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EFFICIENCY COMPARISON OF LARGE, MEDIUM AND SMALL UNIVERSITIES IN PAKISTAN: AN APPLICATION OF DEA

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ABSTRACT

Performance measurement and efficiency analysis in the non-profit organizations especially in higher education sector, leads to the economic and socio-political growth of nations. This paper conducts an application of data envelopment analysis (DEA) technique to access the mean efficiencies of large, medium and small universities in Pakistan for the year 2009/10. Output-orientation for CCR (Charnes, Cooper & Rhodes) and BCC (Banker, Charnes & Cooper) models is used for comparison. Efficiency comparison results suggest that medium universities in Pakistan are working more efficiently than the large and small ones. Moreover, performance of large universities needs to improve, as pool of large universities consists of public sector with performing more inefficiently than the medium and small higher education institutions (HEIs.)

Key Words: Efficiency measurement, Data envelopment analysis, Pakistani HEIs

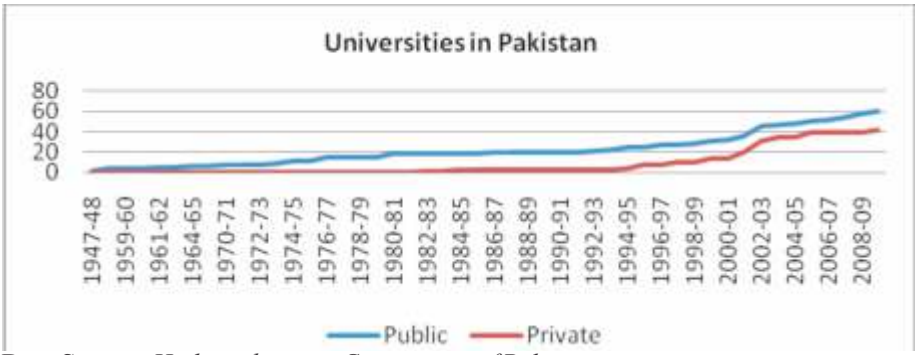
INTRODUCTION

Pakistan gained independence in 1947, and at that time country had only one university (Punjab University). Then in 1947-48 university of Sindh was established by Government of Pakistan. From 1947 to 1983, Pakistani higher education system was centered on public universities, which played an important role in the development of human capital for newly independent nation. By the end of 1983, there was a change in trend of Pakistani higher education when first charter was given to Aga Khan University, Karachi, followed by Lahore University of management science, Lahore in 1985, in private sector. In 1995-96, country had 27 public and private universities. With the establishment of HEC in early 2000s, the higher education system in Pakistan went under a complete overhaul. By the end of 2011 Pakistan had 132 universities and Degree awarding institutions in total, out of them 74 were in public sector and 62 in private sector including four universities of Azad Jammu and Kashmir. Quality of education has great variation in private and public sector. Therefore, HEC launched the "Quality Enchantment Cells" to assess the quality of academic programs to strengthen the education quality in Pakistani public and private universities. Initially, these Quality Enhancement Cells are working in 69 public and 15 private universities of Pakistan.

Higher education institutions are fountainheads of modern science and technology. Last decade was very flourishing for Pakistani higher education sector. After careful

evaluation of the higher education sector, Professor Michael Rode, chairman of the United Nations Commission on Science, Technology and Development, wrote in (2008) "Never before I have seen such rapid positive changes in any country in the higher education sector as witnessed in Pakistan in a short period of six years. The current evolution in educational environment does not mean that higher education system in Pakistan is just right. Every system always has room for improvement, so is with Pakistan.

Figure: 1



Data Source: *Higher education Commission of Pakistan*

According to the field and functionalities of the universities, HEC categories Pakistani universities into seven groups namely, Agriculture / Veterinary, Art & Design, Computer Sciences & IT, Business Education, Engineering & Technology, Medical, General Universities. Furthermore, General universities are divided into three sub-categories: Large, Medium and Small. A general university falls in the category of Large, Medium and Small if strength of university students is above 7000, in-between 3000 to 7000 and below 3000, respectively. This study aims to compare overall performance of Large, Medium and Small universities using non-parametric technique. This would help to improve overall performance of general universities.

Efficiency Measurement Techniques

In education sector, different methods are used in order to estimate its production function for future improvement and policy implications. Data envelopment analysis (DEA) is one of the most common non-parametric techniques used to measure efficiency of non-profit organizations. DEA is a linear programming method which measures efficiency of each decision making unit (DMUs) as the ratio of weighted output to weighted inputs. To reflect the unit at its most efficient relevant to all other DMUs in the data set, weights are estimated by technique itself.

Stochastic frontier analysis (SFA) is the main alternative to DEA, to measure cost and production functions. SFA is a parametric approach and needs to make assumptions

regarding the functional forms of the best practice cost or production frontiers. Cobb-Douglas and Trans-log production functions are commonly used in SFA. Apart from functional assumptions, SFA also makes distributional assumptions of residuals obtained in regression analysis. In fact, in SFA the residuals are sum of two components: one is the result of inefficiency and second is pure random term and for these error components some distributional assumption are required. This is an advantage of DEA that there is no preconceived functional form imposed on the data to calculate the efficiency. The researches have many options to estimate the efficiency of higher education sector; however, multiple input-output nature of education production function makes DEA more attractive technique in absence of input-output prices (Johnes, 2005).

There are some limitations of DEA method, first DEA identifies more than one University on the efficient frontier which means that more than one university are allocated 100% efficiency score but in reality even the hundred percent efficient university may not be operating on the frontier, secondly DEA is a non-statistical and non-parametric approach therefore it is not possible to undertake statistical tests to check the significance of estimated frontier (Abbott & Doucouliagos, 2003). Another important issue, but it is same for both techniques, is reliable data set for efficiency indicators especially for developing countries. Apart from limitations, this was very important to throw light on the current performance of Large, Medium and Small universities in Pakistan to check which group is more efficiently involved in development of human capital through higher education.

DEA and Higher Education

Many studies have been conducted to measure the efficiency of different university departments or among the different universities using DEA for different countries. Tomkins and Green (1988) estimates the overall efficiency of Accounting departments of UK universities using six DEA models with an output of student numbers and an input of staff numbers. Study concludes that different specifications produce substantially stable estimates. Beasley (1990) measured productive efficiency using financial efficiency indicators such as research income and expenditures as inputs for physic and chemistry departments. He used undergraduate postgraduate and research ratings as output measures. Basely (1995) applied DEA with some weight restriction on the same data set to estimate research and teaching efficiency jointly. Ahn et al. (1987;1988;1989) compared the efficiency of US universities in Texas. He used financial variables as input like Beasley and number of undergraduate students, graduate students, totals credit hours and research funds as outputs.

Abbott and Doucouliagos (2003) used DEA on 36 Australian Public universities to estimate technical and scale efficiency. They considered Academic Staff, Non-Academic Staff, Expenditures, Value of Non-current asserts as inputs and research and Teaching as outputs. They conclude that technical and scale efficiency level of

Australian universities is fairly high relative to each other.

Johnes (2005) applied DEA to measure efficiency of 109 universities on data set of 2000/01. Inputs and outputs of the study are: Undergraduate, graduate and postgraduate students, expenditure on administration, value of interest payments and depreciation, Undergraduate degrees, Postgraduate degrees and Research. Study concludes a significant difference between the best and worst scores for the UK institutions.

Garcia-Aracil and Montero (2006) applied basic DEA models to estimate the efficiency of 43 Public universities in Spain for year 2002 to 2004. In this study, Total expenditures, Academic staff, Non-academic staff, were used as input measures and Graduates, Publications and applied research as output measures. They also include GDP per capita as an external factor for those regions where universities were more efficient. Study concludes that universities located in the richest regions are more efficient then the poor ones.

Carlo (2006) estimates efficiency of per student education cost dividing institutions into five sub-categories for 36 professional higher education institutions in Netherlands for the year 2000 including Total Students, Research, Personal, Non-personal variables as input/output measures. Results show that data envelopment method performs better than traditional method to estimate per student cost.

Performance of higher education sectors has been measured by different researchers for different countries. Avkiran and Necmi (2001); Worthington, Lee ands Boon (2008); measured performance for Australian Universities. Ying and Sung (2000); Johnes and Li (2008); for Chinese Higher Education, Johnes, Geraint & Johnes (1993); Johnes (1996); Athanassopoulos and Shale (1997); for UK Education sector. Bonesronning, Hans & Rattso; Jorn (1994); for Norwegian Education, Murias and José; Miguel and David (2008); for Spanish, Melville, McMillan & Datta (1998); for Canadian Universities and Nickolaos and Halkos (2010) measured performance for state owned Greek university (University of Thessaly).

Data Envelopment Analysis

Data envelopment analysis is a linear programming method use in operation research. It was introduced by (Charnes, Cooper & Rhodes, 1977). On the basis of input and output efficiency estimators, DEA empirically identifies the efficient frontier of the relative DMUs. The efficiency estimates, obtained through DEA, differentiate between the efficient and inefficient DMUs by establishing whether the DMU is placed on efficient frontier or below the frontier, also efficiency score indicates that how far DMU is located from efficient frontier.

Assume that there are 'n' DMUs, each DMU having 'm' inputs and 's' outputs. Relative efficiency of each DMU can be measure as optimal value to the following fractional program.

Max $$\frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

Such that: $$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \qquad u_1, u_2, \ldots\ldots, u_s \geq o$$

$$v_1, v_2, \ldots\ldots, v_m \geq o$$

The above fractional program can be converted to a linear program to estimate the optimal value

Max $$\sum_{r=1}^{s} u_r y_{ro}$$

s.t $$\sum_{i=1}^{m} v_i x_{io} = 1 \qquad \sum_{r=1}^{s} u_r y_{rj} \leq \sum_{i=1}^{m} v_i x_{ij}$$

$$v_1, v_2, \ldots\ldots, v_m \geq o \qquad u_1, u_2, \ldots\ldots, u_s \geq o$$

To identify the relative efficiency scores of 'n' DMUs we will run above problem 'n' times. Each DMU selects input and output weight that maximizes its efficiency. If any DMU score is equal to 1, than it considers fully efficient and if efficiency score is less than 1 than it means that DMU is less efficient.

Orientation and Variables Specifications

A clear identification of "objective of the study" is fundamental for DEA and it should be obvious that what is to be achieved from analysis. In a recent study Zhu et al. (2013) has explained the "Orientation" as: If the purpose of the study is to maximize outputs keeping the same level of inputs then output-orientation should be use. On the other hand if minimization of inputs is required while keep same level of outputs then input-orientation is a better option. Thus the analyst needs to eloquent the purpose of the study whether input reduction, output expansion or both. Although under the same return to scale conditions (CRS/VRS), DEA models provide the same efficiency scores for input and output orientations. However in case of Pakistani HEIs, this study uses the output-orientation following the (Johnes, 2005). One of the reasons is, for developing countries like Pakistan, input-orientation leads to unemployment as teaching staff is used as input

Different studies vary in the definition of input/output variables. Most of the researcher concludes that inputs for HEIs can be categorized as capital , students (undergraduate, graduate, postgraduate), Staff (Teaching & admin) and while outputs can be divided into research and teaching. Table 1 shows the different input/output variables of different studies.

Table 1: Inputs/outputs used in previous studies

Author	Analyzed Country	Inputs	Outputs
Johnes & Li Yu (2008)	109-HEI's In China	Staff time Staff Quality PG Students Books Area	Research HEI-Repute Publications
Johnes (2006)	109-English HEI's	Undergraduate Enrollment Postgraduate Students Number of research & Teaching Staff Admin Expenditure Library & Computer Expenditure Interest Payments	Number of Graduates Number of First degree Graduates (weighted) HEC Grants
Chuen & Kuan (2011)	Hypothetical Example of 30 universities	University expenditures Number of research staffs Average research staffs' qualifications Number of research students Research grants	Number of graduates from research Number of publications Number of awards Number of intellectual properties
Abbott & Doucouliagos (2001)	42-Astralian Universities	Academic Staff Non-Academic Staff Expenditures Non-Current assets	Number of Graduates Number of Postgraduates Research Output Research Funding
Athanassopoulos & Shale (1997)	45-UK Universities	Academic Expenditures Undergraduates Students	Degree holders UG Degree holder PG Research rating (weighted)

		Postgraduates students Academic Staff	
Beasley (1995)	52-chemistry departments & 50 Physic dept. in UK	General Expenditure Equipment expenditure Research	Number of undergraduates Number of Postgraduates Research
Breu & Raab (1994)	25 universities USA	SAT/ACT mean/ midpoint Dr faculty % age Faculty to student ratio Per student Expenditure Tution charges/ student	Graduation Rate Freshman retention rate
Ahn et al (1988)	161-universities USA	Instructional expenditures Overhead exp. Physical investments	Undergraduate enrolled Graduates enrollment research grants

HEIs are multi-output organizations that produce research, teaching, capital, and community services. However, this paper focuses on the efficiency comparison of teaching production of large medium and small HEIs in Pakistan. In this study, numbers of graduate and postgraduate students are taken as output variables, these variables were used by Athanassopoulos and Shale (1997); Madden et al. (1997); to measure teaching efficiency. Four input variables are used for this study. Selection of these variables is based upon previous studies, Johnes (2005); Johnes and Li (2008) and availability of the data. Table-2 defines the input/output variables.

Table 2: Definition of input and output variables for the DEA

	Inputs
FTTF	Full time teaching faculty is equal to sum of 1/3(Visiting faculty) and permanent non doctoral faculty
FTDF	In Full time doctoral faculty only
LB	Total library books include central libraries and departmental libraries
TCS	Total computers for students does not include those which are under use of faculty and administration
	Outputs
GPS	Graduate and post graduate s
UGS	Under graduate students

Table-3 shows the descriptive statistics for the efficiency indicators used for the study

Table 3: Descriptive Statistics for efficiency indicators

Variables	All Universities		Large-Universities		Medium Universities		Small Universities	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FTTF	343.60	276.93	669.47	249.31	255.07	87.29	143.05	77.24
FTDF	63.11	75.46	127.94	98.16	57.07	37.36	14.95	9.23
LB	101302.40	183521.09	210750.12	285007.89	88369.73	87416.08	21939.48	17733.04
TCS	1022.72	1265.22	2050.29	1762.59	835.80	504.59	324.38	250.28
GPS	2853.94	3205.48	6156.76	3556.21	2157.13	1622.76	677.95	382.67
UGS	4046.89	4077.38	8802.76	3955.79	2741.80	1142.65	1129.10	591.86

RESULTS AND DISCUSSION

One of the sensitive issues in DEA is the number of inputs and outputs specified however there is not a conventional method to choose one DEA model specification for efficiency analysis. Therefore, it is better to change the input-output specification to check the sensitivity of the results (Johnes, 2005/06) For this study, three DEA model specifications are defined with six efficiency indicators explained above. Table 4 shows the different combinations of inputs/outputs.

Table 4: Different Model specifications

	Model Specification-1	Model Specification-2	Model Specification-3
Inputs	FTTF	FTTF	FTTF
	FTDF	FTDF	FTDF
	TCS	TCS	
	LB		
Outputs	GPS	GPS	GPS
	UGS	UGS	UGS

As we can observe, Model specification-1 contains all variables included in the study, then one by one variable are dropped in model specification-2 & 3 respectively. Output-oriented DEA (DEA Frontier by Zhu is used to analysis the data) is applied on four groups of data set separately. First group consist of 53 general universities of Pakistan. Results are reported in Table-A1 in appendix. For this group, Average efficiency score

varies between 62 to 85 percent and inefficiency ranges between 27 to 41 percent in all specifications. In particular, Minhaj University, Lahore is the most inefficient for specification-3, in this group. Why this university and many others are not achieving the appropriate efficiency level relative to the others? One of the possible reasons is homogeneity. This group is a combination of Large, Medium and Small HEIs in Pakistan, therefore, as a group it does not satisfy the homogeneity condition. In such cases, it's better to categories HEIs in different groups (Large & Small; Medical & Non-Medical; Public & Private; etc) as suggested by Johnes (2008). For this study, three groups: Large, Medium and Small are developed to hold the possible homogeneity condition. DEA Frontier used for three groups to analysis data and results are given in table-5.

Table 5: Efficiency scores of Large, Medium and small Universities

Categories of Universities	Model Specification-1		Model Specification-2		Model Specification-3	
Large Universities	*CRS*	*VRS*	*CRS*	*VRS*	*CRS*	*VRS*
Bahauddin Zakariya University, Multan.	0.50	0.73	0.49	0.73	0.42	0.71
Bahria University.	1.00	1.00	0.71	0.72	0.70	0.70
Federal Urdu University of Arts, Science & Technology.	1.00	1.00	0.49	0.56	0.36	0.54
Govt. College University, Faisalabad.	1.00	1.00	1.00	1.00	0.53	0.66
Hazara University Mansehra, KPK.	0.86	0.93	0.85	0.89	0.69	0.69
International Islamic University.	0.86	1.00	0.83	1.00	0.59	0.98
National University of Modern Languages, Islamabad.	1.00	1.00	1.00	1.00	0.70	1.00
Preston University, Kohat	1.00	1.00	1.00	1.00	0.79	0.79
The Islamia University of Bahawalpur, Pakistan.	0.61	0.84	0.60	0.84	0.48	0.83
University of Education, Lahore.	1.00	1.00	1.00	1.00	1.00	1.00
University of Gujrat.	1.00	1.00	1.00	1.00	0.94	0.94
University of Karachi.	0.71	1.00	0.71	1.00	0.58	0.93
University of Lahore, Lahore	1.00	1.00	1.00	1.00	1.00	1.00
University of Peshawar.	0.65	0.74	0.62	0.71	0.54	0.66
University of Sargodha.	1.00	1.00	0.94	1.00	0.64	0.78
University of Sindh.	1.00	1.00	1.00	1.00	1.00	1.00
University of The Punjab.	0.63	1.00	0.63	1.00	0.63	1.00
MEAN	***0.87***	***0.96***	***0.82***	***0.91***	***0.68***	***0.84***

Medium Universities	***CRS***	***VRS***	***CRS***	***VRS***	***CRS***	***VRS***
Fatima Jinnah Women University, Rawalpindi.	0.84	1.00	0.84	1.00	0.84	1.00
Forman Christian College, Lahore	0.76	0.84	0.76	0.84	0.76	0.84
Quaid-i-Azam University, Islamabad.	1.00	1.00	1.00	1.00	1.00	1.00
Riphah International University	0.89	1.00	0.89	1.00	0.89	1.00
Shah Abdul Latif University, Khairpur.	1.00	1.00	1.00	1.00	1.00	1.00
The University of Azad jammu & Kashmir Muzaffarabad.	0.78	0.90	0.68	0.90	0.68	0.89
University of Balochisan, Quetta.	1.00	1.00	0.81	1.00	0.81	1.00
University of Central Punjab, Lahore	1.00	1.00	1.00	1.00	1.00	1.00
University of Management & Technology, Lahore	0.88	0.89	0.88	0.89	0.88	0.89
GC University, Lahore.	0.64	1.00	0.60	1.00	0.60	1.00
Gomal University Dera Ismail Khan.	1.00	1.00	0.98	1.00	0.98	1.00
Hamdard University, Karachi	1.00	1.00	1.00	1.00	0.85	1.00
Jinnah University for Women, Karachi	1.00	1.00	1.00	1.00	1.00	1.00
Kohat University of Science and Technology.	0.68	0.69	0.50	0.62	0.49	0.59
Mohammad Ali Jinnah University	1.00	1.00	1.00	1.00	1.00	1.00
MEAN	***0.90***	***0.95***	***0.86***	***0.95***	***0.85***	***0.95***
Small Universities	***CRS***	***VRS***	***CRS***	***VRS.***	***CRS***	***VRS.***
Greenwich University, Karachi	1.00	1.00	0.83	0.93	0.83	0.93
Hajvery University, Lahore	0.95	1.00	0.95	1.00	0.95	1.00
Kinnaird College For Women.	1.00	1.00	0.91	1.00	0.91	1.00
Minhaj University, Lahore	1.00	1.00	0.48	0.63	0.48	0.63
Mohiuddin Islamic University	0.66	1.00	0.66	1.00	0.66	1.00
Newport Institute of Communications & Economics, Karachi	1.00	1.00	1.00	1.00	1.00	1.00
Preston University, Karachi	0.84	0.87	0.84	0.87	0.84	0.87
Sardar Bahadur Khan Women's University, Quetta.	1.00	1.00	1.00	1.00	1.00	1.00
Sarhad University of Science and Information Technology, Peshawar	0.92	1.00	0.89	1.00	0.89	1.00
The Superior College, Lahore	1.00	1.00	0.78	1.00	0.50	1.00
University of Faisalabad, Faisalabad	0.56	0.64	0.56	0.64	0.56	0.64
University of Malakand.	1.00	1.00	1.00	1.00	0.84	1.00

University of South Asia, Lahore	1.00	1.00	1.00	1.00	1.00	1.00
Beacon house National University, Lahore	0.75	0.77	0.70	0.76	0.70	0.75
Dadabhoy Institute of Higher Education, Karachi	0.74	1.00	0.74	1.00	0.74	1.00
Foundation University, Islamabad	0.54	0.77	0.54	0.77	0.54	0.77
Frontier Women University.	1.00	1.00	1.00	1.00	1.00	1.00
GIFT University, Gujranwala	0.98	1.00	0.98	1.00	0.98	1.00
Karachi Institute of Economics & Technology, Karachi	0.57	0.67	0.57	0.67	0.57	0.67
Karakorum International University.	0.47	0.66	0.47	0.66	0.47	0.66
National Defence University.	1.00	1.00	0.82	0.97	0.82	0.97
MEAN	***0.86***	***0.92***	***0.80***	***0.90***	***0.78***	***0.90***

Results show that, In category of large HEIs, three universities (University of education, Lahore; University of Lahore, Lahore, and university of Sindh), In Medium category, four universities(Quaid-i-Azam University, Islamabad; Shah Abdul Latif University, Khairpur; Jinnah University for Women, Karachi; Mohammad Ali Jinnah University) and, in category of small HEIs ,three universities (Newport Institute of Communications & Economics, Karachi; Sardar Bahadur Khan Women's University, Quetta; University of South Asia, Lahore) are fully efficient in all models. All other HEIs keep some inefficiency level at least in one of the model specifications. To conduct the comparison among three groups, rank correlation or any consistency analysis is not required because "Average efficiency" score of each model gives a one point summary for comparison. Average efficiency scores of three models are compared within the Large Medium and small HEIs and this one point summary concludes that Medium universities in Pakistan are working more efficiently comparative to large and small HEIs. Table 6 shows the average efficiency scores of Large, Medium and Small HEIs in Pakistan.

Table 6: Mean efficiency scores of all models

Categories of Universities	Model Specification-1		Model Specification-2		Model Specification-3	
Mean	*CRS*	*VRS*	*CRS*	*VRS*	*CRS*	*VRS*
Large-universities	0.87	0.96	0.82	0.91	0.68	0.84
Medium- universities	0.90	0.95	0.86	0.95	0.85	0.95
Small- universities	0.86	0.92	0.80	0.90	0.78	0.90

CONCLUSION

All of the results for this study relate to DEA with output-orientation, allowing for constant return to scale and variable return to scale assumptions with three model specifications. The output-orientation focuses on amount by which outputs can be proportionally increased without the reduction of inputs.

The approach taken was to first apply DEA on all public and private universities together in a pool. Results are given in the table A1 in appendix .This entire pool does not meet the criteria of homogeneity. At the next stage, which is the main purpose of the study, universities are divided into three categories: Large, Medium and Small and conduct DEA on separate pool of large medium and small. Results are reported in table 5. Results of specification-1 and specification-2 are very similar to each other but differ from specification-3. This indicates that LB is not as important as TCS for students enrolled in Pakistani HEIs. The average efficiency score varies from 68% to 96% across the two models. One to one comparison of large medium and small universities indicates that medium universities in Pakistan contain higher efficiency level than others. In contrast, average efficiency score of large universities are lowers those medium and small universities. In the group of large universities, almost all universities are working in public sector, while medium and small universities are mix of public and private sector. This suggests that higher education commission of Pakistan should take necessary actions to improve the quality of large universities in Pakistan. Those universities that show the efficiency score close to the efficient frontier(close to 1) require a few changes in order to move the efficient frontier and fundamental reforms are required for those HEIs which are far from efficient frontier.

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Appendix

Table A-1: Efficieceny scores of all HEIs

	CRS	***VRS***	***CRS***	***VRS***	***CRS***	***VRS***
Bahauddin Zakariya University, Multan.	0.47	0.73	0.47	0.73	0.42	0.71
Bahria University.	0.99	1.00	0.71	0.72	0.70	0.70
Federal Urdu University of Arts, Science & Technology.	0.98	1.00	0.45	0.56	0.36	0.54
Govt. College University, Faisalabad.	1.00	1.00	0.81	1.00	0.53	0.66
Hazara University Mansehra, KPK.	0.84	0.86	0.84	0.85	0.69	0.69
International Islamic University.	0.76	1.00	0.76	1.00	0.59	0.98
National University of Modern Languages, Islamabad.	1.00	1.00	0.93	1.00	0.70	1.00
Preston University, Kohat	0.99	1.00	0.99	1.00	0.79	0.79
The Islamia University of Bahawalpur, Pakistan.	0.58	0.84	0.54	0.84	0.48	0.83
University of Education, Lahore.	1.00	1.00	1.00	1.00	1.00	1.00
University of Gujrat.	1.00	1.00	1.00	1.00	0.94	0.94
University of Karachi.	0.66	1.00	0.66	1.00	0.58	0.93
University of Lahore, Lahore	1.00	1.00	1.00	1.00	1.00	1.00
University of Peshawar.	0.64	0.74	0.60	0.71	0.54	0.66
University of Sargodha.	0.93	1.00	0.80	1.00	0.64	0.78
University of Sindh.	1.00	1.00	1.00	1.00	1.00	1.00
University of The Punjab.	0.63	1.00	0.63	1.00	0.63	1.00
Fatima Jinnah Women University, Rawalpindi.	0.64	0.76	0.64	0.76	0.48	0.48
Forman Christian College, Lahore	0.68	0.69	0.68	0.69	0.58	0.64
Quaid-i-Azam University, Islamabad.	0.68	0.69	0.68	0.69	0.68	0.69
Riphah International University	0.68	0.71	0.68	0.71	0.68	0.69
Shah Abdul Latif University, Khairpur.	0.92	0.92	0.91	0.92	0.78	0.83
The University of Azad jammu & Kashmir Muzaffarabad.	0.70	0.70	0.65	0.66	0.53	0.55

University of Balochisan, Quetta.	0.45	0.47	0.43	0.47	0.33	0.47
University of Central Punjab, Lahore	1.00	1.00	1.00	1.00	0.82	0.84
University of Management & Technology, Lahore	0.81	0.81	0.80	0.81	0.70	0.73
GC University, Lahore.	0.47	0.48	0.47	0.48	0.47	0.48
Gomal University Dera Ismail Khan.	0.70	0.70	0.60	0.62	0.54	0.59
Hamdard University, Karachi	1.00	1.00	1.00	1.00	0.66	0.70
Jinnah University for Women, Karachi	1.00	1.00	0.99	0.99	0.80	0.82
Kohat University of Science and Technology.	0.54	0.54	0.49	0.49	0.38	0.39
Mohammad Ali Jinnah University	1.00	1.00	1.00	1.00	0.78	0.84
Greenwich University, Karachi	0.93	1.00	0.64	0.67	0.50	0.60
Hajvery University, Lahore	0.87	0.89	0.87	0.89	0.86	0.87
Kinnaird College For Wom en.	1.00	1.00	0.70	0.76	0.70	0.75
Minhaj University, Lahore	1.00	1.00	0.31	0.32	0.27	0.30
Mohiuddin Islamic University	0.65	0.75	0.65	0.75	0.65	0.65
Newport Institute of Communications & Economics, Karachi	1.00	1.00	0.91	1.00	0.72	1.00
Preston University, Karachi	0.63	0.70	0.63	0.70	0.46	0.62
Sardar Bahadur Khan Women's University, Quetta.	0.98	1.00	0.98	1.00	0.98	1.00
Sarhad University of Science and Information Technology, Peshawar	0.76	0.76	0.75	0.76	0.64	0.66
The Superior College, Lahore	0.82	0.86	0.47	0.48	0.46	0.46
University of Faisalabad, Faisalabad	0.42	0.43	0.42	0.43	0.31	0.35
University of Malakand.	1.00	1.00	0.85	0.88	0.54	0.60
University of South Asia, Lahore	0.97	1.00	0.97	1.00	0.97	1.00
Beaconhouse National University, Lahore	0.57	0.64	0.57	0.61	0.52	0.60
Dadabhoy Institute of Higher Education, Karachi	0.64	1.00	0.60	1.00	0.44	1.00
Foundation University, Islamabad	0.42	0.44	0.41	0.44	0.41	0.43

Frontier Women University.	1.00	1.00	1.00	1.00	0.99	1.00
GIFT University, Gujranwala	0.73	0.88	0.73	0.88	0.64	0.88
Karachi Institute of Economics & Technology, Karachi	0.47	0.49	0.47	0.49	0.42	0.44
Karakurum International University.	0.41	0.41	0.40	0.40	0.31	0.32
National Defence University.	1.00	1.00	0.43	0.80	0.43	0.80

Ateeq-ur Rahman Irshad: PhD (Econometric)
Area of Specialization: Parametric and Non-Parametric Approaches Area of interest: Performance measurement Current Position: Assistant Professor (Visiting In NUST and IIU)
Publications: 2 publications are under process

Mudassar Rashid: PhD Scholar (Econometric) (.Two Positive foreign evaluation reports has been received and Viva-Voce is expected at the end of this month) Area of Specialization: Model Specification Search Methods Area of Interest: Theory and Application Current Position: Audit Officer (In-charge) at Directorate Local Funds Audit, Muzaffarabad, Azad Kashmir