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Efficiency Comparison of Participation and Conventional Banking Sectors in Turkey between 2007-2013

Abdurrahman Yilmaz[a*], Nizamülmülk Güneş[b]

[a] *Tasarruf Mevduatı Sigorta Fonu, Sigorta ve Risk İzleme Dairesi, Esentepe, İstanbul, 34394, TURKEY*
[b] *Tasarruf Mevduatı Sigorta Fonu, Denetim Dairesi, Esentepe, İstanbul, 34394, TURKEY*

Abstract

The reason of paying attention to the relative efficiency of banks will differ in conjunction with the perspectives of related parties such as regulators, customers, managers, and stakeholders. Within this context, banking is an over regulated sector by governments. It means that banks operate their functions in compliance with these frameworks. Banking sector is also enormously sensitive against economic changes that lead to the fragile side of the economy. Hence, from the regulators' perspective, inefficient banks are riskier and have more probability of failure. Further, the efficiency of banks is in relation with the productivity of the economy is an issue. Without a sound and efficiently performing banking system, the economy cannot perform smoothly and efficiently.

Due to their theoretical conceptualization and operational differences, Islamic and conventional banks may financially perform in a different way; and hence efficiency scores can be differentiated in terms of operational and external factors. This paper hence aims to focus on Participation banks (PBs) or Islamic and conventional or Deposit banks (DBs) in Turkey by examining their efficiencies in a comparative manner.

Capability of savings and the degree of channeling into investment are also important for Turkey. This research aims at measuring and comparing the technical (TE), pure technical (PTE), and scale efficiencies (SE) of Participation (Islamic) Banks (PBs) and Conventional Deposit Banks in Turkey by using Data Envelopment Analysis (DEA) for the period of 2007-2013 with a sample of 4 PBs and 28 DBs.

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Keywords: participation banks, deposit banks, technical efficiency, pure technical efficiency, scale efficiency.

* Corresponding author. Tel.: 0 5327822145 ; fax: 0 212 2884958
E-mail address: nizamgunes@yahoo.com

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1. Introduction

The purpose of the economic units that produce goods and services is to make profit, as profit stems from and also motivates the competitive power of economic units and provides financing of new investments. Fundamentally, the banking sector is not outside the scope of this paradigm. The conventional banking theory hypothesises that banks make profits from being the intermediary between borrowers and depositors by using its competitive advantage at gathering information and underwriting risk (Santos, 2000).Islamic banking performs the same intermediary function with the difference of not receiving or paying a pre-determined interest. In addition, there are fee-based banking services that are similar to the conventional banks minus pre-determined interest payment/receipt in the transaction. Principally, in the Islamic banking system the interest is prohibited. Instead of the interest rates, there is a profit share agreement between parties, which is determined by the extent of the risk participation (Ariff, 2007).Despite the main stream banking is conventional in the world and the Islamic financial institutions' total assets represent only 2% of global assets; recently, academic interest on Islamic banking and finance has increased considerably, which leads to a better understanding of the new form of banking.This is, perhaps, due to the rapid growth of Islamic banking industry in the financial markets. According to the Ernst and Young World Islamic Banking Competitiveness Report 2013–14, Islamic banking assets reached US$1.7t in 2013 and succeed an annual growth of 17.6% over last four years in the world. Turkey is one of the rapid growing markets together with Qatar, Indonesia, Saudi Arabia, Malaysia, UAE, (QISMUT countries) and Bahrain. Due to these countries holding a large pool of financial and intellectual capital which will provide the next wave of development in this sector, Islamic banking assets are expected to grow at a compound annual growth rate (CAGR) of 19.7% over 2013-18 across the QISMUT countries to reach US$1.6t by 2018 (2012: US$567b). However, as compared to the Islamic banking, the top three conventional banking groups in 2013 had much larger assets. For instance, Industrial & Commercial Bank of China performed (ICBC) US$ 3.2t; HSBC Holdings reached US$ 2.8t; and China Construction Bank Corporation had US$ 2.6t. Further, Barclays Plc., ranked as the tenth, and had assets of US$ 2.3t, which was 1,35 times greater than the assets of all Islamic financial institutions.The main aim of this paper is to explore and analyses the efficiency of PBs and DBs between 2007-2013 years in Turkey by using Data Envelopment Analysis (DEA) in terms of technical (TE), pure technical (PTE) and scale efficiencies (SE).

2. Literature Review

Extensive studies have been conducted on bank efficiency, which can be classified into two groups in line with our case as Bader et al. (2008) suggested.The first group involves studies that evaluate the performance of Islamic and/or conventional banks employing traditional financial ratios. Some of those studies compared their results with conventional banks.The second group concentrates on banks' efficiency and employs frontier approaches. This group may be subdivided into i) the studies which assess the efficiency of Islamic banks ii) the studies which evaluate the efficiency of conventional banks and iii) the studies which compare the efficiency of Islamic banks with conventional ones. However, due to the fact that it is not possible to mention entire literature, a sample studies on the efficiency comparisons between Islamic and conventional banks are given in this paper with the exception of Turkey samples.Beck et al. (2013) compared the business models, efficiency, asset quality and stability of conventional and Islamic banks by employing a data set compiled from the balance sheets and income statements from 22 countries for the period of 1995-2009. They introduced that conventional banks were more efficient, but they had lower intermediation ratios and asset qualities. Moreover, conventional banks were worse capitalized than Islamic ones. They also introduced that Islamic banks were operated better than conventional ones in crisis periods with regard to capitalization and asset quality by taking into consideration the differences among countries.Majid (2010) compared the Islamic banks with conventional banks in terms of efficiency in 10 countries and attempted to build a relationship with secondary factors. He found that conventional banks' rate of return-to-scale is lower than the Islamic ones with the exception banks in Jordan and Malaysia. Moreover, he presented that the efficiency scores of Islamic banks are higher than the conventional ones.

Bader et al. (2008) measured and compared the cost, revenue and profit efficiency of 43 Islamic and 37 conventional banks in 21 countries during the period of 1990-2005 by employing DEA. They evaluated the average and overtime efficiency of those banks based on their size, age, and region by using static and dynamic panels. The findings pointed out that there are no significant differences between conventional and Islamic banks' overall efficiency results.Kamaruddin et al. (2008) applied DEA for evaluating the cost and profit efficiencies of Malaysian Islamic banks and conventional bank Islamic windows for the period of 1998-2004. The results revealed that Islamic banks are more efficient than Islamic Windows in terms of costs but not at generating profits.Zaim (1995) measured the impacts of liberalization policies on the efficiency of Turkish commercial banks in the post-1980s by employing DEA. The results introduced that financial liberalization had a positive impact on both technical and allocative efficiencies, and state owner banks were more efficient than private banks.Yolalan (1996) employed financial ratios to examine the efficiency of Turkish commercial banks during the period of 1988-1995, who found that foreign-owner banks were the most efficient group, the second was private banks, and the least efficient group was state-owned banks. Also noted that the oligopolistic structure of banking sector and interest rate spread obstructed a careful analysis of bank performance.Jackson et al. (1998) assessed the efficiency and productivity growth in Turkish commercial banking by employing DEA based on Malmquist index between 1992 and 1996 period. They found that foreign and private banks are more efficient with the exception of the period of 1993-1994 financial crises.Jackson and Fethi (2000) employed DEA and Tobit analysis to measure Turkish Banks technical efficiency for the year of 1998. They found that larger and profitable banks more likely to have ability to perform at higher levels of technical efficiency and the capital adequacy ratio has a statistically significant negative effect on the performance of Turkish banks.Isik and Hassan (2003) analyzed the productivity growth, efficiency change and technical progress in Turkish commercial banks by employing DEA-Malmquist Total Productivity Change Index. They found that all forms of Turkish banks have succeeded significant productivity gains due to mainly efficiency increases rather than technical progress. On the other side, efficiency increases mostly depended on improved resource management practices instead of improved scales.Lastly, Er and Uysal (2012) analyzed and compared the efficiencies of four PBs and 26 conventional banks for the period of 2005-2010 by employing DEA, who found that the total efficiency score of PBs were higher within the chosen period.

3. Developments of Islamic or Participation Banking Sector in Turkey

Special Finance Houses (SFHs) in Turkey, which were established initially as equivalent of Islamic banks as a result of Decree 83/7503 (16 December 1983), the existence of which was the result aggressive liberalization programme and also identity search in Turkey, even though SFHs were discriminated against within the financial system of Turkey in many fronts including not being able to use the 'name' until recently. Therefore, SFHs were not subjected to the banks' legal framework and they were operating under the directives of Cabinet Resolution until later years (Asutay, 2013). In 1985, the first and the second SFHs - Albaraka Turk and Faisal Finans established with the majority stakes of Arab Gulf based partnerships. Over the years, all with Turkish capital and ownership other SFHs-Anadolu Finans in 1991, Ihlas Finans in 1995 and Asya Finans in 1996 were established. However, banking sector experienced a catastrophic disaster during the financial and curreny crisis in Turkey during 1999–2001 with a number of conventional banks' bankruptcies which had never seen before. Also, Ihlas Finans failed in 1999 due to systemic reasons and corporate governance failures (Ali, 2007).Banking crises inspired new regulations to make the financial system robust. To this end, the new Banking Act of 1 November 2005 constituted a milestone for Islamic banking in Turkey. SFHs' names were changed to Participation Banks (PBs) which overcame the discrimination observed in the legal, regulative and operative framework of these banks since their inception in 1985 due to the acceptance of the their banking nature. However, persistence continued upon the label 'Islamic' in new Act (Asutay, 2013).Although the number of these SFHs was 6 at the beginning, such significant changes caused the merger of two SFHs, Anadolu Finans and Family Finans with the name of Turkiye Finans PB at the end of 2005 with entirely Turkish capital. There are currently four active PBs, namely, Albaraka Turk (a member of the Albaraka Banking Group), Bank Asya (wholly Turkish capital), Kuveyt Turk (in which Kuwait Finance House has a majority equity stake) and Turkiye Finans (in which Saudi National Commercial Bank (NCB) acquired 60% of Turkiye Finans for $1 billion in 2007).

3.1. Trends and Performances of PBs and DBs

Turkey's PBs is still so far from the GCC and Southeast Asian countries when we look at its performances since 1985. For instance, as of 2012, the total assets of PBs in Turkey has increased to 5,6 percent of the financial system, while the same ratio for Saudi Arabia is 53 percent, for Qatar 24 percent, Malaysia 20 percent, UAE 17 percent, and Indonesia 4,6 percent (Ernst and Young, 2014). However, the Government and the Participation Banks Association of Turkey (TKBB) have targeted a 15% share of total financial assets by 2023 and PBs in the economy is expected to attract investors from the GCC and Malaysia (Thomson Reuters, 2013).On the other hand, looking at the banking reforms in Turkey, new Banking Act of 1 November 2005 distinguishes banks into three subdivisions: Deposit banks, Participation (Islamic) banks, and Development and Investment banks pursuant to the type of operation they conduct. By the end of 2013, there exist 49 banks (including foreign banks) in operation totally-32 deposit banks, 13 investment banks and 4 participation banks (TBB, 2014). Seven large banks (deposit banks) represent 75,3% of the entire banking industry show that Deposit banking is mainstream (Thomson Reuters, 2013).In addition, comparison between DBs and PBs is useful to develop a better understanding regarding the place of PBs in Turkey. Therefore, Table 1 represents the trends in the assets of PBs and DBs over the years.

Table 1. Asset Development of PBs and DBs in Turkey Between 2007-2013 Years

Year	Assets of Total Banking Ind. (USD-million)	Asset Growth of Total Banking Industry (%)	Assets of PBs (USD-million)	Asset Growth of PBs (%)	Share of PBs in Total Banking Industry (%)	Assets of DBs (USD-million)	Asset Growth of DBs (%)	Share of DBs in Total Banking Industry (%)
2007	500.756	-	16.688	-	3,3	467.854	-	93,4
2008	482.228	-3,7	16.989	1,8	3,5	450.093	-3,8	93,3
2009	560.076	16	22.363	31,6	4	519.677	15,5	92,8
2010	656.531	17	28.073	25,5	4,3	608.426	17,1	92,7
2011	648.118	-1	29.514	5,1	4,6	596.669	-1,9	92,1
2012	773.375	19	39.451	33,7	5,1	704.273	18	91,1
2013	814.380	5	45.018	14,1	5,5	736.324	4,6	90,4

As can be seen from Table 1, the asset growth rate for the banking sector was -3,7% in 2008, which was 1,8% for the PBs and that was -3,8% for the DBs. 2008 was also the lowest growth rate year with regard to assets of these sectors separately. As the table shows, PBs had better thriving trajectory in terms of trends in the growth of assets with respect to conventional DBs. Despite such an effort, however, the role and share of PBs in the banking system has remained substantially low. The share of PBs in the total banking system demonstrated a gradual but very small growth from 3,3% in 2007 to 5,5% in 2013, which is too low in relation to the potential of the Turkish economy.

4. Modelling, Data and Methodology

4.1. DEA As a Method of Analysis

In this paper, first, one of the typical non-parametric approaches 'data envelope analysis' or DEA is used for measuring efficiency by evaluating all the input and output combinations of the Decision Making Units (DMUs) in the sample and generating efficiency frontiers in terms of technical, pure technical and scale efficiencies. We used DEA Solver Professional Version 5.0. to obtain efficiency scores.DEA is an efficiency measurement approach employed for similar groups that operate in the same field (Thanassoulis, 2003). Efficiency measures take a value between 0 and 1. The two of most frequently used methods in DEA are the CCR model suggested by Charnes-Cooper-Rhodes in 1978 and the BCC model developed by Banker-Charnes and Cooper in 1984. The basic difference between two models is the method on how to deal with the returns to scale. The first model presumes that the decision units operate with constant return to scale (CRS); nevertheless, the latter is based on variable return to scale (VRS).

4.2. Definition and the Choice of Variables

In using DEA, it is necessary to determine which approach is to be used in the selection of inputs and outputs; it is also essential to make sure that the selected approach is input or output oriented. This study uses input-oriented measures due to the fact that cost control is one of the banks' objectives. Input orientation aims to minimize inputs while satisfying at least the given output levels and output orientation attempts to maximize outputs without requiring more of any of the observed input values (Cooper et al., 2000). Input orientation is preferred in various studies due to banks usually have no direct control over the amount of services demanded by their clients (Schaffnit et al., 1997). Moreover, the input and output-orientated measures identify the same frontier.On the other hand, the choice of variables significantly affects the results in efficiency studies (Denizer at al. 2000). There exist mainly two approaches, namely, production and intermediation, determining the inputs and outputs to measure the efficiency of banks (Sealey and Lindley, 1977).Under the production approach, pioneered by Benston (1965), banks are mainly considered as the providers of services to customers. The input-set under production approach involves physical variables (e.g. labor and material) or their related costs due to only physical inputs are required to perform transactions, process financial documents, or provide advisory services to customers. The output-set under this approach includes the services presented to customers and is best measured by the number and type of transactions, documents processed or specialized services presented over a given period (Berger and Humphrey, 1997). This approach has mainly been utilized in studying the efficiency of bank branches.The intermediation approach pioneered by Sealey and Lindley (1977) followed in this study for the definition of inputs and outputs used. Berger and Humphrey (1997) argue that the intermediation approach is the best for assessing an entire bank since it includes interest expenses, which often correspond to one-half to two-thirds of the total costs.

4.3. Measurement of Technical, Pure Technical, and Scale Efficiencies: CCR and BCC DEA Models

In DEA, technical efficiency (TE) can be viewed from two perspectives. First, input-oriented TE works on the opportunity of decreasing inputs to produce given output levels. Second, output-oriented TE considers the possible growth in outputs for a given set of input quantities. A measure of input and output-oriented TE for a DMUo can be defined as

θ_o^{input} = minimum possible input$_o$ / actual input$_o$, or
θ_o^{output} = actual output$_o$ / maximum possible output$_o$.

To yield a scalar measure of TE, it requires determining the divergence between actual production and production possibilities frontier which resumes DMU's all technological possibilities transforming inputs into outputs. If the production arise within the inside of this frontier, DMU is accepted technically inefficient. A measure of scale efficiency (SE) can be obtained by comparing TE scores acquired under the assumptions of CRS and VRS. The TE measure relating to CRS assumption states overall TE, which measures efficiencies due to the input-output shape and the size of operations. The efficiency measure relating to VRS assumption states pure technical efficiency (PTE), which measures efficiencies due to only managerial performance. SE = TE /PTE results a measure of scale efficiency (Kumar and Gulati, 2008).It should be noted that technical, pure technical, and scale efficiency measures can be stated as linear programming models. Although, there have been various mathematical programming models, each of these models fundamentally attempts to set up which of DMUs determine the efficiency frontier.

In our study, we employed both CCR and BCC model to attain efficiency measures under CRS and VRS assumptions, respectively. Mathematical expression of input-oriented DEA models for measuring TE scores for DMUo, under different scale assumptions are as follows (Kumar and Gulati, 2008):

(1) a) $\min_{\theta_o,\lambda_1,\lambda_2,\ldots,\lambda_n,s_i^-,s_r^+} \text{TE}_o = \theta_o - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$ subject to

b) $\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta_o x_{io}$

c) $\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{ro}$

d) $s_i^-, s_r^+ \geq 0 \qquad (i = 1,\ldots,m;\ r = 1,\ldots,s)$

e) $\lambda_j \geq 0$, if constant return to scale (CSR)
f) $\sum_{j=1}^{n} \lambda_j = 1$, if variable return to scale (VRS)

where xio = amount of input i used by DMU o,
yro = amount of input output r produced by DMU o,
m = the number of outputs,
s = the number of inputs,
n = the number of DMUs, and
ε = a small positive number.

If we assume that DMUo will remain within the reference technology, the solution of the problem (1) is taken as the largest compression of DMUo's input to be performed. The constraints (b) and (c) create the convex reference technology. The constraint (d) limits the input slack (s_i^-) and output slack (s_r^+) variables to be positive. The constraint (e) restricts the intensity variables to be positive. The model including (a) and (e) indicates the envelopment form of CCR model and suggests Farrell's input-oriented TE measure under the assumption of CRS. The measure of efficiency presented by CCR model is TE and indicated as θ_o^{CCR}. The last limitation puts VRS assumption on the reference technology. The model including (a), (d) and (f) indicates BCC model and suggests Farrell's input-oriented TE measure under the assumption of VRS. The measure of efficiency presented by BCC model is PTE and indicated as θ_o^{BCC}. The ratio ($\theta_o^{CCR}/\theta_o^{BCC}$) presents a measure of SE, which does not demonstrate whether the DMU in case is operating at IRS or DRS (Kumar and Gulati, 2008). The nature of returns-to-scale can be ascertained from the size of optimal $\sum_{j=1}^{n} \lambda_j^*$ in the CCR model (Banker et al., 1984).

4.4. Sample and Data

Owing to the entry and exit factor, the efficiency frontier is constructed by using an unbalanced sample of 4 PBs and 28 DBs which have operated in Turkey throughout the period 2007-2013, yielding 224 bank year observations. Data for the empirical analysis is sourced from The Banks Association of Turkey (TBB) as well as individual bank's annual balance sheet and income statements.The PBs and DBs are modelled as multi-product firms producing three outputs, namely: total loans (y1), which include loans to customers and other banks; income (y2), which include income derived from investment of depositors' funds and other income from banking operations; and investments (y3), which include investment securities held for trading, investment securities available for sale, and investment securities held to maturity, by engaging two inputs, namely: total deposits (x1), which include deposits from customers and other banks; and capital (x2). All variables are measured in millions of Turkish Liras (TRY).

4.5. Analyses and Results

In this section, the empirical findings in relation to the technical efficiency change of the PBs and DBs of Turkey between 2007-2013 are presented, which is measured by the DEA method and its decomposition into PTE and SE components. It is significant to note that input-oriented efficiency measures address the question: 'By how much can input quantities be proportionally reduced without altering the output quantities produced?' In the event of the existence of scale inefficiency, we will attempt to provide evidence on the nature of the returns to scale of each PBs and DBs. Initially, PBs and DBs' overall efficiency is examined for each year before we proceed to examine the PBs and the DBs' efficiency results separately.As suggested by Bauer et al. (1998), Isik and Hassan (2002) and Sufian et al. (2009), constructing an annual frontier specific to each year is more flexible and thus more appropriate than estimating a single multi-year frontier for the banks in the sample. Following the earlier studies, for the purpose of this study, we prefer to estimate separate annual efficiency frontier for each year. Isik and Hassan (2002) argued that the primary advantage of having panel data is the ability to observe each bank more than once over a period of time. The issue is also critical in a continuously changing business environment because the technology of a bank that is most efficient in one period may not be the most efficient in another. Furthermore, by doing so, we alleviate, at least to an extent, the problems related to the lack of random error in DEA by allowing an efficient bank in one period to be inefficient in another, assuming that the errors owing to luck or data problems are not consistent over time (Isik and Hassan, 2002).

Table 2 presents the mean efficiency scores of the all banks which contain PBs and DBs for the years 2007, 2008, 2009, 2010, 2011, 2012, 2013 and All Years. The results seem to suggest that the all banks' mean technical efficiency scores have been on a decreasing trend for every other year, while SE increasing, TE and PTE decreased in 2013. It is clear from Table 2 that during the period of the study, all of the banks have exhibited mean technical efficiency of 82 percent. The overall results suggest that the all banks could have saved 18 percent of the inputs to produce the same amount of outputs that they produced. In other words, all banks could have produced the same amount of outputs by using only 82 percent of the inputs they used.

Table 2. Summary Statistics of Efficiency

		All Banks				Participation Banks				Deposit Banks			
Year	Efficiency measures	Mean	Min	Max	SD	Mean	Min	Max	SD	Mean	Min	Max	SD
2007	TE	0,899	0,367	1	0,136	0,922	0,787	1	0,101	0,896	0,367	1	0,142
	PTE	0,934	0,493	1	0,111	0,925	0,792	1	0,099	0,936	0,493	1	0,114
	SE	0,959	0,688	1	0,076	0,996	0,991	0,996	0,005	0,954	0,688	1	0,079
2008	TE	0,859	0,374	1	0,171	0,918	0,79	0,991	0,093	0,851	0,374	1	0,179
	PTE	0,904	0,414	1	0,165	0,977	0,924	0,977	0,036	0,894	0,414	1	0,174
	SE	0,951	0,676	1	0,074	0,941	0,79	0,941	0,101	0,952	0,676	1	0,072
2009	TE	0,899	0,391	1	0,14	0,927	0,821	1	0,077	0,895	0,391	1	0,148
	PTE	0,925	0,481	1	0,126	0,939	0,822	1	0,084	0,923	0,481	1	0,132
	SE	0,97	0,753	1	0,057	0,988	0,961	1	0,019	0,968	0,753	1	0,06
2010	TE	0,582	0,171	1	0,238	0,535	0,48	0,657	0,082	0,588	0,171	1	0,252
	PTE	0,863	0,207	1	0,22	0,902	0,852	1	0,067	0,858	0,207	1	0,234
	SE	0,679	0,434	1	0,2	0,591	0,55	0,657	0,046	0,691	0,434	1	0,211
2011	TE	0,872	0,406	1	0,15	0,912	0,868	0,941	0,031	0,867	0,406	1	0,16
	PTE	0,913	0,44	1	0,153	0,955	0,899	1	0,042	0,907	0,44	1	0,162
	SE	0,956	0,826	1	0,054	0,955	0,919	0,982	0,027	0,957	0,826	1	0,057
2012	TE	0,826	0,408	1	0,16	0,869	0,805	0,909	0,045	0,82	0,408	1	0,169
	PTE	0,901	0,462	1	0,165	0,985	0,965	1	0,017	0,889	0,462	1	0,174
	SE	0,919	0,793	1	0,076	0,881	0,824	0,909	0,04	0,924	0,793	1	0,079
2013	TE	0,799	0,392	1	0,178	0,831	0,728	1	0,125	0,795	0,392	1	0,186
	PTE	0,867	0,403	1	0,187	0,927	0,833	1	0,077	0,858	0,403	1	0,198
	SE	0,926	0,725	1	0,083	0,893	0,831	1	0,074	0,931	0,725	1	0,085
All Years	TE	0,82	0,171	1	0,197	0,845	0,48	1	0,153	0,816	0,171	1	0,203
	PTE	0,901	0,207	1	0,164	0,944	0,792	1	0,065	0,895	0,207	1	0,173
	SE	0,909	0,434	1	0,138	0,892	0,55	1	0,14	0,911	0,434	1	0,137

The decomposition of technical efficiency into its PTE and SE components points out that scale inefficiency dominates pure technical inefficiency of the all banks during all years with the exception of the year 2010, when SE was higher than PTE. Overall, with the analysis of PTE and SE measures for the industry as a whole, the results imply that overall technical inefficiency is due to both poor input utilization (i.e., pure technical inefficiency) and failure to operate at most productive scale size (i.e., scale inefficiency) in Turkish banking industry which consists of PBs and DBs in this paper with the exception of Development and Investment Banking Sector. The average PTE score for all banks has been observed to be 0,901 which implies that 9,9 percentage points of about 18 percent of overall technical inefficiency is due to the bank managers who are not following appropriate management practices and selecting incorrect input combinations. The rest of overall technical inefficiency appears due to inappropriate scale of banking operations. Further, lower mean and high standard deviation of the PTE scores compared to SE scores indicate that a greater portion of overall technical inefficiency is due to pure technical inefficiency.Table 2 also presents the results of the PBs in Turkey. It is clear that the Turkish PBs' efficiency scores were on a decreasing trend from the years 2007 to 2010 (nonetheless increasing trend of PTE in 2008 and TE and SE in 2009), increased in 2011, before decreasing again during the years 2012 and 2013 with the exceptions of PTE and SE in 2012 and 2013, respectively. The overall results seem to suggest that Islamic banks have exhibited mean technical efficiency

of 84,5 percent, suggesting mean input waste of 15,5 percent. This implies that the PBs in Turkey could have produced the same amount of outputs by only using 84,5 percent of the amount of inputs they employed. From Table 2, it is also clear that scale inefficiency outweighs pure technical inefficiency in determining the overall technical efficiency of the PBs in Turkey during the period of 2007-2013, due to the fact that the average SE score for Islamic banks has been observed to be 0,892, which implies that 10,8 percentage points of the about 15,5 percent of overall technical inefficiency is due to the inappropriate scale of banking operations. The rest of overall technical inefficiency appears due to the bank managers who failed to following appropriate management practices and selecting incorrect input combinations. Further, lower mean and high standard deviation of the SE scores compared to PTE scores indicate that a greater portion of overall technical inefficiency is due to scale inefficiency.Similar to banking industry as stated above, the results from Table 2 seem to suggest that DBs' mean technical efficiency scores have been on a decreasing trend for every other year, however, while PTE increasing, TE and PTE decreasing in 2008 and 2013, respectively. It is clear from Table 2 that during the period of study, the Turkish DBs have exhibited mean technical efficiency of 81,6 percent, which suggest that the DBs could have saved 18,4 percent of the inputs to produce the same amount of outputs that they produced. In other words, the DBs could have produced the same amount of outputs by using only 81,6 percent of the amount of inputs they used. The decomposition of technical efficiency into its PTE and SE components points out that pure technical inefficiency dominates scale inefficiency of the DBs during all years with the exception of the year 2010, when scale inefficiency was higher than pure technical inefficiency score. Overall, with the analysis of PTE and SE measures for the DBs as a whole, the results imply that overall technical inefficiency is due to both poor input utilization (i.e., pure technical inefficiency) and failure to operate at most productive scale size (i.e., scale inefficiency) in Turkish DBs. The average PTE score for DBs has been observed to be 0,895 which implies that 10,5 percentage points of the about 18,4 percent of overall technical inefficiency is due to the bank managers who are not following appropriate management practices and selecting incorrect input combinations. The rest of overall technical inefficiency appears due to inappropriate scale of banking operations. Further, lower mean and high standard deviation of the PTE scores compared to SE scores indicate that a greater portion of overall technical inefficiency is due to pure technical inefficiency.During the all years, DBs has exhibited a lower mean technical efficiency of 81,6 percent compared to PBs which suggested 84,5 percent, while DBs' pure technical inefficiency outweighs scale inefficiency in determining the overall technical inefficiency in contrast to PBS. Microeconomic theory points out that one of the main objective of the firms is to operate at most productive scale size which provides the constant returns-to-scale (CRS) in order to minimize costs and maximize revenue. In the short run, firms may operate in the zone of increasing returns-to-scale (IRS) or decreasing returns-to scale (DRS). However, in the long run, they have to move towards CRS by becoming larger or smaller to survive in the competitive market. The process might involve changes of a firms' operating strategy in terms of scaling up or scaling down of size. The regulators may use this information to determine whether the size of representative firm in the particular industry is appropriate or not. The findings depict that the banks that lie on the efficiency frontier. The composition of the efficiency frontier suggests that the number of 100 percent efficient banks varies between 9 and 18 banks. During the period of this study, despite four DBs have failed to appear at least once on the frontier, DBs seem to have dominated the efficiency frontier in comparison to Islamic banks. It is also clear from the results that two DBs, namely, Ziraat Bankasi and JP Morgan Chase Bank, were the global leaders by appearing the most times on the efficiency frontier.Our results indicate that while the small banks usually tend to operate at CRS or IRS, the large and middle scale banks usually tend to operate at CRS or DRS.

Table 3. Composition of Returns to Scale

No.	DMU	Type	2007	2008	2009	2010	2011	2012	2013	Count Bank
1	Albaraka Türk	Participation	DRS	DRS	CRS	DRS	DRS	DRS	DRS	1
2	Banka Asya	Participation	DRS	DRS	IRS	DRS	DRS	DRS	DRS	0
3	Türkiye Finans	Participation	CRS	DRS	DRS	DRS	DRS	DRS	CRS	2
4	Kuveytturk	Participation	CRS	IRS	DRS	DRS	DRS	DRS	DRS	1
5	Ziraat Bankası	Deposit	CRS	CRS	CRS	CRS	CRS	CRS	CRS	7
6	Turkiye Halk Bankası	Deposit	DRS	CRS	CRS	DRS	DRS	DRS	DRS	2
7	Turkiye Vakıflar Bankası	Deposit	DRS	DRS	DRS	DRS	DRS	DRS	DRS	0
8	AkbankTurk	Deposit	DRS	DRS	CRS	DRS	DRS	DRS	DRS	1

9	Anadolubank	Deposit	DRS	DRS	DRS	DRS	DRS	DRS	IRS	0
10	Fibabanka	Deposit	CRS	IRS	CRS	CRS	CRS	CRS	IRS	5
11	Sekerbank	Deposit	DRS	DRS	CRS	DRS	DRS	DRS	DRS	1
12	Tekstil Bankası	Deposit	CRS	DRS	CRS	DRS	CRS	DRS	CRS	3
13	Turkish Bank	Deposit	IRS	IRS	IRS	CRS	IRS	CRS	IRS	2
14	Türk Ekonomi Bankası	Deposit	CRS	IRS	DRS	DRS	DRS	DRS	DRS	1
15	Turkiye Garanti Bankası	Deposit	CRS	DRS	DRS	DRS	DRS	DRS	DRS	1
16	Turkiye Is Bankası	Deposit	DRS	DRS	DRS	DRS	DRS	DRS	DRS	0
17	Yapı ve Kredi Bankası	Deposit	DRS	DRS	DRS	DRS	DRS	DRS	DRS	0
18	Alternatifbank	Deposit	CRS	IRS	CRS	DRS	CRS	CRS	CRS	5
19	Arap Türk Bankası	Deposit	CRS	CRS	CRS	CRS	IRS	CRS	IRS	5
20	BankMellat	Deposit	CRS	CRS	CRS	CRS	CRS	IRS	IRS	5
21	Burgan Bank	Deposit	CRS	CRS	CRS	DRS	DRS	DRS	IRS	3
22	City Bank	Deposit	CRS	DRS	IRS	DRS	CRS	DRS	DRS	2
23	DenizBank	Deposit	CRS	CRS	CRS	DRS	DRS	DRS	DRS	3
24	Deutsche Bank	Deposit	DRS	DRS	CRS	CRS	CRS	CRS	CRS	5
25	Finans Bank	Deposit	DRS	DRS	CRS	DRS	DRS	DRS	DRS	1
26	Habib Bank Limited	Deposit	CRS	CRS	IRS	CRS	CRS	CRS	CRS	6
27	HSBC Bank	Deposit	DRS	DRS	CRS	DRS	DRS	DRS	DRS	1
28	ING Bank	Deposit	DRS	CRS	DRS	DRS	CRS	DRS	CRS	3
29	JP Morgan Chase	Deposit	CRS	CRS	CRS	CRS	CRS	CRS	CRS	7
30	Socıete Generale	Deposit	CRS	IRS	CRS	CRS	CRS	CRS	CRS	6
31	The Royal Bank of Scotland	Deposit	IRS	CRS	CRS	CRS	CRS	DRS	IRS	4
32	Turkland Bank	Deposit	IRS	DRS	IRS	CRS	DRS	CRS	IRS	2
	Count Year		16	10	18	11	12	10	9	

5. Conclusion

This paper aims at evaluating the extent of technical, pure technical, and scale efficiencies of Turkish banking industry in terms of PBs and DBs using cross-sectional data for 4 PBs and 28 DBs for the period of 2007-2013. DEA framework has been applied in which the estimates of technical, pure technical, and scale efficiencies for individual PBs and DBs have been obtained by CCR and BCC model.The present study followed an intermediation approach to select input and output variables. The input vector contains two inputs: i) total deposits and ii) capital while output vector contains three outputs: i) total loan, ii) income and iii) investments. The results indicate that during the period of study, Participation banks have exhibited mean technical efficiency of 84,5 percent, suggesting mean input waste of 15,5 percent. This implies that the PBs could have produced the same amount of outputs by only using 84,5 percent of the amount of inputs they used in Turkey. However, DBs have exhibited mean technical efficiency of 81,6 percent which also suggests that the DBs could have produced the same amount of outputs by using only 81,6 percent of the amount of inputs they used.The decomposition of technical efficiency into PTE and SE components point out that the scale inefficiency dominates the pure technical inefficiency in determining the overall technical efficiency of the PBs in Turkey during ‘All Years’ due to the fact that the average SE score for Islamic banks has been observed to be 0,892 which implies that 10,8 percentage points of the about 15,5 percent of overall technical inefficiency is due to the inappropriate scale of banking operations. The rest of overall technical inefficiency appears due to the bank managers who are not following appropriate management practices and selecting incorrect input combinations. In contrast to PBs, DBs’ pure technical inefficiency dominates the scale inefficiency during All Years due to the average PTE score for Deposit banks has been observed to be 0,895 which implies that 10,5 percentage points of the about 18,4 percent of overall technical inefficiency is due to the bank managers who are not following appropriate management practices and selecting incorrect input combinations. The rest of overall technical inefficiency appears due to inappropriate scale of banking operations.In its entirety, the study reveals that there is a broad scope for enhancement in the performance of both inefficient PBs and DBs by selecting a correct input-output mix and preferring appropriate scale size.

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