Volume and Issues Obtainable at Center for Sustainability Research and Consultancy

Review of Economics and Development Studies
ISSN:2519-9692 ISSN (E): 2519-9706
Volume 1: Issue 1 June 2015
Journal homepage: www.publishing.globalcsrc.org/reads

Efficiency Analysis of Public and Private Sector Schools of Multan District: A Non-Parametric Approach

[1]Sumaira Batool, [2]Fatima Farooq, [3]Imran Abbas, [4]Muhammad Abbas

[1]Lecturer, Department of Economics, The Women University Multan, Pakistan, sumairaimran@hotmail.com
[2]Assistant Professor, School of Economics, Bahauddin Zakariya University, Multan, Pakistan, fatimafarooq@bzu.edu.pk
[3]Ph.D. student, School of Economics, Bahauddin Zakariya University, Multan, Pakistan, imran_thaheem@hotmail.com
[4]Assistant Professor, Air University Multan campus

ARTICLEDETAILS

History
Revised format: May 2015
Available online: June 2015

Keywords
DEA,
Efficiency,
technical efficiency,
scale efficiency,
public schools,
private schools

JEL Classification
I12, I15, I18

ABSTRACT

The purpose of this paper is to evaluate the efficiency of public and private sector secondary and higher secondary schools in Multan district. We use output oriented data envelopment analysis to measure technical and scale efficiency of a sample of 100 public and private sector schools, using data for the year 2014. DEA is employed to compare efficiency of both types of schools because it is the most popular technique used to measure the relative efficiency of non-profit organizations due to the absence of prices or relative values of educational outputs. Moreover, it can handle multiple inputs and outputs with great ease. As public and private schools are working under similar environmental conditions, we have used a single frontier, incorporating four educational inputs and four outputs. The results of the data demonstrate that public schools lag behind private schools in terms of CRS and VRS technical efficiency scores and scale efficiency scores. Our study of schools validates the dominant paradigm that private schools outperform the state-run institutes.

© 2015 The authors, under a Creative Commons Attribution-NonCommercial 4.0

Corresponding author's email address: sumairaimran@hotmail.com
Recommended citation: Batool, S., Farooq, F., Abbas, I. and Abbas, M. (2015). Efficiency Analysis of Public and Private Sector Schools of Multan District: A Non-Parametric Approach. *Review of Economics and Development Studies, 1* (1) 45-56
DOI: https://doi.org/10.26710/reads.v1i1.115

1. Introduction

Education, a basic human need as well as right, plays an important role in all spheres of human life. The importance of education in development process of any nation is quite evident and all economists have acknowledged it. Education is a vital component of human capital as it enhances labour productivity. This productive and skilled labour force plays key role in poverty alleviation and development process of a country. During last three decades or so, privatization has become a dominant paradigm in education sector. Like other parts of the world, Pakistan has witnessed mushroom growth of private educational institutions. The general perception is that private educational institutions are superior to public educational institutions for a number of reasons including better management, accountability to parents, greater scope for innovation by teachers and school management. Literature relating to South Asia almost is in favor of private educational institutions.

The concept of privatization of the educational institutes is closely linked to the classical and neo-classical theory of free market economy to provide education (the service) to the students (the customer) in the most efficient way (Rutkowshi & Rutkowshi, 2009). Like all over the world, educational system in Pakistan consists of two types of institutions namely public sector educational institutes and private sector educational institutes. Even when Pakistan came into being in 1947, both types of institutes were engaged in the provision of education as public sector alone cannot fulfill the growing demand of education. In developing countries, particularly in Pakistan, government education sector is hampered by a number of problems such as poor management, non-accountability, political instability, ill qualified teachers, lack of professional competencies, shortage of funds, absence of monitoring mechanism and lack of capital investment in educational sector.

The paper attempts to analyze efficiency of public and private sector schools of Multan district. The efficiency of public and private sector schools will be calculated through Data Envelopment Analysis (DEA) indexes of both types of schools. These indexes will be further decomposed to compute technical efficiency of boys and girls schools of both sectors separately. The paper comprises of five sections. The review of previous studies on the issue will be presented in section two, followed by data and methodology. Empirical results will be presented in section four, followed by conclusion.

2. Literature Review

Using PISA 2000 data, Dronkers and Robert (2008) measured the differences in scholastic achievement of private and public schools in 22 comparable countries and showed that the higher gross educational outcomes are for private government dependent schools.
Again in the same year 2008 Dronkers and Robert analyzed the effectiveness of various types of public and private schools in 19 OECD countries and concluded that performance of private government-dependent schools' students was higher than the students from public schools. In 2001, Dronkers concluded that privately administered schools performed better in Flemish Belgium, France, Germany, Hungary, the Netherlands, and Scotland.

Jimenez, Lockheed and Paqueo (1991) suggested a positive relationship between attending private schools and students' performance in Colombia, the Philippines, Dominican Republic, Thailand and Tanzania. Research conducted by Asadullah (2009) concluded that Pakistan private schools appeared to be more effective than public schools in boosting students' achievements. Kingdon (1996) found conducive to greater superiority as such schools were technologically efficient as well as cost-efficient as compared to other types of schools in Utter Pradesh. Like other studies, Chudgar and Quin (2012) also pointed dissatisfaction of parents with the performance of public schools. Using the TIMSS 2003 data, Rutkowski and Rutkowski (2009) concluded that private schools showed significantly higher

achievements. Coulson (2009) reviewed the research conducted all over the world in the past several decades and concluded that the private sector outperformed the public sector. Braun, Jenkins & Grigg (2006) also came to the same conclusion, when they used NAEP 8th grade mathematics achievement. They had controlled the data for selected student and school variables.

3. Data and Methodology

3.1. Data Source:

Data have been collected through a field survey, with stratified random sampling technique.

3.2. Sampling Size:

In our research plan, only those secondary and higher secondary schools of Multan district were included, which are affiliated with Board of Intermediate and Secondary Education, Multan due to time and resource constraints. The reason for this was as BISE provides the results of only affiliated institutions by name while the students of remaining institutions, appearing in the examinations, are treated as private students. Finally, sample from schools was selected as follows:

Table 1: Total Number of Schools in Multan district

Schools	**Govt.**	**Pvt.**	**Total**
Male	115	97	212
Female	58	111	169
Total	173	208	381

Out of 381 total schools, 100 schools were selected as sample.

Table 2: Sample Sizes of Schools in Multan district

Schools	**Govt.**	**Pvt.**	**Total**
Male	30	26	56
Female	15	29	44
Total	45	55	100

3.3. Data Collection Procedure:

For the collection of data, a survey was conducted in randomly selected schools of Multan district. These institution were selected from all three tehsils and keeping in view the rural-urban divide. A questionnaire was prepared for this self-administered survey. Matriculation examination results were collected from the BISE and the record of CM extra-curricular activities and some other information were collected from different education and administrative offices.

3.4. Variables of the Study:

In DEA model, two types of variables i.e. input and output variables are used.

3.4.1. Input Variables:

We have taken following four input variables.

Table 3: Input Variables

Abbreviation	Variable
NT	Number of Teachers
NC	Number of Class-Rooms
ATET	Average Teaching Experience of Teachers
TE	Total Expenditures

Output Variables:
We have used following four output variables.

Table 4: Output Variables

Abbreviation	Variable
NS	Number of Students
PR	Percentage Result
WAPPM	Weighted Average of Passing Students' Percentage Marks
SECA	Score of Extra-Curricular Activities

Out of above-mentioned eight variables, six have been used in a number of previous studies. We have included two output variables in our model, which have not been used previously. WAPPM is Weighted Average of Passing Students' Percentage Marks. This variable is constructed on the basis of the marks of the passing students of the institutes. The variable was developed to capture the percentage marks of all students in an institute. WAPPM was developed by taking the weighted average of the all grades, obtained by the students of the institute. Grades' minimum marks were taken as the weights and they were multiplied with the number of students of the institution, falling in that grade. SECA is the Score of Extra-Curricular Activities, which is constructed with 3 extra-curricular activities including oral (Speech), written (Essay-writing etc.) and sports, each category having maximum 1 score. If any institution had participated in any level of CM Punjab's last year competition, it was assigned 0.5 score and for wining a competition, 1 score was awarded to the institution and for nonparticipation no score was awarded. The references of the remaining variables are given in **Table 5**.

Table 5: Input & Output Variables:

Variable Name	Reference
NT	Johnes (2005), Abbot & Doucouliagos (2003), Martin (2003), Avkiran(2001)
NC	Johnes & Yu (2008), Bedi & Garg (2000), Dronkers & Robert (2008)
ATET	Johnes & Yu (2008), Lassibille & Tan (2010), Oliver, Belluzzo & Pazello (2013)
TE	Castano & Cabanda (2007), Cuenca (2011), Johnes (2006), Martin(2003)
NS	Avkiran (2001), Dills & Mulholland (2010), Lassibille & Tan (2010), Johnes & Yu (2008), Bedi & Garg (2000), Johnes (2006)
PR	Chudgar & Quin (2012), Perelman & Santin (2011),

	Dronker & Robert (2008), Horowitz & Spector (2005), Rutkowski & Rutkowski (2009), Cavalcanti, Guimaraes &Sampaio (2010).

3.5. Analytical Tool:

Data Envelopment Analysis has been used for analysis in the study. The linear programming method of DEA is based on frontier approach. For relative performance, DEA is most suitable frontier method. Dyson, et al. (1998) suggested that sample size of DMUs should be greater than the product of number of inputs and outputs while Stern, et al. (1994) recommended that number of DMUs should be greater than thrice the sum of inputs and outputs.

Max [2(m×n),3(m+n)]

3.6. Area Profile:

Multan district, with an area of 3,721 square kilometres, has three tehsils including Multan, Shujabad and Jalapur Pirwala. According to 1998 census, Multan district's population was 3,116,851, with 42 percent urban population. Now the population is estimated around 7 million.

Literacy rate in Multan district is estimated to be 66 percent (BOS 2013). In Multan district, there are a total number of 1,397 public sector educational institutions. Out of which, 1,012 are located in urban areas and the remaining 385 are in rural areas. The total enrolment of students in these institutions is 350,101 (153,350 in urban area institutes and 196,751 in rural area institutions. As many as 10,227 teachers are serving in these institutions. Out of these, 5,395 are teaching in urban area institutions and 4,832 are teaching in rural area institutions.

3.7. Descriptive Analysis:

Table 6: Summary Statistics of Schools' Data

Descriptive Statistics of Schools					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
NT	100	12	104	43.51	20.79165
NC	100	10	88	29.73	13.29301
ATET	100	5	22	11.96	4.02748
TE	100	6900000	78000000	24734831	14407124.55
NS	100	386	3862	1317.6	727.33279
WAPPM	100	54.55	100	83.1502	10.94726
PR	100	51.47	75.53	59.9409	5.63311
SECA	100	0	3	1.25	0.8056

Correlation Matrix Schools' Data:

Table 7: Correlation Matrix of Schools' Data

Correlation Matrix of Schools Data								
	NT	**NC**	**ATET**	**TE**	**NS**	**PR**	**WAPPM**	**SECA**
NT	1	0.746027	0.282874	0.942934	0.921178	-0.15052	-0.02949	0.330323
NC	0.746027	1	-0.16624	0.741798	0.763479	0.030713	0.333782	-0.0573
ATET	0.282874	-0.16624	1	0.320228	0.241282	0.106399	-0.2899	0.75029
TE	0.942934	0.741798	0.320228	1	0.895777	-0.10834	0.042298	0.350212
NS	0.921178	0.763479	0.241282	0.895777	1	-0.11891	-0.0211	0.314621
PR	-0.15052	0.030713	0.106399	-0.10834	-0.11891	1	0.634734	0.123538

WAPPM	-0.02949	0.333782	-0.2899	0.042298	-0.0211	0.634734	1	-0.10606
SECA	0.330323	-0.0573	0.75029	0.350212	0.314621	0.123538	-0.10606	1

4. Public and Private Schools' Efficiency: An Empirical Analysis

The ability to produce the output with the minimum inputs required is called efficiency (Sherman, 1988). Abbot (2003) explains that "Technical efficiency investigates how well the production process converts inputs into outputs while Scale efficiency shows the extent by which an institution can take the advantage of return to scale by altering its size towards the optimal size". An institution can be technically efficient even if with too much or too little output. Scale efficiency provides the information about the scale of production. The results are computed using Solver and DEAP software. CRS technical efficiency represents overall efficiency and VRS technical efficiency shows pure technical efficiency while scale efficiency is measured as a ratio of CRS to VRS technical efficiency scores. For the segregation of pure technical efficiency from scale efficiency, technical efficiency is measured on both CRS and VRS models. DEAP software has been used to compute results.

Table 8: DEA Results for Efficiency Comparison
(Public & Private Schools)

Institutions		**EFFECIENCY**		
		CRS TECHNICAL EFFICIENCY	**VRS TECHNICAL EFFICEINCY**	**SCALE EFFICIENCY**
Public	Mean	0.849	0.949	0.892
	Median	0.865	0.98	0.886
Private	Mean	0.897	0.958	0.936
	Median	0.931	0.986	0.972
All	Mean	0.876	0.954	0.916
	Median	0.886	0.983	0.943
T test P-value		0.035	0.471	0.012

Source: Author's estimations

Figure 1: DEA (CRS) Results for Efficiency Comparison
(Public & Private Schools)

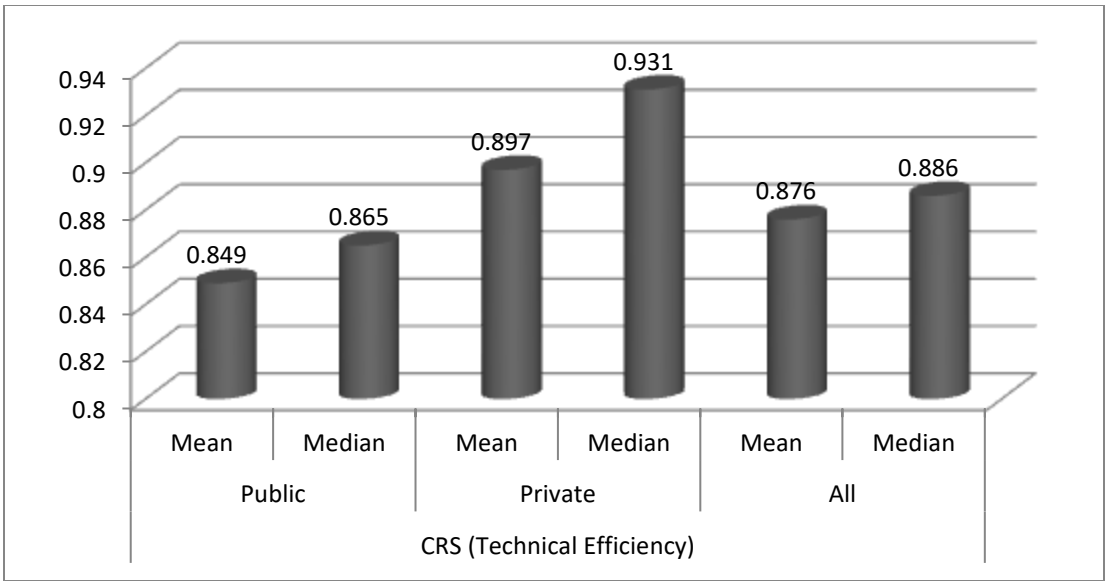


Figure 2: DEA (VRS) Results for Efficiency Comparison (Public & Private Schools)

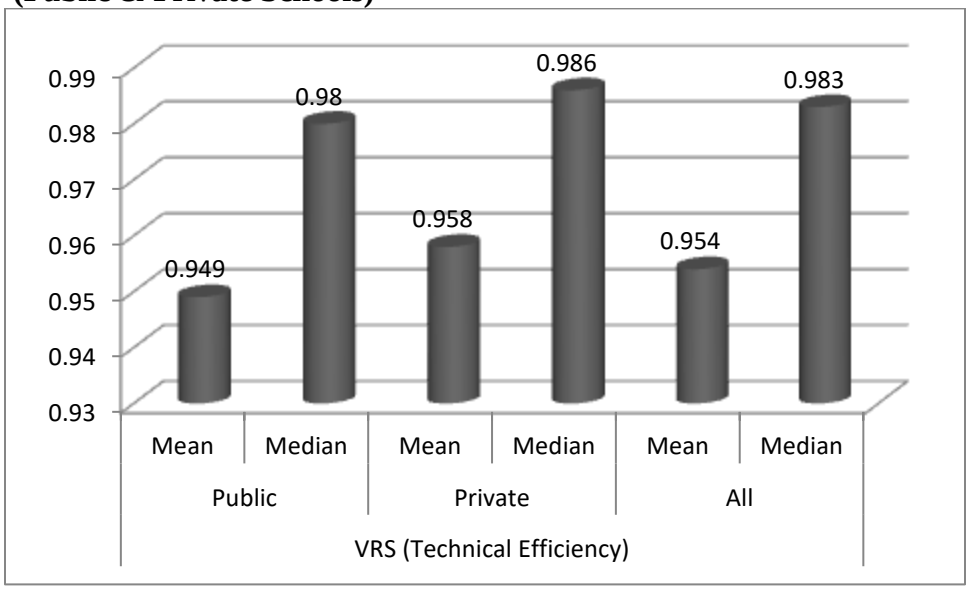
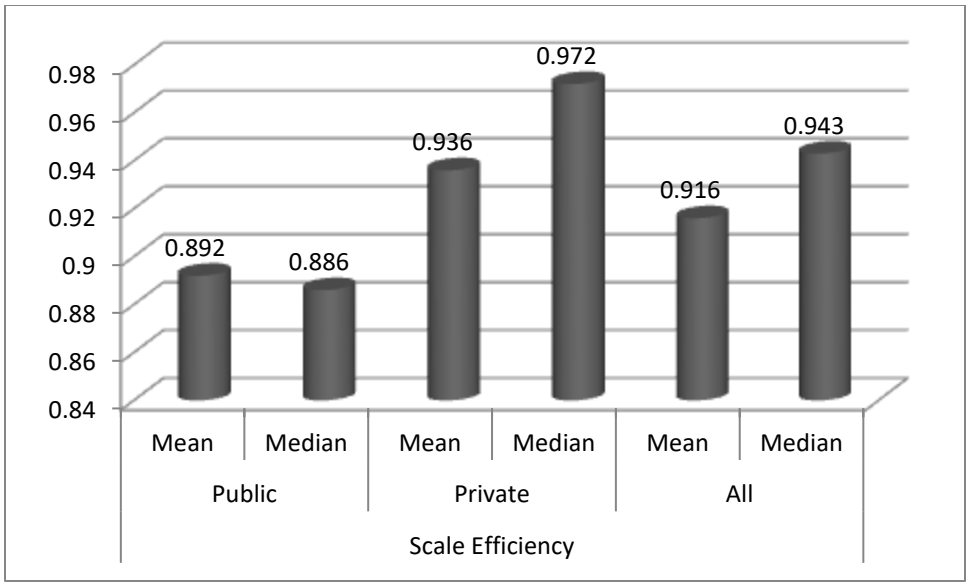


Figure 3: DEA (Scale) Results for Efficiency Comparison (Public & Private Schools)



Results of the data demonstrate that public schools lack behind private schools in terms of CRS and VRS technical efficiency scores, and scale efficiency score. There exists significant difference in CRS technical efficiency score and scale efficiency score.

Table 9: DEA Results for Efficiency Comparison
(Public & Private Boys' Schools)

Institutions		**EFFECIENCY**		
		CRS TECHNICAL EFFICIENCY	**VRS TECHNICAL EFFICEINCY**	**SCALE EFFICIENCY**
Public	Mean	0.817	0.934	0.871
	Median	0.794	0.947	0.859
Private	Mean	0.884	0.945	0.935
	Median	0.906	0.978	0.963
All	Mean	0.848	0.939	0.901
	Median	0.85	0.967	0.901
T test P-value		0.04	0.001	0.404

Source: Author's estimations

Results of the data demonstrate that public boys schools lack behind private boys schools in terms of CRS and VRS technical efficiency scores, and scale efficiency score. Significant difference exist in CRS technical efficiency score and scale efficiency score.

Table 10: DEA Results for Efficiency Comparison
(Public & Private Girls' Schools)

Institutions		**EFFECIENCY**

		CRS TECHNICAL EFFICIENCY	**VRS TECHNICAL EFFICEINCY**	**SCALE EFFICIENCY**
Public	Mean	0.909	0.954	0.916
	Median	0.942	1	0.942
Private	Mean	0.915	0.979	0.934
	Median	0.943	0.998	0.972
All	Mean	0.911	0.972	0.936
	Median	0.943	1	0.971
T test P-value		0.04	0.001	0.404

Source: Author's estimations

Significant difference exist in VRS technical efficiency score and scale efficiency score as the results of the data demonstrate that private girls schools are performing better in comparison with the public girls schools in terms of CRS and VRS technical efficiency scores, and scale efficiency score.

Table 11: DEA Results for Efficiency Comparison
(Boys & Girls Government Schools)

Institutions		**EFFECIENCY**		
		CRS TECHNICAL EFFICIENCY	**VRS TECHNICAL EFFICEINCY**	**SCALE EFFICIENCY**
Boys	Mean	0.817	0.934	0.871
	Median	0.794	0.947	0.859
Girls	Mean	0.915	0.979	0.934
	Median	0.942	1	0.942
All	Mean	0.849	0.949	0.892
	Median	0.865	0.98	0.886
T test P-value		0.04	0.001	0.404

Source: Author's estimations

Results of the data demonstrate that public girls schools have performed better as compared to public boys schools in terms of CRS and VRS technical efficiency scores, and scale efficiency score. Significant difference exist in CRS and VRS technical efficiency score and scale efficiency score.

Table 12: DEA Results for Efficiency Comparison
(Boys & Girls Private Schools)

Institutions		**EFFECIENCY**

		CRS TECHNICAL EFFICIENCY	**VRS TECHNICAL EFFICEINCY**	**SCALE EFFICIENCY**
Boys	Mean	0.884	0.945	0.916
	Median	0.906	0.978	0.963
Girls	Mean	0.909	0.954	0.935
	Median	0.943	0.998	0.972
All	Mean	0.897	0.958	0.936
	Median	0.931	0.986	0.972
T test P-value		0.04	0.001	0.404

Source: Author's estimations

Results of the data demonstrate that private girls schools' performance is better than private boys schools in terms of CRS and VRS technical efficiency scores, and scale efficiency score and the difference is significant.

5. Conclusion and Policy Implications

Using DEA, CRS Input oriented model, our findings conclude that private schools are performing better as compared to government owned schools and colleges. Our study validates the dominant paradigm that private schools outperform the state run institutes. The efficiency of private schools is attributed to a number of school and student related factors. School related factors include better educated teachers, a huge stock of physical resources and infrastructure at the disposal of private schools, their accountability to the parents of students as well as their better management practices. Other factors affecting the efficiency of private schools are related to students' rich and educated family background. In private schools, teacher absenteeism/skipping classes is almost zero because management is accountable to the parents who pay huge amounts of fee. Private schools have low student–teacher ratio as compare to public schools which is also helpful to increase their efficiency.

On the other hand, the efficiency of public schools is hampered by a number of problems such as extra duties of teachers, poor management, non-accountability, political instability, shortage of funds, absence of monitoring mechanism and lack of capital investment in educational sector. Keeping in view the results of the study, it is suggested that the government should give incentives to private sector but lower and middle classes should not be left at the mercy of private sector, which considers education as a business. Better infrastructure should be provided and strict monitoring system should be introduced to enhance public sector schools' performance and school teachers should be exempted from all extra duties. Policy of public private partnership should be implemented.

References

Abbot, M., & Doucouliagos, C. (2003). The Efficiency of Australian Universities: A Data Envelopement Analysis. Economics of Education, 22, 89-97.

Asadullah, M. N. (2009). Returns to Private and Public Education in Bangladesh and Pakistan. Journal of Asian Economics, 20, 77-86.

Avkiran, N. K. (2001). Investigating Technical and Scale Efficiencies of Australian Universities Through Data Envelopment Analysis. Socio-economic Planning Sciences, 35(1), 57-80.

Bedi, A. S., & Garg, A. (2000). The Effectiveness of Private vs. Public Schools: The Case of Indonesia. Journal of Development Economics, 61, 463-494.

Castano, M. C. N., & Cabanda, E. (2007). Sources of Efficiency and Productivity Growth in the Philippine State Universities and Colleges: A Non-Parametric Approach. International Business & Economics Research Journal, 6(6), 79-90.

Cavalcanti, T., Guimaraes, J., & Sampaio, B. (2010). Barriers to Skill Acquisition in Brazil: Public and Private School Students Performance in a Public University Entrance Exam. The Quarterly Review of Economics and Finance, 50, 395-407.

Chocran, W. G. (1977). Sampling Techniques. 3rd Ed., New York: Wiley.

Chudgar, A., & Quin, E. (2012). Relationship between Private Schooling and Achievement: Results from Rural and Urban India. Economics of Education, 31, 376-390.

Coleman, J. S. (1997). The Design of Schools as Output-Driven Organizations. . In R. Shapira & P. W. Cookson (Eds.), Autonomy and Choice in Context: An International Perspective 249-270.

Coulson, A. J. (2009). Comparing Public, Private, and Market Schools: The International Evidence. Journal of School Choice, 3, 31-54.

Cuenca, J. S. (2011). Efficiency of State Universities and Colleges in the Philippines: A Data Envelopment Analysis. (No. DP 2011-14).

Dills, A. K., & Mulholland, S. E. (2010). A Comparative Look at Private and Public Schools' Class Size Determinants. Education Economics, 18(4), 435-454.

Dronker, J., & Robert, P. (2008). Differences in Scholastic Achievement of Public, Private Government -Dependent, and Private Independent Schools: A Cross-National Analysis. Educational Policy, 22(4), 541-577.

Dronkers, J. (2001). More Parental Choice in Europe? Overview of Effectiveness Differences between Religious Schools and Public Schools in Several European Societies.

Dronkers, J., & Robert, P. (2008). School Choice in the Light of the Effectiveness Differences of Various Types of Public and Private Schools in 19 OECD Countries. Journal of School Choice, 2(3), 260-301.

Dyson, R. G., Thanassoulis, E. and Boussofiane, A. (1998). Data Envelopment Analysis. Retrieved from http://www.csv.warwick.ac.uk/~bsrlu/dea/deat/deat1.htm

Economic Survey of Pakistan 2013-14. Ministry of Finance, Government of Pakistan.

Friedman, M. (1997). Public Schools: Make Them Private. Education Economics, 5(3), 341-344.

Government of Pakistan (1998). National Education Policy (1998-2010). Islamabad: Ministry of Education.

Government of Pakistan (2009). Educational Policy. Islamabad: Ministry of Education.

Hanushek, E. (1986). The Economics of Schooling: Production and Efficiency in Public Schools. Journal of Economic Literature, XXIV, 1141-1177.

Horowitz, J. B., & Spector, L. (2005). Is There a Difference Between Private and Public Education on College Performance? Economics of Education, 24, 189-195.

Jacobs, R. (2001). Alternative Methods to Examine Hospital Efficiency: Data Envelopment Analysis and Stochastic Frontier Analysis. Health Care Management Sciences, 4(2), 103-115.

James, E. (1994). The Public-Private Division of Responsibility for Education. International Journal of Educational Research, 21(8), 777-783.

Jimenez, E., Lockheed. M. E., & Paqueo, V. (1991). The Relative Efficiency of Private and Public Schools In Developing Countries. The World Bank Research Observer, 6(2), 205-218.

Johnes, J. (2006). Data Envelopment Analysis and its Application to the Measurement of Efficiency in Higher Education. Economics of Education, 25, 273-288.

Johnes, J., & Yu, L. (2008). Measuring the Research Performance of Chinese Higher Education Institutions Using Data Envelopment Analysis. China Economic Review, 19, 679-696.

Kingdon, G. G. (1996). The Quality and Efficiency of Private and Public Education: A Case-Study of Urban India. Oxford Bulletin of Economics and Statistics, 58(1), 57-82.

Lynd, D. (2007). The Education System in Pakistan: Assessment of the National Education Census. Islamabad: UNESCO, 25-6.

Martin, E. (2003). An Application of the Data Envelopment Analysis Methodology in the Performance Assessment of the Zaragoza University Departments. Documentos de trabajo, 6(1).

Ministry of Education (2005). Pakistan Education Statistics, 2005 AEPAM/NEMIS Statistics Study No. 2martin15.

National Education Census (2005). Bureau of Statistics Pakistan.

Pakistan Education Statistics 2011-12. Ministry of Education, Government of Pakistan.

Pakistan Education Statistics 2011-12 (2013). National Education Management Information System, AEPAM, Ministry Of Education, Government of Pakistan, Islamabad.

Perelman, S., & Santin, D. (2011). Measuring Educational Efficiency at Student Level with Parametric Stochastic Distance Functions: An Application to Spanish PISA Results. Education Economics, 19(1), 29-49.

Pritchett, L. (2001). Where Has All the Education Gone? World Bank Economic Review, 15(3), 367-391.

Punjab Development Statistics 2013. BOS, Government of Punjab

Rutkowski, L., & Rutkowski, D. (2009). Private and Public Education: A Cross-National Exploration with TIMSS 2003. In Annual Conference of the American Educational Research Association.

Sherman, H. D. (1998). Service Organization Productivity Management. The Society of Management Accountants of Canada, Hamilton, Ontario.

Statistics of Arts & Science Intermediate and Degree Colleges. Academic Year 2012-13 (2012-13). Bureau of Statistics. Government of Punjab

Statistical Pocket Book of the Punjab 2012, (2013) Bureau of Statistics, Government of Punjab

Stern, Z. S., Mehrez, A. and Barboy, A. (1994). Academic Departments Efficiency via DEA. Computers and Operations Research 21(5), 543-556.

Vandenberghe, V., & Robin, S. (2004). Evaluating the Effectiveness of Private Education across Countries: A Comparison of Methods. Labour Economics, 11(4), 487-506.