

## Do the Australian Universities Have Scope to Enhance Organizational Efficiency? Lessons from Bangladesh

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*The Australian universities and the Bangladeshi universities have similar teaching and non-teaching staffing pattern. In both cases, the ratio of the teaching to non-teaching staff is irrational. The research explores the implications of such phenomena in the context of Bangladesh using panel data and econometric technique. The results showed that the Bangladeshi public universities could have saved education cost by 8 percent per student, if the ratio were rational. The lesson for the Australian universities is that the Australian universities can save a significant amount of education expenditures per student by rationalising the non-teaching staff. In the context of diminishing Australian government's support to the universities, it may be a strategic way to survive in the long run.*

**Key words:** University unit cost, Australia, Bangladesh, higher education, productivity.

JEL classification: I22

### Introduction

The Australian Federal government has declared funding cut from July amounted to \$ 2.8b from the university sector in order to give funds to the primary school. Of this projected saving, the government has calculated 2% efficiency dividend amounted to \$ 900m from the university sector. The government's decision about proposed funding cuts has generated huge debate in the society regarding its likely adverse impact on the students' participation in the universities. In the context of the debate, the paper investigates the scope of the efficiency dividend in the university sector. Conceptually the term efficiency dividend is based on a simple rationale: cutting inputs with changing the level of output (Department of Finance and Deregulation 2011, p. 19). In the literature the concept is similar to 'allocative efficiency, where selection of inputs involves selecting a mixture of inputs (e.g. Labour and capital) which produces a given quantity output (Coelli, Rao, & Battese, 1998). However, the question is does the scope of the efficiency dividend exists in the Australian university sector?

In an educational enterprise, two major categories of inputs are used: labour and physical capital. Of them labour is divided into two categories: teaching and non-teaching staff (or support staff). In the short run, physical facilities are fixed. Under the given circumstances, allocative efficiency relies on input mixture of the teaching, the non-teaching and the physical factors. In an educational enterprise, the non-teaching staff is required in an academic institution to assist the teaching staff; so that the teaching staff can be involved in teaching without interruption (Mynard 1971).

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The role of non-teaching staff is auxiliary and the role of teaching staff is essential. But the teaching and the non-teaching staff is not substitutable for each other to discharge their respective responsibilities. Under such a circumstance, any oversized non-teaching staff or teaching staff may create allocative inefficiency that resulted in wastage of public fund on the economic ground. Ernst and Young, (2012 p. 17) claimed that that a knowledge based professional firm cannot survive with a ratio of supporting staff to front line staff of over 0.3 to 0.5 unless it is not supported by the government or otherwise.

The main objective of the paper is to explore the extent of efficiency dividend association with rational staffing in the Bangladeshi universities and to replicate the lesson for the Australian university sector. Since the data regarding Australia was not available when the research was undertaken, the paper uses the data regarding the Bangladeshi public universities to explore the issue of efficiency dividend. The most recent time-series data on a broad cross-section of nineteen Bangladeshi public universities are used. This is a quantitative research paper. By applying explanatory research, based on multivariable regression analysis the paper explores the relative contribution of the teaching and non-teaching staff to the per unit cost of education at the institution level. On the basis of the lessons, the paper replicates the implications for the Australian universities.

The concept of cost in literature is very confusing; as a result it is imperative to clarify the concept of cost used in the paper. In economics, the concept of cost includes both direct and indirect cost. All costs concepts adopted in the paper are direct costs. In the study, (education) cost is defined as an institutional gross recurring cost (or expenditure) incurred by an institution to generate graduate students irrespective of its degree attainment. Total (institutional) recurring cost is equal to a sum of total personnel costs, total educational contingencies, and total administrative costs. Personnel costs include all salaries, fringe benefits, and pension benefits; while educational contingencies include costs related to the instructional process. Finally, the administrative costs include all administrative consumables.

The definition of unit cost is used in the research in different ways. Such as cost per pupil enrolled, cost pupil actually attending school, cost per graduate, cost by level of education attained, cost per pupil of the relevant age-group population, cost of education per capita, the cost per class, average recurring cost per teacher, and capital cost per place (Tsang 1988:194). In the paper, the unit cost is defined as a gross recurring cost per full time student, enrolled in a university for an undergraduate and a graduate degree program only. We do not consider students enrolled in a part-time diploma, certificate, or any non-degree programs in order to keep out calculation simple.

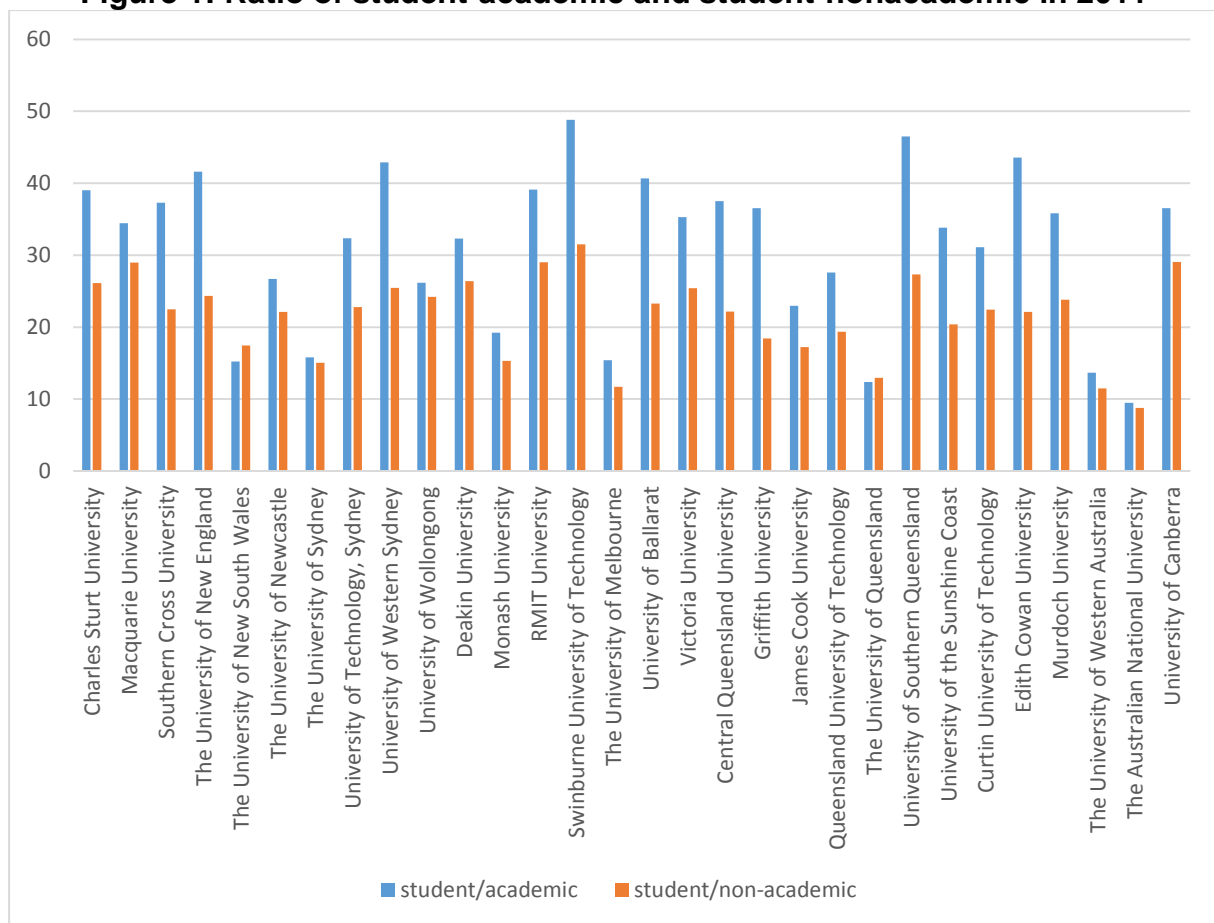
The article is structured in the following ways. The next section describes the state of human resource utilisation in both the Australian public university and the Bangladeshi public university. The third section discusses about background literature. The fourth section discusses about data, theory, and the methodology. The empirical result is provided in the next section. The article concludes with an implication and a conclusion.

## State of Resource Utilisation

Australian university education is dominated by the public university, though there is a great deal of diversity among the students. In the Australian university sector there are a few world top-ranked universities who are known as G8 universities: Adelaide, New South Wales, Sydney, Monash, Melbourn, Western Australia, Queensland, and Australia National University. These universities provide only on-campus education. The remaining universities provide both on-campus and distance mode of education. The distinguishing feature of the Australian's public university staff is that full-time staff is divided into four categories: only teaching, only research, teaching and research, supporting staff.

On the other hand, all Bangladeshi public university provides on-campus education except one public university that deal with distance education exclusively. On the other hand, in the Bangladeshi public universities, the full-time staff is divided into two categories: teaching staff and support staff who are known as non-teaching staff. The support staff, who is known as non-academic staff, provide student support, academic support, and administrative support.

**Figure 1: Ratio of student-academic and student-nonacademic in 2011**



Data source:

<http://www.innovation.gov.au/HigherEducation/HigherEducationStatistics/StatisticsPublications/Pages/default.aspx>

The Figure 1 shows that the ratio of student - academic staff ( i.e. teaching, research, teaching and research staff) ratio in the majority Australian public universities in 2011. In terms of student- staff ratio, in the G8 universities, on average student-academic ratio is 14:1; and in the remaining universities the ratio is on average 46:1. Such high ratio of student to academic staff is attributed to high enrolment in distance mode of education in those universities. In the same time, in the G8 universities the ratio of student-academic staff is 13:1 and in the remaining universities the ratio is 35:1 So, it is clear that the majority universities were using the academic staff and the non-academic staff very intensively due to high total student enrolment both on-campus and off-campus.

On the other hand, in the Bangladesh, all public universities, except the Open University of Bangladesh, provides on-campus education. In these universities on average student-academic staff and student- non-academic staff ratio is 17:1 and 8:1 respectively in 2011. (UGC, 2011.). Under the given circumstances, the paper argues, in the majority Australian universities were maintaining intensive utilisation of resource due to economies of scale associated with high student-teaching and student-non-teaching staff ratio; and the elite Australian university was not using both academic and non-academic staff intensively. On the other hand, the Bangladeshi universities were not using the non-academic staff intensively.

## **Background literature**

An accounting firm Ernst and Young prepared and released a report in 2012 regarding the changing facets of the universities in Australia. The report has stated very clearly that “universities have ample scope to increase their organisational efficiency, including reducing the ratio of support staff to academic staff and using assets more efficiently”, (Ernst and Young, p. 17). The report, furthermore, reported that in the Australian universities the required number of support staff was 2-3 times more than the required university teaching staff On the other hand, regarding the Bangladeshi public universities similar concerned was expressed in the Annual Progress Report, prepared and released, by the University Grant Commission (UGC) of Bangladesh in 2006. The UGC report (2006, p. 32) reported that “the non-teaching staff is employed irrationally in the public universities”.

In Australia, the cost of education growth has always been higher than the rate of inflation growth ( Valadkhani, Worthington and Layton 2000). The researchers showed that the growing household cost of education is attributed to increasing numbers of students’ enrolled in non-government schools and the introduction of the Higher Education Contribution Scheme (HECS). But in the East Asian country context, the fading productivity measured in terms of pupil – teacher ratio was responsible for the rising cost of education (Gundlach and Wößmann, 2000). Atkinson (1983, p.17-18) discussed the issue of rising unit cost in school education in the USA where the author argued that variation in unit education expenditures among the education enterprise occurred because some schools were ‘over-staffed’ in terms of the teacher employed.

Australian’s Department of Education Employment and Workplace Relation (DEEWR) report (2011) identified six cost drivers in the Australian higher education

sectors. They are scale factors (total number of students), staffing, students (on-campus and external), geography, discipline mix of delivery, research intensity. The report furthermore found that scale factors and staffing had statistically significant relationship with teaching costs per full-time student (p. 40). The scale effects have already been investigated by the research in the past (Abbott and Docucouliagos, 2003). The DEEWR (2011) investigated staffing effects. The study found that where there was a higher proportion of staff to students, teaching and learning costs are also higher. An increase in the ratio of staff to students by one percentage point was associated with an increase in costs per full-time student of around \$360 - \$380. However, the main weakness of the report was that the staff is not categorized into teaching and non-teaching staff. Disaggregation of data is necessary to estimate accurate effects of staffing.

Kaur, Satvinder and Raikhy (2009) attempted to examine the unit cost of higher education in the Indian state of Punjab for the years 1991-92 and 2005-06 to see the trends during the post-reforms era. The study also attempted to examine the determinants of unit recurring costs in the Punjab University and the Guru Nanak Dev University. The empirical results showed that student to teacher ratio were the most important determinant of unit cost changes.

The World Bank (1991) carried out a research on the basis of data compiled from annual recurrent budget submissions for the years 1985/86 and 1986/87 in Pakistan. The study found that non-teaching staff was 70%-90% of the total personnel recruitment. The non-teaching staff outnumbered the teaching staff; and the ratio was 4:1. Furthermore, the study looked into a unit cost in those public universities. The results were that the low unit cost of large universities was strongly related to a more intense utilisation of teaching and non-teaching staff. On average, institutions with student-faculty ratios lower than 8:1 had unit costs 2.5 times higher than those with a ratio of 8:1 or more. And unit cost was 86% higher, when the ratio of student to the non-teaching staff was 3:1 or less. So, it is clearly noticeable that the unit cost of education is directly related to distribution of staff. So our hypothesis is:

*The unit cost of university education is highly responsive to the teaching staff.*

## **Data, Theory, and Methodology**

Currently in Bangladesh, total numbers of the public universities are around thirty five. In the year 2002 and 2007, total numbers of public universities were 15 and 25. The paper analyses the data of the eighteen public universities for the period 2002-2007. The unit of analysis was university. The eighteen sample universities are selected randomly. The data were collected from the University Grant Commission (UGC), a public autonomous body, responsible for collecting data every year. It is an unbalanced panel data composed of eighteen cross-section units and six time periods of observations. It is unbalanced panel data because data of five universities were not available for the whole study periods.

Our dataset is unbalanced [total number of observations are 103 [ 13 Univ. x6 yrs]] + [5 Univ. x5 yrs.] = 103 , because four new universities were added in the year 2003. Neither any university leaves the university sector, nor is any data missing in

our dataset. We do not face any major problem in collecting data. We deflated all cost data using the Consumer Price Index at the national level taking the year 2002 as the base year. For analytical purposes, we divide total cross-section units into four groups relating to degree offered by the university. They are the agricultural university, the engineering university, the general university, and the science and technology university. These sorts of grouping data help us to maintain homogeneity of data within the cross-section units.

In education, productivity of an educational institution is defined as the relationship between program inputs and outputs (Bakia et al. 2012, p. 1); in other words, it means effectiveness and efficiency. If a university production function consists of two inputs say labour and capital respectively, then a typical production function of a university production is equal to  $q = f(L, K, )$ , where  $L$  stands for labour input and  $K$  stands for (physical) capital input, and  $q$  stand for total output. Here total out is measured by the total number of students following past literature ( e.g. Cohn et al. 2989; Izadi, oskrochi & Crochley 2002; Cheng and Wu, 2008; Johnes and Johnes 2009) So, the total cost function of a university ( analogous to a firm) is as follows:

$$C = f(w.L + r.K). , \text{ if physical capital is fixed in the short-run then}$$

$$C = f(w.L) \quad \text{Equation 1}$$

$$\frac{\Delta C}{\Delta q} = w \frac{\Delta L}{\Delta q} = w_1 \frac{\Delta L_1}{\Delta q} + w_2 \frac{\Delta L_2}{\Delta q}$$

$$MC = (w_1 \frac{1}{MP_{L1}} + w_2 \frac{1}{MP_{L2}}) \quad \text{Equation 2}$$

Equation 2 indicates that according to the microeconomics theory of cost, marginal cost (of providing education services in a single university) is equal to the wage rate of the teaching staff ( $L_1$ ) and the non-teaching staff ( $L_2$ ) multiplied by the inverse of labour productivity. As role of two different categories of labour is different from each other, enhancing the marginal productivity of a teaching staff will not generate any change to the marginal productivity of a non-teaching staff. So, the relative contribution of two groups of labour to total (university) productivity is very important to understand about the available scope to increase the productivity of a university.

### **Econometric Model**

On the basis of the inputs, the specific cost function derived from Equation 1 is as follows

$$C_{it} = f(aru_{it}, nonaru_{it}, pruu_{it}, z_{it}) \quad \text{Equation 3}$$

Where  $C_{it}$  is per student recurring costs;  $aru_{it}$  = per student academic resource utilisation;  $nonaru_{it}$  = per student non-academic resource utilisation;  $pruu_{it}$  = per student physical resource utilisation. Our explanatory variables are (a) student-teacher ratio ( $x_1$ ), (b) student -non-teaching staff ratio ( $x_2$ ), and (c) per student physical space ( $x_3$ ), other possible factors (error term) counted by  $z_{it}$ .

There are two different types of models: fixed effects and random effects. As our dataset consists of units of analysis which is random, we select random effects model over fixed effects model for our data. Our panel data random-effects model is as follows:-

$$C_{it} = \alpha + x_{it}\beta + v_i + \varepsilon_{it} \quad \text{Equation 4}$$

Where, unobserved effects  $v_i$  are not correlated with explanatory variable  $x_{it}$ . We estimate unit (average) cost function applying panel data random effects model. By incorporating institution-specific random effects in the model, the paper takes into consideration important sources of variation across the institutions. Two estimation techniques are used: Generalized Least Squares (GLS) estimate under no auto correlation and/or heteroscedasticity, and GLS estimates in presence of auto correlation and heteroscedasticity. Statistical data analysis software Stata is applied to estimate parameter coefficients. Generally special treatment to handle the unbalanced nature of the panel data is essential; however, in this case, no special treatment was necessary because the Stata has inbuilt command to handle the unbalanced data.

The paper investigates the relative effects of the extent of human and physical resource utilisation on the unit cost at the university level applying regression analysis. In the public universities of Bangladesh, the human resource is employed in four categories – teacher, officer, 4<sup>th</sup> class employee, and 3<sup>rd</sup> class employee. Except the teaching staff, the remaining three categories of staff are classified as non-teaching staff.

To measure resource utilisation, the paper considers three types of variables (a) student to teacher ratio, (b) student to non-teaching staff ratio, and (c) student to physical resources ratio. The justification of using ratio rather than absolute number as a variable is to capture the rate of resource utilisation in terms of per unit output (in this case is per student). Calculation of per student resource utilisation has been done dividing the total quantity of resources by the total number of students. Segregation data related to human resources is done in two parts: - (i) professional teaching staff, and (ii) non-teaching staff. The paper considers the physical space per student calculated by total space/total number of students. Descriptive statistics of the variables are presented in the Table 1. The statistics demonstrate that there is heterogeneity among the universities in terms of ratio.

**Table 1: Descriptive statistics**

Variables	Obs	Mean	Std. Dev.	Min	Max
Unit Cost (C) [in BDT in constant (2000) price]	103	34846.95	23391.39	9726.87	120644.10
Student teacher ratio ( $x_1$ )	103	16.02	6.08	4.45	31
Student: non- teaching staff ratio ( $x_2$ )	103	6.453	3.563	0.517	18.70
Student space ( $x_3$ ) [in sq. ft.]	103	72.713	34.88	1.428	186.66

### **Empirical results**

Our estimated regression coefficients are presented in Table 2. The estimated results of both GLS-methods produce almost similar results with an overall  $R^2$  value equal to 0.56 and 0.57 respectively. Our findings suggest that out of three explanatory variable student to non-teaching staff ratio ( $x_2$ ), and student to physical space ratio ( $x_3$ ) are statistically significant at 5% and 1% level of significance; on the other hand the variable student to teacher ratio is not statistically significant at either 5% or 1% level of significance in our panel data set.



<b>Table 2: Estimated models</b>		
Total no. of observation = 103		
Dependent variable : Unit cost		
Parameters (variables)	Random effects	
	GLS- Coefficients (z- value)	GLS with AR(1) disturbance Coefficient (z-value)
Our $\hat{\beta}$ (constant)	36541.38 (4.88)*	39114.4 (5.19)*
$\hat{\delta}_1(x_1)$	- 478.04 (-1.27)	- 671.61 (- 1.29)
$\hat{\delta}_2(x_2)$	-2414.27 (- 3.54)*	- 2384.66 (- 3.68)*
$\hat{\delta}_3(x_3)$	293.56 (5.98)*	298.76 (5.82)*
$R^2$ overall	0.56	0.57
between	0.62	0.64
within	0.41	0.41
Wald Chi2	88.71	88.59
Note: * = Statistically significant at 1% level of significance.		

estimated parameter coefficients of variables  $x_1, x_2$  have negative relation with the unit cost as it is expected theoretically. In the data, the prevailing average the non-

teaching staff to the student ratio was around 1:8. After controlling student to teacher ratio, and student to physical resource ratio, the empirical investigation shows that student to non-academic staff ratio is the most the important statistically significant determinant of unit cost of university education. It implies that increasing the ratio, the Bangladeshi university may generate efficiency dividend. Furthermore, the estimation shows that the public university can generate the efficiency dividend amount to BDT 2300 – 2400 by increasing the student to non-teaching staff ratio increase by one point. So, our null hypothesis is rejected against alternative hypothesis is the rising cost of higher education is attributed to under-utilisation of non-teaching staff (labour) in Bangladesh.

### **Conclusion and Policy Implications:**

As education is labour intensive industry, the opportunity of the efficiency dividend potentially to be related to efficient use of labour. In the education industry, there are two categories of labour are used: the academic and the non-academic staff. From the empirical analysis of the Bangladeshi public university data the lesson we learned is that due to a high ratio of the non-academic staff -student ratio, the opportunity of the efficiency dividend lies in intensive utilisation of the non-academic staff. From the Figure 1, we have already learned that as both the academic and the non-academic staff are used intensively, the opportunity of the efficiency dividend does not prevail in all Australian public universities in general. The G8 member universities may be the subject matter of further scrutiny in this regards, because the scope of intensive use of human resources is limited to these universities for their solo engagement in on-campus education. These G8 member universities are comparable with Bangladeshi universities in terms of teaching mode (on campus teaching) and student-staff ratio. In such a situation, the potentiality of efficiency dividend may be feasible for the large Australian universities by recruiting the non-teaching staff rationally.

### **References**

- Abbott, M & Doucouliagos, C. (2003) The Efficiency of Australian Universities: a Data Envelopment Analysis, *Economics of Education Review*, 22 (1), pp. 89-97.
- Atkinson, G.B.J. (1983). *The Economics of Education*, Hodder and Stoughton Publishing, London.
- Coelli, Tim; Rao, D.S. P., & Battese, G (1998) *An Introduction to Efficiency and Productivity Analysis*. Kluwer Academic Publishers. USA.
- Bakia, M., Shear, L., Toyama, Y., and Lassetter, A. (2012) *Understanding the Implications of Online learning for Educational Productivity*. U.S.Departmental of Education, Office of Educational Technology. Centre for Technology in Learning.
- Cheng, G., WU, K. (2008). The Internal Efficiency in Higher Education: An Analysis Based on Economies of Scope, *Frontier Education China*, 3 (1), pp. 79 – 96.
- Cohn, E., Rhine, S.L. and Santos, M.C. (1989). Institutions of Higher Education as Multi-product Firms: Economies of Scale and Scope, *Review of Economics and Statistics*, 71 (2), 284 – 290.

- DEEWR (2011) *Higher Education Teaching and Learning Costs*, a report. Available at Department of Industry, Innovation, Climate change, Science, Research and Tertiary Education web site  
<http://www.innovation.gov.au/Pages/default.aspx>. Access on 31/05/2013
- DDepartment of Finance and Deregulation (2011) *Review of the Measures Accessed Agency Efficiency*, Commonwealth of Australia. Available at  
<http://www.itsanhonour.gov.au/coat-arms/>
- Ernst and Young (2012) *University of the Future: a Thousand Year Old Industry on The Cusp of Profound Change*. A report. Ernst and Young, Australia.
- Gundlach, E. and Wößmann, L. (2001) The Fading Productivity of Schooling in East Asian, *Journal of Asian Economics*, 12, pp. 401-417.
- Izadi, H. J., Oskrochi, R., and Crouchley, R., (2002). Stochastic Frontier Estimation of a CES Cost Function: The Case of Higher Education in Britain. *Economics of Education Review*, 21 ( 1), 61 – 71.
- Kaur, Satvinder and Raikhy, P. S., (2009) Determinants of Unit Cost of Higher Education : A Study of University Education in Punjab. *The FedUni Journal of Higher Education* , vol. IV, no. 3 & 4, pp. 65-83. Available at SSRN:  
<http://ssrn.com/abstract=1447237>
- Maynard, J (1971). *Some Micro Economics of Higher Education: Economies of Scale*, Lincoln, Nebraska, University of Nebraska Press.
- Tan, J. and Mingat, A. (1992). *Education in Asia: A Comparative Study of Cost and Financing*, The World Bank Regional and Sectoral Studies, The World Bank Publication, Washington D.C.
- Tsang, M. C. (1988). Cost Analysis for Educational Policymaking: A Review of Cost Studies in Education in Developing Countries. *Review of Educational Research*, 58 (2), 181 – 230.
- University Grant Commission (UGC) (2006). *Strategic Plan for Higher Education in Bangladesh: 2006 – 2026*, Publication number 108, UGC Publication, Dhaka, Bangladesh.
- University Grant Commission (UGC) (2011) 38<sup>rd</sup> Annual Progress Report , UGC Publication, Dhaka, Bangladesh.
- Valadkhani, A., Wortington, A. C., and Layton, A. (2005) 'A note on The Rising Cost of Education in Australia', *Economic Papers*, 24 (2) pp. 97-106.
- World Bank (1991) *Costs and Finance of Higher Education in Pakistan*. The World Bank working paper. Population and Human Resource Department, Washington D. C.