A Non-Parametric Approach to Assessing Efficiency in Conventionaland Participation (Islamic) Banks ofTurkey

Sani Abdul-Aziz

Istanbul Commerce University, Sütlüce Mahallesi
İmrahor Cd. No:90, 34445 Beyoğlu, Istanbul – Turkey
E-mail: abziiz@yahoo.co.uk
Tel: +90 507 623 3762

Abstract

Over the past forty years, global Islamic banking has experienced phenomenal growth. Along with this growth is the associated the global Islamic banking and finance industry faces some challenges. The last decade has seen the evolution of special finance houses within Turkey into fully-fledged participation banks or Islamic Banks operating under the dictates of the Shari'a.

Based on these developments this study sought to assess the technical efficiency of these participation banks in comparison with their conventional counterparts using the non-parametric frontier: Data Envelopment Analysis (DEA). An input-oriented DEA based on the intermediary approach was adopted. The technical efficiencies were calculated under notions of both the variable returns to scale (VRS) and constant returns to scale (CRS).

Results indicated fairly high levels of efficiency attained by both Participation Banks and Conventional Banks with the latter generally on the higher side of the percentage technical efficiency.

Keywords: Data envelopment analysis, Islamic banking, performance, technical efficiency, scale efficiency, decision making unit, and Turkey.

JEL Classification Codes: G21, C14

1. Introductıon

After experiencing phenomenal growth over the last forty years, the global Islamic banking and finance industry faces some difficult challenges principal of which are argued to be that the industry has moved away from pursuing ideals conveyed by its brand-name products towards a convergence to the conventional banking. Uppal and Mangla (2014) even suggested that the dictates of the economic and financial theory might be at conflict with the Islamic Banking and Finance market niche strategy. The operational challenges facing the industry in the implementation of risk management techniques and regulatory compliance is also a bone of contention forstakeholders ofthe industry.

The industry, since it came into existence, has seen a whooping growth to more than 1.8 trillion dollars in total assets as per the estimates of Ernst and Young in the year 2012. Projections by an HSBC report issued in the same year however indicates that the industry could grow to USD 4.4 trillion by the year 2020 with its then average annual growth rate of 10%.

Turkey, no stranger to the rise of the Islamic banking and finance phenomenon, made efforts to encourage the inflow of capital from the Middle East and Northern African region in the early eighties. This culminated into the establishment of Special Finance Houses (SFHs). These SFHs were providing purely Islamic services (non-interest) and succeeded in attracting funding from a particular group of

investors (Okumus 2005).The last decade has witnessed the evolution of SFHs into fully-fledged Participation Banks (PBs) or Islamic Banks (IBs). Please note that PBs and IBs will be used interchangeably from this point onwards in this study.

The country as at the second quarter of 2016 boasts of six of such banks namely Albarka Turk Participation Bank, Bank Asya Participation Bank, Kuveyt Turk Participation Bank,Turkiye Finans Participation Bank, Vakif Participation Bank and last but not least Ziraat Participation Bank.The rationale behind Islamic Banking and Finance is that, like the historical prohibition of usury by the Church, Islamic law prohibits receiving and paying a predetermined fixed interest on borrowing; rather it prescribes that the financial transactions should be based on equity participation and profit-loss sharing basis.

These PBs offer a wide range of products and servicesalongside Conventional Banks (CBs). This poses various competitive and legislative challenges for the PBs. It is against this background that this study seeks to assess the Technical Efficiency (TE) of these PBs in comparison with the CBs using the non-parametric frontier: DEA.

1.1 Objectives of the Study

The core objective of the research is to assess and analyze the levels of efficiency of PBs and that of CBs using a non-parametric comparative approach. The objective can be further elucidated as follows:
  i.   To determine the efficient and/or non-efficient PBs in the industry.
  ii. To ascertain how the PBs are doing with respect to their conventional counterparts.
  iii. To contribute to the enrichment of literature on DEA based efficiency assessments in the Turkish financial services sector.
  iv. To critically analyze the trend in the change or lack thereof technical efficiency of the participation banking subsector.
  v.   To forge and deliver valuable suggestions on the subject for future research and also to the industry itself.

2. Islamic Banking at a Glance

For more insight into Islamic banking and finance it is crucial to highlight two essential elements; *Riba* and *Gharar*. These two elements must be eschewed under any circumstance in all transactions under the Islamic banking enclave to protect their integrity with regards to lawfulness.

2.1 Riba

Riba in the simplest of terms can be described as interest or usury. This is the excess charged over and above the original amount lent (principal) in lieu of time and by way of a conditionality at the time the amount is loaned. With money seen as only a medium of exchange in Islam with no intrinsic value other than its fiat nature, any premium charged on money borrowed or lent is considered as *Riba* regardless of the amount as such a charge presents undue advantage to one party at the expense of the other for no fitting consideration. *Riba* represents both simple and compound interests as known on modern banking and finance. This is believed to be a stumbling block to true prosperity in Islam.

Muslim jurists have unanimously agreed on two separate classes of assets are liable to *Riba*, namely currency (same or different) and a few commodities, usually food items. The requirements of an exchange involving these two types of assets are of the same nature. Even though conventional finance justifies the charging of interest using inflation and the fall in the value of money from the time it is borrowed to the end of the term of the loan, Islamic ruling contends that this loss of value is in no way the fault of the borrower and as such should not be burdened with it by way of a premium on the principal. Interest taking and interest payments hold the same status in *Shari'a* – forbidden.Uppal and Mangla (2014) draw our attention to the fact that usury is prohibited not only in Islam but by

Christianity and Judaism as well. This is a generally known fact even though followers of the latter two religions do not uphold this as much as Muslims do in modern times.

2.2 Gharar

Gharar is another element that must be avoided at all cost in any *Shari'a* compliant transaction. *Gharar* basically means uncertainty and also encompasses such meaning as hazard, deceit, risketc. This generally has to do with uncertainty on the subject matter of an agreement and uncertainty of value of said subject matter. Muslims are advised to restrain from all transactions with a high element(s) of uncertainty. *Gharar* implies the inadequacy of knowledge or too much uncertainty that could result in an outcome detrimental to one or more parties to the transaction. This inadequate knowledge, as well as a lack of control of the outcome of any transaction, may be a result of misrepresentation, mistake, fraud, negligence, duress, or terms beyond the knowledge and control of one of the parties to the contract. Information asymmetry, known to be one of the major problems in modern finance, also contributes to an increase in the element of *gharar* in a particular transaction.

In practice *gharar* is generally linked to aspects of a transaction such as pricing, delivery, quantity and quality of subject matter that would most likely affect the terms and conditions if known before-hand by all the parties involved. For instance, one cannot buy an 'option' at a certain price to have the right to purchase its underlying shares, as an 'option' is not ascertainable and is thus uncertain. An option is just a right. It is not an asset whose specifications are without ambiguity and at the same time not readily available. In modern day conventional insurance, the premium taken from the policyholders and the indemnity provided by the insurer on claims are correspondingly uncertain, thereby making conventional insurance non-compliant to the *Shari'a*.

Unlike *Riba*, which is ascertained by a fixed ideology as previously described in the earlier parts of this section, the determination of *Gharar* is based on various underlying factors. This is because the parameter of knowledge or consent and the risk tolerance by society is not fixed. To sum it all, Islamic commercial law has a generally accepted distinction between major uncertainty, which is to be avoided at all times, and minor uncertainty, which is countenanced by the Muslim society.

2.3 Principles of Islamic Banking

The prohibition of *riba* and *gharar*when taken into perspective could be further broken down into four principles upon which the IB model is built:

- Risk-sharing - the terms and conditions of financial transactions need to reflect a symmetrical risk/ return distribution each participant to the transaction may face;
- Material relevance - a financial transaction needs to have materiality, i.e. it has to be directly or indirectly linked to a real economic item or commodity of value. The purchase and sale of an option falls under the example of contracts lacking materiality in the IB sense and thus considered inappropriate.
- Exploitation free – a financial/banking transaction should not result in the eventual exploitation of any of the parties to the transaction. The welfare of all parties must be accorded the utmost value and importance to avoid the exacerbation of any financial woes one or more of the parties may be facing as the point such an agreement is made. IB should be focused on improving the livelihoods of the community.
- Halal (permissible) – all contracts and transactions under IB should be devoid of any element of haram. This means all illicit or non-permissible actions or subject matters from an Islamic point of view should be avoided at all cost. Haram is basically anything considered sinful in Islam. Examples of such prohibited actions in IB include the financing of alcohol trade and or production, dealing with pork production and any other thing prohibited in the *Shari'a*. This is not normally a focal point for CBs when making a credit decision.

2.4 Maxims of Islamic Banking and Finance

Islamic banking as a field has a set of salient features that characterizes and differentiates it from its conventional counterpart. These features are globally recognized in part or wholly in all Islamic banking and finance settings and basically sets the tone for how these institutions operate. A few of these maxims are outlined below.

a) Interest free

One of the thoroughly well disseminated feature of IB is its interest-free nature, this means that all activities must be devoid of any element of interest[1], paid or received, simple or compound. According to the *Shari'a*, any commercial exchange of two similar usurious items or assets such as giving money in return for money or food for food. Modern conventional banking is based on the lending of money for a premium – interest. Islamic Banks should endure to eliminate all forms of interest, whether in cash or in kind. A term deposit account in a CB is a typically epitomizes the structure the interest payment concept adopted by these institutions on the amount deposited by their clients. IBs avoid interest on so many levels like in the case of where they refuse to advertise gifts or incomes on savings and current accounts on a *Wadiah* or *Qard* contract as such an advertised gifts or 'incentives' could be deemed as form of interest in kind payable to account holders. Although a gift such as a bag, pen set or books are not given in terms of currency, they will still be considered as extra gain for the lender over and above the principal. Interest of any form, cash or kind is not legitimate according to the *Shari'a*.

b) The need for underlying assets

Islamic finance stipulates that all banking business based on sale or lease must be performed with respect to an underlying asset. This can be in the form of goods or services. Since the IB either acts as a seller of the goods or usufruct dealer, the existence of a clearlyformed or defined terms of service or an assets measurable in terms of currency with a clear delivery period is of predominant importance. The absence of an underlying asset will render the contract null and void from the beginning from an IB point of view whereas in CB the an underlying asset element is not necessarily required. It is only vital if its serving as collateral security which could be sold in the event of a default to mitigate or eliminate in totality the risk burden of the lender (CB) at the expense of the borrower especially when such a default if by no fault of the client. It should be noted that this asset was never a part of the credit transaction but a security measure employed by banks to secure the transaction in hand.

c) The avoidance of excessive uncertainty (Gharar) or gambling

All transactions made under the Islamic Banking scheme should be devoid of elements of excessive uncertainty (Gharar) and gambling. All terms must be clearly stated at the time of the agreement. The subject matter must be accorded a full description with regards to its value, measurements, characteristics and all other features, desirable or undesirable. This helps to avoid unwanted disputes in the course of business as a results of misrepresented facts or even fraudulent information. Gambling as it is generally known is putting in a bet with no clear cut line of action to guarantee the outcome by any fair means. Gambling enriches one party at the expense of the other and thus has no real economic benefit for such losing party or the economic activities s/he is engaged in, thus from an Islamic perspective an illegal act.

d) Profit and loss sharing

One key factor in finance is the risk/returns conundrum. As it is generally known, the higher the risk, the higher the expected returns. This implies that with every business venture or financial transaction there is a certain degree of risk involved and this according to IB should not be the sole burden of one party (bank nor client) as both parties are to benefit mutually in the event of high returns and commensurately bear any losses together as parties to the said transaction if the contrary is the case. Profit and loss sharing is derives its roots from this belief in IB. The

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[1]Quran 2:275-281, 4:161, 3:130-132, 30:39.

bank (investor) will share in the profit and losses with the client (entrepreneur) either equally or based on an initially agreed upon profit/loss sharing ratio. In the case of a loss, the loss will be borne by the bank under a Mudarabah contract or by both parties proportionately in the case of a Musharakah contract. This feature is quite native to IB as CB doesn't hold such beliefs.

e) Shari'a compliant

The focal point of IB is compliance with the *Shari'a* – Islamic legislation – in all activities with no exceptions. *Shari'a* advisory and supervisory committees and boards are formed as a peculiar component of the Islamic finance structure to ensure strict adherence and compliance to the *Shari'a*. Conventional financial institutions do not require the existence of such a board in order to operate. Such boards are formed not only in the banking sector but also insurance, microfinance and all other Islamic banking. All Islamic financial institutions of high repute make it a point to establish and maintain a well-positioned *Shari'a* board with highly informed and adequately qualified members who possess a wealth of knowledge in Islamic legislation and jurisprudence. It goes without saying that *Shari'a* compliant finance should also be devoid of any unlawful activities in its transactionwhere dealing with goods or services. Examples of such unlawful goods and services may include but not limited to non-slaughtered animal products, pork, intoxicants, pornography, gambling and illicit drugs. The avoidance of these unlawful goods and service also include not financing the sale, distribution and advertising.

3. Literature Review

Banking efficiency is a critical component of performance analyses in the sector whether it's focusing on branches of the same bank or comparing banks in the industry as a whole. This section of the study will touch on a number of studies that measured banking efficiency using various approaches with dominance alluded to DEA.

Soteriou and Stavrinde (1997) investigated the use if DEA to measure and assess service quality (as an output) of bank branches by showing how service measures can be incorporated into a model which can provide useful insights and suggestions towards service quality improvement. After running both input minimization and output maximization models, the research concluded that technical efficiency alone could not measure the effect service quality has on overall bank efficiency

Gerrard and Cunningham (1997) touched on an overview of Islamic Banking in Singapore. It was established that in Singapore, which has a minority of Muslims in its population, both Muslims and non-Muslims were generally unaware of the culture of Islamic Banking. Attitudes towards the Islamic banking movement just as opinions were divided. With the most significant being interest on savings. The desire to be paid higher interest was far stronger with non-Muslims.

Avkiran (1999) demonstrates the application of DEA in examining the efficiency of bank branches relative to other branches of the same bank. He further delved into showing that accounting variables can be complemented by non-accounting variables controllably by management. The importance of DEA in establishing banking best practices was also outlined.

Rosly and Baker (2003) researched the performance of Islamic and conventional banks in Malaysia and found that IBs have recorded higher return on assets (ROA) as they are able to utilize existing overheads carried by conventional banks. As this lowers their overhead expenses, it was however discovered that the higher ROA for IBs did not represent efficiency. It was also inconsistent with their relatively low asset utilization and investment margin ratios. The research contended that Islamic banking that thrives on interest-like products (credit finance) is less likely to outshine conventional banks from an efficiency point of view.

A research investigating the efficiency of a sample of Islamic and conventional banks in 10 countries that operate Islamic banking for the period 1996–2002, using an output distance function approach was undertaken by Abdul-Majid et al. (2009). The paper obtained measures of efficiency after allowing for environmental influences such as country macroeconomic conditions, accessibility of

banking services and bank type. While these factors were assumed to directly influence the shape of the technology, it was assumed that country dummies and bank size directly influence technical inefficiency. The parameter estimates highlighted that during the sample period, IB appears to be associated with higher input usage. On top of that, by allowing for bank size and international differences in the underlying inefficiency distributions, the study was also able to demonstrate statistically significant differences in inefficiency related to these factors even after controlling for specific environmental characteristics and IB.

Sufian and Noor (2009) conducted a research to provide a comparative analysis on the performance of the Islamic banking sector in 16 MENA (Middle East and North Africa) and Asian countries. A two-stage procedure was followed to examine the efficiency of Islamic banking sectors in 16 MENA and Asian countries. First, data envelopment analysis (DEA) was used to estimate the technical, pure technical, and scale efficiency for each bank in the sample. The empirical findings indicated that during the period of study, pure technical inefficiency outweighs scale inefficiency in both the MENA and Asian countries banking sectors. Banks from the MENA region were found to be the global leaders by dominating the efficiency frontier during the period of study. A positive relationship was also found between bank efficiency and loans intensity, size, capitalization, and profitability.

Beck et al (2010) discussed Islamic banking versus Conventional banking vis-à-vis their business model, efficiency and stability. This paper discussed Islamic banking products and interpreted them in the context of financial intermediation theory. Anecdotal evidence showed that many of the conventional products can be redrafted as *Shari'a*-compliant products, so that the differences are smaller than expected. Comparing conventional and Islamic banks and controlling for other bank and country characteristics, the authors found few significant difference in business orientation, efficiency, asset quality, or stability. While Islamic banks seemed more cost-effective than conventional banks in a broad cross-country sample, this finding reverses in a sample of countries with both Islamic and conventional banks. However, CBs that operate in countries with a higher market share of Islamic banks were found to be more cost-effective but less stable. There was also consistent evidence of higher capitalization of Islamic banks and this capital cushion plus higher liquidity reserves explained the relatively better performance of Islamic banks during the 2007-08 global financial crisis.Quite contrary to this, Okumus and Artar (2012) determined that on a large scale CBs were more stable financially in comparison to IBs while on a small scale Islamic banks had more financial stability.

Moussawi and Obeid (2011) sought to propose a method of evaluating the productive performance of Islamic banks operating in the GCC region over the period 2005-2008. Thus, they evaluated the productive performance of Islamic banks using DEA to decompose the productive efficiency into technical efficiency, allocation efficiency, and cost efficiency. The application of this technique on a sample of 23 Islamic banks revealed that the technical inefficiency and allocation inefficiency increased bank costs, on average, by about 14% and 29%, respectively. In addition, the results showed that internal and external factors seem to contribute significantly to the evolution of efficiency scores of Islamic banks operating in the GCC region.

Mostafa (2011) attempted to measure the relative efficiency of the top 100 Islamic banks. DEA method was applied to evaluate the relative efficiency of IBs using cross-sectional data for the year 2009. The results indicated that the performance of several banks is sub-optimal, suggesting the potential for significant improvements. Separate benchmarks were derived for possible reductions in resources used, and significant savings are possible on this account.

Yahya et al (2012) outlined the difference in the efficiency level of Islamic and conventional banking in Malaysia. Taking into account the constraints posed by Islamic tenets, data envelopment analysis was used to measure the efficiency levels of banks in both sectors. Within the three year period considered, it was found that there existed no significant difference in the level of efficiency between IBs and CBs.

Johnes et al (2013) compared the efficiency of IBs and CBs during the period 2004–2009 using data envelopment analysis (DEA) and meta-frontier analysis (MFA). The use of the non-parametric MFA allowed for the decomposition of gross efficiency into 2 components: net efficiency and type efficiency. The analysis was performed in two stages. The first stage employs DEA and MFA to compare banks on the basis of gross efficiency and its components (net and type). Findings showed that Islamic banks were typically on a par with conventional ones in terms of gross efficiency, significantly higher on net efficiency and significantly lower on type efficiency. Second stage analyses, which account for banking environment and bank-level characteristics, confirmed these results. The low type efficiency of Islamic banks could be attributed to lack of product standardization whereas high net efficiency reflects high managerial capability in Islamic banks.

Ahmad and Rahman (2012) researched the efficiency of Islamic and conventional banks in Malaysia. The study used DEA to measure the relative efficiency of the selected banks based on data gathered between years 2003 to 2007 and found that CBs outperformed their Islamic counterparts in all measures of efficiency.

4. Research Methodology and Data
4.1 Data Envelopment Analyses (DEA)

Several scholars have employed various methodology in assessing efficiency in the financial services sector like the Return on Asset (ROA) (Rosly and Baker, 2003), the Stochastic Frontier Approach (Srairi, 2009), Output Distance Function (Abdul-Majid et al, 2009), Meta Frontier Analyses (Johnes et al 2013), Data Envelopment Analyses (DEA) and so on. This research, like many other on bank efficiency, employs DEA in measuring the efficiency of PBs with regards to other sector players and conventional banks in the Turkish economy.

DEA is a technique of linear programming which facilitates the determination of a Decision Making Unit's (DMU) efficiency based on selected inputs and outputs, and compares it to other DMUs involved in the analysis. Giving no room to statistical error, DEA can be described as data-oriented as it affects performance evaluations and other inferences directly from the observed data with minimal assumptions.

The efficiency of a DMU is ascertained relative to all other DMUs in the analysis with the simple postulation that all DMUs lay on, above or below the extreme frontier (mark of efficiency). This non-parametric approach does not require any assumption of a functional form.

Analyzing each DMU separately and calculating maximum performance for each unit, DEA determines which DMU is efficient or not based on given inputs and outputs from a set of DMUs in the analysis.

Data Envelopment Analysis was introduced by Charnes, Cooper and Rhodes (1978) to assess the relative efficiency of organizational units with multiple inputs to produce multiple outputs. The authors of DEA defined the efficiency of the unit under evaluation as the ratio of the sum of its weight outputs to the sum of its weight inputs.

Based on this initial research, several research has been carried out on DEA within the past years on various models of the method and applications are countless including Agriculture, Branch Banking efficiency analyses, sports betting, health just to mention a few.

In this study,the DEA Return to Scale models will be employed in measuring the technical efficiency of PBs using an excel solver add-in software developed by Joe Zhu. Data will be fed into the excel solver to make comparison between PBs in the subsector and then among these banks and CBs in the banking sector as a whole.

This non-parametric linear programming technique calculates a comparative ratio of outputs to inputs for each unit, which is then stated as the relative efficiency score. The efficiency score is generally expressed as either a number between zero and one or 0 and 100 per cent. A decision-making unit with a score less than one is deemed inefficient relative to other units. As Avkiran (1999) pointed

out, DEA's main benefit lies in its ability to generate potential improvements, achievable targets, for inefficient units and consequently identifying DMUs to benchmark.

As an efficient frontier technique, DEA identifies the inefficiency in a particular DMU by comparing it to similar DMUs regarded as efficient in the analysis, rather than trying to associate a DMU's performance with statistical averages that may not be applicable to that DMU.

Figure 2 shows a simple DEA model to throw light on this principle. The solid line going through efficient DMUs L, M and N portrays the efficient frontier that embodies achieved efficiency.Evidently, the efficient frontier envelopes all other data points, thus giving rise to the name data envelopment analysis (Avkiran, 1999). As an example, DMU K is classified as inefficient in this sample of ten units and it needs to travel to K[1] on the frontier before it can be considered efficient. DMU K would be directly compared to units M and N on the efficient frontier in calculating its efficiency score.

Figure 1: A one input, two output DEA indicating the efficient frontier
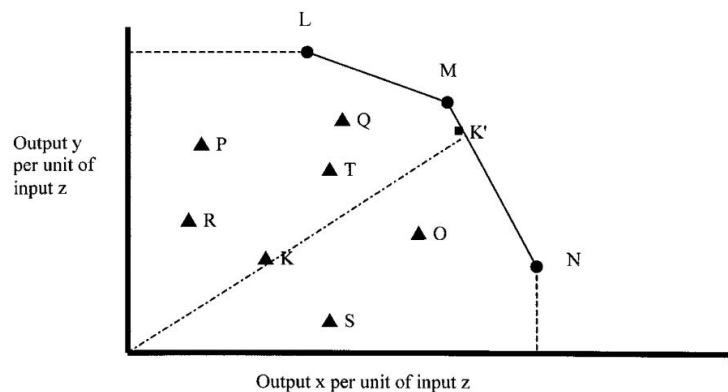
Source: Adapted from Avkiran (1999), An application reference for data envelopment analysis in branch banking: helping the novice researcher. International Journal of Bank Marketing, Vol. 17 Issue 5 pp. 206 – 220

In this case, DMU M would make a greater contribution to DMU K's score. DEA modeling serves the researcher with the capability to choose inputs and outputs in consonance with a managerial locus. This is a pivotal advantage of DEA as it paves way to what-if analysis. Additionally, the method is applicable with variables of different units without the need for standardization (e.g. currency, number of transactions, or number of branches).

Even though the need for definite and dependable is the same for all statistical analysis, DEA is especially responsive to unreliable data because the efficient frontier is determined by units deemed efficient based on the data provided in any particular analysis thus, influencing the efficiency scores of all other DMUs under this frontier.

This is so because those DMUs indicated as efficient are only efficient in comparison to others in the given sample. It may be possible for a unit outside the sample to achieve a higher efficiency than the best practice DMU in the sample. Determining which efficient DMUs are most comparable to the inefficient DMUs the analyst to establish an understanding of the nature of inefficiencies and re-allocate scarce resources to improve productivity. This feature of DEA is very useful tool in benchmarking and standardization.

It is imperative to use a homogeneous group of DMUs in DEA if confusing effects are to be minimized and results are to be comparable. For example, bank branches cannot be joined with branches of furniture retailers because these businesses are subject to different operational and production variables (Avkiran, 1999).

4.2 The Zhu Model

This study seeks to systematically analyze data gathered from audited annual financial reports of banks using a DEA solver tool modeled by Zhu (2002) as an Microsoft Excel add- in. This model's cost efficiency model is briefly summarized below for the CRS approach as:

$$min \sum_{i=1}^{m} p_i^o \widetilde{x_{io}} \qquad (1)$$

$$CRS \sum_{j=1}^{n} \lambda_j x_{ij} \leq \widetilde{x_{io}} \qquad i = 1,2,\ldots,m; \qquad (2)$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r = 1,2,\ldots,s; \qquad (3)$$

$$\lambda_j, x_{io} \geq 0. \qquad (4)$$

Subject to
Alternatively the revenue efficiency model is structured as:

$$max \sum_{r=1}^{s} q_r^o y_{ro} \qquad (5)$$

Subject to

$$CRS \sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{io} \qquad i = 1,2,\ldots,m; \qquad (6)$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq \widetilde{y_{ro}} \qquad r = 1,2,\ldots,s; \qquad (7)$$

$$\lambda_j, \widetilde{y_{ro}} \geq 0 \qquad (8)$$

4.3 Definition of Variables

4.3.1 Inputs
These are the resources employed by the banks to produce the desired outputs. The main inputs considered for the study are as follows;

4.3.1.1 Fixed assets
This consists of the total tangible and intangible fixed assets to the banks' name as at the end of the reporting period. Tangible fixed assets of the banks may include buildings and premises, lands, vehicles and so on. Intangible fixed assets on the other hand may include goodwill, patents and other related assets. Fixed assets are literally the basic building blocks upon which banks are established.

A bank as a financial intermediary will produce loans through employing the resources it has in its disposal such as branches, offices and other fixed assets that gives it the fiduciary image from the perspective of the general public (potential and existing clients).

4.3.1.2 Total Deposits

This is the sum of all funds gathered from clients in the banks' possession by way of safe keeping or investment. This is primarily the source of money to be lent to loan applicants in the classical banking sense, ergo acquiring funds from those with surplus (investors) and making it available to those with deficits (entrepreneurs). This paper seeks to assess how well participation banks and conventional banks convert these deposits to loans in the Turkish banking sector.

4.3.1.3 Other Operating Expenses

This signifies the amount of expenses incurred by the banks in converting deposits into loans. Employee salaries, golden handshakes, bonuses, fixed assets amortization expenses, provision for the fall in value of assets to be sold, administrative expenses, advertisement costs and related expenses are only but a few of such operating expenses. This research aims to reveal the need for inefficient banks to minimize these expenses in producing the same levels of loans and operating income.

4.3.2 Outputs

The ultimate goal banks seek to achieve in their endeavors as profit making entities are creating and disbursing loans and earning income as a results of this and other banking operations. These are the outputs selected for the study.

4.3.2.1 Total loans

This represents the sum of credit disbursed for operational purposes. Conventional banks generally earn interest on loans whilst Participation banks are entitled to shares in profit and loss for any given loan (credit).

4.3.2.2 Net Operating Income

Eventually banks, like most business entities aim to make profits from their operations and definitely avoid losses in case profits are not achieved during a particular year. The operating income sets the base for the profit making or loss incurring rhetoric of banks.

The operating income of banks generally comprises of net interest income (or net profit and loss sharing income in the case of participation banks), net charges and commissions, dividends from investments, earnings from money and capital markets, and other operating income.

Table 1: Bank Categories under the Study

Category	Name
Participation (Islamic)Banks	Albaraka Türk Katılım Bankası A.Ş.
	Asya Katılım Bankası A.Ş.
	Kuveyt Türk Katılım Bankası A.Ş.
	Türkiye Finans Katılım Bankası A.Ş.
State Owned Conventional Banks	T.C. Ziraat Bankası A.Ş.
	Türkiye Halk Bankası A.Ş
	Türkiye Vakıflar Bankası T.A.O.
Private Conventional Banks	Akbank T.A.Ş.
	Anadolubank A.Ş.
	Fibabanka A.Ş
	Şekerbank T.A.Ş.
	Türk Ekonomi Bankası A.Ş.
	Turkish Bank A.Ş.
	Türkiye İş Bankası A.Ş.
	Yapı ve Kredi Bankası A.Ş.
Foreign Conventional Banks	Alternatifbank A.Ş.
	Arap Türk Bankası A.Ş.
	Bank of Tokyo Mitsubishi UFJ Turkey A.Ş

Category	Name
	Burgan Bank A.Ş
	Citibank A.Ş.
	Denizbank A.Ş.
	Deutsche Bank A.Ş.
	Finansbank A.Ş.
	HSBC Bank A.Ş.
	ICBC Turkey Bank A.Ş.
	ING Bank A.Ş.
	Odea Bank A.Ş
	Rabobank A.Ş
	Turkland Bank A.Ş.
	Türkiye Garanti Bankası A.Ş.

5. Discussions of Results and Findings

This study makes use of data envelopment analysis (DEA) in investigating the efficiency of the banks in Turkey focusing on the performance of participation banks (PBs) against the conventional banks (CBs). To make this study more realistic and only commercial banks were considered in the sampling since they have common grounds with the PBs in terms of fundamental banking operations. These CBs are however classified into three (3) categories for a more detailed varied comparison namely; State Owned, Private and Foreign. Separate DEA is performed on the PBs against each of these categories for the years 2010, 2011, 2012, 2013, 2014 and 2015. DEA can be applied by utilizing either constant returns to scale (CRS) orvariable returns to scale (VRS) form. The results achieved will be discussed in this section of the study.

This study investigates overall technical efficiency (TE) of each bank under CRS and VRS modules of DEA also calculating their respective scale efficiencies in the process. This research concentrates on the VRS module as it allows for the comparison of DMUs.

In order to be able to compare the conventional banks in the country to the PBs, the intermediation approach was selected where banks are viewed as the converters of deposits to credit who earn income on this process through commissions, interests and other related sources. This would mean the exclusion of specialized investment banks, development banks and so on.DEA efficiency scores in this research are represented between 1 and 0 in the percentage form. Logically the difference between a 100% efficiency and the specific DEA makes the percentage inefficiency value. The percentage form of representation was chosen for easier representation and clarity of information.

Owing to technical limitations in the computer software used in this analyses, it was not possible to compare all the banks in the sample under one single efficiency frontier hence the categorization. Also, financial data gathered and used for the research had to be limited to the year end 2015 since most of the banks had only released their audited financial reports as at the time of the analyses for that particular year.

Table 7:   Technical Efficiency CRS

Technical Efficiency (TE) - CRS						
Comparison Type	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
PB vs State Owned Conventional Banks	99.93%	99.35%	94.78%	95.01%	94.03%	92.41%
State Owned Conventional Banks vs PBs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
PB vs Private Conventional Banks	98.04%	99.29%	91.02%	94.34%	93.08%	90.29%
Private Conventional Banks vs PBs	88.25%	95.53%	92.22%	96.20%	95.39%	97.12%
PB vs Foreign Conventional Banks	97.73%	98.28%	92.70%	96.29%	80.06%	79.47%
Foreign Conventional Banks vs PB	89.80%	96.05%	93.64%	96.74%	84.88%	94.56%

Source: Own calculations

Fromtable 2 the comparison under the constant return to scale (CRS) technical efficiency scores are depicted through the years 2010 to 2015 for the participation banks (PBs) in Turkey as against the conventional banks (CBs) broken down into three categories. When all the PBs were compared to the state owned commercial banks, the average efficiency for the PBs was 99.93% for the year 2010. The efficiency scores not following any particular pattern still show a fall from the initial year 92.41% in the final year of assessment. The PBs averaged an efficiency score of 95.92% (4.08% inefficient) when compared to the state owned commercial banks who consistently chalked a 100% efficiency throughout the comparison with the PBs. The reason for such a level of efficiency attained by these state owned banks could be derived from their size.

When comparison was made between PBs and Private Commercial banks however, the scores were quite different from the results attained in the PB – Public Commercial banks data envelopment analysis. Efficiency scores for both sides were quite high even though none of the sides attained a perfect efficiency score. The PBs had higher scores with a maximum of 99.29% (0.71% inefficient) with the minimum efficiency scores under this frontier going to the Private commercial banks at 88.25% (11.75 inefficient). The PBs prove to be more efficient under the CRS analyses with an average score of 94.34% as against the 94.12% obtained by the private commercial banks.

The final comparison under the CRS module is that of the PBs against the foreign commercial banks operating in the Republic of Turkey. Under this analysis a major difference in efficiency scores was witnessed in the year 2015 when the number of PBs in the sample reduced to three adversely affecting their results to as low as 79.47% (20.53% inefficient). This was a huge drop considering the 97.73% and 98.28% efficiency scores achieved in the 2010 and 2011 analyses respectively. Making the assertion based on the average efficiency scores under the CRS module for the period in contention, the foreign commercial banks tend to be more efficient than the PBs in the country at with an efficiency score of 92.61% (7.39% inefficient) as against the 90.76% (9.24% inefficient) acquired by the PBs.

To summarize the results from the CRS DEA for the period under this research, the PBs can be deemed as less efficient when compared to the CBs in the country with efficiency scores being below that of the CBs in two categories and slightly above them in one category.

Table 8: Technical Efficiency VRS

Technical Efficiency (TE) - VRS						
Comparison Type	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
PB vs State Owned Conventional Banks	100.00%	100.00%	97.23%	98.43%	98.11%	99.00%
State Owned Conventional Banks vs PBs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
PB vs Private Conventional Banks	99.35%	99.45%	93.45%	95.01%	93.78%	91.49%
Private Conventional Banks vs PBs	99.10%	100.00%	99.16%	99.81%	98.83%	99.53%
PB vs Foreign Conventional Banks	97.88%	98.97%	95.32%	96.92%	86.14%	91.81%
Foreign Conventional Banks vs PB	93.42%	98.40%	98.04%	97.21%	97.24%	98.23%

Source: Own calculations

In order to better comprehend the DEA for more reliable efficiency scores, the VRS module was also employed in this study. This module works under the notion that increases or decreases in outputs do not necessary result in proportional increases or decrease in outputs. This is important and most relevant in our research since the different market conditions even though have some similarities, also pose significant challenges to the PBs and CBs in varied ways. A simple example will be the likelihood of the decision of people to deposit funds in a PB or CB based on their religious beliefs. A country like Turkey with contrasting religious views would definitely provide an almost non-even playing field for banks operating under the Islamic credos. This asymmetry may play to the advantage or otherwise of the PBs.

DEA results under the VRS module proved to provide a more substantial level of efficiency for all the banks under the research. Just as it was for the CRS the public commercial banks registered

perfect efficiency scores when compared to the PBs under the VRS module. The PBs also had a higher score with two perfect scores for the 2010 and 2011 analyses. Relative to the CRS module higher efficiency scores of 97.23%, 98.43%, 98.11% and 99% were achieved by the PBs for the years 2011, 2013, 2014 and 2015 respectively when comparison was carried out against the public commercial banks under the VRS module.

In the comparison of the PBs with the private commercial banks, the PBs proved to be the less efficient side with an average efficiency score of 95.42% (4.58% inefficient) as against the 99.41% (0.59% inefficient) secured by the private commercial banks. Even with a lower average efficiency score, the PBs actually were more efficient that the private commercial banks in the year 2010 with a score of 99.35%. The private commercial banks achieved a 99.10% under this frontier essentially being less efficient than the PBs albeit very meager in terms of difference. The lowest score obtained by the PBs against the private commercial banks was 91.81% in the year 2015.

DEA for the research period carried out between PBs and foreign commercial banks under a VRS frontier indicated higher efficiency as opposed to the CRS analyses made for the same banks during the same span of time. As it is usual with this particular study, the participation banks were the most efficient in the first three years (2010, 2011 and 2012) than they were in the last three (2013, 2014 and 2015). The PBs averaged an efficiency score of 94.51% (5.49% inefficient) with the foreign commercial banks obtaining a higher score of 97.09% (2.91% inefficient). One efficiency score worthy of note is that of the PBs for the year 2014 when the lowest was seen at 86.14% (13.86% inefficient). This was the highest inefficiency in the VRS analyses.

6. Conclusion

The global growth of Islamic banking has posed several questions regarding their efficiency as banking institution and their ability to compete in the financial markets effectively with conventional banking bodies. The PBs in Turkey, no stranger to the restrictions imposed on Islamic banks by the *Shari'a*, their competitiveness in terms of efficiency is explored to bring demonstrated how they stand in comparison with their conventional counterparts.

Efficiency in banking has taken center stage in recent research to provide a wide range on insightful and valuable inputs for the benefit of the industry and its continual development. Naturally, like any other form of efficiency, there are several methods of measuring banking efficiency that all seek to give viable results. Some of the methods are based on financial ratios, parametric and non-parametric econometric approaches. This research investigates the efficiency of participation banks vis-à-vis conventional banks in Turkey using the non-parametric approach: DEA.

The research posed certain questions and sought to have them answered after the analyses. Key among these questions is the one that sought to determine whether or not PBs in Turkey were efficient. Another was to ascertain the rise or fall in the trend of efficiency across the research period of these banks. Finally, the relative inferiority or superiority in efficiency of PBs was to be determined with respect to CBs.

DEA was selected for this research as it determines efficiency relative to the sample provided for a particular frontier. With special attention paid to the VRS module efficiency scores for the six year period were obtained for PBs against all three categories of CBs. The data used was sourced from audited year-end financial reports of the banks sampled. It is important to note that not all PBs in the country were included in the sample as a couple of them were still new and as such had not published any year-end audited financial statements. Another limitation that obviously impacted the efficiency scores of PBs was the closure of one of the industry players in 2015. PBs figures and efficiency scores for 2014 were also affected by drastically due to the troubled bank that eventually got shut down.

Based on the DEA performed in this thesis, a general assertion can be made regarding PBs in the country; participation banks even though lack a perfect efficiency score are highly efficient and are poised to maintain the balance in the competition. The results clearly display a highly competitive

atmosphere in the banking industry with particular PBs making waves in terms of efficiency. Throughout the entire course of the DEA efficiency scores of less than 50% were obtained twice by individual banks one of which was a PB (Albaraka Türk Katılım Bankası A.Ş. with a 46% CRS score in 2015) and the other a CB in the foreign banks category (Deutsche Bank A.Ş. with 47% CRS score in 2010).

These findings could serve as the basis for other researchers to actually delve into the competition structure of the market and make conclusive assertions of factors affecting the choices of banking product consumers to prefer PBs to CBs or vice versa. The DEA results obtained under this study demonstrates a generally high level of efficiency for the PBs just like it is for the CBs hence.

This suggests that their consistent growth in size and number will definitely contribute to an advantage for the PBs as being the choice banks would translate into higher earnings which would make up for some of the slacks observed in the DEA on the Total Operating Income component of the output variables. Of course that is not to say that only this component contributes to efficiency. A detailed restructuring or improvement of the processes, not forgetting to maintain compliance with the *Shari'a* these banks utilize can contribute to a higher level of overall technical efficiency as deduced by the slacks seen in this DEA. Finally, the size of the operations have been observed to have an effect on efficiency. Bigger banks under this study generally obtained higher efficiency scores.

References
[1]   Abdul-Majid M., Saal D.S. and Battist G. (2009), "Efficiency in Islamic and conventional banking: an international comparison", *Springer.*
[2]   Ahmad S, and Rahman A.R.A. (2012), "The efficiency of Islamic and conventional commercial banks in Malaysia", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 5 Iss 3 pp. 241 – 263.
[3]   Avkiran N.K. (1999), "An application reference for data envelopment analysis in branch banking: helping the novice researcher", *International Journal of Bank Marketing*, Vol. 17 Iss 5 pp. 206-220.
[4]   Beck T., Demirgüç-Kunt A. and Merrouche O. (2010), "Islamic vs. Conventional Banking Business Model, Effiency and Stability", *Policy Research Working Paper* 5446 World bank.
[5]   Charnes A., Cooper W. & Rhodes E. (1978). *"*Measuring the Efficiency of Decision Making Units"*, European Journal of Operational Research,* 2: pp 429-444*.*
[6]   Gerrard P. and Cunningham J.B. (1997), "Islamic banking: a study in Singapore", *International Journal of Bank Marketing*, Vol. 15 Iss 6 pp. 204 – 216.
[7]   Johnes J., Izzeldin M. and Pappas V. (2013), "A comparison of performance of Islamic and conventional banks 2004–2009", *Journal of Economic Behavior & Organization*.
[8]   Mostafa M.M. (2011), "Modeling Islamic banks' efficiency: a non-parametric frontier approach", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 4 Iss 1 pp. 7 – 29.
[9]   Moussawi C.E. and Obeid H. (2011), "Evaluating the Productive Efficiency of Islamic Banking in GCC: A Non- Parametric Approach", *International Management Review* Vol. 7 No. 1.
[10]   Okumus H.S. (2005). "Interest free banking in Turkey: A study of customer satisfaction and bank selection criteria", *Journal of Economic Cooperation*, 26 (4), pp.51 – 86.
[11]   Okumus H.S. and Artar O.K. (2012), "Islamic Banks and Financial Stability in the GCC: An Empirical Analysis", *Istanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi,* Vol.11 Sayi: 21 Spring 2012 / 1 pp.147 – 164.
[12]   Participation Banks Association of Turkey 2014*,* "Participation Banks", (*http://www.tkbb.org.tr*) (Accessed: 15.01.2016)
[13]   Rosly S.A. and Bakar M.A.A. (2003), "Performance of Islamic and mainstream banks in Malaysia", *International Journal of Social Economics*, Vol. 30 Iss 12 pp. 1249 – 1265.

[14] Soteriou A.C and Stavrinides Y. (1997), "An internal customer service quality data envelopment analysis model for bank branches", *International Journal of Operations & Production Management*, Vol. 17 Iss 8 pp. 780 – 789.

[15] Srairi S.A.(2009), "Cost and profit efficiency of conventional and Islamic banks in GCC countries", *Springer*.

[16] **Sufian F. and Noor M.A, (2009). "The determinants of Islamic banks'efficiency changes", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 2Iss 2 pp. 120 - 138**

[17] Uppal J.Y. and Mangla I.U. (2014), "Islamic Banking and Finance Revisited after Forty Years: Some Global Challenges" *Journal of Finance.*

[18] Yahya M.H, Muhammad J. and Abdul Hadi A.R (2012), "A comparative study on the level of efficiency between Islamic and conventional banking systems in Malaysia", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 5 Iss 1 pp. 48 – 62.

[19] Zhu, J., (2002). "Quantitative Models for Performance Evaluation and Benchmarking: Data Envelopment Analysis with Spreadsheets and DEA Excel Solver". *Norwell, MA: KluwerAcademic Publishers Group.*