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Gender Differentials in the Cost of Primary Education: A Study of Pakistan

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The paper examines the differences in the cost of primary education by gender and by province. It shows that the growth in enrolment outstrips the growth in the relevant population cohort, except in Sindh, and that this is faster in the case of girls than boys; that the school construction programme for girls in Sindh, unlike other provinces, outstrips the growth in female teacher employment. This is also seen in the boys' school in Pakistan. Cost of providing education are a function of the availability of teachers and schools, opportunity cost of employment, urbanisation and female literacy. The growth in both recurring and capital outlays and in output costs per student are higher for girls and boys except in Balochistan.

Using a pooled time series and analysis the paper concludes that there is an optimal level for the availability of schools per 1000 population [6.02 and 5.67 respectively for girls and boys in the Punjab and 3.88 for boys in NWFP and Balochistan] and for the number of teachers per 1000 students [7.69 for girls and 3.36 for boys]. It suggests the policy prescription to reallocate resources to employing more teachers for boys for greater cost effectiveness.

1. INTRODUCTION

The Government of Pakistan prepared the second Perspective Plan in 1987-88 for the fifteen years ending in 2002-2003. The Plan recognised that the long-term objectives could be achieved only if the human capital stock in Pakistan was improved. The Plan, therefore, developed a strategy for improving the education, skills, nutrition and health of the people. These objectives have become the cornerstone of the donor supported Social Action Programme (SAP). However, there is general recognition of the resources constraint within which these objectives are to achieved. The low priority that has been attached traditionally to allocations to the social sectors, particularly directed for the female part of the population, has led to increasing the shortfalls in allocation with respect to need. SAP envisages the expansion of primary infrastructure, particularly for female education, through an accelerated school construction programme using cost effective approaches to

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delivery including need-based criteria for school location and changes in the pattern of allocation of funds among sector inputs. It is in this context that this paper examines the issue of cost effectiveness of the primary education sector in Pakistan and attempts to establish implications for a possible future strategy. Section 2 presents the historical profile of the sector from 1977 to 1991. Section 3 sets out the theoretical framework for analysis. Sections 4 and 5 first estimate the costs and then identify the determinants of spatial and inter-temporal variation in these costs. Section 6 summarises the key conclusions.

2. TRENDS IN PRIMARY EDUCATION

Estimates of enrolment published by the Central Bureau of Education (CBE) of the Government of Pakistan indicate that it is increasing at a faster pace than the growth in population of the relevant age cohort (5–9 years) for each of the Provinces, except for Sindh, gender notwithstanding (see Table 1). As may be seen, the differential in the two growth rates is higher for girls than it is for boys. In the largest province, Punjab, primary enrolment by girls has increased at more than two and a half times the growth rate in the relevant population cohort between 1973 and 1991. In the same period the enrolment of boys has increased by slightly less than twice the growth in the cohort population.

Table 1

Growth Rates in Enrolment and School Going Age Population, 1972-73 to 1990-91

(Percent)

	Pakistan	Punjab	Sindh	N.W.F.P.	Balochistan
Cohort Population	2.98	2.15	3.42	3.46	7.22
Girls	3.05	2.16	3.79	3.30	7.16
Boys	2.92	2.14	3.16	3.60	7.28
Total Enrolment	4.23	4.53	2.61	4.34	9.52
Girls	4.95	5.42	3.04	4.41	8.24
Boys	3.90	4.01	2.44	4.33	9.80

Table 2 gives the corresponding growth rates in the number of schools and teachers. This differential in growth rates between enrolments and education inputs indicates that the average number of students per teacher has been increasing with the passage of time for both boys and girls generally, except in NWFP for both and in Sindh for the girls. However, the number of boys per teacher has seen a worsening of the situation more than for girls. Also the average school size, measured as students per school, has been increasing for the boys school in each province. In the case of the girls school this is seen only in the case of schools in Punjab and Balochistan.

Table 2

Growth Rates in Inputs to Primary Education
1972-73 to 1990-91

(Percent)

	Pakistan	Punjab	Sindh	N.W.F.P.	Balochistan
Schools	4.16	3.97	4.73	3.91	4.19
Teachers	3.87	3.49	2.92	6.71	8.45
Girls' Schools	5.92	3.97	11.19	6.97	2.25
Girls' Teachers	4.76	4.39	4.84	7.38	5.91
Boys' Schools	3.19	3.96	1.44	2.35	4.57
Boys' Teachers	3.39	2.92	1.99	6.47	8.88

A higher growth rate in the number of schools than in the number of teachers tends to imply that the quality of education is declining with the passage of time. This may be the direct result of the decline in the number of teachers available per school. This would tend to suggest that the teacher:student ratios have worsened. Moreover, this also indicates that the share of capital costs in the provision of education at the primary stage will be increasing over the period. This phenomenon is observed in the case of Punjab and Sindh. Gender differential growth rates indicate that this trend in the decline of the quality of education is observed in the case of female primary education in Sindh and male primary education in Punjab.

3. THEORETICAL FRAMEWORK

Different approaches can be adopted for deriving the cost function for primary education of provincial governments. One approach is to view the provincial governments as engaging in a cost minimisation behaviour, given knowledge of the production function of enrolments with respect to inputs like schools, teachers, etc. In this view unit costs are the minimum average costs for achieving a target enrolment ratio. However, this approach assumes rational behaviour with full knowledge of the production function, and no resource constraints such that targets can be fully met. These assumptions are generally not satisfied in practice.

A more realistic view of how provincial governments behave is that they generally operate in an overall resource constrained framework, both for recurring and development expenditures, and that given the overall quantum of resources available in the recurring budget and the ADP, funds are allocated to primary education on the basis of inter-sectoral priorities. According to this view then the actual choice of level of inputs need not correspond to the cost minimising combination. As such some inputs are likely to be overused while others remain at sub-optimal levels. For example, if development allocations for primary education

are high, especially in recent years following the launching of SAP, then too many schools may be built relative to teachers whose numbers may be constrained by lack of revenues to finance recurring expenditures.

We set up the theoretical framework which is consistent with the latter view. Accordingly if the development and recurring allocations for primary education are $\overline{I_t}$ and $\overline{E_t}$ respectively in year t than the incremental number of schools, ΔS_t, is given by

$$\overline{\Delta S}_t = C_t * \overline{I_t} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (1)$$

where C_t is the unit capital cost (at constant prices) per school.

The total number of schools, S_t, in year is

$$\overline{S_t} = \overline{S}_{t-1} + \overline{\Delta S_t} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

The capital stock embodied in these schools is evaluated at historic cost and represented by K_t in year t. We have that

$$K_t = K_t\,(\overline{S_t}) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (3)$$

The number of teachers, T_t, is given by

$$T_t = \frac{\overline{E_t}}{W_t} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (4)$$

where W_t is the average wage rate (at constant prices) of teachers. This wage rate includes overhead costs and costs of inputs (books, etc.) which are complementary to teaching.

The total cost of primary education to provincial governments is given by where υ_t is the rental price of capital and includes a depreciation component and a component for the opportunity cost of capital.

$$C_t = W_t \overline{T_t} + \upsilon_t \overline{K_t}(S_t) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (5)$$

The production function of primary education is represented as

$$E_t = f_t(\overline{T_t}, \overline{S_t}, Z_t) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (6)$$

where E_t = enrolments and Z_t a vector of variables on the demand side determining the rate of utilisation of education facilities.

Therefore, we have that the average cost, Ac_t, in year t per enrolment as

$$AC_t = \frac{C_t}{E_t} = \frac{W_t \overline{T_t} + \upsilon_t K_t(\overline{S_t})}{f_t(\overline{T_t}, \overline{S_t}, Z_t)} \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Differentiation of the average cost function yields

$$\frac{\delta AC_t}{\delta \overline{S_t}} = \frac{1}{f_t^2}\left[f_t \upsilon_t \frac{\delta K_t(\overline{S})}{\delta \overline{S_t}} - C_t \frac{\delta f_t}{\delta \overline{S_t}} \right] \gtrless 0 \quad \ldots \quad \ldots \quad (8)$$

$$\frac{\delta AC_t}{\delta \overline{T_t}} = \frac{1}{f_t^2}\left[f_t W_t - C_t \frac{\delta f_t}{\delta \overline{T_t}} \right] \gtrless 0 \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

If provincial governments engaged in cost minimisation behaviour then both derivatives would be zero at the optimal levels of S_t and T_t. But since these magnitudes are given exogenously at $\overline{S_t}$ and $\overline{T_t}$ respectively it is likely that both derivatives diverge from zero. Different possibilities can be identified as follows:

$$\frac{\delta AC_t}{\delta \overline{S_t}} < 0, \frac{\delta AC_t}{\delta \overline{T_t}} < 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (i)$$

This implies that both inputs are being underused from the view point of cost minimisation. This case highlights the likelihood of under expenditure generally on primary education.

$$\frac{\delta AC_t}{\delta \overline{S_t}} > 0, \frac{\delta AC_t}{\delta \overline{T_t}} > 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (ii)$$

In this case, both inputs are being overused.

$$\frac{\delta AC_t}{\delta \overline{S_t}} < 0, \frac{\delta AC_t}{\delta \overline{T_t}} > 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (iii)$$

In this case, there exists a case for reallocation of funds from teacher's salaries to building more schools if cost effectiveness of the sector is to be enhanced.

$$\frac{\delta AC_t}{\delta \overline{S_t}} > 0, \frac{\delta AC_t}{\delta \overline{T_t}} < 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (iv)$$

Here, there is a case for more teachers and fewer schools.

Therefore, our approach enables determination of the future expansion path of inputs into primary education which maximises cost effectiveness of expenditures.

We also have from Equation (7) that

$$\frac{\delta AC_t}{\delta W_t} = \frac{\overline{T_t}}{f_t} > 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

$$\frac{\delta AC_t}{\delta \upsilon_t} = \frac{K_t}{F_t} > 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

$$\frac{\delta AC_t}{\delta Z_t} = -\frac{C_t}{f_t^2} * \frac{\delta f_t}{\delta Z_t} < 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

Therefore, determinants of average cost are given by

$$AC_t = AC_t\left[\overline{S_t}, \overline{T_t}, W_t, \upsilon_t, Z_t\right] \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

4. ESTIMATION OF COSTS

Information on public sector costs of providing education are contained in the annual budget documents of the provincial governments.[1] A more meaningful analysis is by gender of school (boys/girls) and by location (urban/rural). Unfortunately, disaggregation of the data in this manner is not available. Information on the numbers of schools constructed for boys and girls separately is contained in the Federal and Provincial Annual Development Plans and the profile of completions is available from the statistics published by the CBE. In addition, the number of male and female teachers employed is also available in the CBE data base. The annual "Demand for Grants: Recurring Expenditure" provides the budgeted costs for the ensuing year, the revised costs for the current year and actuals of the preceding year for the province as a whole aggregated for both the categories of schools and teachers. Costs have been allocated by gender on the basis of teachers (establishment charges) and schools (other costs).

Information on the development expenditure is provided in the Annual Development Plan in considerable detail and is summarised in the "Demand for Grants: Development Expenditure". As the construction of schools is spread over a number of years, the data on development outlay would need to be lagged. Moreover, given inter-provincial differences in construction speeds, this lag should ideally reflect this. Unfortunately, data for this is not available, thus a constant two-year lag for each of the Provinces has been used.

The sum of these represent the effective annual outlay of resources on primary education. The cost of providing primary education to a particular student is the

[1]Indicates the share of provincial governments in provision

aggregate expenditure incurred over the five years he/she spends in school. Further, as these costs are incurred at different periods of time one needs to convert these into real terms. In arriving at the costs of providing education to students the enrolment at the end of the fifth year has been equated to be the output from the schooling system. The PIHS from 1990-91 also shows the rate of attrition within the first four years of schooling to be exponential in character. Our data which is intertemporal also indicate this at the macro level.

The recurring expenditure series of each of the four provinces has been converted to real terms (at constant prices of 1990-91) by inflating the nominal values by the implicit deflator for the Public Administration and Defence sector of the economy. Development expenditures largely represent the construction of schools. Therefore, the nominal expenditures have been adjusted to real terms using the implicit deflator for the Construction sector. The trend growth rate in these implicit deflators indicates that the former has been rising by 8.1 percent annually and the latter by 8.8 percent annually. This would imply that the construction of more schools in preference to the provision of more factor inputs may be less cost efficient.

In real terms N.W.F.P. has been increasing its recurring expenditure much more rapidly than the other Provinces, and much more so in the case of female primary schools. Sindh, however, outstrips the others in its annual increase in development expenditure, particularly for girls' schools. Inter-provincial differences in growth rates may be seen in Table 3. These clearly highlight the priority in the mix of expenditure for each of the provinces.

Table 3

Real Growth in Expenditures on Primary Education
(1972-73 to 1990-91)

(Percent)

	Pakistan	Punjab	Sindh	N.W.F.P.	Balochistan
Recurring	4.96	4.03	5.76	8.61	2.00
Girls	5.48	4.07	6.59	9.12	1.10
Boys	4.46	3.98	4.59	7.86	2.71
Development	2.95	2.35	5.08	3.41	1.97
Girls	4.18	2.52	8.29	5.21	1.70
Boys	172	2.20	1.10	1.23	2.18

An important conclusion by comparison of the growth rates in Tables 2 and 3 respectively is the fast increase in expenditure relative to the growth in physical inputs. This indicates that the unit cost, C_t, of constructing a school has been rising in real terms while the real recurring cost per teacher has also demonstrated some increase. The growth rate in these magnitudes is given in Table 4.

Table 4

Growth in Costs of Primary Education Inputs
1972-73 to 1990-91
(1990-91 = 100)

(Percent)

	Recurring Cost per Teacher	Construction Cost per School
Pakistan	5.21	2.08
Punjab	5.21	2.01
Sindh	5.07	5.13
NWFP	5.60	2.50
Balochistan	3.46	2.22

The output of the primary stage of education is the number of students completing the fifty year. As information on completions, successful or otherwise, is not available, the output at this stage has been equated to the enrolment in class 5. To estimate the recurring costs spent on a student produced by the system we have aggregated the cost per enrolment over the five year span.

The value of the base stock of schools in 1973 has been derived by first estimating the average per school cost in real terms and then applying this to the base quantum. This however, underestimates the value of the base stock as it does not include the value of those primary level classrooms available in the higher category of schools (middle and high). Information for the marginal capital cost of such classes is not available. To this base year estimate each year's addition to the capital stock is added. This is then converted into an annualised stream by aggregating the opportunity cost of the stock of schools each year and the current year's depreciation. The opportunity cost has been assumed to be 12.5 percent (the long term return on government bonds) of the value of the stock. The life-span of a primary school has been assumed to be 40 years. These have then been translated to the per student cost.

These province-wise estimates on a per student basis of primary education are presented in Table 5, and Table 6 summarises the growth rates in enrolment and output costs.

It is also of some interest to note the inter-provincial and inter-gender variation in costs. In the Punjab and NWFP which started with output costs for both boys and girls at about the same level, the output costs of girls have outstripped that for boys by 1990-91. Sindh started with higher output costs for girls and this differential has only increased with time. Balochistan, however, has seen no change in the relative costs. Costs in the NWFP and Balochistan are higher because of the high component of capital costs due largely to higher costs of construction.

Table 5

Enrolment and Output Costs Per Student in Primary Education
(At 1990-91 Prices)

	Punjab				**Sindh**			
	Enrolment Costs		Output Costs		Enrolment Costs		Output Costs	
Year	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
1973	782	810			690	795		
1974	815	850			751	856		
1975	858	852			925	788		
1976	857	853			928	799		
1977	833	842	4,145	4,208	874	730	4,169	3,967
1978	910	916	4,274	4,314	991	830	4,470	4,003
1979	883	906	4,342	4,370	948	790	4,667	3,937
1980	908	920	4,391	4,438	1,006	821	4,748	3,970
1981	929	942	4,464	4,527	1,030	843	4,849	4,014
1982	928	946	4,558	4,631	1,068	850	5,043	4,134
1983	1,038	1,052	4,686	4,766	1,217	943	5,269	4,247
1984	1,094	1,172	4,896	5,032	1,192	929	5,513	4,386
1985	1,108	1,130	5,097	5,241	1,320	1,014	5,826	4,579
1986	1,293	1,293	5,461	5,592	1,766	1,274	6,562	5,010
1987	1,339	1,330	5,872	5,976	2,127	1,391	7,622	5,551
1988	1,363	1,346	6,197	6,270	2,266	1,442	8,671	6,050
1989	1,359	1,341	6,462	6,440	2,416	1,228	9,894	6,349
1990	1,299	1,243	6,653	6,553	2,484	1,210	11,059	6,545
1991	1,348	1,309	6,707	6,569	2,387	1,092	11,680	6,362
	NWFP				**Balochistan**			
1973	1,927	1,838			1,952	2,530		
1974	1,988	1,924			1,836	2,446		
1975	1,884	1,923			2,069	2,430		
1976	1,935	1,911			1,950	2,501		
1977	1,905	1,898	9,638	9,495	1,941	2,371	9,748	12,278
1978	2,004	1,962	9,715	9,618	2,050	2,393	9,846	12,141
1979	1,992	2,002	9,719	9,696	2,105	2,494	10,114	12,190
1980	2,079	2,096	9,913	9,869	2,278	2,520	10,323	12,280
1981	2,307	2,157	10,286	10,115	2,265	2,650	10,638	12,428
1982	2,591	2,231	10,972	10,448	2,355	2,852	11,052	12,909
1983	3,249	2,384	12,217	10,871	2,254	3,036	11,257	13,552
1984	3,456	2,427	13,682	11,296	2,171	3,143	11,323	14,201
1985	3,851	2,493	15,454	11,693	2,190	3,128	11,235	14,809
1986	3,903	2,620	17,050	12,155	2,632	3,299	11,603	15,458
1987	4,373	2,780	18,832	12,703	2,482	3,560	11,729	16,166
1988	4,325	2,945	19,907	13,264	2,692	3,570	12,167	16,700
1989	4,518	2,909	20,970	13,746	2,392	3,403	12,388	16,959
1990	4,767	2,883	21,887	14,136	2,382	3,297	12,580	17,128
1991	4,700	2,803	22,684	14,319	2,259	3,172	12,208	17001

Table 6

Real Growth in Enrolment and Output Costs of Primary Education
1972-73 to 1990-91
(*At 1990-91 Prices*)

(Percent)

	Pakistan	Punjab	Sindh	N.W.F.P.	Balochistan
Annual Cost per Student	3.76	3.31	5.52	4.83	1.99
Girls	4.24	3.43	7.20	6.34	1.51
Boys	3.43	3.19	3.21	2.92	2.37
Output Cost	4.31	3.73	6.06	5.50	2.50
Girls	5.21	3.81	7.43	7.30	1.82
Boys	3.36	3.66	4.20	3.28	3.02

5. DETERMINANTS OF COSTS

The general specification of the average cost function (with respect to enrolment) of primary education for provincial governments is given by Equation (14). For econometric estimation we scale the number of schools by the school going age population in age group of five to nine years. The latter variable reflects potential demand. Similarly, the number of teachers is scaled by the number of schools, to yield the input mix. Also, since the impact on unit cost of $\overline{S}$ and $\overline{T}$ is ambiguous, these variables enter in a polynomial form in the cost function.

The resulting equation to be estimated is as follows:

$$AC_t = \beta_0 + \beta_1\left(\frac{\overline{S_t}}{\overline{A_t}}\right) + \beta_2\left(\frac{\overline{S_t}}{\overline{A_t}}\right)^2 + \beta_3\left(\frac{\overline{S_t}}{\overline{A_t}}\right)^3 + \beta_4\left(\frac{\overline{T_t}}{\overline{S_t}}\right) + \beta_5\left(\frac{\overline{T_t}}{\overline{S_t}}\right)^2 + \beta_6\left(\frac{\overline{T_t}}{\overline{S_t}}\right)^3 + \beta_7 Y_t + \beta_8 U_t + \beta_9 I_t + \varepsilon \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

where

$\overline{A_t}$ = school going age population in year *t*,
Y_t = real per capita income,
U_t = extent of urbanisation, and
I_t = relative price index for wages to construction cost.

Y_t is included to capture the real wage effect (inclusive of labour into school construction) and a possible demand effect. U_t is a demand related variable. I_t derives the cost implications of a divergence between inflation in wages and construction costs.

The magnitudes of β_2 to β_6, are of special significance. These will help in identifying the presence of economies or diseconomies in the use of inputs.

Equation (14) is estimated separately for genders on a pooled time series data for the four provinces for the period, 1972-73 to 1990-91. The results are given in Table 7. The cubic term with respect to the availability of schools skews the results substantially by reducing the importance of the availability of teachers. In fact its inclusion leads to a result where the impact of a teacher become insignificant. As this is counter intuitive, the term has been dropped. Intercept and slope dummies for the provinces have been used wherever significant. The intercept term was insignificant and was, therefore, neglected in the subsequent analysis. Only the provincial dummy for Balochistan was significant. The results inclusive of all provincial dummies is shown as a footnote so that the reader may be able to draw conclusions independently of the author. The estimated equation demonstrates that there are some significant inter-regional differences in these coefficients, with Punjab and Sindh falling into one group and NWFP and Balochistan into another group.[2]

[2]

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
FSPOP	–5633.686	2753.216	–2.046220	0.0462
FSPOP2	3225.714	733.6745	4.396656	0.0001
FSADPS	–2824.831	499.1484	–5.659300	0.0000
FTCHS	2544.277	2777.290	0.916101	0.3642
FTCHS2	–416.9571	935.0591	–0.445915	0.6577
FTCHS3	18.80473	69.86479	0.269159	0.7890
PCINC	0.547088	0.372830	1.467393	0.1488
URBAN	698.7680	239.8615	2.913214	0.0054
IND	–3994.553	1855.635	–2.152661	0.0364
BAL	2347.518	2819.734	0.832532	0.4092
SIND	–19237.87	8264.563	–2.327754	0.0242
NWF	–4106.616	3103.411	–1.323259	0.1920

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
MSPOP	–6913.986	1824.217	–3.790111	0.0004
MSPOP2	755.0930	210.1301	3.593455	0.0008
MSADPS	–183.7410	72.13917	–2.547035	0.0141
MTCHS	11170.93	6502.811	1.717862	0.0923
MTCHS2	–1919.994	2478.339	–0.774710	0.4423
MTCHS3	53.68137	307.8388	0.174381	0.8623
PCINC	0.103565	0.121893	0.849637	0.3997
URBAN	408.6920	60.18213	6.790920	0.0000
IND	–2411.989	732.2949	–3.293741	0.0019
BAL	11060.06	1901.702	5.815872	0.0000
SIND	–7318.895	868.6464	–8.425631	0.0000
NWF	4326.896	1929.039	2.243032	0.0295

Table 7

Results Of Regressions
Average Cost per Enrolment is the Dependent Variable

	Girls		Boys	
Variable***	Coefficient	*t*-ratio	Coefficient	*t*-ratio
$(\overline{S_t} / \breve{A}_t)$	–1231.099	–1.035**	–5430.697	–5.638*
$(\overline{S_t} / \breve{A}_t)^2$	2293.720	7.368*	700.412	8.163*
$(\overline{S_t} / \breve{A}_t)^2 . DPS$	–2191.407	–11.951*	–221.149	–14.168*
$(\overline{T_t} / \overline{S_t})$	5742.642	5.079*	25887.877	7.853*
$(\overline{T_t} / \overline{S_t})^2$	–1407.147	–3.476*	–7784.920	–5.063*
$(\overline{T_t} / \overline{S_t})^3$	89.609	2.634*	780.281	3.465*
U_t	–21518.984	–1.932**	–8172.684	–3.826*
Y_t	0.603	1.571**	0.369	2.036**
I_t	–6209.950	–4.317*	–6049.055	–6.750*
DUMBAL	5857.647	7.889*	4605.334	19.003*
R^2	0.956		0.987	
F	121.325		429.087	
Degrees of Freedom		49		49

DUMBAL = 1 for Balochistan; zero otherwise.
DPS = 1 for Punjab and Sindh; zero otherwise.
* Significant at 1 percent level.
** Significant at 5 percent level.
*** Significant at 10 percent level.

For all provinces the equation indicates that the average cost falls initially and then rises subsequently with increase in $(\overline{S_t} / \breve{A}_t)$, the ratio of schools to school-going age population. Therefore, there exists for each province and within provinces for each gender an optimal $(\overline{S} / \breve{A})$ which minimises unit costs. Any expansion in schools beyond this level raises the unit cost. With regard to teachers per school, we observe a rise in costs initially and then a fall with increase in $(\overline{T} / \overline{S})$ upto a level beyond which costs rise once again.

The estimated optimal cost minimising magnitudes of inputs by gender for each province are given in Table 8. The optimal number of schools per 1000 school-going age population in Punjab and Sindh is 6.02 for girls and 5.67 for boys. Sindh was close to this level by 1990-91, and Punjab had substantially more than the optimal for boys. For NWFP and Balochistan the corresponding optimal magnitude is 3.88 for boys. In the context of girls, the optimal level of 0.27 schools per 000

Table 8

Actual (1990-91) And Optimal Number of Schools per 1000 School-going Age Population and Teachers per School by Province*

	Actual (1)		Optimal (2)	Difference (2-1)
Girls				
		S/A		
Punjab	1.43		6.02	4.59
Sindh	1.58		6.02	4.44
NWFP	2.73		0.27	–2.46
Balochistan	0.69		0.27	-0.42
		T/S		
Punjab	8.21		7.69	–0.52
Sindh	6.65		7.69	1.04
NWFP	2.72		7.69	4.97
Balochistan	2.32		7.69	5.37
Boys				
		S/A		
Punjab	6.95		5.67	–1.28
Sindh	5.86		5.67	–0.19
NWFP	5.03		3.88	–1.15
Balochistan	4.22		3.88	–0.34
		T/S		
Punjab	2.56		3.36	0.80
Sindh	2.66		3.36	0.70
NWFP	3.14		3.36	0.22
Balochistan	2.66		3.36	0.70

population appears to be unrealistic. This may possibly be due to the very low level of enrolment which exists in both NWFP and Balochistan. The result, therefore, needs to be considered with caution. However, it would appear that given the very low levels of enrolment, the optimal for these two provinces cannot be readily determined for the girls' schools. Therefore, in at least two provinces of the country, Punjab and Sindh, the priority in allocation of resources has to shift from school building for the boys. This activity can perhaps only be justified on regional equity considerations in areas which are backward and have low levels of coverage.

Table 8 also indicates there is underprovision generally of teachers for both boys and girls. It appears that their role in raising quality and demand for primary

education has not been fully recognised. Actually inputs of teachers per school are above cost minimising levels only in the context of girls in the Punjab. Overall we have the conclusion that the composition of expenditure budgets (with the possible exception of Balochistan and, perhaps, also NWFP) has to be dramatically altered. The recurring allocations for employing more teachers need to be raised and simultaneously development allocations scaled down in the case of boys. The same strategy is recommended for the Social Action Programme. However, expansion in number of primary school teachers raises issues of adequate training facilities, remuneration levels and decentralisation of management down to community level to increase accountability of teaching inputs. In addition, the availability of female teachers for the rural areas poses some problems which need to be tackled within a social development/awareness framework.

6. CONCLUSIONS

This paper has examined the degree of cost effectiveness of the primary education sector of Pakistan. Annual enrolment and output costs have been estimated by gender for each province for the period, 1972-73 to 1990-91. These have shown a rising trend generally because of the increase in real recurring costs per teacher, in costs of school construction and because of the divergence in the physical level of use of education inputs, schools and teachers, from the cost minimising levels. In particular, the number of teachers and of schools is substantially below optimal levels in the context of girls. There also appears to be an over supply of schools for boys. In this instance some improvement is needed in the number of teachers per school to attain optimal levels. This indicates that cost effectiveness of provision of primary education can be significantly enhanced if the allocation of funds is shifted towards recurring expenditures for employment of more teachers away from development allocations for construction of new schools in the context of boys' education at the primary level.

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