Chapter 3

EDUCATION[1]

Education has improved substantially in Ecuador in recent decades, but progress has slowed in recent years and there are signs of deterioration. Of particular concern is that the education gap between the indigenous/black and mestizo (mixed race) population groups appears to be widening, especially after primary school. And as part of this phenomenon, the gap between education levels for the rich and the poor is widening. This paper analyzes the education sector and provides recommendations for a more efficient use of budgetary resources, especially with regard to the achievement of the Millennium Development Goal (MDG) of universal primary education. The main recommendations, based on studies to determine the factors keeping some children away from school, are: (a) to improve the quality and training of teachers while making efforts to reduce the overall number of teachers as a means to save resources; (b) use these resources to improve school infrastructure and increase subsidies and incentives to the poor; and (c) target cash incentive programs for school attendance towards the urban poor where they appear to have the greatest impact. Here the model suggests the cash transfer (Bono Desarrollo Humano) need not be conditional on school attendance in order to be effective. More decentralized decision-making (e.g. assigning a greater role to local communities in teacher appointments) is expected to promote school enrollment, in particular among urban non-poor and rural poor.

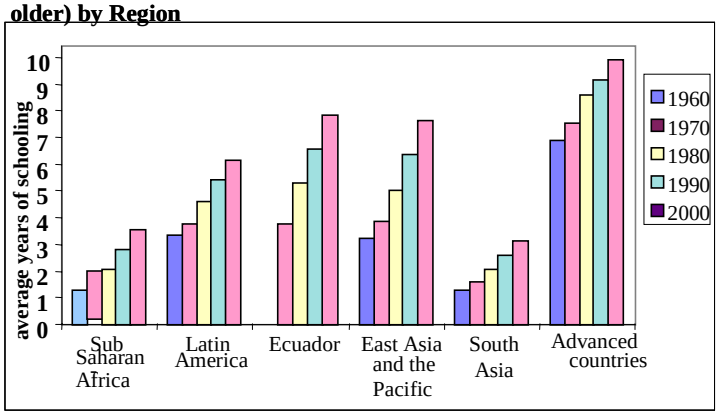
3.1 The Ecuadorian government spends more on education than on any other public sector program. Ecuador has good coverage of primary education, but its quality is poor and transition to secondary education is low. Also inequality in access to education has increased between urban and rural population groups and between rich and poor. However, the gender gap in education appears to have closed. This study assesses the equity, efficiency, and sustainability of educational expenditure, inputs, and results. In section 2 we summarize the performance of Ecuador's education system during the 1990s up to the early 2000s, looking both at education outcome indicators and internal and external efficiency measures. In Section 3 we summarize recent changes in education policies. Section 4 analyzes the causes of the declining trend in education spending since the 1980s, which has reversed since 2000 mainly due to increases in teacher salaries. Section 5 discusses the degree of equity in public spending on education, finding that spending on primary education is pro-poor but spending on secondary and tertiary education is not. In section 6 we analyze the determinants of access to primary and secondary education to help make spending more cost-effective. These findings are subsequently used in Section 7 for a scenario analysis of alternative education budget allocations aiming at reaching the Millennium Development Goals in education. This budget analysis also sets out the parameters for an education budget tracking system that should allow the government to prepare result-oriented, multi-annual budgets. Measuring outputs and outcomes will provide information to fine tune the public quality and effectiveness of provision of education services.

1 This paper was prepared by Rob Vos (Institute of Social Studies, The Hague, Netherlands) and Juan Ponce (IDB Consultant).

I. Education Performance in the 1990s

3.2 *Education Outcomes.* Educational indicators for Ecuador have continued to improve during the 1990s and into the first decade of the new millennium. In comparison to previous decades though, the speed of educational improvement has slowed down and educational inequality has grown in many respects. Figure 3.1 shows continuous growth in the average level of schooling of the Ecuadorian population since the 1970s. According to the population census of 2001, the average Ecuadorian adult had 7.3 years of schooling completed, up from 6.7 years in 1990. Ecuador's average schooling level is above that of the Latin American mean and about the same as that of East Asia's population. Educational levels for females have risen much faster than for males, so that the gender gap in terms of years of schooling has practically been closed. It is now 7.5 years for males against 7.1 years for females (see Table 3.1). In terms of net enrollment rates, girls already outperform boys at all educational levels (see Table 3.2). Total net enrollment in primary education increased from 88.9 to 90.1 percent between 1990 and 2001.

Figure 3.1. Average Years of Schooling (population 25 years and older) by Region



Source: Population Census data (1974, 1982, 1990, 2001); Other Regions: World Bank (2003).

Table 3.1. Illiteracy Rate and Years of Schooling of Adult Population (25 years and older), 1990-2001

	Illiteracy Rate		years of Schooling	
	1990	**2001**	**1990**	**2001**
By Gender				
Men	9.5	7.7	7.1	7.5
Women	13.8	10.3	6.3	7.1
By Area				
Rural	20.8	15.5	4	4.9
Urban	6.1	5.3	8.3	8.7
By Ethnic Group				
Indigenous	n.a.	28.2	n.a.	3.3
Blacks	n.a.	11.6	n.a.	5.9
Other	n.a.	7.4	n.a.	7.6
National Average	11.7	9	6.7	7.3

Source: Population Census, 1990 and 2001.

3.2 This relatively favorable educational performance comes with a number of important qualifications.

3.3 *First*, the speed of educational improvements slowed down significantly during the 1990s compared to the 1970s and 1980s. Net primary school enrollment, for instance, increased by 20 percentage points during the 1980s (from 68.6 to 88.9 percent), but only by a meager 1 percentage point during the 1990s. Similarly, during the 1970s and 1980s about 1.5 years were added per decade to the average education level of the population, while between 1990 and 2001 less than one year was added.[2]

3.4 *Second*, the transition rates from primary to secondary education and from secondary to tertiary education are low and have not improved much during the 1990s. According to the 2001 population census, net enrollment in primary education is 89 percent, but for secondary education it is just 45 percent, and at the tertiary level it is 12 percent (see Table 3.2). Net secondary school enrollment is well below the Latin American average (including the Caribbean)

2 It should be noted that the data for the 1970s and 1980s refer to eight-year time intervals (1974-82 and 1982-90), whereas the change during the 1990s refers to an eleven-year period, such that the slowdown is in fact even starker than suggested in the text.

of 64 percent and also below that of neighboring Andean countries which all have rates well over 50 percent (except for Venezuela which just scores 50 percent). These numbers suggest that Ecuador has been outpaced by its neighbors in terms of access to education beyond the primary level, and therefore may lose its advantage in terms of years of schooling in the years to come unless there are renewed efforts to improve educational performance.[3]

Table 3.2. Net Enrollment Rates by Educational Level, 1990 and 2001

	Net Enrollment Rates					
	Primary		Secondary		Tertiary	
	1990	2001	1990	2001	1990	2001
By Gender						
Men	88.6	89.9	42	43.9	10.3	11.1
Women	89.2	90.4	44.1	45.4	11.3	12.6
By Area						
Rural	84.4	86.7	23.2	28.8	3.2	4.3
Urban	92.5	92.7	57.7	55.7	15.4	16.2
By Ethnic Group						
Indigenous	n.a.	86.1	n.a.	22.7	n.a.	2.9
Blacks	n.a.	86.2	n.a.	36.9	n.a.	6.5
Other	n.a.	90.8	n.a.	47.1	n.a.	13.2
National Average	88.9	90.1	43.1	44.7	10.9	12.3

Source: Population Census, 1990 and 2001.

3.5 *Third*, except for the gender gap, important disparities remain and by several measures educational inequality has been on the rise. The average level of schooling of the rural population is almost half that of the urban population (4.9 against 8.7 years) and this gap remained about the same during the 1990s. The education gap is even larger for the indigenous and black population, as the averages for these groups are estimated at 3.3 and 4.5 years of schooling in 2001 respectively, well below the national average (7.3 years).[4] Differences in schooling indicators by geographical location correlate strongly with the proportion of the population that is rural and indigenous and with differences in the quality of education inputs, such as the number of students per classroom and teacher qualifications. We analyze these causal relations further in Section 6.[5]

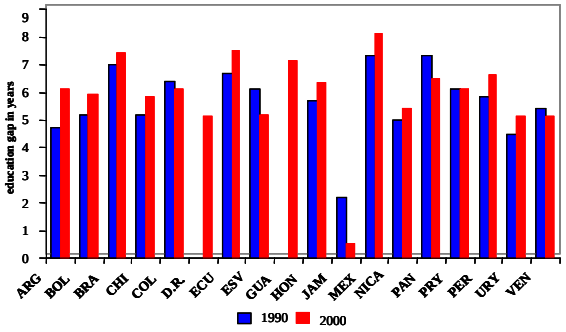
3 Comparison with Latin America is based on World Bank data (WDI 2003), which are more optimistic for some neighboring countries than UNESCO data, which put Bolivia and Venezuela below Ecuador in secondary school enrollment. Discrepancies also exist between various Ecuadorian data sources. Data from the Ministry of Education (SINEC database) give a more optimistic figure than the population census data, showing a net enrollment rate for secondary education of 48 percent in 2000-2001. The Ministry of Education data also suggest the transition rate from primary to secondary has improved more than the census data would suggest. The SINEC data indicate a rise in the transition rate between 1995 and 2001 from 67 to 73 percent, where the transition rate is defined as the percentage of graduates of primary school continuing to first grade of secondary school. This improvement in the transition rate should lead to faster growth in the net secondary school enrollment rate than suggested by the census data (indicating a rise from 43.1 to 44.6 percent between 1990 and 2001). In the text we assign greater reliability to the population census data in measuring actual school enrollment.

4 Population censuses prior to 2001 do not identify population by ethnicity, so no change in this gap can be reported. Available evidence from household surveys shows improvement from very low levels in educational achievement for the indigenous population and only very slight (if any) catching up with the rest of the population. According to data from the Living Standards Measurement Study (LSMS) surveys the average level of schooling for the indigenous population increased from 2.2 to 2.9 years between 1995 and 1999, while that for the non-indigenous population increased from 7.3 to 7.9 years in the same period.

5 See Statistical Annex Table A42 for educational output indicators at the provincial level. This table shows the results of a simple cross-section model of determinants of years of schooling and net enrollment rates using population census data at the cantonal (district) level for 2001. The shares of rural and indigenous populations are significant in all cases, affecting schooling indicators negatively. Poverty indicators, like the unsatisfied basic needs index are also significant with a negative sign, but are in turn highly correlated with the shares of the rural and indigenous population, and so were not included in the same specification. School infrastructure variables (as measured by student-classroom ratios and the share of single-teacher, *uni-docente* schools) correlate negatively with education performance indicators by district, while higher availability of trained and experienced teachers has a positive impact. Only in the case of secondary school enrollment was the infrastructure variable not found significant for reasons explained below. These findings are consistent with the cost-effectiveness model analysis

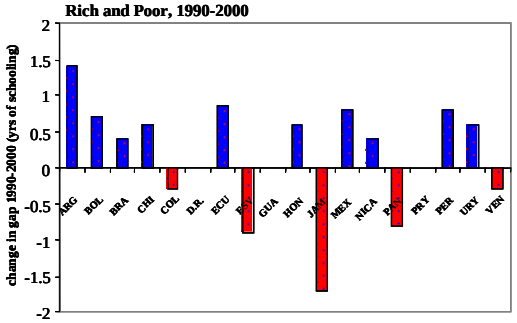
3.6 *Illiteracy* rates are also much higher among the rural, indigenous and black population groups. As shown by Table 3.2, net enrollment rates in primary education do not show such stark differences by rural/urban and ethnic divides, suggesting some catching up is taking place at this level. In contrast, net enrollment rates for the rural population and for indigenous and black people at secondary and tertiary schooling levels are substantially below that of the rest of the population. Thus, the education gap seems to have widened from secondary school and up. This hypothesis is confirmed when looking at the education gap by income levels. The gap has increased between the poorest and richest quintiles of the income distribution, following a region-wide trend (see Figures 3. 2a/b).

Figure 3.2a. Latin America: Education Gap Between Rich and Poor, 1990–2000



Source: Ecuador: LSMS survey 1995 and 1999; Other countries: World Bank (2003).
Note: Difference in years of completed schooling between first and fifth quintile of income distribution.

Figure 3.2b. Latin America: Change in Education Gap Between Rich and Poor, 1990-2000



*Source:*Ecuador: LSMS survey 1995 and 1999; Other countries: World Bank (2003).

Table 3.3. Education Gap Between Rich and Poor, 1995-99 (difference in education indicator between first and fifth quintile of distribution of per capita consumption)

	1995	1999	Change 1995-99
Years of schooling	6.6	7.5	0.8
Males	6.6	7.4	0.8
Females	6.7	7.5	0.9
Net enrollment primary	6.7	9.5	2.8
Males	7.1	8.9	1.8
Females	6.2	10	3.8
Net enrollment secondary	55.4	59.1	3.7
Males	58.7	58.1	-0.6
Females	51.7	60.4	8.7
Net enrollment tertiary	21.1	36	14.9
Males	24.7	36.1	11.4
Females	18.3	35.8	17.5

Source: Calculations based on LSMS (ECV) surveys 1995 and 1999. See Statistical Annex Table A33 and A34 for further detail. Differences for years of schooling are expressed in years and for enrollment rates in percentage points.

3.7 In fact, the increase in Ecuador is the second largest in the region (Argentina shows the largest change). Only five of eighteen countries in the region show a reduction in the education gap during the 1990s (see Figure 3.2b). In Ecuador, the gap between rich and poor increased by 0.8 years of schooling (about equally for men and women) during 1995 and 1999 (Table 3.3).

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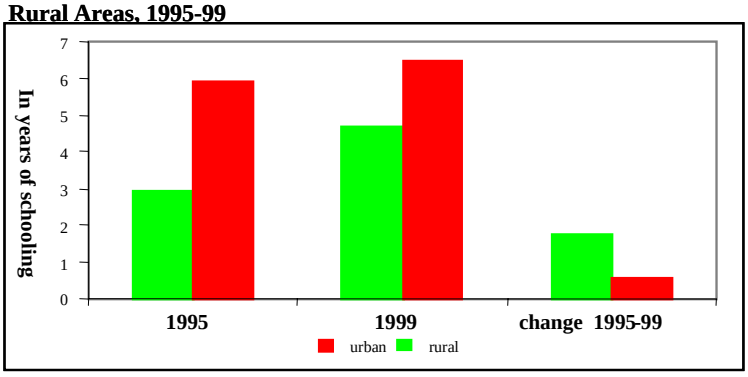
of Section 6. Remarkably though, we could not find a relationship between the same set of determinants and the quality of education as measured by test scores for students at grades 2, 6 and 10 (see Statistical Annex Table A43).

3.8 *Educational* inequality rose faster in rural than in urban areas (Figure 3.3). Inequality between rich and poor in terms of enrollment rates also increased at all education levels during the period 1995-99, but secondary and tertiary education were the worst-hit. Using a different data set, but for a longer time period, the evidence shows that during the 1990s the education gap between rich and poor in urban areas widened gradually, but at a stronger pace for males than females, which is consistent with the trend observed above of a closing gender gap (see Table 3.4).

Figure 3.3. Education Gap Between Rich and Poor in Urban and Rural Areas, 1995-99



Source: Calculations based of LSMS (ECV) surveys for 1995 and 999. Difference in years of schooling is between first and fifth quintile of the per capita consumption distribution for rural, respectively urban areas. See Statistical Annex Table A33 for additional detail.

Table 3.4. Urban Ecuador: Education Gap Between Rich and Poor, 1988-2002
(difference in years of schooling between first and fifth quintile of distribution of per capita income)

	1988	1990	1995	2000	2002	change 1990-2002
Education gap for urban population	5.7	5.3	5.8	6.8	6.6	1.2
Males	6.7	4.8	5.6	5.5	6.5	1.6
Females	5.1	6.2	6.2	7.4	6.9	0.7

Source: Calculations based on INEC, Urban Household Surveys, 1988, 1990, 2000 and 2002. Difference in years of schooling is for adult population of 25 years and older.

3.9 *Fourth*, the quality of education is poor. The little information available on test scores shows that students are on average deficient in basic mathematical and language skills. The evidence in Table 3.5 gives scores on a scale of 20 with 13 as a minimum pass score. Students in 2nd, 6th and 9th clearly score on average substantially below the minimum, particularly for mathematics. Test scores appear to have worsened between 1996 and 2000, the short period where figures are available. Unfortunately, achievement tests are no longer being administered, so a continuous monitoring of the quality of education is not possible. More disaggregated evidence (see Statistical Annex Table A36) shows that girls score slightly better in language skills and boys in mathematics skills, while students in urban areas outperform those in rural areas, those in the Sierra region do

Table 3. 5. Test Scores for Language and Mathematics Skills, 1996-2000

	1996	1997	2000
Second grade			
Spanish language skills	10.43	8.24	9.45
Mathematics	9.33	7.21	8.48
Sixth grade			
Spanish language skills	11.15	9.31	9.78
Mathematics	7.17	4.86	6.03
Ninth grade			
Spanish language skills	12.86	11.17	11.7
Mathematics	7.29	5.35	6.01

Source: APRENDO
Notes: Test scores are on a scale of 20 with 13 considered as the pass grade. Ninth grade refers to third year of secondary school.

better than their peers in the Costa, and private school enrollees better than those in public schools. For all categories it holds that average scores are below the minimum.[6] The little comparable data on test scores in the region sketch a gloomy picture of the quality of Ecuador's education. Test scores for Ecuadorian students appear at Latin America's bottom end as (Table 3.6) shows.

3.10 To sum up, education performance in Ecuador has improved substantially in past decades. However, points of concern are that progress has slowed recently, while education gaps between rich and poor, between rural and urban, and between indigenous/black and *mestizo* population groups are large and widening, particularly at the secondary and tertiary school level. As we shall discuss further below, these findings are all the more worrisome in the light of increasing demand for labor with a skill level of at least lower secondary education.

Table 3. 6. Test Scores Fourth-Graders of Primary School in Selected Latin

	Test Scores (percent of students scoring in each range)				Average Score
Country	**0-25**	**26-50**	**51-75**	**76-100**	**On 100 scale**
Argentina	2.7	38.5	54.1	4.8	52.8
Bolivia	4.2	67.4	25.8	2.6	44.2
Costa Rica	0.7	33.9	49.6	15.7	57.5
Chile	2.7	39.8	47.5	9.9	53.6
Ecuador	**13.6**	**59.7**	**25.2**	**1.5**	**41.2**
Dominican Republic	2.2	60.7	34.9	2.2	46.8
Venezuela	0.8	30.7	49.8	18.7	59.1
Average of sample	4.1	47.2	40.2	8.5	50.8

Source: UNESCO-OREALC. Por qué, cómo y para qué medir la calidad de la educación, Volumes I, II, and III. Paris: UNESCO.

Note: Test scores refer to internationally comparable tests taken in the indicated countries. Scores are the average for language and mathematics skills. In Ecuador the test was taken by a (representative) sample of 3,000 pupils in 159 primary schools across the country.

3.11 *Internal Efficiency.* Internal efficiency in education relates educational inputs to outcomes. There are several ways of measuring internal efficiency. The most used indicators refer to repetition and desertion rates. Repetition and desertion are captured simultaneously in the education efficiency indicator defined by UNESCO as the ratio of the number of students of a particular cohort that completed a given level of education with respect to the 'ideal' number of students that would have reached that level with zero repetition and desertion. Table 3.7a shows that this ratio is about 88 percent for primary education after a slight deterioration in

Table 3.7a. Internal Efficiency Indicators for Primary Education, 1995 and 2001

	Retention rate (5th grade) %		Years to complete school		Efficiency indicator (5th grade) %	
	1995	**2001**	**1995**	**2001**	**1995**	**2001**
By Gender						
Women	84.13	81.5	6.75	6.84	88.90	87.74
Men	84.29	81.37	6.79	6.86	88.36	87.43
By Area						
Urban	87.69	84.58	6.56	6.68	91.41	89.78
Rural	76.34	74.16	7.32	7.3	81.95	82.14
National Average	84.22	81.44	6.77	6.85	88.63	87.59

Source: SINEC data base. Refers to school years of 1994-5 and 2000-1.

Note: Efficiency indicator as defined by UNESCO stands for the ratio of the number of students of a particular age group which completed a given level of education with respect to the 'ideal' number of students that would have reached that level with zero repetition and desertion.

6 The exceptions are for language skills of ninth graders in the Sierra (1996 only) and of students in private schools in sixth and ninth grade (1996 only). In all other cases and observations for these cases in subsequent years scores are below the minimum.

the second half of the 1990s.[7] Other indicators confirm this decline in the internal efficiency of primary education in Ecuador. First, the number of years pupils need to complete primary education increased from 6.77 to 6.85 years between 1995 and 2001, while the survival to grade 5 of primary school has fallen from 84 percent to 81 percent in the same period.

3.12 The internal efficiency in secondary education also deteriorated in the second half of the 1990s (see Table 3.7b), but more starkly for girls than boys. Dropout rates for girls are still lower than for boys, but data from the 1999 LSMS show the stark rise in the dropout rate of girls could be associated with teenage pregnancies and pressure to take on household tasks and work in the farm household as the economy moved into crisis. The latter hypothesis would be consistent with the observed rise in secondary school dropout in rural areas between 1995 and 2001. The rising dropout rate of boys from secondary school could also be due to economic reasons.[8] We return to this issue in Section 6.

Table 3.7b. Internal Efficiency Indicators for Secondary Education, 1995 and 2001

	Retention rate at 5th grade%		Years to complete school		Efficiency indicator at grade 5%	
	1995	**2001**	**1995**	**2001**	**1995**	**2001**
By Gender						
Women	94.2	75.2	6.6	7.6	90.3	76
Men	77.6	70.5	7.6	8.0	76.1	72
National average	85.6	72.8	7.0	7.8	83.2	74.2

Source: SINEC data base. Refers to school years of 1994-5 and 2000-1.

Note: Efficiency indicator as defined by UNESCO stands for the ratio of the number of students of a particular cohort which completed a given level of education with respect to the 'ideal' number of students that would have reached that level with zero repetition and desertion.

3.13 Retention rates and education quality are likely negatively affected by the high rate of teacher absenteeism and frequent teacher strikes in Ecuador. No evaluations are available to verify the impact. Nonetheless, the available information does suggest that these are important problems. Box 3.1 gives data on teacher absenteeism in primary schools based on a special survey conducted in 2002-3. Teachers were found absent for unaccounted reasons in 15-19 percent of the cases. Teacher strikes mostly affect both primary and secondary schools at the same time. Over the past 15 years on average one month of education has been lost per year to strikes.[9] Rojas (2003) quotes evidence that in poorer areas an average of nine school days *per month* are lost to strikes and absenteeism. At the end of 2003, all public schools were closed for two months because of a teacher strike over a small salary increase. Earlier in 2003 there was another strike that closed schools for 6 weeks. Despite these problems, it is not obvious that teacher absence is affecting school enrollment, as explained in Box 3.1. The determinants of both phenomena seem to diverge. No doubt, such high rates of absence affect quality of education.

7 See Statistical Annex Table A37 for detail by province and Table A38 for a comparison with other Latin American countries. In comparison with the rest of the region, Ecuador scores relatively well in terms of the internal efficiency of primary education when taking SINEC data based on the records of the Ministry of Education. According to these estimates, Ecuador would have a similar internal efficiency to Argentina, Mexico, Uruguay and Venezuela; and one well above that of Colombia and Dominican Republic. However, UNESCO estimates using the reconstructed cohort method show a lower persistence rate of students in primary education that would put Ecuador in the league of countries with low efficiency.

8 Economic reasons are reported as the main reason, by far, for school non-attendance and dropout at the secondary level among boys in the 1999 LSMS.

9 Estimate based on data from SIISE and Rojas (2003).

Coupled with the negative effects of teacher's strikes, these rates of absence could also be taken into account during political negotiations with Government's authorities.

Box 3.1. Teacher Absence in Primary Schools

As part of the Public Expenditure Review (PER) work, and in collaboration with a multicountry study initiated by the World Bank as a background paper for the World Development Report 2004, a pioneer national teacher tracking survey was carried out in Ecuador. (See Rogers et al. 2004 in Volume II.) It aimed to determine teacher absence rates and their main correlates in Ecuador. During 2002–03, survey teams interviewed a random sample of 720 teachers in 102 primary schools in 51 randomly selected *parroquías* were surveyed. Each school was visited twice, in December 2002 and again in January–February 2003, to allow two observations of teacher attendance.

Of the 670 fulltime teachers who would normally have been teaching at the time of the survey visit, 86.5 percent. On average, teachers were found in the classroom (or accompanying the enumerator) 79 percent of the time, although in a fifth of those occasions the teacher was not teaching at that moment. The overall teacher absence rate, measured as the fraction of teachers who could not be found anywhere in the school, was about 14 percent, with a relatively small number of teachers apparently accounting for a larger share of the absence than in other countries. About half of the overall absences were not accounted for by the school directors.

Percentage of time the teacher was found…	December 2002	January–February 2003	Total (both rounds)
In the classroom teaching	59.5	64.8	62.1
In the classroom not teaching	16.0	14.9	15.5
Out of class on scheduled break	0.0	0.0	0.0
Out of class but in school premises	6.0	5.1	5.6
Doing administrative work	2.2	1.6	1.9
Cannot find/absent	**14.6**	**12.5**	**13.5**
Accompanying surveyor	1.8	1.1	1.5

Source: Rogers et al. (2004).

The study also analyzed the correlates of (and hence possible reasons for) absence, with some notable results. Overall, Bangladesh, India, Indonesia, Papua New Guinea, Uganda, and Zambia all recorded higher teacher absence rates than Ecuador, and only Peru's absence rate was lower (Chaudhury et al 2004). Surprisingly, in Ecuador absence is not more likely in remote, rural areas—as is often found in other countries—but rather in urban areas. In fact, teachers in urban schools (outside Quito) are absent at twice the rate of teachers in the most remote rural schools, perhaps because of greater employment opportunities and distractions in the urban areas. Also, one-teacher schools (*escuelas unidocentes*) are not associated with higher teacher absenteeism, although multi-teacher *polidocente* schools apparently are; thus as a general matter, the effects of having to teach various grades at the same time are ambiguous. In general, a better community (lower poverty rate) and institutional environment are associated with reduced teacher absence, whereas individual characteristics of teachers (age, tenure, education, union membership) do not seem to make much of a difference. Some factors that might be expected to raise performance through formal monitoring and enforcement of attendance—notably, proximity to a Ministry of Education office, and the past use of discipline by the school director—are indeed associated with lower absence. On the other hand, active parent committees, per se, do not appear to reduce teacher absence. Finally, and perhaps more significant, contract teachers (especially those not hired at the school level) have a higher probability of absence than regular teachers, despite the greater leverage that schools and communities might be thought to have over contract teachers. Hence, special contracts may not be the right "quick fix" for the problem.

In the analysis of access to education, no doubt absence will affect the quality of education, but the survey is less clear to what extent it will influence school enrollment. As indicated, rural school enrollment rates are much lower than enrollment rates in urban areas, and are thus seemingly unrelated to teacher absence. Also, teacher quality does appear to have a positive influence on school enrollment, but does not affect absence.

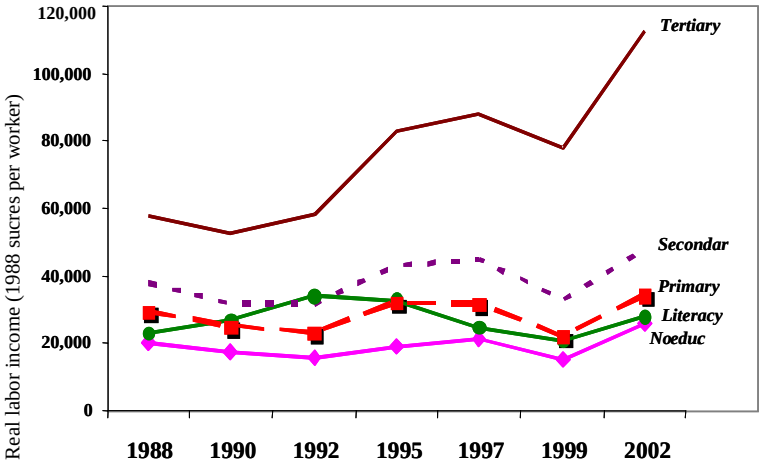
3.14 *External Efficiency.* Improved access to education is generally seen to enhance the probability of getting better remunerated work, reducing the likelihood of poverty and social

exclusion, and providing positive externalities in terms of higher productivity growth and enhanced health (e.g. by being better informed about health risks). It also leads to improve functioning of institutions and democracy. There is ample evidence that these advantages hold equally for Ecuador.

3.15 A recent study by Vos and León (2003) shows that demand for more educated (skilled) workers increased during the 1990s and associates this with the process of trade liberalization that started around 1990. Skill-intensity increased substantially in all sectors of the economy between 1990 and 2001, except for some parts of the service sector, usually in the informal sector. The increased demand for skilled labor has also come at the cost of less demand for unskilled workers in many sectors. Vos and León take 9 years of schooling as a cut-off point to distinguish between skilled and unskilled workers, but the trend is the same at different cut-off points. The increase in demand is even stronger for those with tertiary education and, given the relative scarcity of highly educated workers, earnings of university-trained workers have risen steeply whereas those with primary education or less have stagnated (see Figure 3.4). Rising skill-intensity and the increased movement of unskilled labor to informal employment explain much of the observed rise in overall labor income inequality and the difficulties for reducing poverty rates, which also affects public perceptions about trade liberalization.[10] This pattern is similar to that found in other parts of Latin America (see Vos, Taylor and Paes de Barros, 2002). In the case of Ecuador, the Vos-León study shows, this shift in employment and remuneration explains why positive aggregate employment and real wage growth due to trade liberalization do not translate into less poverty as workers from poorer households are less likely to be among the winners.

3.16 These findings are consistent with rising rates of return to education. Using a fairly standard Mincerian function of labor earnings, we find that the rate of return for each additional year of schooling increased from about 6 to 7 percent for urban workers between 1990 and 2002, whereas the earnings premium of having completed primary education (against having no education) dropped from 28 to about 19 percent, and that of having completed tertiary education (against primary education) increased from about 65 percent to close to 80 percent (see Statistical Annex Table A44 and A45).[11] Data

Figure 3.4 . Urban Ecuador: Real Monthly Labor Incomes by Education Level of Workers, 1988-2002 (sucres per worker, per month; constant prices of 1988)



Source: INEC, Urban Labour Force Surveys (*Encuestas Urbanas de Empleo y Desempleo*)

10 The Gini coefficient of labor income inequality in urban areas increased from 0.48 in 1992 to 0.54 in 2002 (estimates based on INEC's urban labor force surveys).

11 The basic earnings function that was estimated is specified as:

availability for earnings inequality in rural areas is more limited, but the World Bank's Poverty Assessment (World Bank 2004) shows an average skill premium of about 50 percent for agricultural workers with a permanent labor contract.[12] The same study also shows that, as expected, education improves agricultural productivity, with specialized agricultural training having a stronger influence on productivity of small-scale farms and more formal education for the farm operator on that of medium and large-scale farms.

3.17 Putting this evidence of the external efficiency of education together with the evidence of inequality in access to education yields a rather discomforting picture: rising inequality in access to education favoring higher income groups and a rising skill premium associated with the economic growth process is perpetuating ever-rising inequality, and hence limiting the poverty reduction effect of the gains from economic growth. It also suggests that an education policy striving for primary education for all is far from sufficient. Improving transition rates to secondary education and broadening access to tertiary education are necessary conditions for stimulating productivity growth and reducing income inequality.

3.18 *Education Policies in the 1990s.* Education policies during the 1990s tried to respond to some of the shortcomings in education performance and inequity. At the beginning of the decade Ecuador subscribed to the "Education for All" declaration, striving for universal access to basic education. During the 1990s several education reforms have been set in motion to improve both access to, and the quality of, public education. Following a national dialogue with broad participation from stakeholders from civil society and the education sector, consensus was reached regarding a major reform of the basic education system in 1996:

- A ten-grade basic education system should be introduced, integrating one year of pre-school education, six years of primary and three years of lower secondary education.
- Curriculum reform to improve teaching of Spanish and mathematics.
- Strengthening of bilingual education for indigenous groups.
- Curriculum reform with greater emphasis on active learning and analytical skills, as well as more attention to social values, multicultural learning and environmental awareness.

3.19 The basic education system should help extend the expected years of schooling beyond the traditional six years of primary schooling, increase coverage of pre-primary schooling and achieve gains in external efficiency. The introduction of the new system has been slow, however. By the end of 2003, the basic education system had still not been introduced throughout the country. The Intercultural Bilingual Education system was created in 1998 and reached about

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$$\ln[w(s,x,Z)] = \alpha_0 + \rho_s s + \beta_0 x + \beta_1 x^2 + \gamma Z + \varepsilon$$

where w is hourly earnings per worker, s is schooling level, x is age or work experience and Z is a vector of individual and household attributes. The function has well documented limitations (see Heckman et al., 2003), but the consistency with other empirical findings suggests we are dealing with robust findings. The estimates are after correcting for sample selection bias and controlling for differences in sex, sector of employment, type of occupation and geographic location.

12 Farm-size and labor contracts also influence rural wage inequality, but skilled workers (whether working on small landholdings or not, or whether having a temporary or permanent contract) always earn more than unskilled workers. The premium is substantially higher (about 300 percent) when comparing skilled and unskilled workers with a temporary contract (see World Bank 2004, Table 4.4).

90,000 students in almost 2,000 schools by 2003, which corresponds to 4-5 percent of the total, and about 10 percent of rural primary school enrollment in that year. There is no precise estimate of how much of the target group (indigenous families) is reached, but given the proportion of the rural population that still speaks indigenous languages this should be somewhere between two-thirds and three-quarters of the children in that category. Secondary bilingual education is available to 13,700 students in 2003 (about 1 percent of secondary school enrollment).

3.20 The curriculum reforms have been supported by World Bank and IDB-supported programs (*EB/PRODEC* and *Redes Amigas*) to improve the quality of basic education in urban and rural areas. These programs have made an important contribution to a more decentralized education system and increased active participation by the communities. The most important experiences include the creation of 120 Education Matrix centers (*Centros Educativos Matrices*, CEM), with each CEM being made up of 15 to 30 primary schools and kindergartens. Parents and communities have an important say in the management of these networks of schools. The Autonomous School Networks program, known as *Redes Amigas*, also promotes decentralized school management at the level of a network of again 15 to 30 schools administered through a so-called Education Unit Center (EUC), as compared to the previous system where one administrative unit supervised up to 3,000 schools. After 1999, this was taken a step further, allowing schools belonging to the same EUC to form autonomous school networks, manage their own budget and design their own teacher incentive systems. Currently, the program covers about 140,000 pupils, 2,200 schools and 6,000 teachers operating in 187 networks. This implies coverage of 58 percent of pupils enrolled in public primary schools in rural areas and 40 percent of those living in the poorest areas of Ecuador. About 60 networks (30 percent) are managed by indigenous communities. A third example is the decentralization of approximately 1,800 secondary schools which receive lump sum transfers directly from the Ministry of Economy and Finance and have control as autonomous units to use the resources to pay teachers and cover basic operational costs. As we shall see in Section 6, more decentralized management of schools appears to have a positive influence on school enrollment, particularly in basic education. In Section 5, we discuss additional plans to enhance equity in education spending via a new allocation mechanism of transfers by province.

3.21 The objectives of all these reforms (or at least their intentions) have been confirmed more recently in 2002 with the "Social Contract for Education," in which the Ecuadorian government subscribes to an initiative from civil society agents. In this declaration, among other things, the importance of an incentive policy based on the implementation of a national evaluation system to improve educational quality is stressed. A system of academic achievement tests (APRENDO) was introduced in 1996. However, it has been without a budget (and thus no further tests were performed) from 2000 onwards. This came about due to resistance from the powerful teachers' union (UNE), which felt the system would unduly evaluate teacher performance. The result is that the country has no system to monitor education quality, let alone one that provides incentives to enhance the quality of teaching. The social contract does not provide any specific proposal to reintroduce such a system, as it lacks precise guidelines as to how reach the goals.

3.22 In addition to the earlier-mentioned reforms, two social assistance programs have been introduced that have helped promote school enrollment. First, the school meal program (*Colación Escolar*) increased its coverage significantly after the 1999 economic crisis and now reaches about 1.4 million children of primary school age, or about 85 percent of the target group; this coverage is up from 45 percent in 1998 (Parandekar, Vos and Winkler, 2002). The majority

of beneficiaries come from the poorest families. However, as analyzed in Vos et al. (2003), the near universal coverage of the program also implies significant leakage of benefits to the non-poor. While there is no impact evaluation as yet available, the program most likely has had a positive influence on school enrollment, as much as it has helped keep children in school during the deep economic crisis of the late 1990s. Second, also as an upshot of the 1999 economic crisis, a conditional cash transfer program, *Beca Escolar*, was created in 2001 to enhance access of the rural poor to primary education. The program started with a pilot program of 22,000 beneficiaries (children aged 6-14 years) and reached about 69,000 beneficiaries by September 2003 or 10-15 percent of the rural poor of primary school age. The targeting mechanism involves a combination of geographical targeting based on composite poverty characteristics and individual means testing of potential beneficiaries in poor *parroquias* selected through the geographical targeting mechanism. Each beneficiary household receives a cash transfer of US$5 per month per child, subject to proof of school attendance. Households may receive benefits for up to two children. The effectiveness of this program to enhance school attendance is discussed further in Section 6, but its focus on the rural poor of primary school age may not be sufficient to make a very large impact in terms of redressing the indicated inequalities in Ecuador's education system.

3.23 In 2003 a new, conditional cash transfer program was introduced, the *Bono de Desarrollo Humano,* which is to gradually replace existing cash transfer systems, merging the *Beca Escolar and* the *Bono de Desarrollo Humano*. This is available to both children attending primary school and mothers with young children attending health centers.[13] As with the *Beca Escolar*, the reason to add the conditionality to the cash transfer was that an evaluation of the unconditional cash transfer program (the *Bono*) showed that it helps to improve school enrollment, but in effect only for those close to the poverty line, whereas no such improvement was observed at the bottom end, i.e. for the extreme poor (Vos and Leon, 2001). This is why the cash transfer program system has been retargeted towards the extreme poor in rural areas.

3.24 *Trends in Education Expenditures.* Social expenditure levels are low in Ecuador compared to other Latin American countries, both as a share of GDP and on a per-capita basis (see Vos et al., 2003). Real expenditures per capita have fallen more or less continuously over the past two decades. Ecuador spent approximately 4-5 percent of GDP (or on average about US$55 per capita) on social programs during the 1990s, compared to a Latin American average of 12 percent (or US$550 per capita)[14]. The per-capita figure for Ecuador improves slightly, to approximately US$130 per capita, or around 9 percent of GDP, when social security benefits are included. However, pensions are paid only to those retiring from jobs in the formal sector and mostly do not reach the poorer segments of society.[15] Real per capita social expenditure has

13 Specifically, the conditions for the target group are that:
- in education: the nuclear family has children aged 6-15, who are enrolled in school and are registered to attend at least 90 percent of classes;
- in health: the nuclear family has children aged 0-6 years who should be receiving bi-monthly health controls at designated health centers;
- for families with children in both age groups, the conditions for education prevail in order to receive the cash transfer.

14 Figures are in constant 1997 US dollars as reported in ECLAC (2001) and, for Ecuador, Vos et al. (2003). Data refer to spending by the central government only and do not include social security spending.

15 This observation needs some qualification though as, after the 1999 crisis, the real value of pension benefits plunged and the financial assets of pensioners were decimated, turning many elderly into the 'new poor'.

fallen staggeringly since the early 1980s, and although there has been a visible recovery since 2000, it currently stands below levels reached a quarter of a century ago (see Table 3.8 and Figure 3.5).

Table 3.8. Social Expenditure[1] of Central Government as a Percentage of GDP[2]

	1973	1975	1980	1985	1990	1995	2000	2001	2002	2003	2004[3]
Total Social Expenditure	3.5	3.3	5.3	4.7	4.4	3.6	4.0	4.3	5.1	5.0	4.8
Education	2.9	2.5	4.3	3.5	2.8	2.4	1.9	2.2	2.7	2.6	2.6
Health	0.5	0.7	0.9	1.1	1.3	0.9	0.8	0.8	1.3	1.3	1.2
Social Assistance	0.1	0.1	0.1	0.1	0.3	0.3	1.3	1.3	1.1	1.1	1.0
Cash transfer programs							0.8	0.7	0.5	0.6	0.6
Other	0.1	0.1	0.1	0.1	0.3	0.3	0.5	0.6	0.5	0.5	0.5

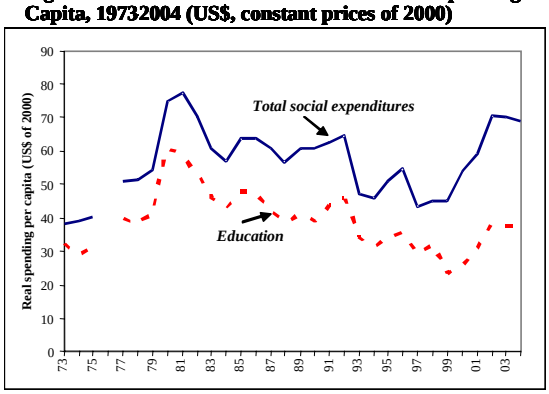
Source: Central Bank and Ministry of Finance data. Updated and adjusted series from Vos, et al. (2003).

Notes: 1. Social expenditures refer to central government budget only. Social expenditures include education, health, social welfare and labor, and cash transfer programs. Cash transfer program refers to Bono Solidario for 1999-2002 and includes Beca Escolar and Bono de Desarrollo Humano thereafter.

2. Social expenditure share in GDP calculated on the basis of constant prices in 2000 dollars . The share at current prices is slightly higher on average (0.3 percent points for the 1990s and 0.1 percent for the whole series), but the trends are the same. The difference between the constant and current price shares is explained by the difference in deflators for government spending and GDP, the former being – on average – slightly higher.

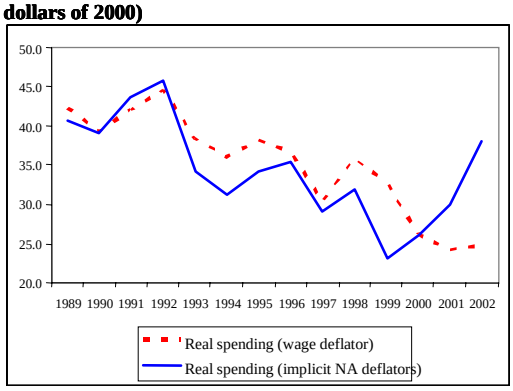
3. Numbers for 2004 refer to the provisional budget for social expenditure and Central Bank projections of GDP growth.

Figure 3.5. Real Social and Public Education Spending Per Capita, 19732004 (US$, constant prices of 2000)



Source: Vos et al. (2003); updated for 2001-3 from Ministry of Economy-UNICEF fiscal database. Public expenditures include education, health, and social assistance (including cash transfer programs).

Figure 3.6. Real Education Spending Per Capita, Using Alternative Deflators, 1989-2002 (in constant price dollars of 2000)



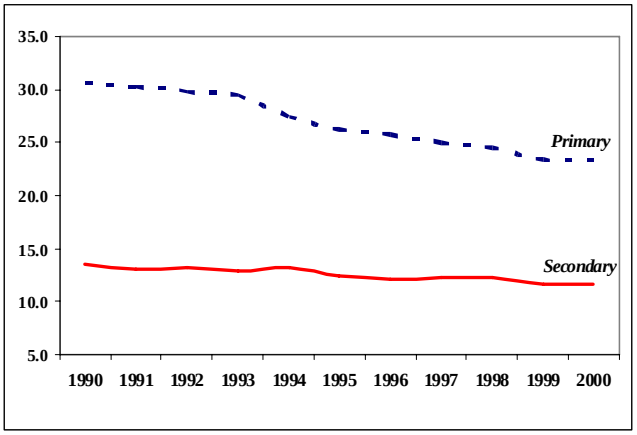
Source: Vos et al. (2003); updated for 2001-3 from Ministry of Economy-UNICEF fiscal database. Public expenditures include education, health, and social assistance (including cash transfer programs).

3.25 The decline in social expenditures has hit education and health spending hardest. During the 1990s, the composition of social spending shifted towards targeted social protection programs (including the introduction of the cash transfer program *Bono Solidario*) and away from budgets for universal social services in education and health. Between 2001 and 2003, education and health budgets increased significantly, mainly due to various rounds of salary increases for teachers and medical personnel. As a result, the student/teacher ratio has also decreased (improved), although available data do not allow to measure whether children are also switching toward private schools. Figure 3.5 also shows the dramatic decline in real per capita public spending on education over the past decades. Despite the recovery in recent years, by 2003 the real level of spending was forty percent below that of 1980. In Figure 3.6, education spending has been deflated using, alternatively, a weighted price for public consumption and

investment (weighted for their respective importance in education spending)[16] and a nominal wage index for public employees. As much of education spending is on teacher salaries (about 80 percent of the total in 2000) and recent budget increases have been mainly driven by salary adjustments, the wage index should be a good proxy for price changes in education services.[17] Figure 3.6 shows that if one takes the wage deflator, there is no actual recovery in real education spending, confirming the hypothesis that most, if not all, budget increases after 2000 went into rising (nominal) teacher salaries and suggesting that the overall rise in real per capita social expenditures during 2000-2004 is overstated in Figure 3.4.

3.26 How have educational services been affected by the decline in real public spending?.[18] The evidence suggests most of the cuts have hit infrastructure spending as there has been no shift away from (more expensive) tertiary education to primary and secondary education and the private sector coverage (23 percent) has not changed since 1996.

Figure 3.7. Ecuador: Pupil-Teacher Ratios in Primary and Secondary Education, 1990-2000



Source: SINEC database

3.27 And student/teacher ratios actually improved in the 1990s: for primary education from 30 to 23 students per teacher and secondary from 13 to 11 (see Figure 3.7).[19] In other words, the country is spending more, not less, on teachers. In addition, authorities are also developing a spending allocation formula that makes it more suitable geographically (inter-provinces) and pro-poor (see next section).

3.28 It is therefore likely that the burden of the decline in education expenditure has fallen on the availability and quality of school infrastructure. While not easy to read from publicly available fiscal data,

16 There are no consistent long data series detailing public expenditures by sector and by expenditure items (e.g. wages, other current expenditures and investment). A national accounts series with disaggregated public sector accounts indicates that originally around 10-15 percent of the education budget was spend on investment in schooling infrastructure, but that this has dropped to below 5 percent in the early 1990s. We use the latter share for weighing the two deflators.

17 Again, no consistent published breakdown exists for public expenditures, let alone social expenditures by ages and other expenditure components. Available breakdowns from a UNICEF-Ministry of Economy and Finance database show a somewhat erratic pattern for 1995-2000 probably due to classification errors. For 1996-98 the share is about 70 percent jumping to over 80 percent in 1999-2000. The national accounts series quoted in the previous footnote would put the share around 75 percent during 1980-1992. This share may be somewhat lower for overall public consumption, but likely the national accounts deflator for government consumption should by and large reflect the trend in the unit cost (wage rate) of public employees. Figure 3. 5 shows this appears to be the case until 2000, but not thereafter.

18 It would have been better to present the trend in education spending per student rather than per capita. However, for the reasons explained in the previous footnotes it is not possible to construct a consistent series for more than a few years in the 1990s and 2000s, given the lack of data by levels of education.

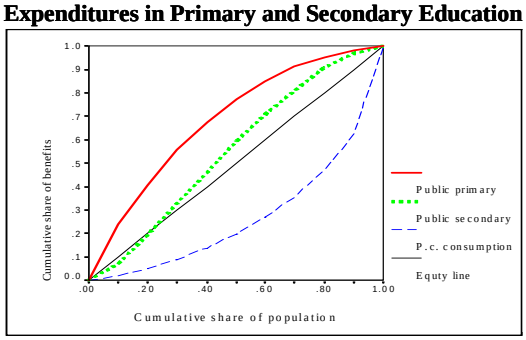
19 These input indicators compare favorably to the rest of the region, particularly for secondary education. In Bolivia, Brazil, Chile, Colombia and Peru, for instance, the ratio is over 20 at this level. The ratio at the primary level is similar to that of neighboring countries with the exception perhaps of Chile, which has a pupil/teacher ratio of 31 in primary education (comparison based on UNESCO data).

there seems to have been a decline in investment in new school infrastructure and provisioning for maintenance of existing schools. Much of school maintenance and operation costs (including electricity and telephone bills) seem to have been passed on to parents. Such 'cost-sharing' has been on the rise as public schools were given greater autonomy. While taking pressure off the government budget, it most likely has negatively influenced school access and performance of children from poor families, as we shall see below.

II. Equity in Educational Spending

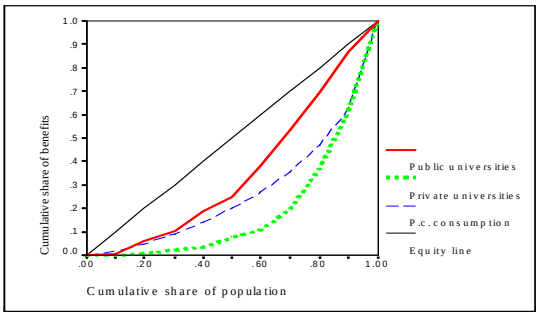
3.29 *Education Expenditure Incidence.* Public spending on primary education is strongly pro-poor; spending on secondary education is distributed fairly evenly across quintiles, while spending on university training mainly benefits the richest segments of society. Vos et al. (2003) provide these findings based on a study of social expenditures in Ecuador. Figures 3.8a and 3.8b summarize the results in the form of Lorenz curves. These show that the poorest quintile receive 35 percent of the 'benefits' of primary education. The curve for secondary education almost

Figure 3.8a. Lorenz Curves for Distribution Public Expenditures in Primary and Secondary Education



Source: Vos et al. (2003).

Figure 3. 8b. Lorenz Curves for Distribution Subsidies to Public and Private Universities



Source: Vos et al. (2003).

coincides with the equity line, making the spending neutral in terms of benefits to the poor. However, the poor hardly share in the benefits of going to universities with less than 3 percent of benefits going to the poorest quintile. Public universities are mainly accessible to the middle and upper income classes so most benefits go the third quintile and up. Subsidies going to private universities almost exclusively benefit the rich.

3.30 These results are obtained using a traditional expenditure incidence analysis inputing the cost of providing education services as benefits to households depending on the number of beneficiaries of subsidized education per household. The estimates have to be taken with the usual caution associated with the method. We will not spell this out here, but see e.g. Demery (2003) and Vos et al. (2003) for a discussion. The estimates in Vos et al. (2003) take account of differences in unit costs per provinces and in urban and rural areas when assigning benefits.[20] Unit costs vary substantially across geographical areas. In primary education, public schooling

20 Benefits are assigned to households as follows:

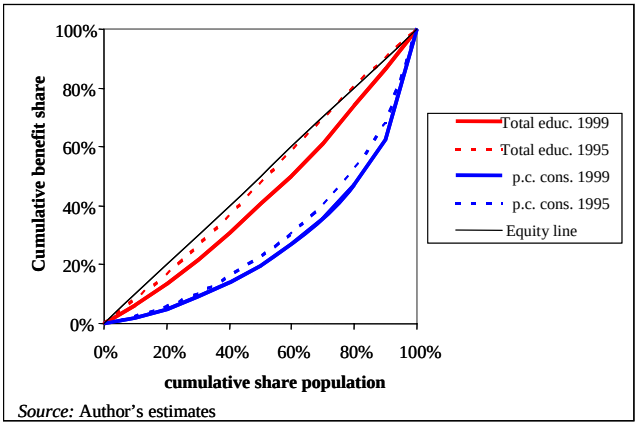
$$X_j \equiv \sum_{k=1}^{n}\sum_{i=1}^{3}\frac{E_{ijk}}{E_i}S_{ik}$$

where *Xj* is the value of the total education subsidy imputed to household *j*. *Eij* represents the number of school enrollments of household *j* at education level *i*, and *Ei* the total number of enrollments (across all households) at that level. *Si* is government spending on education level *i*, and *i (=1, .. , 3)* denotes the level of education (primary, secondary and tertiary). Subscript *k* denotes the region specified in the unit cost estimate, there being *n* regions distinguished.

costs range from US$61 per student in rural Guayas to US$344 per student in sparsely populated rural Galápagos (1999 figures). In secondary education, the variation is between US$133 in urban Guayas to US$475 per student in rural Napo. It could be questioned whether the cost differential also implies a difference in actual benefit. If we assume that all children in school receive the same type and quality of education, then it might be better to take average unit costs as the proxy for the value of the education benefit. Cost differentials for primary and secondary education are mainly due to differences in population density and average class size, as well as to differences in the share of trained teachers with higher pay. As shown in Section 6, both variables affect access to schooling and education performance. Hence, it seems reasonable to assume that cost differentials are associated with differences in education quality. The tests performed in Section 6 are for national averages though. Data limitations prevent us from testing this at the provincial level and finding out whether it is better to estimate the expenditure incidence using average or regionally differentiated costs. However, despite the substantial differences in unit costs across provinces and regions, we find that the given conclusions about the distribution of public spending on education are not altered in any significant way when imputing the same (average) unit cost to all beneficiaries. Statistical Annex Table A39 shows the comparison. Taking average costs shifts the benefit incidence slightly away from the lowest income groups and towards the richer quintiles. For instance, the poorest quintile would receive 30 percent of social transfers in primary education when using average unit costs, against 35 percent when using regionally differentiated costs. This seems consistent with the earlier observation that unit costs are typically higher in rural areas with a more disperse (and mostly poorer) population. The shift in the distribution curves is very slight though and does not alter the overall conclusion that the benefit distribution for primary education is pro-poor, secondary education close to equi-proportional and tertiary education regressive.

3.31 *Marginal Benefit Incidence and Private Expenditures on Education.* Taking all the benefits of public education spending together gives a distributive pattern that is close to equi-proportional, with a slight bias in favor of higher income groups. This is due to the fact that these groups benefit most from spending on relatively more expensive tertiary education. On the whole though, education benefits are distributed much more equally than per capita private consumption (Figure 3.9). Available evidence shows that the distribution of education benefits has become somewhat less unequal in the second half of the 1990s. This shift can be ascribed almost entirely to a slight decrease in the benefits the richest households received from public subsidies to private and public universities (see Statistical Annex Table A40).

Figure 3.9. Lorenz Curves for Distribution Public Spending on Education, 1995 and 1999



Source: Author's estimates

3.32 Social transfers in education were equivalent to 6.1 percent of per capita consumption, about the same as what households were willing to spend out of their own pockets (Table 3.9). In 1999, private expenditures on education amounted to 6.1 percent of household consumption. This share was 2.4 percent for primary, 2.2 percent for secondary and 1.6 percent for tertiary education. As one would expect, the richer households spend relatively more of their income on

education as their children are more likely to get private education and stay longer in the system. However, their relative willingness to pay for education does not exceed that of poor households by a wide margin. The poorest quintile spent about 4.5 percent on education compared to 7 percent for the richest quintile (see Table 3.9).

Table 3.9. Public Transfers and Private Expenditures on Education as a Share of Household Consumption by Deciles, 1999

Deciles	Primary	Secondary	Tertiary-Public	Tertiary-Private	Total
			Public transfers (%)		
1	17.9	4.0	0.0	0.0	21.9
2	8.9	4.3	1.1	0.0	14.0
3	6.0	5.7	1.2	0.3	13.1
4	5.3	4.7	1.5	0.0	11.6
5	3.4	4.2	1.9	0.1	9.6
6	2.7	4.0	1.0	0.5	8.1
7	1.8	3.2	2.7	0.3	8.0
8	1.2	2.6	2.5	0.8	7.0
9	0.6	1.3	2.0	1.6	5.5
10	0.1	0.3	0.9	1.2	2.5
Total Public %	**2**	**2.1**	**1.5**	**0.8**	**6.4**
			Private spending[1]		
1	3.7	1.1	0.0		4.8
2	2.9	1.4	0.1		4.4
3	2.7	1.9	0.3		5.0
4	2.5	2.0	0.4		4.8
5	2.2	2.0	0.7		4.9
6	2.3	2.4	0.6		5.3
7	2.0	2.0	1.1		5.2
8	2.3	2.5	1.3		6.1
9	2.2	2.4	2.3		6.9
10	2.4	2.2	2.4		7.0
Total Private %	**2.4**	**2.2**	**1.6**		**6.1**

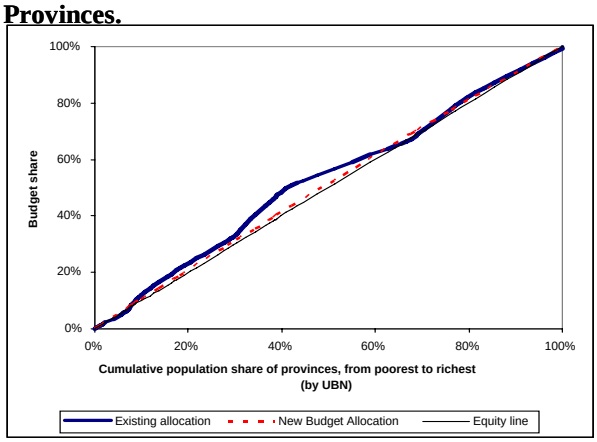
Source : 1999 LSMS survey.

Note: 1. Share for "Tertiaty" is total for public and private universities

3.33 *Decentralization and Equity in Education Spending.* In 2003 the Ministries of Education and of Economy and Finance signed an agreement for a new allocation mechanism of central government transfers to education service units. The formula for allocating resources by province (and then on to public schools or school networks) considers the following variables: population in primary and secondary schooling age, the share of the population with Unmet Basic Needs (NBI), enrollment rate targets and type of school. As to the latter, a larger weight is given to areas with a larger share of schools with one teacher (*uni-docentes*).

3.34 Through this formula, education spending should become more pro-poor. Figure 3.10 shows that the geographic distribution of education spending by provinces is already pro-poor for primary and secondary education. The new allocation mechanism does not alter the existing distribution in a major way, but to the extent it does it would make this equi-proportional when the provincial population is ranked by the NBI indicator from poor to rich. The danger of this new initiative is that by looking only at provinces it may miss out on important differences within the provinces themselves and hence make spending less pro-poor. It also does not consider efficiency criteria and

Figure 3.10. New and Existing Distribution of (primary and secondary) Education Spending by Provinces.



Source: Estimates based on 2001 Central Government

could reward ineffective allocation of spending resources. Of course, cost-effectiveness criteria may be imposed in addition to the allocation mechanism across provinces. This issue is taken on in the next section.

3.35 *Cost-effectiveness of Education Spending*. Improving selected programs in education requires monitoring cost-effectiveness ratios. Ecuador has subscribed to the Millennium Development Goal of ensuring primary education for all by the year 2015. At unchanged population growth, and if school enrollment increases at the same speed as recorded during the 1990s, that target will not be met. In this scenario net primary school enrollment would be 91.7 percent in 2015 and in secondary and tertiary education it would be 46.6 percent and 13.3 percent, respectively. So 'business as usual' is not good enough in order to reach the target. Using the Barro-Lee perpetual inventory method to translate enrollment rates into years of school attainment, we find that if net school enrollment rates for primary, secondary and tertiary education remain unchanged, the average number of years of schooling of the population of 12 years and older would show a slight drop by the year 2007 (using 2001 as a base year).[21] Should the MDG target of 100 percent net primary school enrollment be achieved, then secondary school enrollment would need to increase to 70 percent (up from 45 percent in 2001) and retention rates would need to increase to 80 percent (up from 74 percent) in order to gain one year in the average level of education of the working population (if tertiary school enrollment remained constant). While the net primary school enrollment target may seem within reach (at least by 2015, but possibly also by 2007), increasing net secondary school enrollment to 70 percent seems a tall order given the past rates of improvement. But the above estimates also suggest that without improving access to higher education (currently at a 12 percent net enrollment rate) it may take a long time to make a substantial impact on the average educational level of the work force. Nonetheless, as a working hypothesis, we will set enrollment targets at 100 percent for primary and 70 percent for secondary education and analyze whether it is possible to achieve these by making educational spending more efficient and/or what additional public investment would be required.

3.36 In order to know by how much the education budget would need to increase, or how to make that spending more effective to reach the given goals, we need to analyze in greater detail the determinants of school enrollment. These determinants include the accessibility of schools and the quality of school inputs (such as availability of textbooks, quality of school teachers, and so on). However, problems of access to schooling likely are not merely related to factors on the supply side. Important constraints are also found in the household conditions of the children. The education of their parents typically influences the decision to attend school, as much as the economic situation of the household. If a family is poor and there are significant direct costs to the household for each child attending school (school fees, uniforms, educational material, transportation costs), parents may decide not to enroll (some of) their children. Such circumstances may also lead to a situation where the contribution of children to family income is significant (especially in rural areas) and accordingly the opportunity cost associated with school attendance may be substantial. Attendance will suffer when parents perceive that the return associated with time spent in school does not justify the loss of a child's economic contribution.

21 See Barro and Lee (2000) for an exposition of the estimation method. Please note that these simulations estimate the average level of schooling for the population 12 years and older. According to the 2001 population census data, the average educational level for the population 12 years and older was 7.2 years, against 7.3 years for that of 24 years and older.

Also, parents tend to value the quality of education. That is, if the education is rated to be poor (for instance as measured through test scores), parents may be less likely to send their children to school. Ponce, Bedi and Vos (2003) apply a schooling determinants model for Ecuador identifying the importance of such factors and quantify the impact of changes in such variables on school outcomes. Their model follows that of Gertler and Glewwe (1990) and is described in Annex 3.1. We refer to Ponce, Bedi and Vos (2003) for a detailed description of the quantitative results and estimation procedures. Here we will summarize the main findings relevant for the subsequent education budget analysis and expenditure tracking method developed in Section 7.

3.37 Ponce, Bedi and Vos (2003) analyzed net enrollment determinants for basic[22] and secondary education. They find that the relative importance of schooling determinants varies quite substantially between basic and secondary education, and decision-making behavior differs for urban and rural and for poor and non-poor households.[23] We report their findings here for secondary education, but instead of the results for basic education we re-estimate their model for primary education only, as this provides a better link with the preceding analysis and as the introduction of the basic education system is not fully implemented at the national level yet.

III. Cost-Effectiveness in Primary Education

3.38 Different behavioral responses of rural and urban, and poor and non-poor households to demand and supply factors in primary education can be summarized as follows (Table 3.10).

Table 3.10. Schooling Determinants in Primary Education

	Urban		Rural	
	Poor	**Non-poor**	**Poor**	**Non-poor**
Demand factors	Cost of education (-) Education of mother (+) *Location:* Quito (+) Costa (-)	Costa (-)	Cost of education (+) Education mother (+)	Cost of education (+) *Gender*: Female (+)
Supply factors	Students per class room (-) Share of trained teachers (+)	Share of trained teachers (+) Centralized teacher appointment (-)	Students per class room (-) Centralized teacher appointment (-)	

Source: Ponce, Bedi and Vos (2003).

The relevant elasticities for each of these factors are reported in Table 3.11.

3.39 On the demand side, the direct and indirect costs of education have a weak, but negative effect on primary school enrollment, particularly for poor urban households. For each 1 percent increase in cost, net enrollment of children from poor urban households is

Table 3.11. Elasticities of Determinants of Net Enrollment in Primary Education

	Urban			Rural		
	Total	**Poor**	**Non-poor**	**Total**	**Poor**	**Non-poor**
Socio-economic factors (demand)						
Cost of education	-1.32	-0.19	n.s.	0.06	0.06	0.00002
Education mother	0.08	0.13	n.s.	0.03	0.06	n.s
Sex (males =1)	n.s.	n.s.	n.s.	n.s.	n.s.	-1E-06
Quito	0.11	0.04	n.s.			
Costa	n.s.	-0.14	-0.34	n.s.	n.s.	n.s.
Education supply factors						
Students per class room	n.s.	0.08	n.s.	n.s.	-0.07	n.s.
Share of trained teachers	0.72	n.s.	1.63	n.s.	n.s.	n.s.
Centralized teacher appointments	-0.39	n.s.	-0.38	n.s.	-0.03	n.s.

Source: INEC, *Encuesta de Condiciones de Vida* (LSMS), 1999 and education input data. See Statistical Annex Table A41 for detailed model estimates

22 Under the new schooling system in Ecuador, basic education comprises pre-primary, primary and lower secondary education.

23 Please note that for urban areas the demand for schooling model is estimated in the form of a multinomial logit specification of household decisions to enroll children in either public or private education. In the results presented in the text we only report on the determinants for enrollment in public schools.

expected to fall by 0.2 percent. For the total urban sample the link is much stronger showing a derived elasticity of -1.3.[24] For poor rural households the link is weak, but – unexpectedly – positive. It would suggest education is like an inferior good for the rural population. In any case the link is weak, such that costs do not seem decisive in the determination of rural school enrollment. For both urban and rural poor, the education level of the mother has a significant and positive effect on school enrollment. Being a boy or a girl hardly influences the primary schooling decision, consistent with the observations made earlier about the closing gender gap in education in Ecuador.

3.40 On the supply side of primary education, the share of trained teachers has an important influence on the decision of school enrollment in urban areas, particularly among non-poor households, while for rural households the determinant was not found significant. Poor rural households see packed class rooms as a negative sign of education quality and are more likely to enroll children in schools with a lower ratio of pupils per class room. Next to trained teachers, decentralized appointments of teachers (e.g. by parent committees) influence school enrollment favorably. This is reflected by the negative sign for the share of teachers that are centrally appointed, i.e. through the Ministry of Education. However, when splitting the sample into poor and non-poor households, this variable seems to affect schooling decisions of non-poor urban households most and in a weaker sense poor rural households.

The education policy implications of these findings would be that:

- It would appear to be more cost-effective to target the cash transfer program (*Bono Desarrollo Humano*) towards the urban poor, rather than to the rural poor. Of course, given the fact that the cash transfer program is conditional upon school assistance, it may nonetheless stimulate primary school enrollment in rural areas. For urban areas, the cost-effectiveness model would suggest that the subsidy need not be conditional to stimulate school enrollment.
- Hiring more trained teachers will positively affect school enrollment in urban areas. Given the earlier conclusions about the quality of education, this may also be a policy priority for rural areas, but according to the cost-effectiveness analysis is not expected to raise primary school enrollment among the rural population.
- More decentralized decision-making (e.g. assigning greater role of local communities in teacher appointments) is expected to promote school enrollment, in particular among urban non-poor and rural poor.
- Reducing congestion in classrooms (i.e. ensuring there are sufficient, well-equipped class rooms for a given student intake) will also positively influence school enrollment. While the student-teacher ratio is favorable in Ecuador, infrastructure deficiencies are forcing oversized classes and hampering school enrollment and education quality. These problems are regionally concentrated. For instance, in some municipal areas

24 The model results refer to demand for public education. As a larger share of non-poor are enrolled in private schools the sample for non-poor in primary schooling age is relatively small, which could explain the insignificant estimate for the schooling cost coefficient for this group. The economic interpretation could be that since the non-poor children (or rather their parents) are more likely to prefer private schools, the cost of public schools is less likely to influence their enrollment decision.

(cantons) of Guayas and Los Rios average class sizes are well over 30 and in some cases over 40.

- As a long run policy, improvement in the level of female education should help improve access to primary education. This would require continuous efforts in improving school enrollment. In the short run, literacy campaigns targeted at mothers with young children in rural areas (where illiteracy rates are highest) should be effective in this sense.

3.41 *Cost-Effectiveness in Secondary Education.* Similar to primary education, we find important differences in determinants of secondary school enrollment decisions across urban and rural and poor and non-poor households. The main determinants are found to be the following (See Table 3.12).

Table 3.12. Schooling Determinants in Secondary Education

	Urban		Rural	
	Poor	***Non-poor***	***Poor***	***Non-poor***
Demand factors	Cost of education (-) Education mother (+) *Location:* Quito (+)	 *Gender*: Female (-)	Cost of education (-) Education mother (+) *Gender*: Female (-)	Education mother (+) *Location:* Costa (-)
Supply factors	 Share of teachers with university degree (+)[1]	Students/class room (-) Share of teachers with university degree (+)[1]		Share of trained teachers (+)

Source: Ponce, Bedi and Vos (2003).
Note: 1. Not significant separately for poor and non-poor, but significant for total sample.

The relevant elasticities are reported in Table 3.13.

Table 3.13. Elasticities of Determinants of Net Enrollment in Secondary Education

	Urban			Rural		
	Total	**Poor**	**Non-poor**	**Total**	**Poor**	**Non-poor**
Socio-economic factors						
Cost of education	n.s.	-0.399	n.s.	n.s.	-0.201	n.s.
Education mother	0.146	0.358	n.s.	0.635	0.647	0.339
Sex (males =1)	n.s.	n.s.	0.109	0.104	0.191	n.s.
Quito	n.s.	0.054	n.s.	--	--	--
Costa	n.s.	n.s	n.s.	n.s.	n.s.	-0.101
Education supply factors						
Students per class room	-0.236	n.s	-0.032	n.s	n.s	n.s
Share of trained teachers	n.s	n.s	n.s	n.s	n.s	0.641
Share of teachers with	0.382	n.s	n.s	n.s	n.s	n.s
Centralized teacher	n.s	n.s	n.s	n.s	n.s	n.s

Source: Ponce, Bedi and Vos (2003: Table 6.14).

3.42 *The* direct and indirect costs of education have a strong negative effect on secondary school enrollment, particularly for poor households. For each 1 percent increase in cost, net enrollment of children from poor urban households is expected to fall by 0.4 percent. For poor rural households the implied elasticity is also significant, but lower at 0.2 percent. Among other demand factors, the educational level of parents, particularly that of mothers, is an important explanatory variable of secondary school enrollment in both urban and rural areas. Girls are not found to have a significantly higher or lower probability of accessing secondary education.

3.43 The direct and indirect costs of education have a strong negative effect on secondary school enrollment, particularly for poor households. For each 1 percent increase in cost, net enrollment of children from poor urban households is expected to fall by 0.4 percent. For poor rural households the implied elasticity is also significant, but lower at 0.2 percent. Among other demand factors, the educational level of parents, particularly that of mothers, is an important

explanatory variable of secondary school enrollment in both urban and rural areas. Girls are not found to have a significantly higher or lower probability of accessing secondary education.

3.44 On the supply side of secondary education, the share of trained teachers has an important influence on the decision of school enrollment in urban areas, particularly among poor households, while for rural households the determinant was only found significant for non-poor households. For each percentage point increase in the share of trained teachers, net enrollment among urban poor and rural non-poor is expected to rise by about 0.6 percent. Class size has a significant negative effect on secondary schooling decisions of urban non-poor households.

The education policy implications of these findings would be as follows:

- It would be cost-effective to increase the coverage of the *Beca Escolar* (presently, *Bono de Desarrollo Humano*) program to poor households with children aged 12-18 years. Particularly in rural areas, such a policy would be essential to enhance access of the poor to secondary education.
- Enhancing the share of teachers with a university degree seems critical to increase enrollment in urban areas, and that of trained teachers (with a teaching qualification) to positively influence enrollment decisions of non-poor households in rural areas.
- Class size per se, is not a major problem, except for certain urban areas where large class sizes and insufficient schooling infrastructure seem to hamper enrollment.[25]

3.45 As a long run policy, improvement in the level of female education should help improve access to secondary education. This would require continuous efforts in improving school enrollment in both primary and secondary education. In the short run, literacy campaigns targeted at mothers with young children in rural areas could be effective in this sense.

IV. Education Expenditure Tracking and Budget Scenario Analysis

3.46 Ecuador's government budget system is highly centralized, rule oriented and input based. The education budget forms a prime example. The input-based characteristic has led to incremental allocations (in nominal terms) according to cost changes in the main supply components. The wage bill has been the determining factor for education budget adjustments as rising student numbers led to the hiring of new teachers as well as higher teacher salaries in response to union demands. Government budget rules in Ecuador since the 1970s have included a host of fixed allocations from specified revenues (including the repartition of oil revenues) and fixed-share or growth rules, such as the rule that education should receive at least 30 percent of government expenditures, whereas growth in health expenditures is not allowed to drop below the overall growth in public expenditures. Even though such rules have not been faithfully adhered to in practice and have not been able to prevent real education expenditures from falling, they have imposed rigidities in the spending pattern. Education expenditures have been capped by the 30 percent rule. The biggest problem in practice is that increases have been aimed mostly at teacher's salaries while cutbacks in lean years have come from maintenance and investment

25 As reported in Ponce, Bedi and Vos (2003), this is not merely a problem in urban public secondary schools. The same problem is found for enrollment in private schools.

budgets. The highly centralized system of budget controls and personnel management took resource allocation further away from performance orientation.[26]

3.47 However, the government has been making efforts to move towards a more performance-oriented budgeting system in education and is trying to enhance efficiency and equity in education outcomes. The demand subsidies provided through the *Bono Desarrollo Humano* should improve access to education for the poor. Greater autonomy for decentralized networks of schools should also help a more effective spending of resources, while the new formula to transfer the central education budget across provinces is expected to yield greater equity. However, it cannot be denied that these steps are not a sufficient move towards a more transparent and coherent result-oriented budgeting system. First, the *Bono* is managed separately from the education budget as a social protection program. Second, the budgets for the CEMs and promotion of *Redes Amigas* have been heavily dependent on external resources and managed as off-budget activities. Third, as indicated, the new geographical allocation rule for the education budget on a per capita basis does not eliminate the central management of resources, nor – as we have shown – does it increase equity across provinces.[27]

3.48 A first step towards a more comprehensive result-oriented budgeting system would be to put together all programs and interventions aimed at improving educational outcomes and monitor each for their cost-effectiveness. Increased access to primary and secondary education is a priority target for the government. Therefore, the results of the schooling determinants model of Section 6 may serve as a starting point for the development of a result-oriented expenditure tracking methodology.

3.49 The schooling determinants model serves to establish input-output relationships in education, i.e. between policy interventions and expected educational outcomes measured by net enrollment rates. The relative importance of each determinant discussed in Section 6 may be expressed as an elasticity expressing the impact of a 1 percent change of a given determinant on school enrollment (see Tables 3.10 and 3.11). After linking these to unit costs we obtain a basis for making budget projections for alternative resource allocations. As a first exercise we perform *static* cost-effectiveness simulations, that is, we change effective inputs such that we approach a given target (say, 100 percent net enrollment) using the given elasticities and unit cost to estimate the costs of the interventions. In this exercise we take account of certain interaction effects. For instance, an expansion in the conditional cash transfer program would lead to higher school enrollment, but also to a higher number of students per classroom which has a negative effect on enrollment for some groups of the population of school-going age unless more is invested in class rooms. In the results reported below, we assume that the *pupil-teacher ratio is kept fixed* during the simulation period. Simulations are compared to a baseline scenario that keeps all inputs constant (although the number of teachers may rise as a result of the fixed pupil-teacher ratio assumption) and unit costs adjust for projected inflation only. In the baseline (no policy change), the primary education budget remains at 1.3 percent of GDP and that for secondary education at 1.2 percent of GDP, while net enrollment rates do not improve from 2003 levels.

26 See Reid (1997) for a further analysis of this point and incentives to circumvent budget rules and control through off-budget activities and other devices.

27 That is, of course, taking the Rawlsian view of giving higher weight to resource increments for the poor. The new formula would make the distribution more equi-proportional but less pro-poor as discussed in Section 5.

3.50 *Budget Tracking and Projections for Primary Education*. Table 3.14 shows three budget scenarios.

Table 3.14. Reaching the MDG for Education: Static Budget Projections for Primary Education, 2003-7

	Increase trained teachers		Increase school subsidy program		Combined: trained teachers, school subsidies and rural school infrastructure	
	Additional costs as percentage of Education budget %	Additional costs as percentage of GDP %	Additional costs as percentage of Education budget %	Additional costs as percentage of GDP	Additional costs as percentage of Education budget %	Additional costs as percentage of GDP %
2004	4.1	0.1	3.5	0.0	6.1	0.1
2005	5.4	0.1	4.0	0.1	9.0	0.1
2006	6.2	0.1	4.8	0.1	12.1	0.2
2007	7.1	0.1	6.2	0.1	14.6	0.2

	Increase trained teachers	Increase school subsidy program	Combined: trained teachers, school subsidies and rural school infrastructure
Additional budget requirements (in mln US$)			
2003	0	0	0
2004	16	14	24
2005	22	16	37
2006	27	21	52
2007	32	28	65
Total 2003-2007	**97**	**78**	**177**
Net enrollment rate by 2007			
Urban poor	0.97	1.00	1.00
Urban non-poor	1.00	0.94	1.00
Rural poor	0.87	0.86	0.88
Rural non-poor	0.93	0.93	0.93
Nation-wide	**0.94**	**0.93**	**0.95**
Urban total	0.99	0.97	1.00
Rural total	0.88	0.88	0.89

Source: Author's estimates

3.51 *First*, we increase the share of trained teachers to 100 percent (up from 90 percent in 2003) and reduce the share of teachers with central appointment to 84 percent (down from 94 percent) by 2007. This scenario works to get all urban non-poor children in school by 2007 and would have induced the urban poor to a net enrollment rate of 97 percent (up from 89 percent in 2003). The policy should also help to increase enrollment among the rural poor, but without additional investment in rural school infrastructure the effect will be more than offset by the ensuing increase in the number of pupils per class room. The budget implications of this policy are minimal. All other things being equal, it would require an increase of about 7 percent in the (nominal) education budget by 2007 or about US$30 million as compared to a baseline of no policy change. This policy can be as effective, and even cost-saving if we would drop the assumption of a fixed pupil-teacher ratio of 23 and allow the ratio to increase to 25, implying a reduction in the number of teachers by 3 percent (or about 3,700 teachers).

3.52 *Second*, we expand the *Bono* program to cover all urban poor. The analysis of Section 6 suggests school subsidies (or reducing schooling costs) only significantly influence enrollment for this population group. As this group was not targeted initially by the *Desarrollo Humano* program, this would involve additional budgetary cost; not just from the increase in coverage of the cash transfer program, but also due to rising teacher costs as enrollment increases and the pupil-teacher ratio is kept fixed. In order to have all urban poor in school by 2007, this would involve a slightly smaller additional budget effort of 6 percent over the baseline projection by 2007 or about US$28 million (0.1 percent of GDP). The additional cost may be 'financed' through cost savings by allowing for a slight increase in the pupil-teacher ratio as in the first simulation.

3.53 *Third*, we combine the two policies and also allow for an increase in rural school infrastructure by a sufficient amount such that the rise in the number of pupils per classroom does not have a negative effect on enrollment of the rural poor. Given our model parameters and all other things being equal, we expect this combination of policies to lead to universal access to education for the urban population, but leave the rural population without any visible benefit. The cost would only be marginally higher than for the second budget scenario (an additional 0.2 percent of GDP), mainly due to the extra investment in schooling infrastructure and the rise in demand for teachers as enrollment increases. Again, this policy package could be financed by allowing for a gradual increase in the pupil-teacher ratio to 27.5 by 2007, but requiring a reduction of 9 percent in the number of teachers (i.e. affecting about 11,000 teachers).

3.54 *Budget Tracking and Projections for Primary Education.* Using the cost-effectiveness analysis as a basic input, Table 3.15 shows three budget scenarios for trying to take an important step towards reaching the target of 70 percent of net secondary enrollment by 2007.

Table 3.15. Improving Access to Secondary Education: Static Budget Projections for Secondary Education, 2003-7

	Increase trained teachers		Increase school subsidy program		Combined: trained teachers, school subsidies and rural school infrastructure	
	Additional costs as percentage of Education budget %	Additional costs as percentage of GDP %	Additional costs as percent age of Education budget %	Additional costs as percentage of GDP %	Additional costs as percentage of Education budget %	Additional costs as percent age of GDP %
2004	2.4	0.0	3.1	0.0	13.1	0.2
2005	4.8	0.1	5.0	0.1	22.6	0.3
2006	7.0	0.1	8.1	0.1	38.2	0.4
2007	8.8	0.1	11.9	0.1 p	53.3	0.6

	Increase trained teachers	Increase school subsidy program	Combined: trained teachers, school subsidies and rural school infrastructure
Additional budget requirements (in mln US$)			
2003	0	0	6
2004	8	11	46
2005	17	18	83
2006	27	31	146
2007	35	47	212
Total 2003-2007	**88**	**108**	**493**
Net enrollment rate by 2007			
Urban poor	0.57	0.70	0.70
Urban non-poor	0.83	0.76	0.79
Rural poor	0.24	0.27	0.27
Rural non-poor	0.60	0.52	0.55
Nationwide	**0.56**	**0.58**	**0.59**
Urban total	0.71	0.73	0.75
Rural total	0.32	0.33	0.34

Source: Author's estimates

3.55 *First*, we increase the number of secondary school teachers with a university degree and a teaching qualification to 100 percent (up from about 80 percent in 2003). This scenario would stimulate enrollment in urban areas, except that it would mainly stimulate enrollment for the urban non-poor, leaving the urban poor still at some distance from the target of 70 percent enrollment. The simulation would also predict enrollment of rural non-poor to be up at 60 percent by 2007 (from 52 percent in 2003). The rural poor are not expected to be induced to higher enrollment by such a policy. The policy would imply though that some 27,000 teachers in secondary schools would have to be trained or receive a university degree in a four year time span, which might be a steep order and may have to be spread out over a longer period. We estimate the extra budgetary cost at an annual US$35 million by 2007 or an increase of about 8 percent from the baseline budget for secondary education equivalent to 0.1 percent of GDP.

3.56 *Second*, we expand the *Bono* program to cover all urban and rural poor households with children of secondary school age. The analysis of Section 6 suggests school subsidies (or

reducing schooling costs) will significantly influence enrollment for poor households. As the *Bono* program has not been targeted at secondary education, this would involve additional budgetary cost; not just from the increase in coverage of the cash transfer program, but also due to rising teacher costs as enrollment increases and the pupil-teacher ratio is kept fixed. Under the given assumptions, the policy could reach the 70 percent target for the urban poor. However, secondary school enrollment for the rural poor is very low and the impact of the subsidy (of US$5 per student per month) is not large enough to increase enrollment significantly for this population group. As discussed in Section 6, increasing access for the rural poor to secondary education has to be part of a long-term effort of which targeted subsidies are just one element. This would also require better economic conditions for rural households (requiring less child labor), improved achievement at the primary education level and improvements over time in parental education (especially of mothers). The additional budgetary cost of the school subsidy program as simulated would amount to about US$47 million (0.14 percent of GDP) by 2007.

3.57 *Third*, we combine the two policies and also allow for an increase in school infrastructure by a sufficient amount such that class size (pupils per classroom) remains at 21 and therefore will not impact negatively on urban enrollment (see cost-effectiveness analysis). In this scenario we limit the increase in the share of teachers with a degree to 89 percent, implying about 9,700 teachers would have to be trained during the period. Given our model parameters, we expect this combination of policies to lead to the 70 percent target for both urban poor and non-poor, but the rural poor would still fall short of this target for the reasons mentioned above. The additional infrastructure investment would, however, be substantial at around US$212 million. During 2003-7 about 4,000 new classrooms would have to be constructed to keep the class size at 21. The extra cost would require the secondary education budget to increase by about 50 percent, an annual cost equivalent to 0.6 percent of GDP.

3.58 *In sum*, there exist (financially) feasible scenarios to reach 100 percent of net primary school enrollment in urban areas in the medium term. Such a target may be reached without additional budget effort, if the additional cost of increasing the quality of teachers and increased coverage of demand subsidies is compensated by a slight reduction in the total number of teachers. Meeting the target for the rural population is more complicated and the budget implications could not be quantified based on the cost-effectiveness model. In secondary education, important progress can be made to reach a target of 70 percent net enrollment (with important expected positive externalities for economic growth). Again, the target is within reach for the poor and non-poor urban population by 2007 at a possible additional cost of between 0.1 and 0.6 percent of GDP. The latter option would also have a visible impact on secondary school enrollment in rural areas, but still off target given the extremely low initial levels of schooling access in those parts of the country. Reaching the 70 percent target for the rural population will require a much longer time period. The required extra budget costs for enhanced secondary school enrollment are thus much more substantial than in the case of primary education.

3.59 In all scenarios, budget neutrality would require finding fiscal space for financing key initiatives. An alternative would be to allow the student/teacher ratio to increase. Another would be to shift additional resources from the budget within the fical ceiling (Volume I). In any case, the amounts involved are small, when compared to the potential positive outcomes for human capital development.

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Annex 3.1

Education Cost-Effectiveness Model

A2.1 Demand for Schooling: enrollment, school attendance and student achievement

The first educational outcome that should probably be considered while analyzing the educational sector is school enrollment patterns. In addition there are several other educational outcomes that need to be considered once the enrollment decision has been made. The framework presented here focuses largely on two of these outcomes. In particular, *what are the factors that determine school attendance over the school year* and *what are the determinants of academic achievement?* The framework outlined here links both these outcomes. However, it is also possible to analyze these outcomes individually. Also note that while the focus here is on the attendance decision, it is quite straightforward to modify it to suit the enrollment decision.

The economic contribution of children to families in developing countries (especially in rural areas) and accordingly the opportunity cost associated with school attendance may be substantial. Attendance will suffer when parents perceive that the return associated with time spent in school does not justify the loss of a child's economic contribution. Parental perceptions of school inputs may also affect the attendance cost-benefit calculus as low quality teachers or limited availability of teaching materials may attenuate the expected benefits of attending school. A reduction in days attended probably exerts a negative influence on academic achievement and increases the probability of repetition and desertion.

The framework presented here, and applied in Section 6, explicitly recognizes the link between primary (and secondary) school attendance and student achievement. It is assumed that parents determine the particular pattern of school attendance for their children on the basis of expected gains and the costs of attending school. It is possible to proceed in two steps. First, estimate the effect of child, family and school characteristics on test scores and obtain predicted test scores. In the second step estimate a school attendance model that includes predicted test scores as a measure of the expected gains of school attendance.

School Attendance and Student Achievement – An Analytical Framework

School attendance patterns in developing countries vary substantially across households. Some children may never enter school while others may attend only part-time. The degree of part-time schooling may vary from missing a few weeks to missing several months. The variation in attendance patterns suggests that parents evaluate differently the costs and benefits of attending school and that this evaluation for the same household may also vary according to the particular time of the year. For instance, during the harvest season the opportunity costs of attending school

may far outweigh the benefits, resulting in temporary withdrawal, while at other times the benefits may outweigh the costs and result in regular school attendance.[28] Thus, school attendance over the year may be viewed as the consequence of a daily household decision where a child attends school on a particular day if the expected benefits from attending school on that day are greater than the associated costs.

To formalize these notions and to motivate our empirical work this section presents a framework tailored to our needs.[29] Consider that the school year consists of n days and it is day i of the school year. We assume that each household has a utility function defined over b_i and c_i, where b_i denotes the benefits associated with attending school on day i, and c_i is household consumption on day i. While attending school yields benefits it comes at a cost. Direct and opportunity costs associated with school attendance lower resources available for household consumption. Accordingly, household utility on day i conditional on school attendance (denoted by subscript 1) is given as,

$$U_{i1} = U(b_i, c_{i1}). \quad (1)$$

The associated budget constraint is,

$$y_i = c_{i1} + p_i, \quad (2)$$

where y_i is household income, and p_i represents the total cost associated with school attendance. In a similar fashion the utility associated with not attending school may de defined by,

$$U_{i0} = U(c_{i0}). \quad (3)$$

The budget constraint is $y_i = c_{i0}$. Given the utility associated with both options, households choose the option that yields the highest utility. The solution to the daily unconditional utility maximizing problem is

$$U_i^* = \max(U_{i1}, U_{i0}), \quad (4)$$

where U_i^* is the maximum utility. Alternatively, school attendance may be defined in terms of a dichotomous variable, a_i, where $a_i = 1$ if a child attends school and 0 otherwise. A child attends school i.e., $a_i = 1$ if $U_{i1} > U_{i0}$. Summing up the outcomes of these daily decisions, over the school year, leads to the observed pattern of school attendance.

A2.2 Empirical Specification

Since our purpose is to empirically explore the role of expected gains and costs on the school attendance decision we proceed by specifying linear forms of the conditional utility function. For the schooling option,

$$U_{i1} = \beta_1 b_i + \beta_2 c_{i1} + \varepsilon_{i1} \quad (5)$$

where the β's are coefficients to be estimated and ε_{i1} is assumed to be a mean zero, normally distributed error term with positive variance. Since $c_{i1} = y_i - p_i$, we may rewrite (5) to obtain,

$$U_{i1} = \beta_1 b_i + \beta_2 (y_i - p_i) + \varepsilon_{i1} \quad (6)$$

The utility function for the non-schooling option is,

$$U_{i0} = \beta_2 y_i + \varepsilon_{i0} \quad (7)$$

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28 This is especially true in rural areas.

29 The framework used here is similar to those in Gertler and Van Der Gaag (1988) and Gertler and Glewwe (1990).

Thus, an individual attends school, i.e. $a_i = 1 \; if \;\; \beta_1 b_i - \beta_2 p_i + \varepsilon_{i1} - \varepsilon_{i0} > 0$.

The chances of attending school on a particular day may be expressed in terms of a linear probability model that may be written as,

$$a_i = \beta_1 b_i - \beta_2 p_i + \varepsilon_{ia}, \tag{8}$$

where ε_{ia} is a normally distributed, mean zero, positive variance composite error term.[30] Equation (8) depicts the probability of attending school on any particular day. Since we are interested in the yearly pattern of school attendance we may sum up the outcome of the daily attendance decision over the course of the school year,

$$\sum_{i=1}^{n} a_i = \sum_{i=1}^{n} (\beta_1 b_i - \beta_2 p_i + \varepsilon_{ia}) \tag{9}$$

to yield,

$$A = \beta_1 B + \beta_2 P + \varepsilon_A, \tag{10}$$

where yearly school attendance *A*, depends on *B*, the expected benefits associated with school attendance over the school year and *P*, the yearly costs of attending school.

A2.3 Costs of Attending School

The total cost (*P*) of sending a child to school includes monetary (direct) and indirect or opportunity costs. Since education is largely subsidized the main cost incurred by households is likely to be in the form of opportunity costs. Attending school reduces a child's availability for work in and outside the home. If a child makes substantial contributions to family income, or plays an important role in supporting other working members, then the opportunity cost of attending school is likely to be high and this may curtail the attractiveness of the schooling option.

Both of these cost components are likely to differ across households. For instance, direct costs may vary due to differences in transportation costs. Opportunity costs and the value of a child's time may also differ due to personal characteristics of the child (age, sex) and the value that parents place on a child's time. Since we do not directly observe the costs of attending school we allow *P* to depend on a vector of child, family and other characteristics that capture the cost of attending school.

A2.4 Benefits of Attending School

Parents have to ascertain the total benefits (*B*) associated with school attendance. We consider two types of benefits that may influence parental decision-making. The main benefit associated with attending school is likely to be the expected addition to a child's human capital. To capture this effect we need a measure of the human capital gains associated with school attendance. For this study we incorporate a measure that is widely used to indicate the benefits derived from education: test scores. However, using actual test scores is obviously incorrect due to the potential endogeneity between test scores and attendance. In order to derive an appropriate

30 In this linear utility specification, income has been differenced out of the decision rule and does not directly affect the school attendance decision. Household endowments are assumed to influence the school attendance decision through opportunity costs.

measure of human capital gains we proceed by estimating educational production functions, one for each subject, for those students for whom test score data are available. These test score equations are specified as,

$$H = \delta Z + \varepsilon_H, \qquad (11)$$

where H is a measure of human capital or in this case test scores, Z is a vector of individual, family and school characteristics that influence H, and ε_H is an error term. Estimates from the educational production functions are used to predict test sores for each individual. These predicted values ($\hat{H}$) are included in equation (10) in order to capture the human capital benefits associated with attending school.

In addition to school characteristics that have an impact on test scores, there may be other school characteristics that do not affect academic achievement but do signal the quality (Q) of a school and directly influence the benefits that parents attribute to school attendance. For instance, whether a school has a telephone connection or a sports field may not directly influence academic achievement. However, these are easily observed signals that may be used by parents to judge the quality of a school and in turn may directly influence the benefits that parents associate with school attendance. Thus, some school inputs and facilities may directly influence parental evaluation of the benefits associated with school attendance while others may exert an influence on benefits through their impact on test scores.

To account for the different kinds of benefits that parents may associate with school attendance, equation (10) may be adjusted to accommodate both the expected human capital benefits ($\hat{H}$) and direct benefits (Q) and may be rewritten as,

$$A = \beta_{1\hat{H}}\hat{H} + \beta_{2Q}Q + \beta_3 P + \varepsilon_A, \qquad (12)$$

where $\beta_{1\hat{H}}$ is a coefficient to be estimated and β_{2Q} and β_3 are conformable coefficient vectors to be estimated. As this equation depicts, school attendance is treated as a function of expected human capital benefits, other benefits and costs.

A2.5 Cost Analysis and Budget Projections

Recent contributions to the school effectiveness literature have emphasized the importance of incorporating cost-effectiveness analysis into school quality research designs. While there is little doubt that the identification of factors that affect learning outcomes is important, its usefulness will be considerably enhanced if accompanied by more information on the costs associated with each intervention. On the basis of the analysis suggested in the previous section it should be possible to identify the most important factors influencing educational outcomes. Combing this information with the cost of each intervention would allow an evaluation of the most efficient method of increasing achievement and attendance. This offers a method of comparing alternative policies that can be ranked in terms of achievement gains per shilling invested in each input. Examples of such static cost-effectiveness analyses are available in e.g. Bedi and Marshall (1999) and Harbison and Hanushek (1992).