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NON-PARAMETRIC APPROACH TO MODEL THE BRANCH-WISE EFFICIENCY OF ISLAMI BANK BANGLADESH LIMITED (IBBL): AN EMPIRICAL STUDY

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ABSTRACT

This study examines the branch-wise technical, pure technical, scale and allocative efficiencies of Islami Bank Bangladesh Limited (IBBL) using panel data for the year 2003 to 2007. The technique of Data Envelopment Analysis (DEA) has been utilized to compute the efficiencies of branches. The average allocative efficiency is 61-76%, whereas the average technical efficiency is about 51-65% during the study period. This means that the dominant source of inefficiency is due to both technical inefficiency and allocative inefficiency but technical inefficiency has got more contribution to inefficiency than allocative inefficiency. These results are consistent with the fact that the Islamic banks do not operate in an overall regulatory supportive environment. They are not even technically sound enough in their operations. Average scale efficiency is about 53%, and average pure technical efficiency is about 68%t, suggesting that the major source of the total technical inefficiency for IBBL branches are not pure technical inefficiency (input related) but scale inefficiency (output related). Study results indicate that there has been moderate increase in productivity growth over the years. Productivity increases in IBBL branches are mainly driven by technological change (opening up and penetrating in other markets) not technical efficiency change (efforts of inefficient banks to catch up with the efficient ones). The results show that larger branch size is associated with higher efficiency. These results indirectly support the economies of scale arguments in IBBL branches.

JEL Classification: D61, G21, Z12

Key words: Bank Efficiency, Productivity, Islamic Banking, DEA Approach, Bangladesh

1. INTRODUCTION

The first *Sharīᶜah*-based Islamic bank, in Bangladesh is Islami Bank Bangladesh Limited (IBBL), and has started its functioning on 30 March, 1983. During the last two decades, the IBBL, like other parts of the world, has significantly expanded its network at home and abroad, and has been able to mobilize large amount of deposits, and promote many economic ventures. The volume of its business is more than double of the business of any other private bank of the country. With deposits of Tk. 21,996 crore on 30 June 2009, the IBBL accounts for 8.70% of the country's banking sector. Over the last two decades, this Bank has grown steadily in size, measured in terms of total deposits, at a fairly uniform average annual growth rate of about 30%. In addition, the IBBL has been playing a major role in rendering social services to the generally ignored poverty stricken households from the banking services. Given the different behavior of the Islamic banks from the traditional commercial banks and its involvement in both social and economic activities, there has always been questions about the long run sustainability of the banks. Besides, due to globalization and the free market economy, this industry is facing severe competition in any country and the implementation of the WTO will further increase competition. In addition, the diversified involvement of the Islamic banks in social and economic activities indeed increases its operational costs, which many critics consider as the major constraint for long run sustainability of this newly introduced profit-sharing banking systems. Therefore, after more than two decades have elapsed, it is time to assess the performance of the IBBL.

Performance and efficiency of commercial banks are key elements of the efficiency and efficacy of a country's financial sector. Performance evaluation of banks, particularly in an economy that is dominated by public sector banks that are not driven purely by profit motive, however, is not a simple task. Profitability is definitely a key measure of performance, but its use as the sole measure is disputed by many and therefore, several alternative measures of efficiency have been used in the literature (Chakrabarti and Chawla, 2005). A key issue of judging bank efficiency is the link between management objectives and the selected measure of efficiency. As is the case with any business, banks too seek to maximize shareholder value as well as pursue strategic objectives. Banks at different levels of market share frequently set differing objectives, so any measure other than return on assets is fraught with comparability problems.

Branch performance analysis is commonly done through budgeting, measuring total deposits, and branch profits; the latter two measures generate retrospective information which cannot be used to gauge the potential of a branch to generate retail banking business. Budgeting is criticised for giving too much emphasis on items that are outside the management’s concern, and focusing on expense items rather than overall profitability (Smith and Schweikart, 1992). On the other hand, measurement of total deposits is criticised on such issues as equal treatment of different types of deposits and ignoring revenues from loans (Chelst, Schultz and Sanghvi, 1988). Furthermore, the use of branch profits, which is an aggregate number, as a measure of branch performance, lacks information on specific factors affecting performance and once again, some of these factors may be beyond the branch management’s control (Doyle, Fenwick and Savage, 1979). Therefore, branches would be evaluated by efficiency and productivity measures which are performance and success indicators. The determinants of inefficiency would also be identified by estimating efficiency and productivity and by isolating their effect from the effects of the environment in which banks do its business. Identifying sources of inefficiency plays an important role in designing policies to improve the performance of the branch.

The few previous studies of the bank efficiency of Bangladesh have been narrow in their focus. Therefore, this study examines the branch-wise efficiencies of Islami Bank Bangladesh Limited in Bangladesh (IBBL) from 2003-2007, by using non-parametric approaches. To the researcher’s best knowledge, this is the first time the efficiency of IBBL was estimated using modern techniques. This study employs a nonparametric data envelopment analysis (DEA) to estimate the technical, allocative and scale efficiency of the branches. The outcome of this study will allow us to examine what factors are important in improving efficiency of IBBL, and under what conditions such institutions are sustainable.

The feature of this approach is that it provides a relative measure of efficiency (i.e., efficiency is derived by comparison with the frontier function). If the most efficient branch can be considered efficient, then perhaps the approaches do provide some measure of efficiency in absolute terms.

This study also examines the banks’ structure related factors which might have influence on the efficiency scores. It provides useful information for policy formulation in Bangladesh and serves as an illustration of the findings that may be derived from survey data using these methods. Little work has been done on these issues in Bangladesh, especially on Islamic banking.

1.1 RELATED STUDIES

The studies of efficiency using frontier approaches on banking did not start until Sherman and Gold (1985) initiated their own. They applied the frontier approach to the banking industry by focusing on the operating efficiency of the branches of a savings bank. Since then, numerous studies have been conducted using frontier approaches to measure banking efficiency. There have been extensive studies on bank efficiency done in the US and European countries and most of them focused on conventional banking (Berger and Humphrey, 1997; Goddard et al., 2001).

Despite the considerable development of the Islamic banking sector, there have been very limited studies done focusing on the efficiency of Islamic banks. Several studies that have been devoted to assess the performance of Islamic banks have generally examined the relationship between profitability and banking characteristics. The DEA have been used extensively to measure banking efficiency. Some of the studies that measure efficiency of Islamic banks using DEA are those of Yudistira (2004), Ascarya and Yumanita (2006, 2007a, and 2007b), Sufian (2007) and Zamil and Rahman (2007). Yudistira measured the efficiency of 18 Islamic banks from various countries during 1997–2000 using intermediation approach. Ascarya and Yumanita (2006) measured the efficiency of Islamic banks in Indonesia during 2002 – 2004 using intermediation and production approaches, since Islamic banking not only can be viewed as an intermediary institution, but can also be viewed as a production entity. Sufian measured the efficiency of Islamic windows in Malaysia during 2001–2004 using intermediation approach with the same reason as that of Yudistira. Mokhtar et al. (2007) measured the efficiency of 22 Islamic banks (20 windows and 2 full-fledged) and 20 conventional banks in Malaysia during 1997-2003. Meanwhile, Zamil and Rahman (2007) measured the efficiency of Islamic banks and conventional banks in Malaysia during 2001-2004 using intermediation approach.

A similar approach of efficiency study was conducted by Ascarya and Yumanita (2006) and Yaumidin (2007). They used the DEA method to measure the efficiency of Islamic banks. Ascarya and Yumanita (2006) focused their study on investigating the comparative efficiency between Islamic banks in Malaysia and

Indonesia. The input variables used are total deposits, labor, and fixed assets, while the output variables used are total loans and income. Their interesting finding was that profitable banks tend to be efficient banks. They also found that the majority of Malaysian Islamic banks have been experiencing diseconomies of scale in 2005, especially small and foreign owned banks. Besides that, they concluded that Indonesian Islamic banking has recorded high overall efficiency of 85%, mainly due to the improvement in scale efficiency from impressive growth in the period of observation.

Viverita et. al. (2007) and Kamaruddin et. al., (2008) also applied DEA to assess the cost and profit efficiencies of Malaysian Islamic banks and conventional banks for the period 1998 to 2004. The results generally suggest that an Islamic bank wasted around 30.5% of its inputs relative to the best-practice bank. The results also show that there existed about 30-37% inefficiencies in the operations of Islamic banks over the period of study. Mohamad et. al., (2008) examined the cost and profit efficiency of conventional versus Islamic banks using the Stochastic Frontier Approach. The results suggest that there are no significant differences between the overall efficiency results of the conventional and Islamic banks.

Although there are a lot studies on the estimation of bank efficiency in the literature, so far only a few of this type of study has been conducted in developing countries (e.g., Bhattacharya, Lovell and Sahay, 1997, for India; Taylor et al, 1997, for Mexico; Al-Faraj, Alidi, and Bu-Bshait, 1993, for Saudi Arabia; Zaim, 1995; Isik and Hassan, 2002a, b, for Turkey; and Hassan and Tufte, 2001, for Bangladesh). The results of all these studies reveal that, in general, banking firms experience an average efficiency of 77% and median of 82% (Berger and Humphery, 1997), and these statistics are significantly different across countries. Hamid (1999) evaluates the performance of one of the five Islamic banks in Bangladesh, Islami Bank Bangladesh Limited (IBBL) in comparison with two comparable conventional banks—Arab Bangladesh Bank Limited (ABBL) and Pubali Bank Limited (PBL), using accounting ratios. The IBBL is found to be more productive in terms of total income compared to the other two conventional banks. However, one of the two conventional banks under study, the ABBL, is better than the Islamic bank, the IBBL, in terms of the labor productivity. He reasoned that the comparatively new Islamic bank (IBBL) incurred higher cost because of her strategy of hiring experienced bankers from the conventional banks. Aktan, Masood and Iqbal (2009) conducted a research on the strength and growth of Islamic banking in Bangladesh. He found that the Islamic banks in Bangladesh continued to show strong growth since its inception in 1983 to June 2007. Islamic banks maintained and achieved a strong position in the key areas like capital adequacy, liquidity, assets quality, management and earnings. Dilruba and Khandoker (2005) estimated relative economic and price efficiency of different banks in Bangladesh. However, the few previous studies on the efficiency of Bangladeshi Banks have been narrow in their focus.

This study attempts to avoid the problems inherent in simple measures by constructing a variety of approaches that can be used to measure the extent of different efficiencies. The study avoids the parametric approach although the main attraction is that they allow hypothesis testing and the construction of confidence intervals. However, the drawbacks are the need to assume a functional form for the frontier technology and for the distribution of the technical inefficiency term (Coelli, 1996).

This study uses the programming approach which is nonparametric and does not require one to make such assumptions, i.e., the nonparametric approach is less prone to these types of specification error. However, the major weakness of the programming approach is that it is deterministic, and cannot decompose the unknown effects or unknown errors. The deterministic approach assumes that the error term, and any firm level deviations are attributed to inefficiency (Coelli, 1996). This investigation estimates technical, allocative and scale efficiencies, using different approaches.

2. METHODOLOGY

2.1 SOURCES OF DATA

Different types of branch level efficiencies of the IBBL were estimated based on panel data (2003 to 2007) which was directly collected from the branches using a pre-structured schedule. To compare the findings some secondary data were also used. This study had planned to bring all the branches under study but as the period considered was 5 (five) years (2003 to 2007) in the panel data, hence those branches which started operations after the year 2002 had to be dropped from the study. During the study, there were 200 branches of the IBBL functioning across the country and of them, only 121 branches were selected based on the criteria mentioned above.

2.2 MODEL USED

2.2.1 DATA ENVELOPMENT ANALYSIS (DEA)

The DEA measures efficiency by solving separate linear programming (LP) problems for each firm. Assuming that there are *N* firms which produce a single output using *m* different inputs and the *i*th firm unit produces y_i units of output applying xk_i units of *k*th inputs, the variable returns to scale (VRS) in the DEA model for Technical Efficiency of the branch:

(1) $\underset{\varphi_i \omega_i}{Max}\, \varphi_i$

$$\text{Subject to: } \varphi_i y_i + \sum_{j}^{n} \omega_j y_j - so = 0$$

$$-x_{ki} + \sum_{j=1}^{n} \omega_j x_{kj} + s_{I,k} = 0$$

$$(k = 1,2,3,......., m \text{ inputs})$$

$$\sum_{j=1}^{n} \omega_j = 1 \; (j = 1,2,3,......., n \text{ firm unit})$$

$$\omega_j \geq 0; \; so \geq 0; \; s_{I,k} \geq 0$$

Where φ_i is the proportional increase in outputs that could be obtained by the *i*th branch unit given input vector x_i; so and $s_{I,k}$ are the output slack and the *k*th input slack; and ω_i is the weight of the *j*th firm unit, *n* and *m* are the number of firm units and inputs, respectively.

If the constraint is removed, a constant returns to scale (CRS) output-oriented DEA results would be estimated. Then input saving efficiency measure and output increasing efficiency measure coincide and both coincide with scale efficiency in the case of VRS. The frontier level of production for firm *i*, is denoted by:

$$y^*_i = \sum_{j=1}^{n} \omega_j y_i = \varphi_i y_i$$

The output-oriented DEA frontier maximizes the proportional increase in the output vector while remaining within the envelopment space or efficient frontier. The proportional increase in output is obtained when output slack, s_o, equals zero. The *i*th branch unit is efficient and lies on the frontier if $\varphi_i = 1$, $\omega_i = 1$ and $\omega_i = 0$ for $i \neq j$ and the branch unit is inefficient and lies outside the frontier if $\varphi_i \rangle 1$, $\omega_i = 0$ and $\omega_i \neq 0$ for $j \neq i$. The output oriented technical efficiency (TE) measure of each firm, τ_i^{DEA}, can be estimated by:

$$\tau_i^{DEA} = \frac{y_i}{y^*_i} = \frac{y_i}{\varphi_i y_i} = \frac{1}{\varphi_i}$$

The estimate of technical efficiency of each branch unit in the output-oriented VRS DEA $\left(\tau_i^{VRS}\right)$ will be higher than or equal to that in the output oriented CRS DEA $\left(\tau_i^{CRS}\right)$ as the VRS DEA is more flexible than the CRS DEA.

2.2.2 ALLOCATIVE EFFICIENCY AND COST EFFICIENCY

If one has price information and is willing to consider a behavioral objective, such as cost minimization, then one can measure allocative efficiencies. The allocative efficiencies are estimated by minimizing the following DEA problem:

(2) $$Min_{\lambda, X_i}, w_i^{'} x_i^{+},$$

$$\text{Subject to: } -y_i + Y\lambda \geq 0,$$
$$x_i - X\lambda \geq 0,$$
$$N1^{'}\lambda = 1,$$
$$\lambda \geq 0,$$

Where w_i is a vector of input prices for the *i*th decision-making unit (DMU) and x_i (which is calculated by the model) is the cost-minimizing vector of input quantities for the *i*th DMU, given the input prices w_i and the output levels y_i. The total cost efficiency (CE) of the *i*th branch is calculated as:

(3) $$CE = w_i^{'} x_i^{+} / w_i^{'} x_i^{'}.$$

That is, CE is the ratio of minimum cost and observed cost for the *i*th branch. One can then calculate allocative efficiency (AE) using $AE = CE / TE$.

2.2.3 SCALE EFFICIENCY

Many studies have decomposed the TE scores obtained from a CRS DEA into two components: one due to scale inefficiency and the other due to pure technical inefficiency. This may be done by conducting both a CRS and a VRS DEA upon the same data. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency, and that the scale inefficiency can be calculated from the difference between the VRS TE score and the CRS TE score. The DEA models discussed so far have been variable returns to scale (VRS) DEA models. That is, they permit the constructed production frontier to have (local) increasing, constant or decreasing returns to scale properties. One can easily impose constant returns to scale (CRS) upon the DEA problem in problem (1) by deleting the convexity constraint $N1'\lambda = 1$. This allows calculation of the scale efficiency measure.

Scale efficiency can easily be calculated using the following formula:

(4) $$SE = TE_{CRS} / TE_{VRS}$$

2.2.4 THE MALMQUIST PRODUCTIVITY INDEX

In the presence of panel data, we can use DEA to calculate Malmquist index to measure productivity change and it can be decomposed into technological change and efficiency change. Caves, Christensen and Diewert (1982) developed a productivity index and uses the concept of distance functions in Malmquist's proportional scaling definition, without realizing the direct connection with Farrell efficiency measure.

Malmquist productivity change (Färe, Grosskopf and Lovell, 1985)

(5) $$M_0^{t+1}(x^{t+1}, y^{t+1,} x^t, y^t) = \left[\frac{D_0^t\left(x^{t+1}, y^{t+1}\right)}{D_0^t\left(x^t, y^t\right)} \frac{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^t, y^t\right)} \right]^{1/2}$$

This productivity index is the geometric mean of a pair of ratios of output distance function. The first ratio compares the performance of the data from period *t* to *t*+1 relative to production possibilities existing in period t, and the second compares the performance of the same data relative to production possibilities in period t+1.

The forgoing productivity index may be interpreted as an index of total factor productivity. It takes into account if firms are using the resources efficiency to produce goods and services, and if they using the existing technology to produce goods and services. Values greater than one means increases in productivity, while values less than one indicate decreases in productivity over time.

Färe et al. (1992) decomposed this index into sub indexes measuring changes in efficiency and changes technology:

$$(6)\quad M_0^{t+1}\left(x^{t+1}, y^{t+1}, y^t\right) = \frac{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_0^{t}\left(x^t y^t\right)} \cdot \left[\frac{D_0^{t}\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)} \frac{D_0^{t+1}\left(x^{t}, y^{t}\right)}{D_0^{t+1}\left(x^{t}, y^{t}\right)}\right]^{1/2}$$

The first term of the equation is the change in technical efficiency; and the second term is the change in technology. Values greater than one means increases in output technical efficiency, values less than one means decrease and a value of one indicates no change. The second term is the technological change.

Färe, Grosskopf, and Lovell (1994) further decomposed the Malmquist index by rewriting equation (6) as:

$$(7)\quad M_0^{t+1}\left(x^{t+1}, y^{t+1}, x^t, y^t\right) = \underbrace{\frac{\Delta_0^{t+1}\left(x^{t+1}, y^{t+1}\right) / D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{\Delta_0^{t}\left(x^{t}, y^{t}\right) / D^{t}{}_0\left(x^{t}, y^{t}\right)}}_{\Delta ScaleEfficiency}$$

$$\underbrace{\left[\frac{D_0^{t}\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)} * \frac{D_0^{t}\left(x^{t}, y^{t}\right)}{D_0^{t+1}\left(x^{t}, y^{t}\right)}\right]^{1/2}}_{\Delta PureTechnicalefficiency}$$

$$\underbrace{\left[\frac{\Delta_0^{t+1}\left(x^{t+1}, y^{t+1}\right) / D_0^{t}\left(x^{t+1} y^{t+1}\right)}{\Delta_0^{t+1}\left(x^{t+1}, y^{t+1}\right) / D_0^{t+1}\left(x^{t+1} y^{t+1}\right)} * \frac{\Delta_0^{t}\left(x^{t}, y^{t}\right) / D_0^{t}\left(x^{t}, y^{t}\right)}{\Delta_0^{t+1}\left(x^{t}, y^{t}\right) / D_0^{t+1}\left(x^{t}, y^{t}\right)}\right]^{1/2}}_{\Delta Techno\log y}$$

where Pure Technical Efficiency * Scale Efficiency = Efficiency

Färe, Grosskopf and Lovell (1994) refers to the first term as a measure of change in scale efficiency and the second term as a measure of pure efficiency change. The last term is unchanged and it gives a measure of change in technology.

Any change in scale efficiency may be caused either by: (i) a change in the shape of the technology, (ii) a change in the location of the bank in the input/output space between *t*1 and *t*2, or a combination of (i) and (ii). Additionally, any change in the pure technical efficiency is caused by a movement of the bank, relative to the existing technology. For each distance function, it is necessary to solve a DEA-VRS.

2.2.5 THE MODEL AND ITS ESTIMATION

A linear function (Equation 8) was separately estimated to relate branch specific TE, with the DEA, with branches characteristics, resource and institutional factors.

$$Eff_i = \alpha_0 + \alpha_1 TAB._i + \alpha_2 INV/TA_i + \alpha_3 OI/TA_i + \alpha_4 ASI_i + \alpha_5 TE_i + \alpha_6 OPB_i + \alpha_7 LOB_i + \alpha_8 ERDS_i + \varepsilon_i \quad (8)$$

(i = 1, 2, 3, … , N) where N = 121 (No of Branches)

TAB = Total Assets of the Branches

INV/*TA* = Ratio of Investment over Total Assets

OI/*TA* = Operating Income over Total Assets

ASI = Average Size of Investment

TEB = Total Employee of the Branch

OPB = Operating Period of the Branch

LOB = Location of the Branch

ERDS = Existence of RDS of the Branch

Eff. are estimated different efficiency,

$\alpha's$ are parameters to be estimated

and ε_i is a random error

2.3 DATA AND DEFINITION OF VARIABLES

To determine what constitutes inputs and outputs of banks, one first should decide on the nature of banking technology. In the literature on the theory of banking, there are two main approaches competing with each other in this regard, production and intermediation approach (Sealey and Lindley, 1977). Like many studies on banking efficiency (Isik and Hassan, 2002a; 2002b), we adopt intermediation approach in this paper.

Accordingly, we model Islamic banks as multi-product *firms,* producing three outputs employing three inputs. The input vectors include (i) labor, (ii) fixed capital, and (iii) total assets. We measure the labor by staff costs, capital by costs on premises and fixed assets, and customer and short-term funds by the sum of deposit (demand and time) and non-deposit funds as of the end of the respective year. Hence, the total costs include both non-interest expenses and fees and operating costs and are proxied by the sum of labor, capital and customer and short-term fund expenditures. Obviously, all *input* prices are calculated as flows over the year divided by these stocks: (i) price of labor is measured as total expenditures on employees such as salaries, employee benefits and reserves for retirement pay divided by total assets, (ii) price of capital is measured as non-profit expenses divided by average assets, and (iii) price of fund on profit expenses is defined by the profit paid on deposit divided by total deposit. On the other hand, the *output vector* includes branch-wise (i) profit/loss (ii) funded income and (iii) non-funded income.

This study uses branch-level data which are directly collected from the bank affairs and different statements for each year in the 2003-2007 periods. Table 1 gives the year-wise breakdown of the mean values of the 121 branches of Islamic banks. The input and output variables are defined in Table 1 and their descriptive statistics year-wise are provided in Table 2. Other data sources include the Rural Development Department (RDD), the Human Resources Department (HRD), the Establishment and Common Services (ECSD) and the Financial Administration Department (FAD) of the Islami Bank Bangladesh Limited.

TABLE 1
Brief Description of the Variables for the IBBL

Variables	Description
Cost	Profit paid on deposit, operational expenses, salary allowances & others
Profit/Loss	Total profit or loss of the branches
Funded Income	Investment income
Non-funded income	Other income (commission, exchange & other income)
Total assets	Total amount of cash & bank balances, total investment, furniture fixture and library, premises A/C, other assets, IBG A/C and assets as per contra
Price of Fund on Profit Expenses (%)	Total profit expense / total deposit
Price of Fund on Non-Profit Expenses (%)	Total non profit expense / total deposit
Price of Labor	Total salary expenses / total assets
Price of Capital	Non profit expenses / average assets
Profit Expense	Profit paid on deposit
Operational Expenses	Total operational expenses of the branch
Salary Allowances	Total salary allowances of the branch
Total Deposit	Total amount of deposit (demand deposit, term deposit)
Total Investment	Total amount of investment
Deposit Clients	Total demand deposit and term deposit clients
Investment Clients	Total investment clients
Average size of Investment	Ratio of investment to investors
Average size of Deposit	Ratio of deposit to depositor
Years of Operation	Years of operation up to 31 December, 2007
Total Clients	Total deposit and investment clients
Total Employees	Total number of executives (AVP to DEP), officers (AOG to SPO) and sub-staff
Operating Income / Total Assets	Ratio of operating income to total assets
Existence of RDS	Involvement of RDS with the Branch
Branches Location	Whether the branch is a rural or urban branch

TABLE 2
Descriptive Statistics of Input Variables for Different Branches of the IBBL

Variables	Year of Operation				
	2003	2004	2005	2006	2007
	Mean	Mean	Mean	Mean	Mean
Cost (US $)	458029.43	522694.91	668196.17	1009623.10	1153003.47
Profit/Loss (US $)	345151.59	408218.29	477336.54	544681.67	814534.80
Funded Income (US $)	624027.61	741157.07	949598.59	1318789.87	1724159.61
Non-funded income (US $)	110820.97	144101.41	208213.04	250228.84	232806.80
Total assets (US $)	12982141.03	16546495.13	20054390.07	25213176.04	33035672.26
Price of Fund on Profit Expenses (%)	4.73	4.36	3.27	4.10	5.86
Price of Fund on Non-Profit Expenses (%)	1.52	1.39	0.86	0.94	1.26
Price of Labor	0.71	0.63	0.59	0.7	0.72
Price of Capital	1.37	1.05	0.93	1.05	0.92
Profit Expense (PPD) (US $)	382008.11	432916.51	568895.19	870240.39	1001530.83
Operational Expenses (US $)	24139.17	28931.27	31655.33	38134.36	44788.76
Salary Allowances (US $)	52088.01	61033.61	67877.86	100875.41	120433.57

TABLE 2 (Continued)

Variables	Year of Operation				
	2003	2004	2005	2006	2007
	Mean	Mean	Mean	Mean	Mean
Deposit (US $)	8020163.99	9931724.47	17498634.53	21283401.89	17172489.43
Investment (US $)	7312339.97	9278058.90	11306166.21	13726359.99	17486013.06
Deposit Clients	16119	18023	20578	23212	26455
Investment Clients	1832	2077	2240	2779	3159
Average size of Investment (US$)	5950.73	6984.63	7865.87	9492.00	11648.37
Average size of Deposit (US$)	475.14	514.80	786.34	889.49	624.47
Years of Operation	Initiation up to December 2007				
Clients	17950	20099	22818	25991	29614
Employees	25	25	30	32	35
Operating Income / Total Assets	0.0043	0.0042	0.0044	0.0044	0.0039
Existence of RDS	Involved=77				
Branches Location	Urban =42				

* US $ 1 = Tk. 70.00

3. RESULTS AND DISCUSSION

3.1 EFFICIENCY USING DEA APPROACH

Table 3 reports sample statistics of the various efficiency scores of the IBBL branches for the fiscal years 2003 to 2007. These results suggest that the technical efficiency of most of the branches of IBBL are below the 90% efficiency level which implies that there is a downtrend in the technical efficiency of IBBL branches and the average mean technical efficiency of different branches are 58.2%.

As the results of Table 3 indicate, over the years under study, the average technical is about 36% where the average allocative efficiency is about 71%. Also, in each year, allocative efficiency of the IBBL branches is consistently higher than technical efficiency over the estimation period. This finding suggests that the dominant source of cost inefficiency is technical (managerial) rather than allocative (regulatory). Moreover, these results imply that IBBL branches do a better job choosing the proper input mix given the prices than employing available inputs. Hence, overall inefficiency in the IBBL branches may be attributed to reduce wasting of resources rather than choosing the incorrect input mix.

The technical efficiency (TE), pure technical efficiency (PTE), allocative efficiency (AE), cost efficiency (CE) and profit efficiency (PE) are estimated and the results are presented in Table 6. The results reveal that the estimated mean of TE range from 51 to 63%, PTE range from 72 to 87%, scale efficiency ranges from 70 to 78%, AE range from 61 to 74%, CE range from 82 to 85% and PE are 86 to 95% during the study period.

Furthermore, the decomposition of total technical efficiency (TE) into its components reveals that scale inefficiency for Islamic banks is also persistently higher than pure technical inefficiency. Pure technical efficiency is simply technical efficiency devoid of scale effects, i.e., the difference between technical efficiency and pure technical efficiency represents the cost operating at an incorrect scale. The results show that scale inefficiency is about 36.2%, while pure technical inefficiency is about 20.8%, suggesting that the major source of total technical inefficiency for Islamic banks is both scale inefficiency (output related) and pure technical inefficiency (input related). This finding is consistent with results reported in some studies for other countries.

TABLE 3
Frequency Distributions of Different Mean Efficiencies using DEA Approaches

Efficiency (%)	Technical		Pure Technical		Allocative		Scale	
	Br.	%	Br.	%	Br.	%	Br.	%
< 70	65	53.72	54	44.63	52	42.98	75	63
70-75	21	17.36	23	19.01	4	3.31	13	11
76-80	9	7.44	13	10.74	9	7.44	10	8
81-85	13	10.74	12	9.92	10	8.26	7	6
86-90	8	6.61	3	2.48	13	10.74	9	7
91-95	3	2.48	5	4.13	21	17.36	4	3
96-100	2	1.65	11	9.09	12	9.92	3	2
All	121	100	121	100	121	100	121	100
Mean		58.20		79.20		71.80		73.20
Std. dev.	17.00		15.49		21.87		21.00	
Minimum	45		48		42		49	
Maximum	100		100		99		100	

The frequency distributions of the predicted different efficiencies of the branches are presented in Table 3. This table shows that although there are very high relative frequencies of the efficiencies, there are also some branches which are quite poor in their TE, PTE, AE and Scale performance.

The bank branches mean of TE, PTE, AE, SE, of different years are plotted in Figure 1. This figure shows that during the study period, mean profit and cost efficiency of the branches were much higher than technical and allocative efficiency. The figure also shows that profit and cost efficiency have gradually decreased over the period, while technical and allocative efficiency has sharply increased during the years 2005 and 2006 although these have again decreased in 2007. Mean allocative efficiencies of the branches remain unchanged over the study period.

TABLE 4
Summary statistics for DEA TE, PTE and AE and Scale Efficiency Based on Branches Mean

Year	TE	PTE	SE	AE
	Mean	Mean	Mean	Mean
2003	53.00	75.00	71.00	61.00
2004	51.00	72.00	70.00	73.00
2005	59.00	79.00	75.00	73.00
2006	65.00	83.00	78.00	76.00
2007	63.00	87.00	72.00	74.00

FIGURE 1
Graphical Representation of Different Efficiencies of IBBL Branches for 2003-07

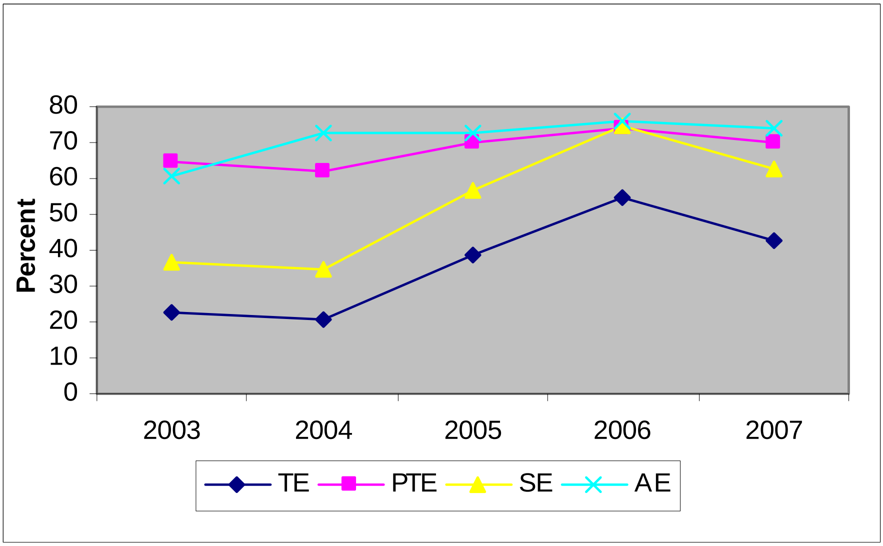

Table 5 shows the mean returns to scale results of the branches. The results show that on average more than 90% of branches show increasing returns to scale. It means that most of the IBBL branches can improve their performances by increasing their inputs and only a small number can improve their performance by decreasing their inputs. It also indicates that managers' capability to utilize branch reserves still needs to be enhanced to increase their efficiency in increasing their deposit and investing fund and improving their services for the clients. These results are very much consistent over the study period.

TABLE 5
Frequency Distributions of Returns to Scale Measures from the DEA Approaches

Returns to Scale	2003		2004		2005		2006		2007	
	Br.	%	Br.	%	Br.	%	Br.	%	Br.	%
IRS	113	93.39	116	95.87	117	96.69	110	90.91	115	95.04
DRS	3	2.48	1	0.83	1	0.83	6	4.96	3	2.48
CRS	5	4.13	4	3.31	3	2.48	5	4.13	3	2.48

3.2 The Most Efficient and Least Efficient Branches and their Characteristics

The most efficient and least efficient branches by efficiency types are presented in Table 6. The results show that Local Office is the most efficient branch in most respects followed by the Khatunganj branch. Meanwhile, Madhabdi is the least efficient branch which is followed by the Dhanmondi and Mongla branches.

The characteristics of the most efficient and least efficient branches may provide reasons for inefficiency. There can be location, year of operations, existence of RDS, size of investment, total employee and total assets effect on inefficiency. These factors are listed in Table 7. For the most efficient branches (Local Office, Khatunganj and Paltan), it is shown that all the 3 most efficient branches are located in the urban area and are authorized of foreign exchange dealership. Of the 3 branches 2 branches are very old while the third one was established in 1998. The least efficient branches (Madhabdi, Dhanmondi and Mongla) have mixed characteristics, unlike those that are most efficient. The characteristics mentioned in the table are mixed with most and least efficient branches, hence it is difficult to draw any conclusion. Therefore, further research can be done for policy recommendation.

TABLE 6
Efficient and Inefficient Branches using Different Approaches based on Five Years Mean Efficiency

Models	Most Efficient (%)		Least Efficient (%)	
	Branches	Efficiency	Branches	Efficiency
Technical Efficiency				
1	Noapara	99.95	Madhabdi	44.85
2	Khatunganj	99.66	Gaibandha	48.68
3	Local office	99.26	Jamalpur	48.76
4	Sylhet	95.88	Mongla	49.20
5	Beani bazar	94.98	Sherpur	50.15
Pure Technical Efficiency				
1	Noapara	100.00	Mongla	54.93
2	Local office	100.00	Madaripur	62.57
3	Bishwanath	100.00	Bogra	62.60
4	Tarakandi	99.98	Sreemongal	65.52
5	Khatunganj	99.90	Sitakundha	65.52
Allocative Efficiency				
1	Local office	99.16	Beani bazar	22.16
2	Highway br	98.20	Sylhet	22.48
3	Nawabpur	97.86	Dhanmondi	28.92
4	Paltan	97.76	Moulavi bazar	32.54
5	Jamalpur	97.68	Ambarkhana	34.40
Scale Efficiency				
1	Noapara	99.95	Highway br	51.12
2	Khatunganj	99.76	Rangamati	51.90
3	Local office	99.26	Teknaf	52.85
4	Gulshan	99.00	Madhabdi	52.94
5	Kushtia	98.80	Kashinthpur	54.25

TABLE 7
Characteristics of Efficient and Inefficient Branches

Characteristics	Most Efficient Branches			Least Inefficient Branches		
Branch Name	Local Office	Khatungang	Paltan	Madhabdi	Dhanmondi	Mongla
Year of Establishment	1983	1984	1998	1992	1998	1990
Location	Urban	Urban	Urban	Rural	Urban	Rural
Branch Type	AD	AD	AD	AD	AD	Non-AD
Average Manpower	322	61	38	31	31	27
Level of Branch Manager	EVP	SVP	SVP	AVP	VP	SPO
Existence of RDS	No	Yes	No	Yes	No	Yes

Notes: EVP=Executive Vice President, SVP=Senior Vice President, VP=Vice President, AVP=Assistant Vice President, SPO=Senior Principal Officer, AD=Authorized Dealer for Foreign Exchange

3.3 PRODUCTIVITY PROGRESS

Table 8 reports results from measuring productivity progress of different branches of the IBBL. The results indicate that these banks have experienced only 11.219% productivity growth over the sample period. It is worth mentioning that productivity changes reflect the product of changes in technical and technological efficiency. According to the study findings, the IBBL branches have been able to achieve such productivity improvement from becoming more technologically advanced (19.622%), than from being more technically efficient (only 6.584%).

TABLE 8
Summary Statistics of Productivity and Efficiency Changes of the IBBL Branches for (2003-07)

Period	EFFCH	TECHCH	PECH	SECH	TFPCH
2003-04	0.896	1.167	0.941	0.954	1.045
2004-05	2.096	0.77	1.175	1.755	1.210
2005-06	1.499	0.694	1.071	1.408	1.190
2006-07	0.955	1.396	0.932	1.013	1.163
All (2003-07)	1.361	1.006	1.029	1.305	1.152

Notes: TFPCH = change in total factor productivity (Malmquist index of productivity); EFFCH = Change in technical efficiency; TECHCH = Change in Technology; PECH = Change in Pure technical efficiency; SECH = Change in Scale Efficiency

3.4 SECOND-STAGE REGRESSION

In order to determine which factors can affect the efficiency scores, the study examines some aspects of banks' structure that are related to efficiency estimates. For this purpose, efficiency scores are regressed on a set of common explanatory variables. The following resource variables: bank size (measured by the value of total assets), profitability (measured by operating income to total assets), size of investment, investment ratio (investment to total assets) and the number of employees were used. The study also considered some institutional factors such as years of operation, location and existence of RDS in the branches.

Table 9 reports the results of the regression estimation. It is important to note that the dependent variables are the DEA efficiency scores. A positive coefficient implies efficiency increase whereas a negative coefficient means an association with an efficiency decline. The results suggest that bank size has a significant positive influence on efficiency, implying that larger banks tend to be more efficient.

Results also reveal that the institutional factor variables have mostly negative impacts upon all efficiency scores except for the years of operation with technical and scale efficiency and in most cases the relationship is significant. The location dummy variable has a negative impact upon all efficiency scores as well, except for scale efficiency and in most cases this relationship is significant. This result implies that those branches that are located in urban areas are comparatively less efficient than rural branches. Although not significant, the existence of RDS activities has negative impact with branches efficiency, indicating that RDS activities hampers branch banking activities.

TABLE 9
Branch Specific Factors Influencing the Efficiencies of the Bank

Parameters	Coefficient			
Dependant Variable	TE	PTE	SE	AE
α_0 Constant	25.689***	1.001***	0.450***	0.622***
A. Resource Factors				
α_1 Total Assets (TA)	0.832***	0.732***	0.524**	0.564***
α_2 Investment/TA	0.120	0.026	0.197**	0.371
α_3 Operating income/TA	0.183**	0.104	0.160	0.287***
α_4 Size of Investment	0.176	0.103	0.100	0.252
α_5 Total Employees	0.184	0.302	0.088	0.212*
B. Institutional Factors				
α_6 Years of Operation	0.114*	-0.337***	0.222**	-0.066
α_7 Location	-0.039	-0.348***	0.242**	-0.149*
α_8 Existence of RDS	-0.20	-0.095	-0.039	-0.006

Notes: ** Significant at the 1% level; * Significant at the 5% level.

4. SUMMARY AND CONCLUDING REMARKS

The paper investigates the relative efficiency of different branches of the IBBL by using a panel data of branches during 2003-2007. Nonparametric (data envelopment analysis) techniques are used to examine efficiency of these branches. Four DEA efficiency measures namely, technical, pure technical, scale and allocative efficiency scores are calculated and have been correlated amongst the IBBL branch accounting measures of performance.

The average allocative efficiency is 61-76%, whereas the average technical efficiency is about 51-65% during the study period. This means that the dominant source of inefficiency is both technical inefficiency and allocative inefficiency but technical inefficiency has got more contribution to inefficiency than allocative inefficiency. These results are consistent with the fact that the Islamic banks do not operate in an overall regulatory supportive environment. They are not even technically sound enough in their operations. Hassan (2003) found that when Islamic banks operate in countries such as Iran and Sudan where the entire banking system operates under the Islamic *Sharīᶜah*, the banks become more allocatively efficient. Average scale efficiency is about 73%, and average pure technical efficiency is about 79%, suggesting that the major source of the total technical inefficiency for the IBBL branches are not pure technical inefficiency (input related) but scale inefficiency (output related). The study results indicate that there has been a moderate increase in productivity growth over the years. Productivity increase in the IBBL branches is mainly driven by technological change (opening up and penetrating in other markets) not technical efficiency change (efforts of inefficient banks to catch up with the efficient ones). The results show that larger branch size is associated with higher efficiency, which indirectly supports the economies of scale arguments in the IBBL branches.

The information obtained from efficiency studies can be used to help bank managers, government regulators and investors. Managerial performance can be improved by identifying "best practice" and "worst practice" associated with high and low efficiency firms, respectively. Success in competitive markets demands achieving the highest levels of performance through continuous improvement and learning.

Islamic banking emerged as a response to both religious and economic exigencies. While religious exigency calls for avoiding any transaction based on interest, economic exigencies, on the other hand, provide a new outlook to the role of banking in promoting investment/productive activities, influencing distribution of income and adding stability to the economy. Islamic banking is thus perceived as an improved system in all dimensions. However, in order to sustain in the long-run, the Islamic banking system has to be internally efficient and technologically advanced in order to sustain in the market.

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APPENDIX 1
Branch-wise Different Mean Efficiencies of IBBL for the Years 2003 to 2007

Sl.	Branch name	TE	PTE	SE	AE
1	Local office	99.26	100.00	99.26	99.16
2	Agrabad	76.57	84.62	90.49	48.44
3	Sylhet	95.88	98.76	97.08	22.48
4	Cmb	72.20	77.98	92.59	88.46
5	Khatunganj	99.66	99.90	99.76	93.16
6	Khulna	65.96	68.42	96.40	79.60
7	Narayanganj	62.26	68.22	91.26	68.56
8	Foreign ex.	88.96	92.56	96.11	70.88
9	Islampur	59.32	70.30	84.38	97.60
10	Barisal	60.52	72.98	82.93	50.58
11	Bogra	57.82	62.60	92.36	63.64
12	Rajshahi	70.86	76.66	92.43	65.20
13	Moulavi bazar	77.22	94.76	81.49	32.54
14	Pabna	92.04	97.44	94.46	76.74
15	Cox's bazar	63.60	72.64	87.56	50.28
16	Rangpur	59.12	75.26	78.55	78.56
17	Nawabpur	86.56	92.20	93.88	97.86
18	Narsingdi	68.26	82.70	82.54	61.38
19	Kishoreganj	55.64	85.94	64.74	83.30
20	Comilla	66.52	73.62	90.36	43.90
21	Feni	75.78	79.28	95.59	38.32
22	Anderkilla	74.92	83.28	89.96	39.80
23	Jessore	57.60	71.80	80.22	87.72
24	Chowmuhani	75.30	79.18	95.10	46.84
25	Zinzira	53.70	83.94	63.97	78.32
26	Beani bazar	94.98	96.98	97.94	22.16
27	New market	70.54	74.54	94.63	37.88
28	Savar	55.36	78.18	70.81	70.88
29	Mirpur	73.08	75.66	96.59	44.06
30	Chapai-n-ganj	59.18	84.20	70.29	82.18

APPENDIX 1 (Continued)

Sl.	Branch name	TE	PTE	SE	AE
31	Kushtia	88.89	89.97	98.80	79.44
32	Chandpur	64.54	84.88	76.04	46.02
33	Noapara	99.95	100.00	99.95	94.00
34	Farmgate	76.88	77.96	98.61	48.40
35	Jubilee road	65.28	77.64	84.08	89.08
36	Dinajpur	51.02	89.58	56.95	81.46
37	Laksham	65.28	93.04	70.16	52.34
38	Mymensingh	50.94	66.58	76.51	85.98
39	Chiringa	59.16	87.58	67.55	64.86
40	Bishwanath	75.18	100.00	75.18	39.48
41	Satkhira	59.46	88.56	67.14	60.76
42	Naogaon	56.76	85.72	66.22	95.54
43	Mouchak	78.80	80.58	97.79	38.74
44	Chaktai	59.86	92.28	64.87	92.54
45	Teknaf	51.24	96.96	52.85	93.76
46	Faridpur	58.04	75.94	76.43	67.28
47	Sirajganj	53.60	83.04	64.55	82.48
48	Mongla	49.20	54.93	89.57	96.94
49	Amin bazar	71.46	86.85	82.28	93.74
50	Saidpur	75.16	90.84	82.74	95.14
51	Jaypurhat	52.06	93.42	55.73	90.20
52	Shahjadpur	52.54	94.92	55.35	90.94
53	Nazipur	51.42	87.45	58.80	94.06
54	Lohagara	67.46	85.24	79.14	39.22
55	Ramna	75.90	79.46	95.52	94.18
56	Gazipur	59.48	74.78	79.54	57.16
57	Tangail	59.32	78.98	75.11	62.30
58	Jhikorgacha	51.02	93.34	54.66	95.90
59	Jamalpur	48.76	84.46	57.73	97.68
60	Chawk bazar	71.38	88.98	80.22	38.78
61	Patiya	56.24	86.56	64.97	65.46
62	Benapole	86.56	96.78	89.44	87.66
63	Kashinthpur	53.10	97.88	54.25	94.20

APPENDIX 1 (Continued)

Sl.	Branch name	TE	PTE	SE	AE
64	Ambarkhana	84.18	96.94	86.84	34.40
65	Station road	59.84	75.34	79.43	77.42
66	Bashurhat	73.88	95.28	77.46	43.96
67	Kalaroa	53.55	79.56	67.24	91.36
68	Hathajari	67.82	95.34	71.13	42.20
69	Madhabdi	44.85	84.62	52.94	89.62
70	Palash	58.62	87.48	67.01	59.88
71	Highway br	50.23	98.25	51.12	98.20
72	Bhola	52.36	91.02	57.53	85.10
73	Jhenaidah	54.54	98.04	55.63	75.34
74	Ashuganj	55.44	96.78	57.24	86.98
75	Gulshan	77.32	78.15	99.00	41.70
76	Tarakandi	64.88	99.98	64.89	88.78
77	Bangshal	90.56	95.45	94.88	96.50
78	Bagerhat	53.42	89.96	59.38	81.74
79	Manikganj	58.32	98.48	59.22	60.44
80	Daulatpur	60.54	93.94	64.45	84.06
81	Jhalakathi	53.48	94.16	56.80	93.46
82	Natore	54.85	86.42	63.43	81.54
83	Gaibandha	48.68	81.82	59.50	96.90
84	Kaligonj	51.72	78.58	65.82	96.34
85	Munshiganj	59.46	95.96	61.96	79.46
86	Sherpur	50.15	77.66	64.51	93.44
87	Hajiganj	68.34	94.42	72.38	46.90
88	Laxmipur	68.18	87.47	77.95	39.36
89	Mohakhali	60.16	78.92	76.25	53.32
90	Patuakhali	53.12	87.34	60.82	77.76
91	Cda avenue	67.72	76.95	88.01	42.78
92	Thakurgaon	52.90	89.95	58.81	89.98
93	Kurigram	50.82	88.45	57.46	95.08
94	B. Baria	64.22	85.56	75.06	53.64
95	Sadarghat	60.46	78.22	77.29	81.94

APPENDIX 1 (Continued)

Sl.	Branch name	TE	PTE	SE	AE
96	Habiganj	59.96	65.75	91.19	64.08
97	Laldighirpar	66.45	70.76	93.84	55.92
98	Pirojpur	55.74	68.95	80.84	72.54
99	Rangamati	50.18	96.68	51.90	95.20
100	Pahartali	61.12	81.26	75.22	76.76
101	Cantonment	64.73	84.22	76.82	44.48
102	Jatrabari	64.38	73.72	87.33	50.46
103	Dhanmondi	82.46	85.94	95.95	28.92
104	Paltan	88.84	89.95	98.77	97.76
105	Uttara	69.43	79.56	87.23	41.90
106	Gopalganj	50.64	88.56	57.14	93.26
107	Shyamoli	72.45	85.12	85.06	42.24
108	Darus salam road	70.02	92.22	75.93	44.52
109	Shibganj	53.52	87.45	61.20	90.50
110	Nilphamari	57.82	68.58	84.31	93.40
111	H.o.complex	89.95	92.92	96.80	37.56
112	Sreemongal	54.74	65.52	83.57	90.92
113	Elephant rd	62.18	82.44	75.42	85.86
114	Tongi	63.75	87.44	72.85	67.60
115	Madaripur	51.45	62.57	81.51	93.42
116	Hajicamp	63.54	79.95	79.47	60.52
117	Gobindaganj	55.58	88.75	62.63	88.70
118	Goala bazar	62.76	79.96	78.49	59.50
119	Sitakundha	51.48	65.52	78.57	92.26
120	Kawran bazar	79.38	83.52	95.04	86.78
121	Vip road	69.18	80.48	85.96	84.04
	Mean of the Mean	65.05	84.50	77.41	71.26