estimate TE scores, TFP, TC and TEC to measure the performance of different banks with their distinct characteristics and different ownerships types. Since the intention is to examine the internal efficiency and productivity, input variables are employed as follows; assets, expenses, bank provisions , and debt to estimate output indicators such as individuals' deposits, total provided loans, total investments, net profits, and earning assets. After estimating TE and TFP scores, they are regressed against bank size age, number of branches and ATMs numbers to detect their impact on TE and TFP. The appendix A contains a brief description of operated banks in Egypt at different categories. Moreover, TE, TFP, TC, and TEC figures are included in the appendix.

The paper is divided as follows: section two covers literature review; section three provides the employed model; section four incorporates a brief description for collected data and variables; section five includes obtained results and their analysis. Finally, section six exhibits conclusions.

2. Literature Review

Despite there are huge number of papers covering TFP with its components, the majority of them are mainly focusing on manufacturing, agricultural and utilities sectors. (Sharma, Sharma, and Barua, 2013) run a survey of the number of 106 published papers across the world about banks from 1994 to 2011 for efficiency and productivity measures. Only 20 of them are related to efficiency and productivity estimation. By grouping them per country, they found 24 for India, 19 others, 17 for Europe, 12 for USA, 10 for cross country, 5 for UK, 3 for Asia, 3 for Australia, and 3 for China.

Even if productivity and efficiency are often used as identical expressions, they have different economic concepts. Efficiency refers to

the operation of a business relative to a reference set with a given level of technological development. Alternatively, productivity implies a change in technology over time (Fare, Grosskopf, and Lovell, 1994). Similarly to efficiency, productivity is defined by the ratio of outputs and inputs.

In theory, TFP is determined indirectly, and it is the output growth not explainable by changes in the amount of inputs (referred to as Solow residual). However, in economic practice, TFP is measured by productivity indices or productivity indicators. Indices have a multiplicative form whereas indicators have additive form. TFP measures changes in total output relative to inputs and the concept derives from the ideas of (Malmquist,1953). In literature, the use of productivity indices on efficiency and productivity has recently experienced an increase in popularity.

(Berg, Forsund, and Jansen, 1992) launched one of the first studies to investigate productivity change in the banking industry. They employed Malmquist index for productivity growth in Norwegian banking system during the deregulation period 1980–1989. They found productivity fell prior to the period experiencing deregulation but grew rapidly when deregulation took place (Casu, Girardone, and Molyneux, 2004). (Mukherjee et al., 2001) estimated TFP growth with its component TC and TEC for 201 large US commercial banks over the initial post deregulation period from 1984 to 1990 via Malmquist productivity indexes. They found overall productivity growth at the rate of about 4.5% per year with productivity decline by 7.61% between 1984 and 1985 and by 0.33% between 1988 and 1989.

(Isik and Hassan, 2003) examined TFP growth, TC, and TEC in Turkish commercial banks during deregulation of financial markets in Turkey. They found that all forms of Turkish banks have recorded productivity gains driven mostly by efficiency increases rather than technical progress. Efficiency increases were mostly owing to improved resource management practices rather than improved scales. They also found that private banks began to close their performance gap with public banks. (El Moussawi and Saad, 2008) examined efficiency and productivity growth of the Arab commercial banking sector via Malmquist index for 11 Arab countries from 1994 to 2004. Results showed a decline in TFP over the study period for all countries. (Kale, Eken, and Selimler, 2015) examined the effects of regulations, macroeconomic changes, and political events on the performance of the Turkish banks from 1997 to 2013, productivity changes of each bank and of the whole sector are

measured by a DEA Malmquist productivity Index. They found efficiency deterioration from 1997 to 2001 due to 2001 crisis; after the crisis, an improvement was observed. All models indicated the source of improvements as efficiency instead of technological changes. They also found that new macroeconomic environment, new regulations, have positive effects on productivity.

(Narwal and Pathneja, 2015) examined the impact of different determinants of productivity and profitability of banks functioning in India. They assessed the performance of public and private sector banks in terms of productivity and profitability from 2003-04 to 2008-09 and from 2009-10 to 2013-2014. The DEA Malmquist index is used to measure TFP of groups and sub-group banks. Results showed that private banks were more productive than public banks over the whole study period. But no significant difference existed in the profitability of two bank groups. (Duygun, Sena, and Shaban, 2016) estimated a non-parametric Metafrontier Malmquist index to evaluate the TFP change among UK-based trademarking and non-trademarking commercial banks between 2005 and 2013. Results suggested that TFP had been increasing among trademarking banks up to the beginning of the financial crisis, but this process had since reversed.

(Jreisat and Hassan, 2016) evaluated productivity change of the Egyptian banking sector
using a data set of 14 operating banks in Egypt from 1997 to 2013. They used a non-parametric approach DEA based analysis to investigate TFP change in the Egyptian banking sector. They found that Egyptian banking sector experienced a decline in TFP growth at the rate of 2.55% in the whole sample period 1997–03. (Kasman and Mekenbayeva, 2016) Examined TE and TFP for Kazakh commercial banks from 2000 to 2013. Results indicated that banks in Kazakhstan operated below their optimum levels. Larger banks were more efficient than smaller ones. Results also indicated the presence of economies of scale for banks of all sizes. The results further indicated that Kazakh banks seem to have experienced a significant productivity growth over the sample period. (Azad et al., 2017) examined bank efficiency in Malaysia using Malmquist meta-frontier analysis with a data set of 43 Malaysian commercial banks from 2009 to 2013. They examined Islamic versus conventional banks and local against foreign banks. The study revealed that Islamic banks have outperformed. The frontier results revealed that local Islamic banks have moved towards

the group technology and foreign Islamic banks have taken the lead in country frontier technology.

(Shair et al., 2021) investigated the efficiency and TFP growth of Pakistani banking industry to determine the impact of risk and competition on efficiency and TFP growth. Data covered the period from 2007 to 2017. Results showed that credit and liquidity risks experienced positive while insolvency risk displayed negative effect on efficiency and TFP growth. The competition led to improve technological efficiency but declines the technical efficiency growth. Among other explanatory variables, operational cost management, banking sector development, GDP growth rate, and infrastructure development showed significant relationships with various efficiencies and TFP growth.

(Bhuyan and Patra, 2022) measured the level of TPF of the Indian banking sector to identify both the bank-specific and macroeconomic determinants of the TFP after the global mortgage crisis. The sample involved 61 commercial banks involving public, private and foreign banks with annual data from 2008 to 2019. Results suggested an increase in technological shift raised the bank's productivity above the optimal frontier. The bank size and bank diversification were significantly declining productivity, whereas credit-deposit ratio and return on asset significantly increased productivity. Inflation, growth rate and fiscal deficit ratio negatively affected productivity, whereas capital formation to GVA ratio boosted the level of productivity.

(Zaman, Valiyattoor, and Bhandari, 2022) investigated TFP change among Indian commercial banks from 1998 to 2017 using Malmquist TFP index. Results showed an improvement in TFP among commercial banks with growth relatively higher during pre-crisis than in post-crisis period. Productivity gains were driven mainly by technological progress rather than efficiency improvements. Foreign owned banks achieved the highest overall productivity gains, followed by domestic privately owned and state-owned banks.

3. The Model

Before estimating TFP for working banks in Egypt, TE is estimated via DEA to check efficiency scores via variable returns to scale (VRS) which are proposed by (Banker, Charnes, and Cooper, 1984). VRS is employed to examine whether there is any variability between input orientation and output orientation. The firm can apply input–oriented

measures if it has the ability to control its inputs efficiently or if it has the ability to produce the same level of output with minimum level of inputs or has the ability to control production costs. This is what is called input orientation. A functional form for input–oriented can be depicted as follows:

$$TE_I (y, x) = \min \{\theta: \theta x \in L (y)\} \tag{1}$$

where TE_I is technical efficiency according to input–orientation method, X is a vector of inputs, L (y) is input possibility set and θ is efficiency score of each observation.

The output–oriented measure can be applied by a firm if it is capable of controlling its output or achieving maximum amount of output from the same level of inputs. The functional form of output–Oriented measure of TE is shown as follows:

$$TE_O (y, x) = [\max \{\Phi: \Phi y \in p (x)\}] \tag{2}$$

where TE_O is the technical efficiency in accordance with output–orientation method, y is maximum amount of output can firm achieve from the same inputs X, p (x) is output possibility set and Φ is efficiency score of each observation. The VRS is utilized to examine whether the banking system is input–oriented or output–oriented or both are different.

The results for VRS technique did not show any variability between input–oriented and output–oriented measures. Thus, the technique of DEA with constant returns to scale (CRS), which is proposed by (Charnes, Cooper and Rhodes,1978) in their paper "Measuring the Efficiency of Decision-Making Units."

After estimating TE, TFP growth with its components TC and TEC is estimated through the Malmquist index via DEA. The advantage of DEA as a non–parametric approach to estimate frontier is that it does not entail a specific functional form for the production function to estimate its parameters. This approach primarily constructs a linear production frontier for each year in the sample through the solution of a series of linear programming problems for each year. Technically inefficient firm is determined through the distance between observed data point and frontier. (Caves, Christensen, and Diewert, 1982) introduced the Malmquist TFP index to measure the TFP change between two data points by calculating the ratio of the distances of each data point relative to common technology. The simplicity of technique is that it does not require

information about input prices. The index also can be decomposed into two components: TEC and TC.

The Malmquist index is calculated as the geometric mean of the ratio of two distance functions providing the maximum increase of output in one period to reach a boundary of the technology set in a previous period. Following (Färe et al., 1994) methodology, the output–oriented Malmquist TFP change index between the two periods t and t+1 is given by:

$$M_1^{t+1}(X_1^t, Y_1^t, X_1^{t+1}, Y_1^{t+1}) = \frac{D_1^{t+1}(X_1^{t+1}, Y_1^{t+1})}{D_1^t(X_1^t, Y_1^t)} \left[\frac{D_1^t(X_1^{t+1}, Y_1^{t+1})D_1^t(X_1^t, Y_1^t)}{D_1^{t+1}(X_1^{t+1}, Y_1^{t+1})D_1^{t+1}(X_1^t, Y_1^t)} \right]^{\frac{1}{2}} \quad (2)$$

$$\underbrace{\qquad\qquad}_{\text{TE Change}} \qquad \underbrace{\qquad\qquad\qquad}_{\text{Technical Change}}$$

Where I stands for the bank , D_1^{t+1} X_1^t, Y_1^t represents the distance from period t observation to the period t+1. TE change is the part that explains the change in productive efficiency. Technical change denotes the rate of technical change between period t and period t+1. When the index has a value greater than one, this indicates a positive or an increase in TFP growth from period t to period t+1, whereas a value less than one implies a decline in TFP growth or productivity slowdown.

After estimating both TE scores and TFP growth, they are regressed against the following variables; 1. Bank size 2. Bank age 3. Number of branches and 4. Number of Auto Teller Machines (ATMs) to detect whether they have any impact on TE scores and TFP growth. This is done for five outputs individually. Both fixed effects (FEM) and random effects models (REM) are estimated for a panel of 26 banks from 2010 to 2021 then Hausman test is performed to determine whether results favor FEM or REM. FEM is estimated through the following functional form:

$$Y_{it} = \alpha_i + \beta_k X_{k,it} + \varepsilon_{it} \quad (3)$$

for $t = 2010, 2011, …., 2021$ and $i = 1, 2....,26$

Where:

Y_{it} = is the dependent variable observed for individual i at time t (TE or TFP)

$X_{k,it}$ = is i[th] (independent and control variables)

β_k = is the coefficient for respective independent and control variables

α_i = (i= 1…, n) is the unknown intercept for each bank.

ε_{it} is the error term

REM is estimated as follows:

$$Y_{it} = \alpha + \beta_k X_{k,it} + u_{it} + \varepsilon_{it} \tag{4}$$

Where

$i = is\ the\ bank\ 1,\ 2\ldots.,26$ and t = time (from 2010 to 2021)

α is the intercept for each bank.

Y_{it} = is the dependent variable observed for individual i at time t (TE or TFP)

$X_{k,it}$ = is ith (independent and control variables

β_k is the coefficient for respective independent and control variables

ε_{it} is the error term

u_{it} is the individual impact of ith bank, is not measurable variables

4. Data Description

The data cover a sample of 26 banks in Egypt involving the period from 2010 to 2021 (the latest available published financial statements). Date about banks are obtained from annual financial statements that are publicized on each bank website that are confirmed and authenticated from external auditors and approved by the central bank of Egypt. Banks are classified as follows:

1. Eight commercial domestic banks
2. Fifteen Arab and Foreign commercial banks work in Egypt
3. Three Islamic banks

The eight domestic bank include three public banks (NBE, BM, and BDC) whereas there are two public banks that did not have regular annual financial statements. The other five domestic banks are either private or joint venture with the government.

Due to fluctuations and depreciation in Egyptian pound across the study period all annual data are converted form million Egyptian pound to million USD taking into account changes in exchange rates. This conversion helps in achieving reliable results and avoiding any misleading nominal values in financial statement. The study avoids to utilize a base year constant prices due to fluctuations in Egyptian currency across study period especially from November 2016 in which the pound has lost 50% of its value relative the period before November 2016. Moreover, the USD is considered stable and global currency and fluctuations in its value relative to main international currencies is negligible. Efficiency scores are estimated via LIMDEP 9 Software. TFP and its components TC and

TEC are estimated through DPIN^{TM} 3 software. FEM, REM estimates are performed via LIMDEP9 software. Another check for FEM, REM, and Hausman test is done via E–views 10.

Variables

Inputs include the following variables ;

1. Debt   2. Exp: it represents each bank expenses

3. Pro: it represents each bank provisions   4. Asset: it represents the sum of total Assets

Outputs include the following variables;

1. Depo: it represents deposits   2. Loan: it represents total provided loans

3. Inv: it represents total investments   4. Net: it represents net profits

5. Earning: it represents earning assets, which include provided loans and investments.

Regressors for FEM and REM are:

1. Size: represents the dummy for the size; small, medium, large and extra-large sized with the

small bank as a reference dummy.

2. Age: represents the age of the bank from establishment

3. Number of branches   4. Number of ATMs

TE and TFP growth with its components are estimated for each output and for different sorts of banks

5. Empirical Results

Empirical results are classified into five main categories:

Part one: TE and TFP estimates for all banks

Part two: TE and TFP estimates for domestic banks

Part three: TE and TFP estimates for Arab and foreign banks

Part four: TE and TFP estimates for Islamic banks

Part five: FEM and REM regression for TE and TFP

Part one: TE and TFP for All Sample Banks

In this part, TE and TFP are estimated for each output. The following tables display efficiency scores and average TFP for sample banks.

TE scores for twenty six banks

Table 1.1 provides CRS average TE scores for deposits, provided loans, investments, net profits, and earning assets indicators.

Table 1.1: Efficiency Scores for all Sample Banks

Indicator	Technical Efficiency CRS			
	Mean	S. Dev	Min	Max
All Sample Banks				
Deposits	0.8616	0.1053	0.0909	1
Provided Loans	0.6976	0.1933	0.0242	1
Investments	0.2268	0.2048	0.0092	1
Net Profits	0.0846	0.1837	0.0000	1
Earning Assets	0.4990	0.1674	0.0446	1

Deposits' average TE scores for all banks is 0.86 with a minimum of 9% for BM in 2013 whereas a successive value is 55% for AIB in 2014. Alternatively, ten banks achieve full TE for 16 observations in which FIBE has achieved maximum TE for 5 years (2011, 12, 17, 18, and 2019). Provided loans average TE is 70% with a minimum of 19% for AIBANK, 2010 whereas the successive value is 23% for AIBANK in 2011. Otherwise, eleven banks achieve full TE for 21 observations in which QNB has achieved maximum TE for 5 years (2010, 11, 18, 19, and 2020). Average TE for investments have a poor performance with the mean of 23% and minimum for 1% . The majority of banking sample did not utilize their investments efficiently except five banks in some years. The best performers are HDB for 2010, 11, and 2012 and FIBE in 2016 and 2020. Average TE scores for net profits indicator is 8% which is poor with minimum of zero values for some banks in which they make loss in some years. Sixteen banks out of 26 have achieved loss for one year at least.

Earning assets are the sum of provided loans and investments. Average TE for earning assets is 50% with a minimum of 5% for AIBANK, 2010. There are many banks with minimum inefficiency scores less than 50% in some years. On the other hand, only four banks are efficient for specific years (HDB in 2010,11 and 2012, AUDI in 2015 and 2016, FIBE in 2016 and 2020 and SAIB in 2010).

TFP average results for the twenty six banks

Table 1.2: Yearly TFP, TC and TEC for all Banks 2010 - 2021

Malmquist TFP Index for Productivity Change Panel contained 26 firms in 12 periods											
Average results across firms and periods											
All Sample banks											
Indicator / Period	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Deposits TFP	1.174	1.242	1.497	1.172	1.218	1.125	1.080	1.072	1.110	1.091	1.132
Deposit TC	1.682	1.887	1.454	1.530	1.611	1.496	1.384	1.354	1.312	1.332	1.343
Deposit TEC	0.698	0.652	0.780	0.766	0.750	0.752	0.781	0.797	0.846	0.815	0.844
Provided Loans TFP	1.089	1.149	1.117	1.243	1.131	0.993	1.055	1.038	1.086	1.040	1.048
Provided Loans TC	1.612	1.728	1.568	1.733	1.580	1.560	1.599	1.507	1.483	1.384	1.402
Provided Loans TEC	0.676	0.665	0.712	0.718	0.716	0.637	0.660	0.689	0.732	0.752	0.748
Investments TFP	0.835	0.941	0. 982	0.903	1.009	0.757	1.086	0.915	0.843	0.873	0.873
Investments TC	1.812	1.896	1. 936	1.809	1.975	1.926	1.918	1.566	1.440	1.783	1.783
Investments TEC	0.4610	0.4960	0.5071	0.500	0.511	0.393	0.566	0.584	0.586	0.490	0.490
Net Profits TFP	1.118	0.969	1.105	1.139	0.970	0.911	0.966	0.927	0.994	1.007	0.897
Net Profits TC	1.775	1.706	1.672	1.793	1.679	1.698	1.607	1.564	1.612	1.598	1.717
Net Profits TEC	0.6299	0.5679	0.6606	0.635	0.578	0.536	0.601	0.593	0.617	0.630	0.523
Earning Assets TFP	1.1063	1.1886	1.125	1.064	1.221	0.912	1.139	1.064	1.022	1.084	1.141
Earning Assets TC	1.798	1.814	1.554	1.635	1.706	2.332	1.804	1.693	1.521	1.540	1.650
Earning Assets TEC	0.615	0.655	0.724	0.650	0.716	0.391	0.632	0.628	0.672	0.704	0.692

Deposits' average TFP for the whole period is around 1.004. Higher TFP scores are for AUDI in 2019, FIBE in 2013, 2015, and 2021,and BM in 2015. Provided loans average TFP for study period show increasing returns to scale (IRS) whereas it displays productivity slowdown in the sixth period. Higher TFP is for FIBE 2020, NBE 2017, AUDI 2017, AUB 2021, CIB 2018, QNB 2018, ABK 2014, and Al Baraka 2015. Lower TFP is for ENDB 2017, Al Baraka 2020 and 2021, HDB 2021, CA 2010 HSBC 2013, and SAIB 2013.

Average TFP for investments shows productivity slowdown in nine periods, CRS and IRS for one period per each. Eighteen banks out of 26 exhibit higher TFP scores in some years but only nine banks display high scores for three years per each, one bank for four years, and one for five years.

The average TFP for the study period for net profit indicator displays productivity slowdown in seven periods. There are around one third of TFP values of observations displays DRS for some years for each bank of the study sample.

Averaged TFP for earning assets indicator display IRS for ten periods. Around two third of all observations display DRS. Lower TFP scores are for CA 2012, BLOM 2013, BM 2014, and for ENDB, AIB, and EBANK 2021. Highest TFP scores are for FIBE 2012, 2015, 2017, 2020, and 20201, AUDI 2012, and SAIB 2015. Table 1.3 displays average TFP per bank for different indicators

Table 1.3: Average TFP per bank from 2010 to 2021

Bank	Indicator				
	Deposits	Provided Loans	Investments	Net Profit	Earning Assets
Domestic Banks					
NBE	1.3218	1.3736	1.3385	1.1804	1.1853
BM	1.2153	1.2177	1.4263	1.2322	1.1141
BDC	1.0151	0.8964	0.8688	1.0793	0.9198
CIB	1.3372	1.5223	1.0660	1.1660	1.2448
EBANK	1.2419	1.2525	1.2548	1.17941	1.3507
EGBANK	1.2063	1.1980	1.1860	1.2466	1.2291
AIBANK	1.4873	1.3505	1.2991	1.0911	1.2407
HDB	1.2751	1.4950	1.2408	1.2447	1.2256
Arab & Foreign Banks					
ALEXBANK	1.034	1.009	0.9543	0.7341	0.7583
AUB	1.0240	1.0861	0.9764	1.0044	1.0963
AUDI	1.4874	1.4714	1.2439	1.0973	1.4497
QNB	1.2413	1.2329	1.2364	1.1896	1.2894
CA	1.0282	1.0200	0.9473	1.1344	0.8383
HSBC	1.2644	1.0711	1.0660	1.1338	0.8171
NBK	1.07	1.1221	1.0854	0.7937	1.0690
ENDB	0.8246	0.9762	1.0402	0.8585	0.6294
BLOM	1.1029	1.1108	1.1868	1.0243	1.0221
AIB	0.8663	0.9515	1.11032	0.8603	0.7942
SAIB	1.1917	1.0076	1.4147	0.8413	1.2017
ADCB	1.0400	1.0358	0.9920	0.7896	0.9486
ABK	1.2990	1.2343	1.1401	1.0643	1.1537
SC	0.8189	0.9863	1.0707	0.7536	0.6204
ABC	1.2097	1.2086	1.0565	1.1440	1.1596
Islamic Banks					
FIBE	1.7103	1.4231	1.5768	1.6462	1.5795
Al Baraka	1.1848	1.2912	1.1916	1.2032	1.2607
ADIB	1.1866	1.3540	1.0178	1.1581	1.1371

From preceding table, it is obvious that public NBE and BM banks are considered the best performers for domestic banks in all indicators. This is maybe regarded as both are the largest and oldest banks in Egypt. CIB and AIBANK as private domestic banks, and HDB as loan provider. Despite NBE and BM have the highest share of collecting deposits, providing loans, running investments and earning profits, their TFP scores are considered not as hoped relative to their capabilities and relative to TFP scores for FIBE as an Islamic bank and for AUDI and QNB as Arab and foreign banks. The major performers for Arab and foreign banks are AUDI and QNB. The best TFP performer for Islamic banks and for all banks is FIBE and this is maybe attributed to its ability to provide a wide range of Islamic products that suit a set of clients who prefer Islamic products.

Part Two : TE and TFP for Domestic Banks

Similarly, Average TE and TFP are estimated for each output solely. Tables below display efficiency scores and total factor productivity for domestic banks. TE scores and TFP figures are displayed in appendix B and C.

Efficiency Scores for the Eight Domestic Banks

Table 2.1 describes efficiency scores for domestic banks for 5 indicators and the appendix provides Kernel density function for efficiency scores.

Table 2.1: Efficiency Scores for the Eight Domestic Banks

Indicator	Technical Efficiency CRS			
	Mean	S. Dev	Min	Max
Domestic Banks				
Deposits	0.9099	0.1146	0.0953	1
Provided Loans	0.7263	0.2047	0.0282	1
Investments	0.6165	0.2648	0.0616	1
Net Profits	0.0756	0.1988	0.0000	1
Earning Assets	0.8097	0.1870	0.1066	1

Average TE for deposits is 91% with a minimum around 10% for BM 2013 and the successive value with 58% is for HDB 2015. Six banks achieve maximum TE scores for 13 observations in which HDB has achieved maximum TE for attracting deposits in 3 years (2010, 11 , and 2012) and AIBANK for 2010,2012, and 2020). Average TE for provided loans is 73% with a minimum of 3% for AIBANK 2010 and 8% for EBANK 2017. Conversely, five banks achieve maximum TE for 11 observations; NBE 2014, BM 2014, CIB for 2010, 2011 and 2012, EBANK 2010, 2018 and 2020, HDB 2010, 2011 and 2012. Investment's average TE is 62% with minimum 6% for BM 2013. Six banks achieve maximum TE with 13 observations as follows; NBE 2014, BM 2015, 2019 and 2020, CIB 2019 and 2021, EGBANK 2010, 2020 and 2021, AIBANK 2021 and HDB 2010, 2012, and 2020. Average TE for net profits is the lowest among working banks in Egypt with 8%. Thirty nine observations out of 96 display minimum TE value of zero whereas only three observations are technically efficient (NBE, 2021 and HDB, 2010, and 2012). This entails that TE net profits for domestic banks is inefficient according to their capabilities despite they have two largest banks in Egypt. Earning assets average TE score is 81% with minimum of 11%. Lower TE values are for AIBANK and EBANK. Maximum TE values are for 19 observations as follows; BM, EGBANK, HDB, NBE and CIB.

Average TFP for the Eight Domestic Banks

Table 2.2: Total Factor Productivity for the Eight Domestic Banks

Malmquist TFP Index for Productivity Change Panel contained 8 firms in 12 periods											
Average results across firms and periods											
Domestic banks											
Indicator / Period	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Deposits TFP	1.436	1.380	1.657	1.939	1.458	1.314	1.674	1.534	1.629	1.786	1.473
Deposit TC	1.849	2.813	2.551	2.859	1.754	2.369	2.814	1.924	2.210	2.466	1.820
Deposit TEC	0.777	0.491	0.650	0.678	0.830	0.555	0.595	0.793	0.731	0.7243	0.810
Provided Loans TFP	0.935	1.586	1.780	1.469	1.535	1.634	1.620	1.166	1.591	1.671	1.217
Provided Loans TC	1.457	2.744	2.740	2.324	1.907	2.896	2.980	1.613	2.580	2.411	1.884
Provided Loans TEC	0.642	0.578	0.650	0.632	0.805	0.564	0.543	0.723	0.617	0.6929	0.646
Investments TFP	1.189	1.337	1.316	1.379	1.537	1.717	1.754	1.324	1.244	1.419	1.417
Investments TC	1.515	1.609	1.805	2.547	2.137	2.633	2.748	2.092	2.010	2.122	2.251
Investments TEC	0.785	0.831	0.729	0.541	0.719	0.652	0.638	0.633	0.622	0.669	0.630
Net Profits TFP	1.384	1.304	1.436	1.208	1.370	1.262	1.411	1.579	1.308	1.440	1.223
Net Profits TC	2.072	2.126	2.240	2.122	1.869	2.381	2.107	2.299	2.091	2.361	2.335
Net Profits TEC	0.669	0.613	0.641	0.569	0.733	0.530	0.670	0.528	0.626	0.610	0.524
Earning Assets TFP	1.190	1.428	1.236	1.217	1.290	1.357	1.512	1.178	1.242	1.208	1.286
Earning Assets TC	1.535	2.10	1.66	1.905	1.530	2.134	2.611	1.632	1.708	1.767	1.649
Earning Assets TEC	0.776	0.679	0.745	0.6388	0.843	0.636	0.579	0.722	0.727	0.684	0.780

Average TFP for deposits exhibits IRS for all periods. Higher TFP are for AIBANK in 2014 and 2020, CIB 2018 and 2020, HDB 2018, NBE 2019, BM 2014. provided loans average TFP for all periods display IRS except first period has DRS. Highest TFP values are for BM 2016, CIB 2012, 2018 and 2020, EBANK for 2011, EGBANK 2012 and 2017, AIBANK 2014 and 2020, and NBE 2017. Minimum average TFP is for BDC 2011 and 2012 and BM in 2011. Investments average TFP for all periods exhibit IRS. Sixty observations out of 96 exhibit IRS in which higher TFP values are for NBE 2016 and 2017, BM 2015 and 2017 , EBANK 2011 and AIBANK 2020. Lower TFP values are for CIB 2011 and 2019 , EBANK 2021, BDC 2018 and 2019 and NBE 2019.

Net profits average TFP display IRS for all periods. Twenty observations exhibit DRS in which lower values are for BDC 2018 and 2019, BM 2019, EBANK 2014 and HDB 2018. Higher TFP values are for NBE 2017, EGBANK 2014, and HDB 2011 and 2019. Earning assets average TFP display IRS for all periods. Twenty five observation exhibit DRS. Lower TFP scores are for BDC 2011, BM 2019 and NBE 2020. Higher TFP scores are for EBANK 2011 and 2017, EGBANK 2012 and 2017, CIB 2012 and 2016, BM 2017 and AIBANK 2021.

It is remarkable that the performance of domestic banks whether public or private are good expect BDC. The good performance of NBE and BM are maybe attributed to the fact that they are benefit from their size and age in which they are the largest and oldest banks in Egypt.

Part Three : TE and TFP for Arab and Foreign Banks

Tables 3.1 and 3.2 display average TE and TFP scores for Arab and foreign banks. TE and TFP figures are displayed in the appendix B and D.

Efficiency Scores for the Fifteen Arab and Foreign Banks

Table 3.1: Efficiency Scores for the Fifteen Arab and Foreign Banks

Indicator	Technical Efficiency CRS			
	Mean	S. Dev	Min	Max
Arab and Foreign Banks				
Deposits	0.9075	0.0975	0.5944	1
Provided Loans	0.7345	0.1831	0.3775	1
Investments	0.3707	0.2550	0.0219	1
Net Profits	0.3777	0.3040	0.0032	1
Earning Assets	0.6833	0.1715	0.3656	1

Average TE for deposits including180 observations of Arab and Foreign banks is 91% with minimum of 59%. Lower TE scores are for AIB form 2010 to 2015, and 2017, SC 2010, and 2013, ENDB 2017, 2018, and 2020 and KNB 2016 and2017. Fourty eight observations achieve maximum TE as follows; AUDI, 2011then form 2013 to 2016 then 2018 then 2020, and 2021 – ABK from 2010 to 2015 – ABC 2010 then from 2017 to 2021- BLOM 2014 then from 2017 to 2020 – SAIB 2010 2017, 2020, and 2021 – QNB, 2011, 2013, 2016, and 2021 – HSBC from 2010 to 2012 – ALEXBANK, 2019 and 2020 – AIB, 2019, and 2021 – SC, 2020, and 2021 – ADCB, 2019, and 2021 – NBK, 2010 – ENDB, 2015 – AUB, 2020 and CA for 2021.

Average TE for provided loans is 73% with the minimum of 38% for SC, 2013. Nineteen observations have achieved maximum TE score; QNB in 2010, and 2011then from 2018 to 2020 – NBK from 2017 to 2021 – AUB 2019 and 2021 – AUDI in 2011 and 2016 – SAIB in 2010 and 2021 – HSBC 2011 – CA 2021 – ADCB and SC 2021. Average TE for investment is 0.37% with minimum of 2% for ALEXBANK, 2018 the values of TE less than 10% are for ALEXBANK from 2011to 2018 – AUDI 2010 – CA 2016 – HSBC 2016 and 2017 – ADCB in 2011 and 2013 – ABK and ABC 2010. The maximum TE is only for eleven observations; SAIB 2010, from 2014 to 2017, and 2020 to 2021, AUDI 2015, 2018, and 2020, CA and BLOM 2021.

Average TE for net profits is 38% with a minimum of zero for SC from 2010 to 2015. The values of TE less than 10% are twenty six observations and the maximum values of TE are eleven observations as follows; CA form 2019 to 2021 – both SC and ALEXBANK for 2020 and 2021 – ABC 2012 – AUDI 2016 – AUB and NBK for 2020.

Average TE for earning assets is 68% with a minimum of 37% for ABC 2015. The values of TE less than 50% are twenty one observations whereas seventeen observations have maximum TE for SAIB 2010, 2014, 2017, 2020, and 2021 – AUDI 2015, 2016, 2018, and 2020 – NBK 2018, 2020, and 2021 – AUB 2020 – QNB, CA, BLOM, and ADCB 2021.

Average TFP for the Fifteen Arab and Foreign Banks

Table 3.2: Total Factor Productivity for Fifteen Arab and Foreign Banks

Malmquist TFP Index for Productivity Change Panel contained 15 firms in 12 periods Average results across firms and periods											
Arab and foreign banks											
Indicator / Period	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Deposits TFP	1.361	1.295	1.047	1.254	1.249	1.266	1.226	1.263	1.121	1.174	1.123
Deposit TC	1.769	1.727	1.212	1.428	1. 807	1.566	1.620	1.586	1.380	1.455	1.315
Deposit TEC	0.769	0.750	0.864	0.879	0.691	0.808	0.757	0.796	0.812	0.807	0.855
Provided Loans TFP	1.340	1.269	1.147	1.248	1.223	1.097	1.140	1.213	1.140	1.110	1.137
Provided Loans TC	1.946	1.839	1.480	1.669	1.833	1.803	1.730	1.806	1.552	1.506	1.508
Provided Loans TEC	0.689	0.690	0.775	0.7488	0.667	0.609	0.659	0.672	0.734	0.737	0.754
Investments TFP	1.098	1.206	1.155	1.139	1.193	1.150	1.322	1.160	1.274	1. 079	1.180
Investments TC	2.084	1.918	2.367	2.203	2.362	2.130	2.140	1.973	2.137	1.913	1.849
Investments TEC	0.527	0.629	0.488	0.517	0.505	0.540	0.618	0.588	0.596	0.564	0.638
Net Profits TFP	1.020	0.940	1.137	1.174	0.962	0. 917	0.890	1.057	1.115	1.032	1.315
Net Profits TC	1.984	2.174	2.074	1.994	1.976	1.674	1.834	1.657	1.670	1.781	2.270
Net Profits TEC	0.514	0.433	0.548	0.589	0.487	0.548	0.485	0.638	0.668	0.579	0.579
Earning Assets TFP	1.159	1.248	1.068	1.148	1.084	1.006	1.061	1.100	1.093	0.979	1.058
Earning Assets TC	1.737	1.727	1.366	1.600	1.577	1.686	1.598	1.670	1.550	1.311	1.371
Earning Assets TEC	0.667	0.723	0.782	0.718	0.687	0.597	0.664	0. 600	0.705	0.747	0.772

Despite average TFP for deposits for Arab and foreign banks exhibit IRS, they are not as domestic banks. Two third of observations show DRS and this may indicate that the availability of Arab and foreign banks in attracting deposits is still low. Higher TFP scores are for AUDI 2012 and 2017, CA 2014, ABK 2012 and 2014, NBK and HSBC for 2011 and AIB for 2018. Average TFP for provided loans display IRS for all periods. Half of observations exhibit DRS with lower TFP for CA 2017, and 2018, SAIB 2016, 2017 and 2020, AIB 2018, and SC 2019 and 2020 . Higher TFP for AUDI 2014 and 2017 and CA 2014 then AUDI 2012 and 2017, SAIB 2011 and 2020, ABK 2012, 2014 and 2015 and ABC 2011.

Average TFP for investments show IRS for all periods. Minimum TFP is for AUB 2014 and AUDI 2011, AIB 2013, and ADCB 2020. Eighty observations exhibit DRS. Higher values of TFP are for SAIB 2016, QNB 2018, BLOM 2019, ABK 2017, HSBC 2011, and AUDI 2017.

Average TFP for net profits show that eight periods display IRS whereas three periods show DRS. Minimum TFP values are for ALEXBANK for 2010 and 2011, NBK 2016, SAIB 2012, and ADCB for 2015 and 2016. Half observations display DRS. Higher TFP values are for CA 2014 and 2021, BLOM 2021, AUB 2021, QNB 2018, ABK 2012, and NBK 2021. Average TFP for earning assets displays IRS in nine periods, CRS and DRS in one period for both. One hundred observations exhibit DRS. Lower TFP values are for HSBC 2014 and 2018, ENDB 2014 and 2018 and SC for 2016 and 2017. Higher TFP values are for CA 2014, AUDI 2012, 2014 and 2017, QNB 2012 and SAIB for 2015 and 2016.

It is also noticeable that the main performer for Arab and foreign banks are AUDI, QNB, HSBC, BLOM, and ABC whereas poor performers are for ENDB and SC.

Part Four : TE and TFP for Islamic Banks

Similarly, TE and TFP are estimated for each output separately. Tables 4.1 and 4.2 display TE scores and TFP for deposits. TE and TFP figures are displayed in the appendix.

Deposits and Efficiency Scores for the Three Islamic Banks

Table 4.1: Efficiency Scores for the Three Islamic Banks

Indicator	Technical Efficiency CRS			
	Mean	**S. Dev**	**Min**	**Max**
Arab and Foreign Banks				
Deposits	0.9565	0.0398	0.8382	1
Provided Loans	0.8618	0.1404	0.4621	1
Investments	0.3432	0.2782	0.0536	1
Net Profits	0.3289	0.2998	0.0519	1
Earning Assets	0.5384	0.2192	0.2193	1

Average TE for deposits covering 36 observations of Islamic banks is 96% which is the highest among banks. The minimum TE is 84% for AIDB 2016. Eight observations out of 36 have maximum TE; FIBE in 2010, 2012, 2014, and from 2017 to 2019 – AIDB 2013 and Al baraka 2014. Average TE for provided loans is 86% with minimum of 46%. Minimum TE is for ADIB 2010 whereas maximum TE is for 11 observations. Average TE for investment is 34% with a minimum of 5% for ADIB 2011. Values for less than 10% are also for ADIB 2010, 2011, 2012, and 2014. Three observation only out of thirty six display maximum TE for FIBE in 2016 and 2020 and ADIB 2013.

Average TE for net profits is 33% with minimum of 5% for ADIB in 2010, 2011, and 2012 and this may be due to the acquisition of National Bank of Development with its loss. Only three observations have maximum TE as follows; FIBE 2018, 2019 and ADIB 2013. Average TE for earning assets is 54% with minimum of 22% for ADIB in 2010 and 2011 as explained earlier. Four observations only achieve TE as follows; FIBE 2016 and 2020, ADIB 2013 and Al baraka for 2014.

Average TFP for the Three Islamic Banks

Table 4.2: Total Factor Productivity for the Three Islamic Banks

Malmquist TFP Index for Productivity Change Panel contained 3 firms in 12 periods Average results across firms and periods											
Islamic banks											
Indicator / Period	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Deposits TFP	1.505	1.730	1.448	1.461	1.614	1.277	1.137	1.252	1.243	1.565	1.482
Deposit TC	2.141	2.170	2.265	2.239	2.023	1.431	1.254	1.654	1.334	2.013	2.106
Deposit TEC	0.703	0.797	0.639	0.653	0.798	0.892	0.907	0.757	0.932	0.777	0.704
Provided Loans TFP	1.240	1.210	1.388	1.223	2.066	1.240	1.198	1.466	1.434	1.675	1.996
Provided Loans TC	2.505	1.647	1.693	2.234	2.766	1.539	1.198	2.134	2.367	2.034	2.574
Provided Loans TEC	0.495	0.735	0.820	0.547	0.747	0.806	1	0.687	0.606	0.824	0.775
Investments TFP	1.537	1.508	1.497	0.869	1.391	1.224	1.430	1.262	1.010	1.584	1.544
Investments TC	2.276	2.432	2.390	2.298	2.359	2.007	1.850	1.424	1.432	2.553	2.333
Investments TEC	0.675	0.620	0.627	0.378	0.590	0.610	0.773	0.886	0.706	0.620	0.662
Net Profits TFP	1.868	1.257	1.220	1.303	1.863	1.214	0.997	1.217	1.287	1.893	1.739
Net Profits TC	2.665	1.873	1.582	2.220	2.382	1.776	1.634	1.789	2.045	2.885	2.484
Net Profits TEC	0.701	0.671	0.771	0.587	0.782	0.683	0.610	0.680	0.629	0.656	0.700
Earning Assets TFP	1.581	1.508	1.557	1.134	1.436	1.336	1.340	1.573	1.049	1.614	1.389
Earning Assets TC	2.271	1.909	1.936	1.607	1.662	2.068	1.340	2.184	1.206	2.242	1.751
Earning Assets TEC	0.696	0.790	0.804	0.706	0.864	0.646	1	0.720	0.869	0.720	0.793

Average TFP for deposits display IRS for all periods. Seven observations out of 36 exhibit DRS whereas 19 remarks show IRS. Lower TFP values are for ADIB 2017, 2019 and 2021, Al baraka 2012, 2016 and 2019 and FIBE 2011. Higher TFP values are for FIBE 2012, 2013, 2015, 2020 and 2021. Average TFP for provided loans for all periods display IRS. Six observations show DRS. Lower TFP values are for ADIB 2012, 2013 and 2019, Al baraka 2012 and 2016 and FIBE for 2011. Twenty eight observations display IRS in which higher values are for FIBE in 2015, 2020 and 2021, Al baraka 2015 and ADIB 2015 and 2020. Investments average TFP for 15 displays DRS, 9 periods show CRS while other periods exhibit IRS. Ten observation show DRS with lower values for FIBE 2014 and 2016 and ADIB 2015 and 2018. Higher TFP values are for FIBE 2012, 2013, 2015, 2020 and 2021. Average TFP for net profits displays DRS for one period and IRS for other periods. Ten observations display DRS with lower TFP values for FBIE 2017 and 2018, Al baraka 2012 and ADIB in 2013,2017, and 2019. Higher TFP values are for FIBE in 2013,2015, 2020 and 2021 and Al baraka 2011. Average TFP for earning assets displays IRS for all periods. Five observations display DRS with minimum TFP for FIBE 2011, 2019 and ADBI for 2012, 2015, and 2019. Higher TFP values are for FIBE 2012, 2013, 2015 and 2020. Appendix E displays TFP, TEC and TC figures for Islamic banks.

It is noticeable that the performance of Islamic banks for all indicators are high relative to other banks especially FBIE which has the highest TFP score across all banks. Higher performance of Islamic banks is maybe ascribed to their capabilities to provide a wide range of diversified Islamic products such as Murabaha, Mudarabah, Musharaka and Sukuk that suits different tastes than conventional banks. Tables 5 and 6 provide summary for TE, TFP, TC and TEC for all, Arab & foreign, and Islamic banks

Table 5: Summary Results for TE Scores for Working Banks in Egypt

Indicator	Technical Efficiency CRS			
	Mean	S. Dev	Min	Max
All Sample Banks				
Deposits	0.8616	0.1053	0.0909	1
Provided Loans	0.6976	0.1933	0.0242	1
Investments	0.2268	0.2048	0.0092	1
Net Profits	0.0846	0.1837	0.0000	1
Earning Assets	0.4990	0.1674	0.0446	1
Domestic Banks				
Deposits	0.9099	0.1146	0.0953	1
Provided Loans	0.7263	0.2047	0.0282	1
Investments	0.6165	0.2648	0.0616	1
Net Profits	0.0756	0.1988	0.0000	1
Earning Assets	0.8097	0.1870	0.1066	1
Arab & Foreign Banks				
Deposits	0.9075	0.0975	0.5944	1
Provided Loans	0.7345	0.1831	0.3775	1
Investments	0.3707	0.2550	0.0219	1
Net Profits	0.3777	0.3040	0.0032	1
Earning Assets	0.6833	0.1715	0.3656	1
Islamic Banks				
Deposits	0.9565	0.0398	0.8382	1
Provided Loans	0.8618	0.1404	0.4621	1
Investments	0.3432	0.2782	0.0536	1
Net Profits	0.3289	0.2998	0.0519	1
Earning Assets	0.5384	0.2192	0.2193	1

Table 6: Summary Results for TFP, TC and TEC for Working Banks in Egypt

Indicator	TFP				TC				TEC			
	Mean	S. Dev	Min	Max	Mean	S. Dev	Min	Max	Mean	S. Dev	Min	Max
All Sample Banks												
Deposits	1.004	0.264	0.419	2.680	1.454	0.727	0.615	2.942	0.779	0.208	0.251	1
Provided Loans	1.053	0.520	0.611	3.923	1.537	0.579	0.728	3.923	0.704	0.202	0.237	1
Investments	0.882	0.468	0.345	3.304	1.798	0.612	0.529	3.303	0.508	0.202	0.177	1
Net Profits	0.977	0.561	0.570	4.241	1.659	0.554	0.596	4.241	0.600	0.221	0.201	1
Earning Assets	0.992	0.296	0.604	2.535	1.712	0.706	0.670	3.290	0.654	0.212	0.224	1
Domestic Banks												
Deposits	1.266	0.442	0.807	3.126	2.244	1.482	0.905	5.985	0.717	0.272	0.223	1
Provided Loans	1.288	0.560	0.027	2.611	2.314	1.405	0.153	5.965	0.641	0.243	0.029	1
Investments	1.210	0.370	0.616	2.479	2.124	1.135	0.708	4.771	0.669	0.245	0.249	1
Net Profits	1.177	0.293	0.629	2.197	2.141	0.816	0.727	3.559	0.621	0.235	0.283	1
Earning Assets	1.189	0.296	0.544	2.281	1.777	0.675	0.893	3.189	0.728	0.204	0.377	1
Arab & Foreign Banks												
Deposits	1.100	0.404	0.424	3.033	1.491	0.748	0.676	3.266	0.803	0.183	0.369	1
Provided Loans	1.102	0.314	0.764	2.630	1.667	0.619	0.876	3.119	0.712	0.194	0.352	1
Investments	1.101	0.363	0.552	2.352	2.092	0.665	0.767	3.531	0.563	0.199	0.197	1
Net Profits	0.962	0.379	0.300	2.320	1.926	0.662	0.412	2.679	0.544	0.227	0.134	1
Earning Assets	0.990	0.393	0.403	2.484	1.539	0.748	0.483	3.347	0.699	0.196	0.188	1
Islamic Banks												
Deposits	1.361	0.476	0.956	2.754	1.803	0.626	0.985	2.852	0.796	0.204	0.443	1
Provided Loans	1.356	0.445	0.822	3.039	2.002	0.844	0.985	3.958	0.739	0.218	0.428	1
Investments	1.262	0.542	0.498	2.624	2.099	0.701	0.498	2.990	0.648	0.264	0.308	1
Net Profits	1.336	0.558	0.708	2.978	2.021	0.666	0.781	2.978	0.692	0.226	0.301	1
Earning Assets	1.326	0.446	0.851	2.581	1.797	0.642	0.980	2.948	0.786	0.218	0.369	1

Part five: FEM and REM regression for TE and TFP

In this part average TE and TFP scores are regressed against size, age, number of branches and number of ATMs to detect their impact on TE and TFP

FEM and REM regression for TE indicators

Table 7 displays FEM, REM, and Hausman test for deposits, provided loans, investments, net profits, and earning assets. Results reveal that deposits favor FEM in which the bank size coefficient has an impact TE score whereas the number of branches has a negative impact on TE scores. Both age and number of ATMs are statistically insignificant. Provided loans favor REM in which bank's age and number of ATMs coefficients are significant whereas size and number of branches are statistically insignificant. Investments favor REM but all coefficients are statistically insignificant, and they have not any impact of TE scores. Net profits favor FEM in which bank's size and number of branches coefficients are statistically significant. Earning assets favor REM but none of coefficients is statistically significant.

FEM and REM regression for TFP indicators

Table 8 displays FEM, REM, and Hausman test for five output indicators. Results reveal that deposits favor REM in which the size coefficient only has an impact on TFP scores. Provided loans favor REM, but all coefficients are statistically insignificant in which they have not any impact on TFP scores. Investments results also favor REM, but all coefficients are also statistically insignificant. Net profits favor FEM in which size coefficient is statistically significant. Earning assets favor REM , but all coefficients are statistically insignificant in which they have not any impact on TFP scores.

Table7: Panel data regression analysis results for size, age, number of ATMS , number of branches variables and TFP growth variable for working banks in Egypt from 2010 to 2021

Variable	Deposits FEM	Deposits REM	Loans FEM	Loans REM	Investments FEM	Investments REM	Net profits FEM	Net profits REM	Earning Assets FEM	Earning Assets REM
Size	0.0619 (0.030)**	0.036 (0.028)	0.013 (0.029)	0.007 (0.026)	−0.018 (0.027)	−0.192 (0.025)	0.092 (0.029)***	0.074 (0.026)***	0.003 (0.027)	−0.002 (0.025)
Age	−0.0007 (0.0018)	−0.0011 (0.0017)	−0.003 (0.002)**	−0.004 (0.005)**	0.0001 (0.002)	0.003 (0.002)	−0.002 (0.002)	−0.002 (0.002)	−0.002 (0.002)	−0.002 (0.002)
branches	−0.007 (0.003)**	−0.006 (0.003)*	−0.005 (0.003)*	−0.004 (0.003)	−0.004 (0.003)	−0.004 (0.003)	−0.007 (0.003)**	−0.005 (0.003)*	−0.005 (0.003)*	−0.004 (0.003)
ATMS	0.001 (0.001)	0.001 (0.001)*	0.001 (0.001)***	0.001 (0.001)***	0.001 (0.001)**	0.001 (0.001)**	0.0001 (0.001)	0.001 (0.001)	0.001 (0.001)**	0.001 (0.001)**
Constant	——	1.1889 (0.054)***	——	1.026 (0.051)***	——	1.152 (0.048)	——	1.056 (0.052)***	——	1.1546 (0.051)***
Fixed vs. Random Effects (Hausman)	9.31 Hausman test favor FEM		5.69 Hausman test favor REM		1.77 Hausman test favor REM		10.31 Hausman test favor FEM		7.23 Hausman test favor REM	
R²	11.97	1.041	12.84	7.26	13.40	6.8	17.55	7.49	15.15	7.3

*, ** and *** illustrate significant levels at 10%, 5% and 1% respectively in a two-tailed test. 312 observations

Table8: Panel data regression analysis results for size, age, number of ATMS, number of branches variables and TE variable for working banks in Egypt from 2010 to 2021

Variable	Deposits FEM	Deposits REM	Loans FEM	Loans REM	Investments FEM	Investments REM	Net profits FEM	Net profits REM	Earning Assets FEM	Earning Assets REM
Size	0.0330 (0.0134)***	0.0291 (0.0106)***	−0.0118 (0.0241)	−0.0125 (0.1960)	−0.0106 (0.0272)	−0.0149 (0.0209)	−0.0412 (0.0239)***	−0.0425 (0.0190)**	−0.0087 (0.0226)	−0.1188 (0.0170)
Age	0.0026 (0.0015)*	0.0005 (0.0007)	−0.0025 (0.0027)	−0.0014 (0.0014)	0.0050 (0.0031)	0.0004 (0.0014)	0.0116 (0.0027)***	0.0007 (0.0013)	0.0056 (0.0025)**	0.0005 (0.0011)
branches	0.0001 (0.0001)	−0.0001 (0.0001)	0.0001 (0.0002)*	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	−0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)
ATMS	−0.0001 (0.0001)*	−0.0001 (0.0001)	0.0001 (0.0001)***	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)
Constant	———	0.8368 (0.0235)***	———	0.7332 (0.0460)***	———	0.2017 (0.0449)	———	0.0806 (0.0425)*	———	0.4702 (0.0350)***
Fixed vs. Random Effects (Hausman)	6.2 — Hausman test favor REM		6.41 — Hausman test favor REM		3.19 — Hausman test favor REM		26.62 — Hausman test favor FEM		6.67 — Hausman test favor REM	
R²	42.26	5.89	44.74	4.65	41.95	12.14	40.49	12.20	38.18	17.10

*, ** and *** illustrate significant levels at 10%, 5% and 1% respectively in a two-tailed test. 312 observations

6. Conclusions

The sample of 26 working banks in Egypt including domestic, Arab and foreign, and Islamic banks is chosen to estimate TE and TFP from 2010 to 2021. Constant returns to scale TE is estimated then TFP with its components TC and TEC are calculated. Results reveal that average efficiency scores for net profits are poor especially for domestic banks. Efficiency scores for investments are also low especially in Arab and foreign banks. Average TE for earning assets are also not as hoped despite they are higher in domestic banks relative to Arab and foreign banks and Islamic banks.

Average TE for provided loans in Islamic banks are higher than domestic banks and foreign and Arab banks. Alternatively, TE for deposits are higher relative to other output indicators such as net profits and investments. Although the majority of banks have the ability to attract and collect deposits, they are not capable of managing and utilizing their provided loans and investments efficiently. This can be supported by the ratio of collected deposits to provided loans in which provided loans is less or equal to 50% of collected deposits for all banks.

For domestic banks, the main performers in collecting deposits are NBE, BM and CIB banks. The main performers for providing loans are NBE and BM. Unfortunately, the performance of investments for domestic banks is poor. Moreover, the performance for net profits is also not as hoped. The performance of earning assets fluctuates across whole period in which only few years witnesses better performance for BM and NBE. Despite NBE and BM are the oldest and largest banks in Egypt, their profits before taxes are less than 3% of total collected deposits according to their financial statements.

The main performers for Arab and foreign banks for different indicators are as follows; the main performers of collecting deposits are AUDI, QNB, BLOM, and ABK. For provided loans the main performers are as follows; AUDI, QNB, and ADCB. For investments,

the chief performers are AUDI, SAIB, and ABC bank. For profit the leading performers are AUDI and ADCB. For earning assets, the main performers are AUDI, QNB, SAIB, and ABK.

The main performers for Islamic banks for five indicators are as follows; the major performer for attracting deposits is FIBE bank. For provided loans, the main performer is ADIB. For investments, the key performer is ADIB. Unfortunately, net profits for Islamic banks is not as hoped. For earning assets, the chief performer is ADIB bank.

Islamic banks in general and FIBE in particular have higher TFP scores followed by domestic then Arab and foreign banks. This is regarded as Islamic banks have a wide range of Islamic products than conventional banks such as Murabaha, Mudarabah, Musharaka, Ijara, Sukuk, and other products that are suitable for and can satisfy clients' preferences. It is also clear that the productivity gains are mainly driven by technical progress rather than efficiency improvements. After estimating TE and TFP they are regressed against bank's size, age, number of branches, and number of ATMs to detect whether they have any impact on TE and TFP. FEM and REM regression models are used along with Hausman test to detect which model is favorable and has more impact on TE and TFP.

To sum up, all banks have to follow a clear strategy aiming at utilizing collected deposits in an efficient way and in most profitable investments to raise net profits and to achieve better performance. Despite NBE and BM have a notable market share of total deposits in the banking sector, they have to adopt innovative policies aim at utilizing deposits in efficient investments and earning assets to achieve higher performance rates and to maximize profits. Conventional banks particularly Arab and foreign banks have to focus on diversifying their products along with providing new products to cope with Islamic banks and to maximize their profits. Additionally, small size and less productive banks have to merge with other banks to constitute large entities to enhance their market share, benefit from economies of scale, provide more products and to maximize profits. The forthcoming paper will focus on the role of financial inclusion in stimulating economic growth.

References

Azad et al. (2017) Bank efficiency in Malaysia: a use of Malmquist meta-frontier analysis. *Eurasia Business and Economics Society*, 7, 287 – 311 published online.

Banker, D., Charnes, A., and Cooper, W. (1984) Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, 30, 1078–1092.

Berg, A., Forsund, F. and Jansen, E. (1992) Malmquist Indices of Productivity Growth during the Deregulation of Norwegian Banking, 1980–89. *The Scandinavian Journal of Economics*, 94, 211 – 228.

Bhuyan, B. and Patra, S. (2022) Measurement and determinants of total factor productivity: evidence from Indian banking industry. International Journal of Productivity and Performance Management, 71 (7), 2970–2990.

Casu, B., Girardone, C., and Molyneux, P. (2004) Productivity change in European banking: A comparison of parametric and non-parametric approaches. *Journal of Banking and Finance* 28 (10), 2521–2540.

Caves, D., Christensen, L., and Diewert, W. (1982) The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity. *Econometrica*, 50, 1393-1414.

Charnes, A., Cooper, W. and Rhodes , E. (1978) Measuring the Efficiency of Decision–Making Units. *European Journal of Operational Research*, 2, 429-444.

Duygun, M., Sena , V., and Shaban, M. (2016) Trademarking activities and total factor productivity: Some evidence for British commercial banks using a Metafrontier approach. *Journal of Banking & Finance*,72, 70–80.

El Moussawi, C. and Saad, W. (2008) Efficiency and Productivity Growth of the Arab Commercial banking sector: A Non-Parametric Approach. *Journal of Development and Economic Policies"*, 10 (1), 5–35.

Färe, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994) Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries. *American Economic Review*, 84, (1), 66-83.

Jreisat, A. and Hassan, H. (2016) Productivity Change of the Egyptian Banking Sector: A Two Stage Non-Parametric Approach. *Topics in Middle Eastern and African Economies journal*, Loyola University Chicago, 18 (1), 145 – 155.

Isik, I., and Hassan, M. (2003) Financial deregulation and total factor productivity change: An empirical study of Turkish commercial banks. *Journal of Banking & Finance*, 27, 1455–1485.

Kale, S. Eken, M. and Selimler, H. (2015) The Effects of Regulations on the Performance of Banks: Evidence from the Turkish Banking Industry. *The Business and Economics Research Journal*, 8 (2), 109 – 145.

Kasman, A. and Mekenbayeva, K. (2016) Technical Efficiency and Total Factor Productivity in the Kazakh Banking Industry. Acta Oeconomica, 66 (4), 685–709.

Malmquist, S. (1953) Index numbers and indifference surfaces. *Trabajos de Estatistica*,4(2), 209–242.
Mukherjee, K., Ray, S. and Miller, S. (2001) Productivity Growth in Large US Commercial Banks: The Initial Post-Deregulation Experience. *Journal of Banking and Finance*, 25, 913–939.

Narwal, K. and Pathneja, S. (2015) Determinants of Productivity and Profitability of Indian Banking   Sector: A Comparative Study. *Eurasian Journal of Business and Economics*, 8(16), 35-58.

Sharma, D., Sharma, A. and Barua, M. (2013) Efficiency and productivity of banking sector : A critical analysis of literature and design of conceptual model. *Qualitative Research in Financial Markets*, 5 (2),195–224

Shair et al. (2021) Assessing the Efficiency and Total Factor Productivity Growth of the Banking industry: Do Environmental Concerns Matters? *Journal of Environmental Science and Pollution Research*, 28 (16), 20822 – 20838

Zaman, M., Valiyattoor, V., and Bhandari, A. (2022) Dynamics of total factor productivity growth: An empirical analysis of Indian commercial banks. *The Journal of Economic Asymmetries*, 26,1-14.

Appendix A: Brief description of operated banks in Egypt

In this section a quick glance is introduced to cover operating banks in Egypt. The latest number of working banks in Egypt is 36 banks after merging, acquisition, or exit from Egyptian market. The national investment bank (NIB) is excluded from the list as it is a governmental bank in which its ownership, fund and activities is devoted to the government ventures and does not deal with people.

The sample covers 26 banks in which they have regular and systematic data. Moreover, sampling banks' annual financial statements are authenticated via Independent Auditors' Report and are confirmed from the central bank of Egypt. The banks of the study are classified into three categories; domestic, Arab and foreign banks, and Islamic banks.

a. Domestic Banks

Domestic banks include public, private and joint ventures Egyptian banks. The sample includes eight domestic banks.

1. National Bank of Egypt (NBE)

NBE is the oldest and the largest a public commercial bank in Egypt. It was established on 1898. NBE total financial position at 31 of December 2021 recorded 3.3 trillion Egyptian pound (209.5 billion USD). NBE total assets represented 37.5% of the banking system assets. Total deposits was 2.4 trillion Egyptian pound (152.38 billion USD) accounting for 37.1% of total banks' deposits. NBE has provided a set of finance schemes that satisfy economic sectors' requirements. By the end of 2021, total provided loans was 1.2 trillion Egyptian pound (76.19 billion USD) representing 50% of total deposit with the market share of 38.7% of the banking loans. Profit before taxes was 66 billion Egyptian pound (4.19 billion USD). The number of ATMs was 6,168 and the number of branches , offices, and banking units are 615 serving 17.8 million clients. Information obtained from NBE website: https://www.nbe.com.eg/NBE/E/#/EN/Home

2. Banque Misr (BM)

BM was established in 1920 by Talaat Harb. It was the first bank that totally owned and managed by Egyptians. BM has funded different activities across multiple domestic sectors. Currently, BM owns shares in 157 companies covering different activities. BM is a public bank that has 800 branches serve 13 million clients in Egypt with 5,000 ATMs. According to BM financial statement, total deposits was 1.23 trillion Egyptian pound (78.35 billion USD). Total provided loans was 591.86 billion Egyptian pound (37. 58 billion USD). BM profit before taxes was 42.6 billion Egyptian pound (2.7billion USD). Information is obtained from BM website: https://www.banquemisr.com/

3. Banque DE Caire (Cairo Bank) (BDC)

BDC is a public bank founded in 1952. According to 2021 BDC financial statement, total deposits was 198.28 billion Egyptian pound (12.59 billion USD). Total provided loans was 101.79 billion Egyptian pound (6.46 billion USD). BDC profit before taxes was 5.81 billion Egyptian pound (368.9 million USD). BDC has 248 branches with 1640 ATMs serving 3 million clients. Information is obtained from the BDC website: https://www.bdc.com.eg

4. Commercial International Bank (CIB)

CIB was founded in 1975 as Chase National Bank, a joint venture between Chase Manhattan bank and NBE. In 1987, Chase divested its stake to NBE, who renamed the former joint venture Commercial International Bank. Over time, NBE's ownership in CIB was declined, and in 2006 a consortium led by Ripplewood Holdings acquired NBE's remaining 19%. CIB is the leading private bank in Egypt. CIB has 200 branches with 1300 ATMs across the country. According to CIB financial statement for 2021, total customers' deposits was 407.24 billion Egyptian pound (25.86 billion USD). Total provided loans was 145.89 billion Egyptian pound (9.26 billion USD). Profit before taxes was 11.33 billion Egyptian Pound (719.08 million USD). Information obtained from CIB website: https://www.cibeg.com/en

5. The Export Development Bank (EBANK)

EBANK was founded in 1983 to boost and facilitate the Egyptian exports for economic sectors. EBANK is a joint venture with a share of 16.32 % for private sector, 42.93% the share of NBE and BM (public Banks), and the share of 40.75 for the National Investment Bank (government bank). EBANK financial statement in 2021 for total deposits was 64.39 billion Egyptian pound (4.09 billion USD). Total provided loans was 34.97 billion Egyptian pound (2.22 billion USD). Profit before taxes was 246.33 million Egyptian Pound (15.64 million USD). EBANK has 42 branches with 82 ATMs across the country. Information is obtained from the EBANK website: https://ebank.com.eg/

6. Egyptian Gulf Bank (EG BANK)

EG BANK is a joint venture in which the Egyptian part has a share of 21% whereas Gulf investors have a share of 79%. EG BANK was established in 1981. The bank has 73 branches with 130 ATMs. EG BANK financial statement for 2021 revealed total deposits of 64.4 billion Egyptian pound (4.09 billion USD). Total provided loans was 23.25 billion Egyptian pound (1.48 billion USD). Profit before taxes was 1.56 billion Egyptian pound (99 million USD). Information is obtained from EG BANK website: https://www.eg-bank.com/En/Index

7. Arab Investment Bank (AIBANK)

AIBANK was established in 1974 as an investment and commercial bank under the supervision of the Central Bank of Egypt (CBE). AIBANK started its operations in 1978 with a capital of 40 million USD. In October 2021, shareholder's structure has been changed where the share of private sector has been raised to be 51% and the share of the government was declined to 49%. The capital has been raised to 5 billion Egyptian pound (317.46 million USD). The bank has 33 branches with 80 ATMs. AIBANK financial statement for 2021 has total deposits of 38.73 billion Egyptian pound (607.62 million USD). Profit before taxes was 471.68 million Egyptian pound (30 million USD). Information is obtained from the AIBANK website: https://www.aibegypt.com/en/

8. Housing Development Bank (HDB)

HDB was established in 1979 as a specialized bank in the field of housing and urban development. HDB has100 branches with 400 ATMs. Owing to HDB financial statement for 2021, total deposits was 61.82 billion Egyptian pounds (3.92 billion USD). Total provided loans was 23.78 billion Egyptian pounds (1.51 billion USD). HDB profit (before taxes) was 2.57 billion Egyptian pound (163.17 million USD). Information is obtained from the HDB website: https://www.hdb-egy.com/en/

B. Arab and Foreign Banks

This section includes Arab and foreign banks that have branches in Egypt

1. Alexandria Bank (ALEXBANK)

ALEXBANK was Established in 1957 as a fourth government bank, In 2007 80% of the government ownership was sold to the Italian group Intesa Sanpaolo and the share of the Egyptian government became 20%. ALEXBANK owns one of the largest private sector branch networks with a total of 175 branches across the country with 425 ATMs with about 1.6 million customers. According to ALEXBANK financial statement for 2021, total deposits was 95.72 billion Egyptian pound (6.08 billion USD). Total provided loans was 51.41 billion Egyptian pound (3.26 billion USD). Profit before taxes was 3.99 billion Egyptian pound (253.33 million USD). Information obtained from bank website: https://www.alexbank.com/en/

2. Ahly United Bank (AUB)

In August 2006 , AUB, as group of investors was acquired a 89.3% stake in Egypt's Delta International Bank which is officially renamed Ahli United Bank Egypt. AUB Egypt operates 42 branches across the country with 120 ATMs. The Financial statement of AUB in 2021 showed total deposits of 53.51 billion Egyptian pound (3.4 billion USD). Total provided loans was 36.72 billion Egyptian pound (2.33 billion USD). AUB profit before taxes

was 1.33 billion Egyptian pound (84.44 million USD). Information obtained from AUB website: https://www.ahliunited.com/eg/

3. AUDI Bank, Egypt (AUDI)

AUDI is a Lebanese banking group established in 1830 in Lebanon. AUDI bank, Egypt launched its operations in Egyptian market after the acquisition of Cairo Far East Bank in 2006. Audi established 69 branches with 283 ATMs, as opposed to a mere 3 branches at the time of acquisition. Capital was raised to be 427 million USD in December 2020. In 2022, the First Abu Dhabi Bank Group (FAB) has officially a share of 100% of AUDI Egypt and name has been changed after acquisition to FABMISR1. AUDI's Financial statement in 2021 revealed that total deposits was 93 billion Egyptian pound (5.9 billion USD). Total provided loans was 34.9 billion Egyptian pound (2.22 billion USD). Profit in before taxes was 1.53 billion Egyptian pound (96.95 million USD). Information is obtained from the AUDI website: https://www.bankAUDI.com.eg

4. Qatar National Bank (QNB AL AHLI)

QNB ALAHLI is established in April1978 with the name NSGB. In 2013 QNB Group acquired the majority stake of NSGB, and its name was changed to QNB ALAHLI. QNB has been expanding its activities to provide banking services to individuals and corporates. QNB is ranked as the second largest private bank in Egypt. QNB provides its services for more than 1,403,658 clients with a network of 232 branches, along with 900 ATMs. QNB financial statement in 2021 showed total deposits of 296.24 billion Egyptian pound (18.81 billion USD). Total provided loans was174.64 billion pound (11.09 billion USD). Profit before taxes was 10.58 billion Egyptian pound (689.03 million USD). Information obtained from QNB website https://www.qnbalahli.com/sites/qnb/qnbegypt/page/en/

5. Crédit Agricole Egypt (CA)

CA was launched in 2006, CA is a European bank in Egypt. CA is committed to bring its international expertise to local market to serve its clients a in line with Egypt's national priorities.CA provides its services in Egypt via 83 branches with 302 ATMs. CA financial statements in 2021 reveals that the total customers' deposits was 48.21 billion Egyptian pound (3.06 billion USD). Total provided loans was 29.57 billion pound (1.88 billion USD). Profit before taxes was 2.23 billion pound (141.75 million USD). Information obtained from CA https://www.ca-egypt.com/en/

6. The Hongkong and Shanghai Banking Corporation Limited (HSBC)

HSBC Bank Egypt was established in 1982 as the Hong Kong Egyptian Bank. The bank was rebranded HSBC Bank Egypt in 2001 after increasing HSBC Group shareholding from 40 percent to more than 90 percent of its issued share capital. HSBC has 43 branches in Egypt. HSBC clients have the ability to benefit from using more than 24000 ATMs across the World. HSBC

financial statements in 2021 disclosed total deposits with106.45 billion Egyptian pound (6.76 billion USD). Total provided loans of 33.14 billion Egyptian pound (2.10 billion USD). Profit before taxes was 4.98 billion Egyptian pound (316.04 million USD). Information is obtained from website: https://www.hsbc.com.eg/

7. The National Bank of Kuwait (NBK)

In 2007, NBK concluded the acquisition of Al Watany Bank of Egypt (AWB). In 2008, the capital of NBK Egypt was increased to one billion Egyptian pounds (200 million USD). NBK has 53 branches with 137 ATMs across the country. In 2021, the paid capital was increased to five billion Egyptian pound (317.46 million USD). The NBK financial statements in 2021 revealed that total deposits was 62.02 billion Egyptian pounds (3.94 billion USD). Total provided loans was 40.73 billion pound (2.59 billion USD). Profits before taxes was 2.2 billion pound (139.68 million USD). Information obtained from NBK website https://www.nbk.com/egypt.html

8. Emirates National Bank Of Dubai (ENDB)

ENDB joined the Egyptian market on June 2013 through the acquisition of the BNP Paribas subsidiary in Egypt. The bank is currently operating with 67 branches and units with 375 ATMs wide geographic coverage in Egypt including major districts and cities.

According to ENDB financial statements in 2021, total deposits was 67.58 billion Egyptian pound (to 4.29 billion USD). Total loans was 38.88 billion Egyptian pound (2.47 billion USD). Profit before taxes was 959.1 million Egyptian pound (60.9 million USD). Information is obtained from ENDB website https://www.emiratesnbd.com.eg/egypt-en/

9. BLOM Bank Egypt (BLOM)

BLOM is a commercial bank offering banking and financial services, with a paid capital of 3 billion EGP. It has a branch network of 41 across the country with 81ATMs. BLOM and Bank ABC Egypt were legally merge in 2022. BLOM financial statements in 2021 exposed total deposits of 42 billion Egyptian pound (2.67 billion USD). Total loans was 12.78 billion Egyptian pound (811.14 million USD). Profit before taxes was 1.22 billion Egyptian pound (77.76 million USD). Information is obtained from BLOM website: https://www.blombankegypt.com/BlomEgypt/Home

10. Arab International Bank (AIB)

AIB was established in 1974 by virtue of an international treaty concluded by the governments of Egypt, Libya, Oman, Qatar, and United Arab Emirates. The purpose of the Bank is to carry out all the banking activities, especially for the interest of the member states. AIB has 22 worked branches in Egypt with 45ATMs. According to AIB financial statements for 2021, total deposits was 4.21 billion USD. Total provided loans was 557.1 million USD. Profit was 23.35 million USD. Information is obtained from AIB website: https://www.aib.com.eg/

11. Société Arabe Internationale de Banque (SAIB)

SAIB was established in 1976, as the first joint Arab Bank working in Egypt. The bank executed all banking activities. SAIB has 37 branches across the country with 123 ATMs. Owing to SAIB financial statements for 2021, total deposits was 3.96 billion USD. Total provided loans was 2.59 billion USD. Profit before tax was 48.90 million USD. Information is obtained from SAIB website: https://www.saib.com.eg/en/

12. Abu Dhabi Commercial Bank (ADCB)

ADCB Egypt was established in 2020 through the acquisition of UNB. With a vision to be the most preferred Bank to its customers. The financial statements for the study period from 2010 to 2020 are belonged to the UNB and for 2021 for ADCB due to acquisition. ADCB has 49 branches spread across governorates with more than 450 ATMs. ADCB financial Statements in 2021 revealed that total deposits was 41.11 billion EGP (2.61 billion USD). Total provided loans was 21.22 billion EGP (1.35 billion USD). Profit before tax was 1.06 billion EGP (67.44 million USD). Information is obtained from ADCB website: https://www.adcb.com.eg/

13. Al Ahli Bank of Kuwait Egypt (ABK)

Al Ahli Bank of Kuwait (ABK) was established in Kuwait in 1967. In November 2015, ABK acquired Piraeus Bank Egypt as part of its plans to expand its regional presence in Egypt. ABK has a network of 44 branches with 109 ATMs. The ABK financial Statements for 2021 disclosed total deposits of 47.87 billion EGP (3.04 billion USD) .Total provided loans was 26.72 billion EGP (1.70 billion USD). Profit before tax was 1.31 billion EGP (83.17 million USD). Information is obtained from ABK website: https://www.abkegypt.com/

14. Suez Canal Bank (SC Bank)

SC bank was established in 1978. The Egyptian joint stock company offers reliable personal, corporate and Islamic banking through 49 branches with 210 ATMs across the country. SC bank adopts the best strategies for unmatched security and profitability. SC bank financial Statements for 2021 showed total deposits of 50.59 billion EGP (3.21 billion USD). Total provided loans was 23.06 billion EGP (1.46 billion USD). Profit before tax was 1.05 billion EGP (66.67 million USD). Information is obtained from the SC bank website: https://scbank.com.eg/index.aspx

15. Arab Banking Corporation (ABC)

ABC bank in Egypt is a subsidiary of ABC Group with a presence in 15 countries. The bank has 25 retail branches & 83 ATM spread across Egypt. According to ACB financial statements for 2021, total deposits was 562.7 million USD . Total provided loans was 292. 08 million USD. Profits before tax was 10.49 million USD. Information is obtained from ABC website: https://www.bank-abc.com/world/egypt/en/

C. Islamic Banks

This section includes working Islamic banks in Egypt

1. Abu Dhabi Islamic Bank -Egypt (ADIB)

ADIB started its operations in Egypt after the acquisition of the National Bank for Development (NBD), through the Emirati consortium between Abu Dhabi Islamic bank and Emirates International Investment Company (EIIC) in 2007. Following the acquisition, paid capital increased from 281million 4 billion Egyptian pound. ADIB Egypt provided a growing portfolio of Sharia compliant products and services across a network of 70 branches with 90 ATMs. ADIB financial statements for 2021 shown total deposits of 75.68 billion EGP (4.81 billion USD) Total provided loans was 45.29 billion EGP (2. 88 billion USD). Profit before tax was 2.28 billion EGP (144.76 million USD). Information is obtained from ADIB website: https://www.adib.eg/

2. Faisal Islamic Bank of Egypt (FIBE)

FIBE is the first Egyptian Islamic bank. The Bank officially started its operations on 5th July 1979. FIBE is a bank operated in accordance with the Islamic Sharia as a model for Islamic banking. The Bank's capital reached one billion USD by the end of 2020. Serving more than 1.7 million accounts. FIBE is operated via 38 branches with 415 ATMs. FIBE financial statements in 2021 revealed total deposits of 109.56 billion Egyptian pound (6.96 billion USD). Total provided loans 30.5 billion Egyptian pound (1.94 billion USD). Profit before taxes was 4.35 billion Egyptian pound (276.19 million USD). Information is obtained from the FIBE website: https://www.faisalbank.com.eg

3. Al baraka Bank Egypt

Al baraka bank Egypt is established in 1980 as an Islamic bank. The bank operates through a network of 33 branches covering Cairo, Alexandria and Delta with 102 ATMs. Bank aims to have a geographical expansion via increasing the number of branches across country by the end of 2025. The bank is serving more than 150,000 clients. Financial statements for Al baraka bank in 2021 illustrated total deposits with 72.57 billion EGP (4.61 billion USD). Total provided loans was 23.6 billion EGP (1.50 billion USD). Profit (before taxes) was 1.75 billion EGP (111.11 million USD). Information obtained from bank website: https://www.albaraka.com.eg/

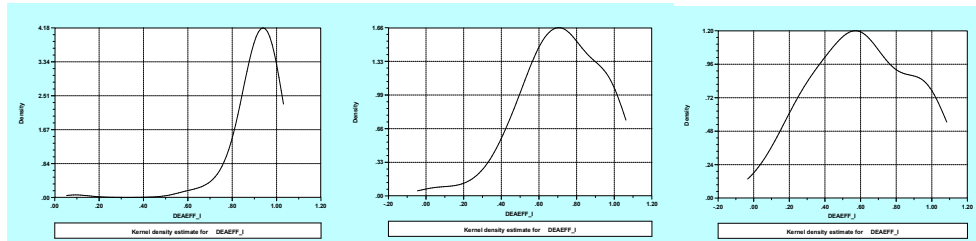**Appendix B: Technical Efficiency scores for Domestic, Arab & Foreign and Islamic Banks**

Figure 1.a Deposits' TE for domestic banks   Figure 1.b Loans TE for domestic banks   Figure 1.c Investments TE for domestic banks
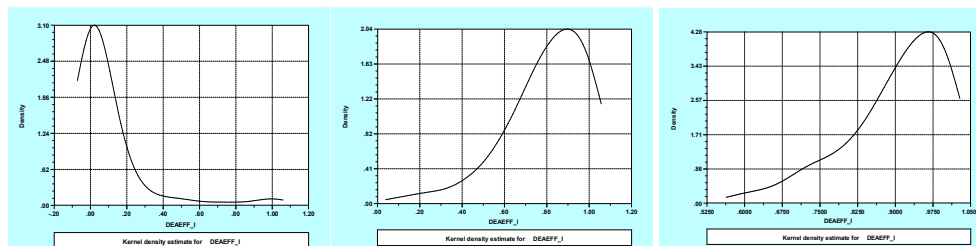
Figure 1.d net profits TE for domestic banks   Figure 1.earning assets TE for domestic banks   Figure2.a Deposits' TE for Arab banks
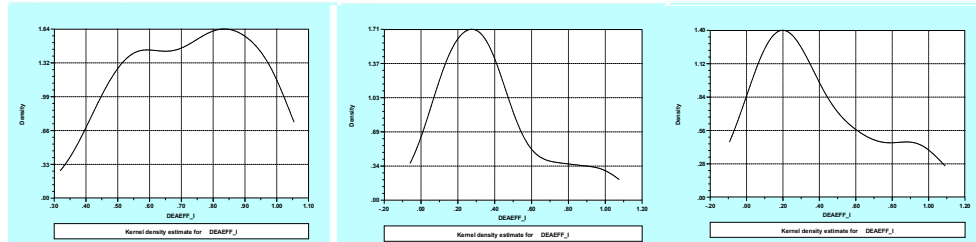
Figure 2.b Loans TE for Arab banks   Figure 2.c Investments TE for Arab banks   Figure 2.d net profits TE for Arab banks
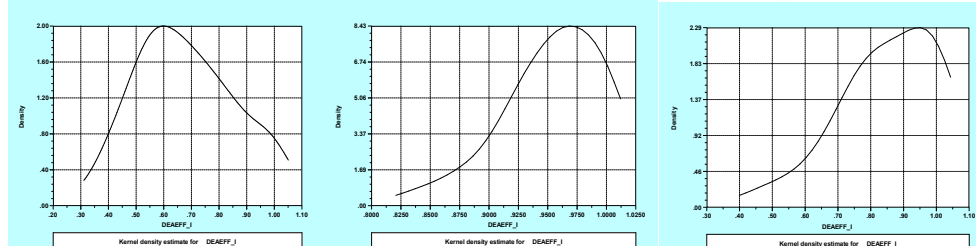
Figure 2.e earning assets TE for Arab banks   Figure 3.a Deposits' TE for Islamic banks   Figure 3.b Loans for Islamic banks
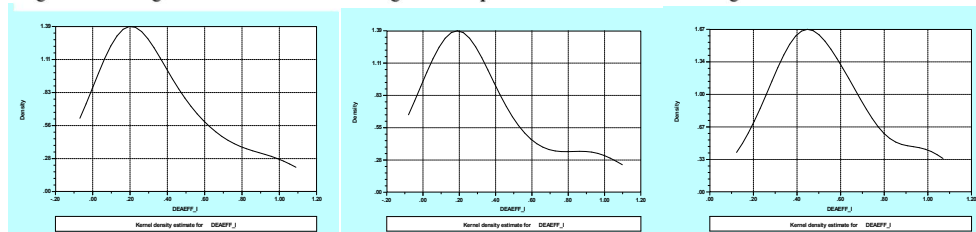
Figure 3.c Investments TE for Islamic banks   Figure 3.d net profits TE for Islamic banks   Figure 3.b earning assets for Islamic banks
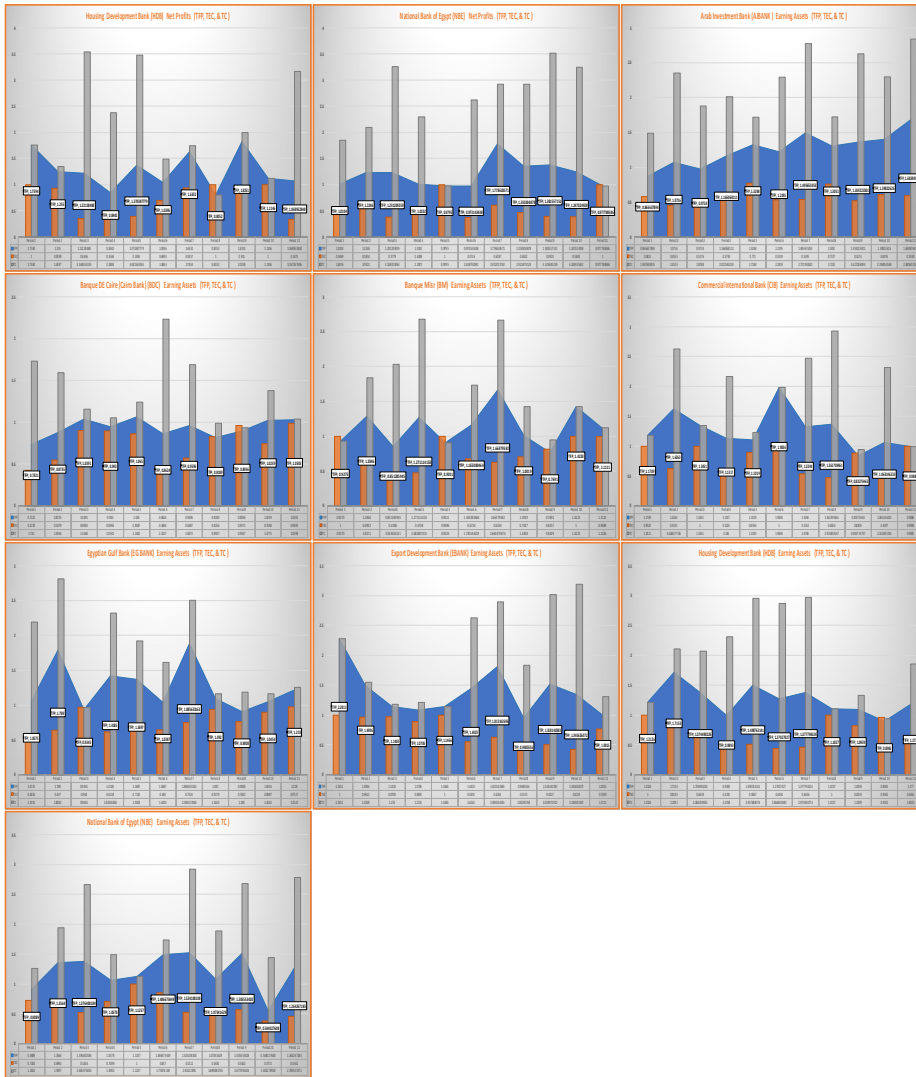
Appendix C: TFP, TEC, and TC for domestic banks
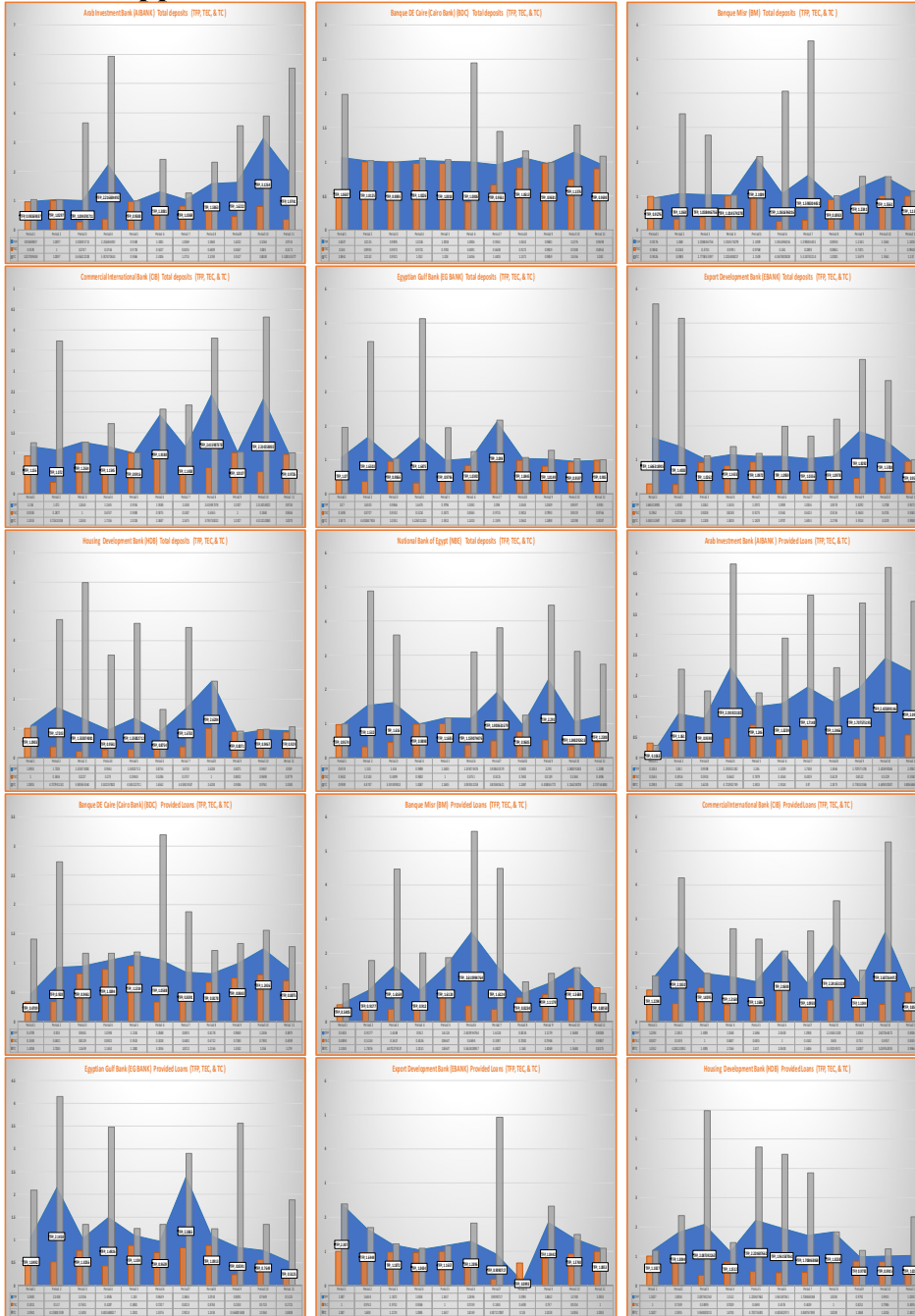
Appendix C: TFP, TEC, and TC for domestic banks
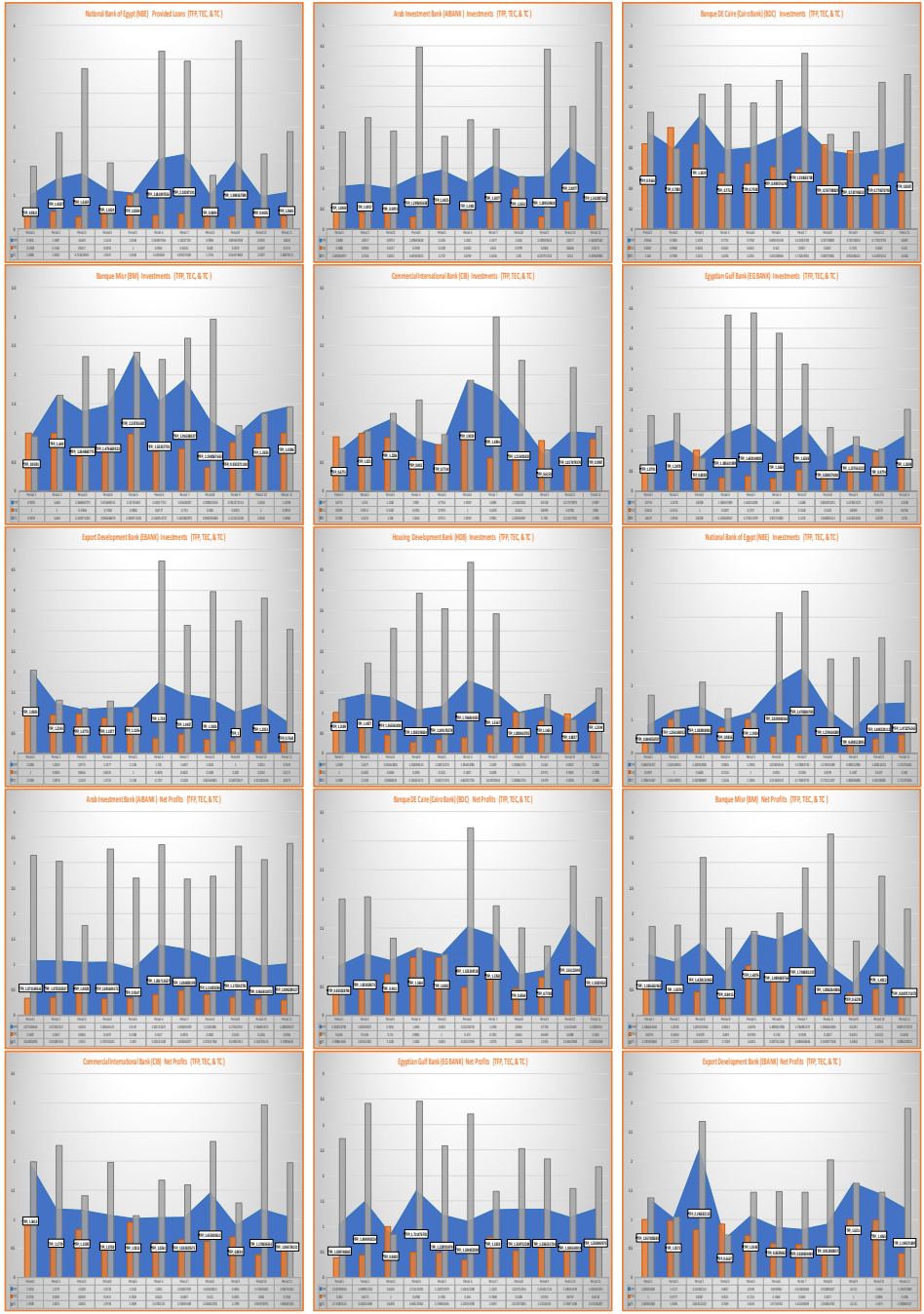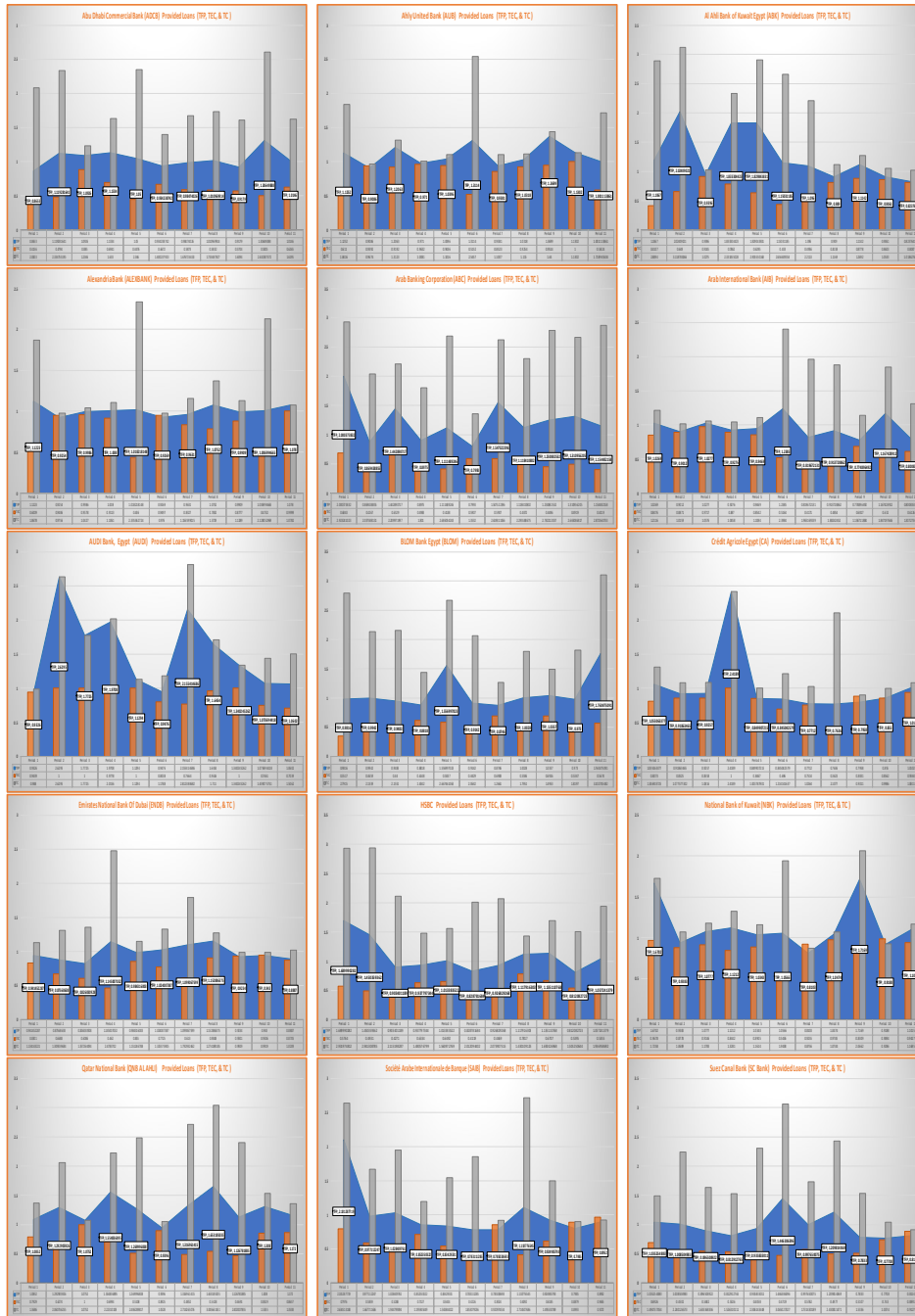
Appendix C: TFP, TEC, and TC for domestic banks

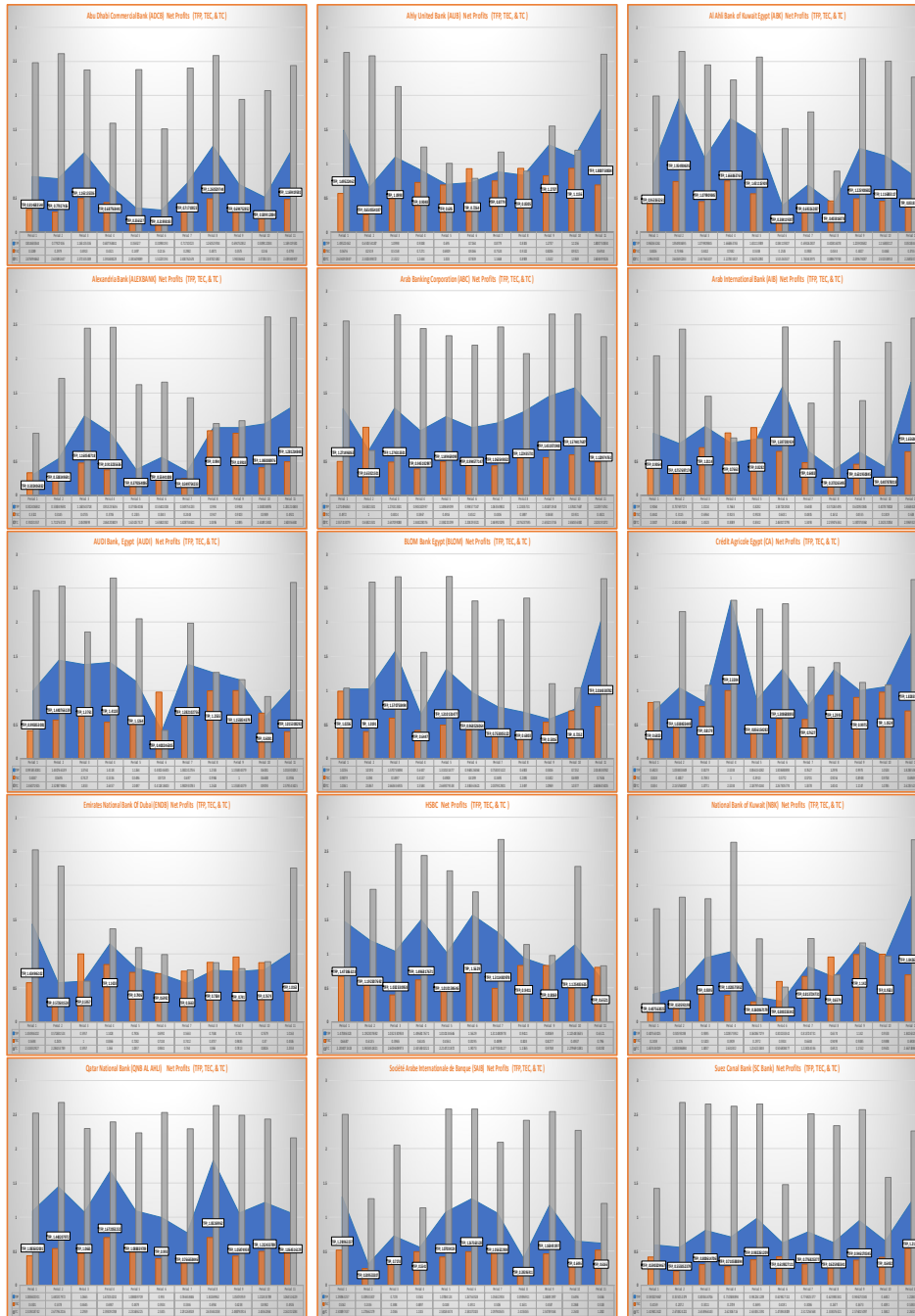# Appendix D: TFP, TEC, and TC for Arab and foreign banks

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Appendix E: TFP, TEC, and TC for Islamic banks