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The Efficiency of the Banking System in Occupied Palestinian Territory (OPT) 2000–2009

Abstract: This study estimates the cost (technical) efficiency of the banking system in Occupied Palestinian Territory (OPT), using a panel of 18 banks during the period 2000–2009. Estimates have been obtained using the stochastic frontier approach. The analyses were extended to cover bank ownership (foreign and local), type (Islamic and commercial) and bank size. Results indicate that the overall cost (technical) efficiency of banks in the OPT is declining during the period of research. The mean of cost and technical efficiency was found to deteriorate through the years. Cost efficiency declined from 0.730 in 2000 to 0.666 in 2009, while technical efficiency declined from 0.733 to 0.713 during the same period. Moreover, the lower allocative efficiency (incorrect input mix rather than utilization or wasting resources) is the main cause of the decline in cost efficiency over the period of analysis. In addition, large banks have lower cost efficiency, which indicates the presence of diseconomies of scale for banks in OPT.

Keywords: Occupied Palestinian Territory, banking, efficiency, stochastic frontier, data envelopment analysis

JEL Classification: D61, G14, G21, C73

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1 Introduction

Palestinian–Israeli peace negotiations, and the subsequent Oslo Accords in 1993, resulted in the establishment of an interim authority in the West Bank¹

¹ Although Jerusalem is an integral part of the West Bank that was occupied in the 1967 war, Israel denies West Bank residents and institutions access to Jerusalem. Thus, all references to

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and Gaza Strip. This has had a great impact on the development of different economic and social sectors. The banking industry was one of those sectors that flourished after the peace agreement. An emerging central bank – Palestine Monetary Authority (PMA) – was established in 1995. New Palestinian banks were licensed to operate and to open new branches under the supervision of PMA. Number of licensed banks has come to 20 banks with 209 branches by the end of 2009, including 10 foreign banks with 105 branches and 3 Islamic banks.² Despite this flourishing period, the Palestinian economy and banking sector in particular are working under extraordinary economic and political conditions, which affect their capability and efficiency. Several factors and exogenous variables distorted market competition, efficiency and the development of banking services; the PMA has no monetary policy tools to control the market; there are no inter-banking tools to regulate the inter-relationships between banks and there are three different currencies circulating in the Palestinian economy [New Israeli Shekel (NIS), US dollar (USD) and Jordanian Dinar (JD)].

Banks in OPT are exposed to various financial, political and economic risks due to the abnormal political and economic conditions in which the Palestinian economy is operating. One example is the presence of three different foreign currencies instead of a national one. This absence of a national currency prohibits PMA from conducting its own monetary policy. It has, however, been playing many of the functions of a central bank, and most importantly, reinforcing domestic and international confidence in the Palestinian monetary and financial system. The overall purpose of the PMA is to regulate and supervise banks in OPT and to implement and operate modern and efficient payment systems. In doing so, the PMA is assisting in maintaining the stability of the Palestinian financial system and promoting sustained economic growth.

This study will analyze the efficiency, cost structure and determinants of efficiency in the Palestinian banking during the period 2000–2009. A number of parametric and non-parametric tests have been employed to measure the efficiency of banking industry in the OPT and to investigate whether domestic banks are more efficient than foreign banks or vice a versa. Another goal of this study is to identify the determinants of banking efficiency in the OPT; in this regard, the effect of some factors on efficiency will be examined. First, we want to investigate how bank size affects efficiency. Another set of variables are included to capture the influence of different institutional aspects, such as

the West Bank are not inclusive of Jerusalem due to lack of any data on Palestinian banking in

² Seven banks were working in 1994 with 33 branches; 5 out of those 7 banks were foreign with 24 branches.

capitalization, overhead costs per employee, asset quality measured as ratio of provision loans to total loans and asset growth.

Being a small economy with many foreign banks, no national currency and in a volatile regional environment implies that the banking system in the OPT is highly responsive to the external shocks which hamper baking performance.³ An example of such shocks is exchange rate fluctuations, which are expected to affect the depositor and bank behaviors.

The importance of this study stems from the vital need of both bankers and policy makers to track improvements and understand mechanisms through which banking efficiency is achieved. Advancing efficiency will improve financial services and lead to a higher volume of funds available in the market. This in turn opens more doors for the banking system to contribute to economic development. Moreover, as efficiency is an important indicator of good performance of individual banks and the productivity of the industry as a whole, measuring efficiency enables banks management, supervisory institutions and policy makers to spot weaknesses in the banking system and identify banks that might face future problems, giving way for precautious measures. This is particularly crucial in light of recent PMA attempts to enhance the Palestinian banking performance and efficiency, as this study will help policy makers and regulators evaluate policy repercussions and provide suggestions to remedies if necessary.

It should be noted that analyzing banking efficiency takes on an added significance in the case of Palestinian banks as they face increasing competition from their foreign counterparts (mainly Jordanian banks) and other financial institutions offering financial services. Finally, measuring banking efficiency can provide some policy implications for issues such as mergers and efficient number of branches.

The literature on banking efficiency in OPT is scant; Odeh (2007) used the translog function to examine and analyze the main characteristics of the production operation of the banking sector in OPT during the period 1996–2005. Al-khalil and Makhool (2004) analyzed credit risks of the Palestinian banking system in a master thesis, which estimated the influence of credit policies on private investment. In addition, Makhool (2006) measured the individual's satisfaction of banking services provided. Therefore, this study is one of the first to specifically address the efficiency of the banking system in OPT.

³ External shocks are usually represented in Israeli measures, such as closures, curfews, controlling borders and restrictions on the movement of people and goods, as well as exchange rates fluctuation.

2 Sample and Variables Selection

The sample data include an unbalanced panel of 18 banks during the period of 2000-2009 representing 174 observations, which account for more than 95% of banking assets in the time period under consideration. Hence, 17 banks were included each year for 2000-2005, while 18 banks were included each year for 2006–2009, this is because Al-Rafah bank started providing services in 2006.⁴

Table 1 shows notable variations between banks in OPT over the sample period 2000–2009. Minimum total cost (TC, \$0.50 million), for example, is too far from the maximum of \$101.87 million. Minimum total assets (\$13.67 million) are very small compared with a maximum of \$2560.43 million. In addition, some banks are running with zero non-performing loans, while others have over \$34.16 million. This suggests a variation in the effectiveness of banks working in OPT over time.

Figure 1 depicts the change in TC compared to the change in outputs (i.e. investment plus total credit facility (TCF)) of banks in OPT. It shows that both have the same trend as both have increased during the period of 2001–2005, and when output decreased during 2006 and 2008-2009, TC also decreased. This might imply that banks in OPT lack long-term strategies to control costs or, at least, do not consider efficiency when setting them, possibly due to the instability of the political environment.

Figure 2 shows that the price of deposits has a major role in determining the behavior of TC of banks in OPT. This implies that banks do use the price of deposits to control their costs, i.e. TC declined when the price of deposits is reduced and vice a versa. This shows the fact that banks do not have long-term strategies. It also indicates that banks reduce their costs at the expense of the depositors by cutting interest expenses. Finally, it implies that banks in OPT are affected by global markets through the price of deposits, as banks use LIBOR as a benchmark for interest rates on deposits in OPT due to the absence of a national currency.

Table 2 reports the *average* of TC, inputs and outputs indicators according to some selected years, bank ownership and bank size. It indicates that average cost (AC) has a decreasing trend over the study period, where it declined from about \$0.084 in 2000 to \$0.047 per unit of output in 2009. This is mostly due to banking reforms that occurred during the study period, especially 2006-2009, when a new structural plan was introduced by the PMA in the aims of increasing

⁴ Panel data is preferable in order to be able to observe each bank more than once over a period of time, which is a critical issue in a changing business environment (Isik, and Hassan 2002). Moreover, panel data provide larger sample size, and therefore, more degrees of freedom, accounting for time variations in efficiency and generating a more satisfactory solution to biases produced by heterogeneity within the dataset (Irsova 2010).

transparency, further regulating the banking sector and tightly supervising banks.

TC fluctuations for all banks over the period of study (2000–2009) are mainly a result of interest expense fluctuations, as this expense accounts, on average, for about 37% of TC over the study period. Table 2 also shows an increase in average input and output variables and prices of capital and labor and a decrease in the price of deposits over time. As expected, the rise in prices of capital is due to the increase of depreciation and amortization of fixed assets over time. While prices of deposits decreased as a result of banks attempting to control their expenses as well as the decline in global interest rates (LIBOR).

As for banks' ownership, Table 2 shows variations between foreign and domestic banks. AC per unit of output of foreign banks is \$0.003 lower than that of domestic banks. Therefore, we might expect foreign banks to be more efficient. In general, foreign banks dominate domestic ones in the input and output markets. Inspection of the price of labor across groups shows that foreign banks pay higher wages and benefits than domestic ones. Over the period of study (2000–2009), foreign banks paid their employees an average of \$21,000 per year, while domestic banks paid an average of \$16,500.

The analysis of the price of capital, measured as the ratio between nonpersonal expenses over total assets, also reveals that foreign banks pay much higher prices (each bank paying an average of \$1.22 million) than do domestic banks (each bank paying an average of \$0.46 million). Hence, foreign banks might be paying more rent for offices and equipment, and they are paying more interest expenses and other financing charges than domestic banks.

Domestic banks, however, paid a lower price for funds; each bank paid an average of \$17,100 compared to \$21,800 for each foreign bank as interest expenses over the period of study 2000-2009. This can be attributed to the fact that foreign banks acquire most of the Palestinian deposits,⁵ (Interest expenses for foreign banks are \$5.94 million, compared to 2.28 million for domestic banks during the same period). In other words, domestic banks need to pay higher interest rate on deposits to attract more deposits.

As for size, large banks pay a lower price of funds compared to medium- and small-sized banks, as the latter pay higher prices to attract more deposits and other sources of funds. Large banks also have a relatively low AC compared to medium- and small-sized banks (Figure 3). In addition, Figure 3 shows the variation of AC of banks before 2006 were higher than they were post 2006.

⁵ Each foreign bank acquires an average deposits of \$350 million compared to \$155 million for each domestic bank.

3 The Model

This study uses the stochastic frontier approach (SFA), as developed by Aigner, Lovell, and Schmidt (1977)), to estimate cost and technical efficiency. The choice of SFA (parametric approach) over data envelopment approach – DEA (non-parametric approach) is justified on the grounds that even though DEA imposes less structure on the efficiency frontier than SFA, they have the drawback of not allowing for random errors, data problems or other measurement errors. Christos et al. (2008) argued that applying DEA in transition economies is a significant disadvantage because uncertainty and measurement problems loom large. On the contrary, SFA allows for measurement error, and the generation of firm-specific efficiency estimates, which are important for bank managers in order to improve their operational efficiency. The fundamental element of the SFA is that each bank potentially produces less than it might because of a degree of inefficiency, specifically:

$$q_{it} = f(x_{it}, \beta) \times \zeta_{it}$$
 [1]

where q_{it} is output, the x_{it} are input quantities, β is a vector of technology parameters to be estimated and ξ_{it} is the level of technical efficiency for bank i at time t; ξ_{it} must be between 0 and 1. If $\xi_{it} = 1$, the bank is achieving the optimal output with the technology embodied in the production function $f(x_{it}, \beta)$. When ξ_{it} < 1, the bank is not making the most of the inputs (x_{it}) given the technology embodied in the production function $f(x_{it}, \beta)$. The degree of technical efficiency is assumed to be strictly positive since the output is assumed to be strictly positive.

Furthermore, output is also assumed to be subject to random shocks, implying that

$$q_{it} = f(x_{it}, \beta) \times \zeta_{it} \times \exp(\nu_{it})$$
 [2]

Taking the natural log of both sides, assuming that there are k inputs and the production function is linear in logs, and defining $u_{it} = -\ln \xi_{it}$ yields:

$$\ln q_{it} = \beta_0 + \sum_{j=1}^k \beta_j \ln x_{jit} + v_{it} - u_{it}$$
 [3]

The study uses cost function approach instead of the profit function approach for mainly two reasons: The profit function requires price data for outputs, and this is difficult to construct in case of Palestinian banking system. The profit function specifies both inputs and outputs, which implies that the number of parameters is significantly higher than that for a cost function. Thus, degrees of freedom become a more severe constraint (Kraft and Tirtiroglu 1998).

Kumbhakar and Lovell (2000) provided a detailed cost version, and they show that performing an analogous derivation in the dual cost function problem allows us to specify the problem as:

$$\ln(C_{it}) = \beta_0 + \beta_q \ln(q_{it}) + \sum_{i=1}^k \beta_i \ln(P_{jit}) + \nu_{it} - au_{it}$$
 [4]

where C_{it} is cost and P_{iit} are input prices, and

$$a = \begin{cases} 1, & For production function \\ -1, & For cost function \end{cases}$$

Intuitively, the inefficiency effect is required to lower output or raise expenditure, depending on the specification.

A likelihood ratio (LR) test was conducted to determine the frontier functional form. The test indicated that the translog functional model is more representative than the Cobb-Douglas model. Thus, a translog function with composite error is used to measure the efficiency of banks in OPT. The parameters of stochastic frontier model are estimated by the maximum likelihood (ML) method. The stochastic cost function is defined as (Kraft and Tirtiroglu 1998):

$$\ln C_{it} = a_0 + \sum_{i=1}^{2} a_i \ln Q_{it} + \sum_{m=1}^{3} b_m \ln P_{mt} + \frac{1}{2} \sum_{n=1}^{3} \sum_{m=1}^{3} \alpha_{nm} \ln P_{mt} \ln P_{nt}$$

$$+ \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \beta_{ij} \ln Q_{it} \ln Q_{jt} + \sum_{i=1}^{2} \sum_{m=1}^{3} \delta_{im} \ln Q_{it} \ln P_{mt} + \sum_{i} \phi_i \ln Z_i + \nu_{it} + u_{it}$$
[5]

where subscript *i* denotes the cross-sectional dimension (banks), *t* stands for the time dimension, $\ln C_{it} = \text{the natural logarithm of TCs for a panel of } N \text{ banks and}$ time T; ln Q_{it} is the natural logarithm of bank outputs; ln P_m is the natural logarithm of the *m*th input price; a_i , b_m , α_{nm} , β_{ij} and δ_{im} are coefficients to be estimated. To ensure homogeneity of degree +1 of the cost frontier in input prices, it is assumed that $\sum_m b_m = 1$ and $\sum \alpha_{nm} = \sum \beta_{ij} = \sum \delta_{im} = 0$. Moreover, theoretical considerations suggest imposing symmetry on the cross-price and quantity effects (i.e. $\alpha_{nm} = \alpha_{mn}$, $\beta_{ii} = \beta_{ii}$ and $\delta_{im} = \delta_{mi}$). However, this study ensures homogeneity through normalizing cost and input prices by the price of capital before taking logarithms to impose linear input price homogeneity (Yildirim and Philippatos 2001). Z_i stands for a set of control variables, asset quality, bank size, equity and dummy variables.

The stochastic components v_{it} and u_{it} represent random errors and inefficiency errors, respectively. The random errors v_{it} are assumed to be uncorrelated across time and panel, and normally distributed with mean zero and variance $\sigma_{\nu}^{2} > 0$.

The components u_{it} are assumed to have a strictly non-negative distribution (it is often referred to as the *inefficiency term*) and it is provided by a truncated-normal distribution with mean μ^+ and variance $\sigma_{\mu}^2 > 0$ (Berger and De-Young 1997).

The sum $(v_{it} + u_{it})$ reflects technical and economic inefficiencies, as well as pure random shocks in the production process that might be due to careless handling and defective or damaged output. It also reflects unfavorable external events such as bad luck, climate and machine performance (Aigner, Lovell, and Schmidt 1977). The technical inefficiency term (u_{ht}) is defined as follows:

$$u_{ht} = \{\exp[-\eta(t-T)]\}u_h$$
 [6]

where technical inefficiency (u_{ht}) decreases, increases or constant over time depending upon whether $\eta > 0$, $\eta < 0$ or $\eta = 0$, respectively.

Similar to many other studies, the intermediation approach is applied in order to measure efficiency, which assumes that the main function performed by a bank is to channel funds between depositors and borrowers at the lowest possible cost (Gilbert and Wilson 1998; Kraft and Tirtiroglu 1998; Rezvanian and Mehdian 2002; Isik and Hassan 2002). According to the intermediation approach, banks are producing two outputs (loans and other investments) and employing three inputs (capital, labor and deposits).

The input vector includes Labor [LAB], the number of full-time employees⁶; Capital [CAP], the book value of premises and net fixed assets⁷; and total deposits [TD], which include time, saving and current deposits. Hence, TCs include both interest expenses and operating costs.8 Prices of inputs were computed in order to calculate cost (technical) efficiency; price of labor is derived by taking total expenditures on wages, salaries and employee benefits divided by the number of employees. Price of deposits is calculated by dividing interest expenses by total deposits. As for price of capital, there were several ways to calculate it. Olena (2005) calculated the price of capital as the depreciation of fixed assets divided by fixed assets. While Carvallo and Kasman (2005) consider the price of capital as the operating costs net of personnel expenses over fixed assets. Moreover, Yildirim and Philippatos (2001) measured the price of physical capital as the ratio of other operating expense to fixed assets. This study defines the price of physical capital as the ratio of non-personnel expenses over total assets. This is due to the unavailability of data on the yearly

⁶ Number of employees in 2006 was estimated as the average of employees in 2005 and 2007.

⁷ Net fixed assets equal to total fixed assets excluding depreciation and amortization.

⁸ TC includes personnel expenses and salaries, maintenance and leasing of buildings, car leasing and equipment, non-banking fees and commissions, insurance expenses, depreciation and amortization and insurance on deposits.

depreciation, though we cannot employ the ratio of non-personnel expenses to net fixed assets as unit price for capital.

The output vector includes total credit facility [TCF]⁹ and total investments [INV] which includes deposits of banks inside and outside OPT, subsidiaries, affiliates, minority interests, subordinated loans, securities available for sale, securities held to maturity and reserves for investments. Moreover, there are some covariates (factors), which are likely to affect banking efficiency in OPT; such as asset quality, bank size, bank ownership and banks' equity.

Bank size may be an important factor in explaining banking efficiency as some banking literature indicates (Roberta, Geraldo da Silva, and Benjamin 2010). Therefore, we test whether bank size can help explain efficiency. To construct this explanatory variable "bank size" we employ the classification provided by Roberta et al. (2010), which is the classification of the Central Bank of Brazil. All banks that add up to 75% of total banking assets are classified as large. Medium-sized banks are the banks that add up from 75% to 90% of total assets. Finally, small banks are the banks that add up from 90% to 100% of total bank assets.

3.1 Hypothesis to Be Tested

The main objective of this study is to investigate the incidence, magnitude and determinants of banking efficiency in OPT during 2000-2009. To achieve this goal, the study will focus on the following questions:

- (a) Does the banking system in OPT, as a whole, show any evidence of efficiency? A t-test will be conducted to test the null hypothesis that the banking system in OPT is fully efficient against the alternative hypothesis that the efficiency of banking system is less than fully efficient.
- (b) Did efficiency estimates improve during the period of interest (2000–2009)?
- (c) Do differences in bank size, bank ownership (foreign vs domestic), bank type (Islamic vs commercial), capitalization, overhead costs, number of employed workers, assets growth and quality of loan portfolio have any impact on banking efficiency in OPT?

4 Empirical Results

Stochastic cost frontier approach is used to generate estimates of cost (technical) efficiencies for each bank over the years 2000-2009. The ML function is used to

⁹ TCF includes loan, overdraft, leasing and provisions.

estimate the cost (technical) efficiency of all banks in OPT using the translog function (stochastic frontier cost function). Robustness tests were applied before running the translog model. Hence, Akaike information criterion (AIC) and LR test were used to choose among various specifications, the selected model (based on AIC) specifies the price of capital as the non-personal expenses divided by total assets.

The LR statistic is used to test whether technical inefficiency effects are not present in the model (i.e. banks in OPT are fully efficient). The null hypothesis is rejected and it is concluded that the inefficiency component is present in the TC. Moreover, a t-test is used to test whether cost (technical) inefficiency effects are not present in the model. The parameter $\hat{\lambda}$ which is defined by $\sigma_u^2/(\sigma_v^2 + \sigma_u^2)$, and it is ranging between 0 and 1, where $\hat{\lambda}$ is 0 implying a full technical efficiency. Hence, the null hypothesis of no cost (technical) inefficiency effects is rejected. In other words, results indicate a presence of cost (technical) inefficiency in the Palestinian banking system. Moreover, $\hat{\lambda} = 0.842$ implying that much of the variation in the composite error term (84.2%) can be attributed to the inefficiency component (Table 3).

LR test is used to test the null hypotheses that technical inefficiency effects are time invariant (H_0 : $\eta = 0$) and have a half normal distribution (H_0 : $\mu = 0$). The test indicates that the bank efficiency has a half normal distribution. This implies that the inefficiency terms are independently and identically distributed i. e. $u_i \sim iid N(u^+, \sigma^2_{ii})$. The time invariance of banking efficiency is rejected at the 5% level, that is the technical efficiency of banks in OPT is not constant over time. Hence $\eta < 0$ indicating that technical efficiency is decreasing over time (Table 3).

Table 3 also presents the estimation of the cost frontier function. Overall, results show a good fit and the signs of estimated coefficients are in line with the theory. The coefficients of the price of labor and funds have a positive and significant influence on TC at 1% level of significance. With respect to the elasticity of TC to the outputs (loans and investments), the estimated coefficients are both positive and statistically significant at the 1% level of significance. The coefficient on the cross-output term is negative and statistically significant at 1% level of significance, and the same applies to the cross-price term. Moreover, the coefficients of asset quality (non-performing loan/total loans) and equity are negative, though not statistically significant. On the other hand, results indicate that the global financial crisis (in late 2007) had a positive influence on TC of banks in OPT, though the coefficient is statistically insignificant. Furthermore, when all independent variables are set to zero, TC will be \$5.7 million.

Results presented in Tables 4 and 5 indicate that the AC (technical) efficiency of banks in OPT is in line with efficiency of those banks in the MENA region and some Arab countries. The overall AC and technical efficiency of

banks in OPT during the period 2000-2009 is about 69.8% and 72.3%, respectively. Ahmad (2000) found that the average overall cost efficiency of banks in Jordan during the period 1990-1996 was about 77.5% or 73.5% based on the econometric frontier approach and the mathematical programming approach, respectively. In addition, Poshakwale and Qian (2009) found that the average scores of cost efficiency of banks in Egypt are generally around 74.8% during the period of 1992-2007. Kablan (2010) predicted the AC efficiency to be around 76.5% in sub-Saharan Africa, 74% in eastern Africa and 76.6% in southern Africa, Bouchaddakh and Salah (2005) predicted the AC efficiency of the Tunisian banking system to be about 86% over the period 1997-2003. Empirical results for developing countries yield close levels of cost efficiency, for example, cost efficiency in Turkey was 68.5% in 1996 (Isik and Hassan 2002).

The overall cost (technical) efficiency of banks in OPT appears to have a downward trend; results in Tables 4 and 5 show that cost (technical) efficiency was 73.0% (73.3%) in 2000, 70.1% (72.6%) in 2004 and 66.6% (71.3%) in 2009. This fall might be attributed to different factors. OPT experienced fundamental and chronic economic and political abnormalities since the establishment of the Palestinian Authority in 1993; this has been exacerbated since the outbreak of the second intifada in late 2000, which added more costs on banks. An increase of employee compensations, which constitute more than 33% of the TC, lowers cost efficiency of banks in OPT. These compensations have also doubled during the 2000-2009 period to about \$103.6 million. Moreover, increasing competitiveness among banks encouraged more branching thus reducing cost (technical) efficiency. In addition, cost efficiency fell over this period partly due to PMA procedures and regulations in monitoring and supervision. These regulations enforced Basel II requirements, which induced relatively new and high costs. 10 Banks, for example, were obliged to install ATM machine for each new branch, to update and modify the accounting systems in line with modern standards; they were also obliged to commit to using effective banking supervision and standards of Basel II. Furthermore, banks were required to introduce new sections and careers, such as "Monitor compliance," which all entail new costs on banks. 11 Finally, banks lack long-term strategies. All these factors have contributed to raising overall banking costs and lowering cost efficiency.

¹⁰ The PMA seeks to become, over the medium term, the central bank for an independent and sovereign Palestinian state.

¹¹ Despite the decline of cost (technical) efficiency in the short term, as a result of developments of banking supervision and monitoring, it is expected that the return on these new developments is very high in the medium and long terms.

As for cost (technical) efficiency according to bank size, results show that small size cost efficiency (75.0%) is higher than that of medium (69.6%) and large size (62.4%). On the contrary, technical efficiency was lower in small banks (67.9%) than that of medium- (71.7%) and large- (79.2%) sized banks over the period of interest (Figure 4). This result coincides with Isik and Hassan (2002), which suggests a negative relationship between banks size and cost efficiency. This can be explained by the competition between small and large banks, where small banks compete with large ones primarily in populated urbanized (metropolitan) markets, and not in rural and remote markets. Therefore, small banks show more market discipline, which leads to higher cost efficiency. In addition, Hasan and Marton (2000) found a negative relationship between a bank's size and allocative efficiency as large banks might be perceived as too big to fail, which could lead to moral hazard behavior.

As for bank nationality, results show that foreign banks have higher cost efficiency (75.2%) compared with (62.7%) of local banks. On the contrary, local banks show higher technical efficiency (80.0%) than their foreign counterparts (66.5%) during 2000–2009 (Figure 5). A higher cost efficiency in foreign banks may be attributed to the high labor productivity (\$1,350 per worker), which is almost double that of local banks (\$790 per worker). Also, foreign banks have the advantage of having more experience than domestic banks, which provides some opportunities for foreign banks to utilize this comparative advantage.

In addition, domestic banks might be slower to adopt new technologies and make investments in automation. This is contrary to the finding of Isik and Hassan (2002), who found that for local banks, technical inefficiency is smaller than allocative inefficiency; which suggest that the dominant source of their cost inefficiency is allocative (regulatory) rather than technical (managerial).

Finally, commercial banks show higher cost efficiency (73.3%) than Islamic banks (53.5%), meanwhile technical efficiency (68.5%) is found to be lower than that of Islamic banks (90.5%) during the period of interest (Figure 6).

The low cost efficiency of Islamic banks is possibly due to the political conditions and adoption of anti-terrorism law by various countries around the world mainly by the USA and Israel. 12 This compelled Islamic banks to implement its banking transactions through a third party (i.e. third bank) which induces higher costs.

Moreover, Islamic banks provide their banking services according to the Islamic law (Al-Shariah) and adopt the principle of Musharakah (partnership in profit and loss); this imposes more risks on these banks due to the high

¹² Al-Aqsa Islamic bank was listed on the terrorism list since 2002 and it was prohibited from conducting any financial and/or banking transactions with the outside world.

uncertainty in OPT. Furthermore, the weak legal environment, the little attention given to Islamic banks by official institutions in the OPT as well as the lack of experience of these banks weaken their performance.¹³ This suggests that the dominant source of cost inefficiency in Islamic banks is allocative (regulatory) rather than technical (managerial). However, the higher allocative inefficiency relative to technical inefficiency implies that managers of Islamic, large and local banks in OPT performed relatively well at utilizing all factor inputs, but they were not so well at choosing the proper input mix given the prices.

Hence, overall banking inefficiency in OPT may be attributed to choosing the incorrect input mix rather than wasting resources. The reason for the high allocative inefficiency overtime might be the considerable volatility in factor prices due to exposure to external factors and shocks, such as exchange rate and interest rate fluctuations, and vulnerability of domestic prices, particularly in Israel (imported inflation). High uncertainty about input prices increases the likelihood of bank managers to make inefficient decisions. Political instability, movement and access restrictions and the absence of a national currency lead to deterioration in the performance of the Palestinian economy in general and both banking and financial sectors in particular.

5 Potential Determinants of Efficiency

Having estimated the cost efficiency scores of banks in OPT, the next step is to determine whether efficiency levels can be explained by specific factors. For this purpose, we provide an explanatory analysis by regressing cost efficiency against a number of financial and structural variables. Generalized least square (GLS) model was utilized to estimate correlation between cost efficiency and other determinants.14

¹³ Overstaffing is common in Islamic banks. Recently, some Islamic banks addressed this imbalance. Palestine Islamic Bank discharged about 50 workers within 2010 and 2011. This bank hired an average of 138 workers during 2000-2009 to produce about \$70 million output, whereas another bank produces about \$190 million with the same number of workers (133) during the same period.

¹⁴ A set of diagnostic tests were made before the running the GSL regression, such as Breusch-Pagan Lagrange multiplier (LM) test of random effects, which show evidence of significant difference across banks, as well as, Breusch-Pagan LM test which indicates that there is no cross sectional dependence (i.e. reject the null hypothesis that residuals are correlated across entities). Finally, a modified Wald test was used to test for groupwise heteroskedasticity. Results indicate the presence of heteroskedasticity and robust order is used to control for this problem.

Table 6 reports the results of the estimation of GLS regression. Overall results indicate that most coefficients are significant and in line with expectations. The coefficient of the size variable is negative and statistically significant at the 1% level, indicating a presence of diseconomies of scale. This result coincides with Odeh (2007), in which he argued that most Palestinian banks are either near or at the optimal size, which means that with more branching and expansion of banks in OPT since 2007, many banks may have moved across the scale to less inefficient production. Banks with higher ratio of non-performing loans to loans (LNPLR) are found to be less cost efficient as the coefficient of LNPLR is negative, but insignificant.

The GDP growth rate variable has a positive coefficient indicating that favorable economic conditions would improve banking efficiency. However, GDP growth rate and total asset growth rate have very low influence on cost efficiency. This is expected since many other factors affects cost efficiency of banks in OPT, such as political conditions and the relatively high uncertainty. Among market structure variables, the degree of competition, measured by Herfindahl-Hirschman index (HHI), has a positive influence on cost efficiency. This result suggests that banks operating in more competitive markets are under more pressure to control their costs by exercising their potential market power. Furthermore, foreign banks operating in OPT appear to be more cost efficient relative to local banks, though the coefficient is insignificant. The dummy variable representing the political instability and conflict has a positive and significant influence on cost efficiency of banks in OPT; this is mainly due to the conservative lending and investment policy adopted by banks during such conflict periods.

6 Conclusion

The analysis of the cost and technical efficiency of the banking industry in OPT during the period of 2000-2009 shows significant differences of cost (technical) efficiency between banks by type, nationality and size. Moreover, results show a downward trend of overall efficiency over the period of study. Despite having a downward trend, the overall average efficiency is in line with that of banks in some MENA and Arab countries.

Finding large and significant differences in cost efficiency in different groups of banks classified by ownership, type and size indicates that these banks are effected by regulatory and competitive environment in different ways. Small banks compete with large banks primarily in metropolitan markets, and therefore, show more market discipline, which leads to higher cost efficiency. Moreover, foreign banks have higher labor productivity, utilize their

comparative advantage of having more experience and adopt new technologies and automation. In the case of local banks, allocative inefficiency is a dominant source of cost inefficiency, revealing that these banks suffer from regulatory issues rather than managerial ones. The higher allocative inefficiency in the case of Islamic, large and local banks indicates that while these banks performed relatively well at utilizing all factor inputs, they did not choose the proper input mix given the vector of prices.

Results also show that the PMA regulations, such as strict banking supervision and monitoring, have a negative influence on banking efficiency. This could be explained by the increase in the cost of upgrading banking technology platforms, enlarging branch networks and managing diverse activities. However, the negative influence is expected to be in the short term, while it is expected that the positive effect of bank reforms will manifest itself in the medium and long term.

Appendix A

Table 1: Descriptive statistics of output and input variables (2000–2009).

Variable*	Definition	Mean	Std. Dev.	Min.	Max.
TC	Total cost	11.34	16.33	0.50	101.87
AC_b	Average cost (TC/total outputs)	0.055	0.021	0.024	0.125
TA	Total assets	303.8	496.0	13.7	2560.4
NPL	Non-performing loans	1.27	3.24	0.00	34.16
Outputs					
TCF	Total credit facility	84.14	125.27	1.20	736.50
INV	Total Investment	169.0	302.7	5.6	1495.5
Inputs					
LAB	Number of employees	198.5	217.6	11	874
TD	Total deposits	267.4	456.7	8.6	2313.6
CAP	Total fixed assets	7.09	9.69	0.05	51.85
Prices of i	inputs				
PC	Price of capital (operating costs net of personnel expenses / total assets)	0.01	0.01	0.003	0.04
PL	Price of labor (employees expenditure/total number of employees)	0.02	0.01	0.01	0.05
PD	Price of deposits (interest expenses / total deposits)	0.02	0.02	0.00	0.09

^a All variables are measured in \$ Million, except labor which represent number of employees.

 $^{^{\}rm b}$ Average cost (AC) measured in dollars per unit of output (AC = TC/(TCF+INV); Number of observation is 174.

Table 2: Mean of bank indicators^a.

Item	17	2	4	a	<u> </u>	>	ACb			INPUTS	0	OUTPUTS	Banks' No.
								ይ	LAB	CAP	TCF	N	
Year													
2000		0.648	0.016	0.044	10.36	2.84	0.083	225.9	183	6.04	71.3	141.2	17
2004		0.438	0.018	0.011	1.87	3.29	0.048	242.9	171	8.14	9.9/	155.1	17
2007		1.276	0.020	0.019	5.36	4.48	0.051	311.9	223	6.14	91.3	208.9	18
2009	11.98	1.858	0.023	0.007	1.88	5.75	0.047	365.3	244	7.68	122.6	201.3	18
Onwership													
Foreign		1.221	0.021	0.022	5.94	4.54	0.054	350.5	216	7.07	99.5	227.7	100
Domestic	7.38	0.455	0.016	0.017	2.28	2.83	0.057	155.0	174	7.11	63.3	9.68	74
Bank size													
Small		1.383	0.019	0.020	0.93	0.97	090.0	43.6	53	1.70	20.4	26.3	62
Medium	7.35	0.484	0.017	0.022	2.82	2.49	0.056	137.7	147	4.85	57.3	81.1	40
Large	26.49	0.495	0.019	0.018	10.48	8.86	0.049	638.2	444	16.45	195.2	437.7	55

Notes: This table shows the average outputs, inputs, and cost structure for 2000 – 2009; all variables are measured in million dollars, except for labor which is measured in numbers of employees.

a Means of variables are computed for all banks in some selected years (YEAR); means are computed for all banks over the period of study (2000 – 2009) according to ownership (OWNERSHIP) and bank size (BANK SIZE).

b AC represents the mean value of average cost for all banks for each year; AC by ownership was calculated for each bank over time and then the mean for all banks is reported above and likewise by bank size.

Table 3: The cost frontier function parameter estimates.

Variable	Coefficient	Std. Err.	<i>t</i> -statistic
Ln(PL)	0.713***	0.039	18.420
Ln(PD)	0.287***	0.039	7.410
0.5*Ln(PL2)	-0.105***	0.023	-4.500
Ln(PL)*Ln(PD)	-0.098***	0.024	-4.180
0.5*Ln(PD2)	0.203***	0.017	11.940
Ln(L)	0.663***	0.064	10.380
Ln(I)	0.293***	0.078	3.740
0.5*Ln(L2)	0.292***	0.024	12.120
Ln(L)*Ln(I)	-0.325***	0.026	-12.510
0.5*Ln(I2)	0.353***	0.035	10.140
Ln(PL)*Ln(L)	0.015	0.026	0.560
Ln(PL)*Ln(I)	-0.086***	0.026	-3.360
Ln(PD)*Ln(L)	0.025	0.019	1.350
Ln(PD)*Ln(I)	-0.006	0.018	-0.320
Ln(NPL/Loans)	-0.116	0.571	-0.200
Ln(Equity)	-0.003	0.027	-0.130
Dummy (d06)	-0.021	0.033	-0.640
Dummy (d08)	0.034	0.032	1.070
Constant	1.740***	0.163	10.690
Mu	0.400***	0.156	2.560
Eta	-0.032*	0.017	-1.890
Gamma (λ^)	0.842	0.075	
sigma_u2	0.063	0.034	
sigma_v2	0.012	0.001	
Number of observations		172	
Log likelihood function		106.3	

Note: ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

Table 4: Predictions of cost efficiency of banks in OPT.

Year		Ва	ınk size	Bank n	ationality	Bank type		TOTAL
	Small	Medium	Large	Local	Foreign	Islamic	Commercial	
2000	0.765	0.740	0.665	0.660	0.779	0.582	0.761	0.730
2001	0.759	0.733	0.656	0.651	0.773	0.572	0.755	0.723
2002	0.753	0.718	0.674	0.643	0.783	0.562	0.759	0.722
2003	0.747	0.718	0.639	0.634	0.760	0.552	0.742	0.708
2004	0.740	0.711	0.630	0.625	0.754	0.541	0.735	0.701
2005	0.734	0.703	0.620	0.616	0.747	0.531	0.728	0.693
2006	0.759	0.672	0.609	0.626	0.741	0.520	0.724	0.690
2007	0.753	0.664	0.599	0.617	0.734	0.509	0.716	0.682
2008	0.753	0.685	0.570	0.608	0.730	0.498	0.710	0.672
2009	0.740	0.635	0.605	0.598	0.720	0.487	0.702	0.666
TOTAL	0.750	0.696	0.624	0.627	0.752	0.535	0.733	0.698

Year		Ва	ınk size	Bank n	ationality		Bank type	
	Small	Medium	Large	Local	Foreign	Islamic	Commercial	TOTAL
2000	0.703	0.710	0.801	0.815	0.676	0.908	0.696	0.733
2001	0.701	0.708	0.800	0.814	0.674	0.907	0.694	0.732
2002	0.699	0.723	0.762	0.813	0.653	0.906	0.681	0.723
2003	0.697	0.704	0.797	0.811	0.670	0.906	0.690	0.728
2004	0.695	0.702	0.796	0.810	0.668	0.905	0.688	0.726
2005	0.694	0.701	0.794	0.809	0.666	0.904	0.686	0.725
2006	0.650	0.739	0.794	0.785	0.664	0.904	0.681	0.718
2007	0.648	0.737	0.793	0.784	0.662	0.903	0.679	0.716
2008	0.647	0.696	0.818	0.783	0.662	0.902	0.679	0.719
2009	0.647	0.742	0.765	0.781	0.658	0.902	0.675	0.713
TOTAL	0.679	0.717	0.792	0.800	0.665	0.905	0.685	0.723

Table 6: Random effect of generalized least square (GLS) regression.

Variable	Coefficient	Std. Error	<i>t</i> -statistic
Bank size (SZ)	-0.005***	0.002	-2.610
Bank nationality (BN)	0.047	0.048	0.970
Bank type (BT)	0.166**	0.074	2.260
Overhead cost per employee (OCE)	0.239***	0.062	3.850
Logarithm of non-performing loans over loans (LNPLR)	-0.006	0.039	-0.150
Total assets growth rate (TAR)	0.000	0.000	0.620
GDP growth rate (GDPR)	0.000***	0.000	-5.810
Herfindahl Hirschman index (HHI)	0.332***	0.076	4.360
Dummy (d06)	-0.008*	0.004	-1.850
Dummy (d01)	0.014***	0.001	10.430
Constant	0.448***	0.077	5.850
Rho	0.991	99.1% of t	he variance
		is due to the	e difference
		ac	ross panels
Number of observation		154	
Wald $\chi^2(10)$		801.3	
$\text{Prob} > \chi^2$		0.000	
R^2		0.403	

Note: Dependent variable is cost efficiency. ***, **, and * indicate 1%, 5% and 10% significance.

Appendix B

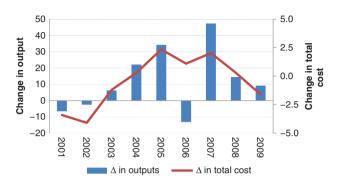


Figure 1: Change in total cost and outputs of banks in OPT.

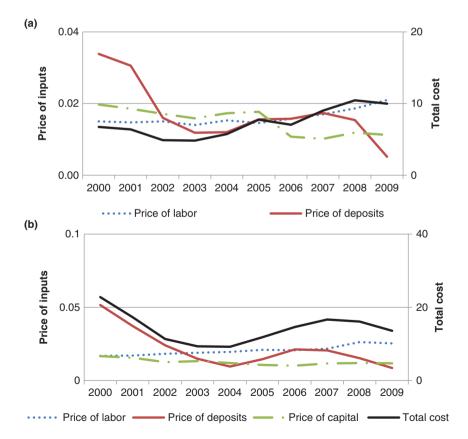


Figure 2: Total cost vs. price of inputs of foreign and domestic (a) and foreign (b) banks.

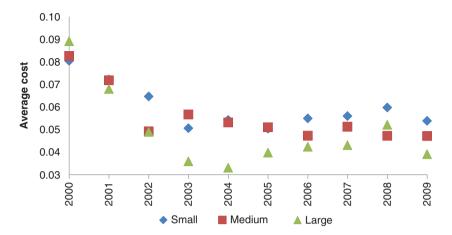


Figure 3: Average cost of banks according to size during 2000 - 2009.

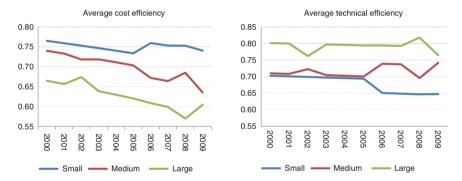


Figure 4: Average cost and technical efficiency according to banks size (2000 - 2009).

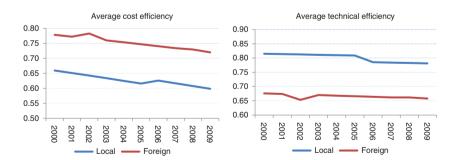


Figure 5: Average cost and technical efficiency by banks' ownership (2000 - 2009).

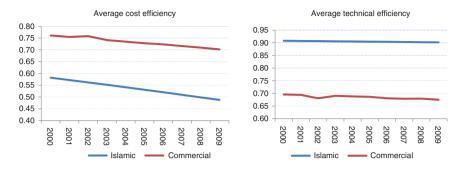


Figure 6: Average cost and technical efficiency by bank type (2000 - 2009).

Abbreviations

PMA

NIS

ML GLS

GDP

HHI

USD Us Dollar JD Jordanian Dinar OPT Occupied Palestinian Territory AC Average cost TC Total cost TCF Total credit facility INV Banking investments TΑ Total assets NPL Non-performing loans LAB Number of employees TD Total deposits CAP Total fixed assets PC Price of capital PL Price of labor PD Price of deposits ΙE Interest expenses W Personal expenses, wages and salaries SFA Stochastic frontier approach DEA Data envelopment approach LR Likelihood ratio test

Maximum likelihood

Generalized least square

Gross domestic product

Herfindahl-Hirschman index

Palestine Monetary Authority

New Israeli Shekel

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