

Making Education in China Equitable and Efficient

Shaikh I. Hossain

Whether China becomes competitive internationally depends on the quality of its human resources. The government's priorities should be to improve the equity, efficiency, and quality of social services, as well as their financing.

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Summary findings

As China consolidates its rapid economic gains and continues its drive toward a market-oriented environment, the country's international competitiveness will depend greatly on the quality of its human resources.

China has made impressive gains in human resource development in the past two decades, and continuing to do so will help reduce poverty in two ways: indirectly, by increasing the productivity and efficiency of its labor force, and directly, by fostering the earning capacity of the poor. Eventually, improving human resources will spur economic growth and enhance welfare.

Progress in human resource development has steadily slowed in recent years, however, because of two broad problems. First, the distribution of education services continues to discriminate against the poor, largely because they have not benefited from recent gains in economic growth and are being choked off from access to services.

Second, some mechanisms and arrangements for delivering services have created targeting inefficiencies.

Hossain argues that the government's priorities should be to improve the equity, efficiency, and quality of social services, as well as their financing.

This paper — a product of the Rural and Social Development Division, China and Mongolia Department — is a revised version of chapter 1 of the World Bank report "China: Social Sector Expenditure Review, 1996," China and Mongolia Department, Washington, D.C., 1996. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Clydina Anbiah, room T7-015, telephone 202-458-1275, fax 202-522-1778, Internet address shossain@worldbank.org, August 1997. (32 pages)

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Making Education in China Equitable and Efficient

by

Shaikh I. Hossain

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INTRODUCTION

The stage is set for China to begin making significant strides in educational development. First, China's economy is buoyant, with a projected annual growth rate of 8 to 10 percent over the next twenty years. As such, additional resources should readily be available from both public and private sources. Second, demographic profile is favorable to the education sector, in particular, the size of the school-age population is declining, reflecting that financial burden both on the government and on working adults will be reduced (Fig 1). Third, shifts in the structure of the economy—rapid employment growth in the industrial and service sectors as well as an increase in the number of workers with post-primary education—mean that China's education sector will assume an increasingly prominent role in the economic growth. (Table 1, Annex 1).

To take advantage of these opportunities, however, China must confront major challenges at each level of its educational system. At the primary level, for example, only two-thirds of primary school students currently complete their entire primary cycle, completion rates are particularly low among poor regions and female students at the secondary level, many families lack the incentive to send their children in school, due largely to both economic and cultural factors. And at the higher level, coverage is extremely low, and the subsector has been slow to respond to the emerging labor market demand inspired by China's growing economy. The purpose of this paper is threefold: to assess the current status of education in China with a regional perspective, to examine the main challenges, and to propose strategic directions for creating an externally efficient education system that enables the country to enter the 21st century on a sound footing.

Overall Development

Educational development in China has been quite impressive. The adult literacy rate, an outcome of past cumulative investment in education, grew from 60 percent in 1960 to 74 percent in 1994. By the early 1960s, China had also achieved virtually universal enrollment in primary education, a coverage rate that still outpaces the rates found in several Asian counterparts. But, China does lag behind other countries regarding other dimensions of educational progress. For instance, its rate of enrollment particularly in higher education is below both the average among all Asian countries and the rates found in low-income countries, let alone its close comparators. Key outcome indicators, such as average grade attainment of the current school-age population and cohort survival rate, although showing steady progress, are modest when compared with those of Malaysia, Korea, Thailand and Sri Lanka (Table 2, Annex 1). For instance, average grade attainment is 5.6 years in China, which is close only to India but significantly lower than its close comparators. Likewise, cohort survival rate is 68 percent, quite lower than its close comparators and similar only to the Philippines.

Yet, when income level is accounted for, the level of educational attainment in China is moderately high relative to other countries (Fig 2). Part of the difference can be explained by how the three levels of education—primary, secondary and tertiary—are

Figure 1

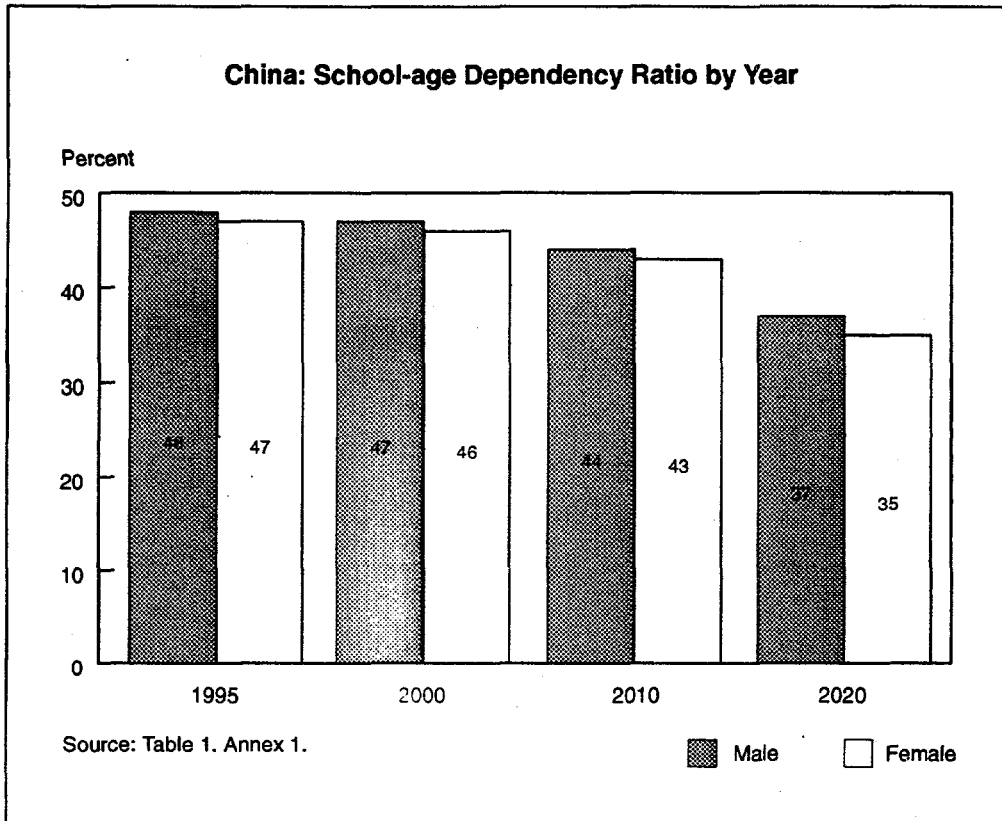
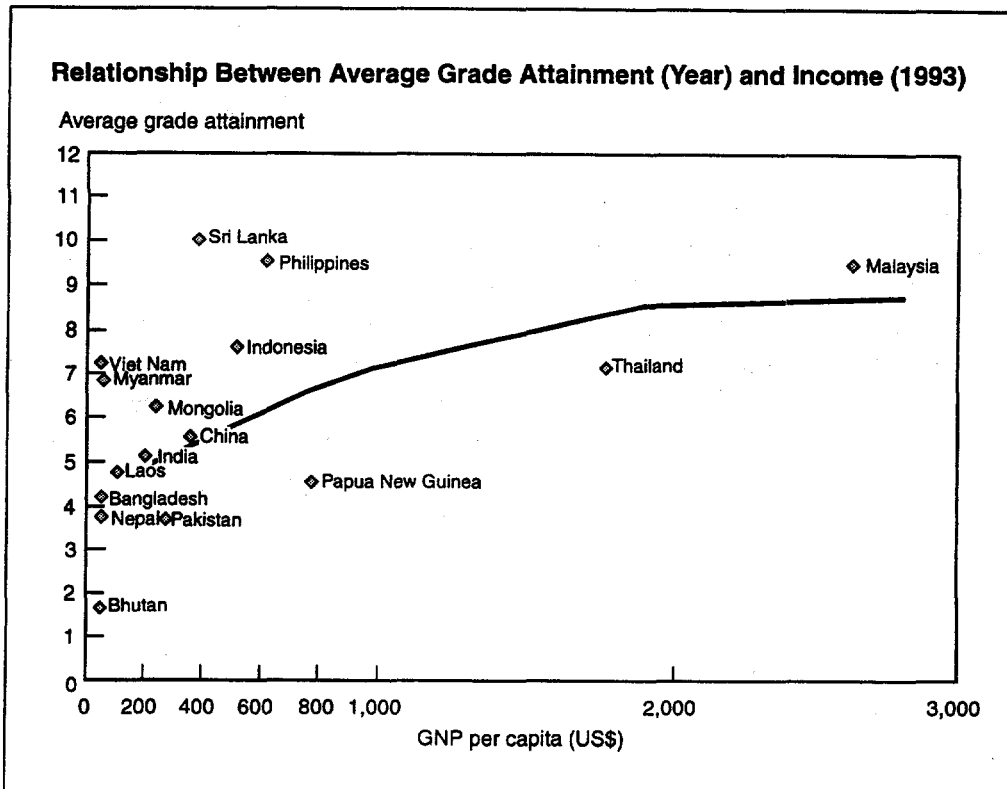


Figure 2



affected by budgetary allocations, private-public sector demand, and level of economic development in China. Thus, the pace of improvements in qualitative indicators in China would depend on the choice of investments and sectoral policies, especially those affecting the development of primary and secondary education in needy areas. There may be little scope for improving quantity but there is room for quality enhancement in schooling, which may in fact generate more significant gains in educational attainment. Evidence from several developing countries suggest that the rate of return to improving the quality of schooling is high compared to improving quantity of schooling of a given quality¹.

Access to Education and Equity within the system

(a) **Access to Education.** Gross enrollment rates at the primary level had been higher overtime, but the enrollment growth compared to other levels is slow because the coverage at this level was already extensive for a long time (Fig 3). Slower growth in enrollment in primary education also stems from declines in birth rates since 1970s and a reduction in dropout and repetition rates that reduced the proportion of students in the primary school-age range. In secondary level, gross enrollment rates rose progressively but at the higher level, both enrollment rates and growth remained low based on the overall experience among Asian countries (Table 1, Annex 1). Although populist policies during the Great Leap Forward period created greater higher educational opportunities for working class and peasants, famine and social conflict in the early 1960s thwarted that momentum, and all universities were closed in the early 1970s in favor of several short-term training courses.² Regular enrollments were restored in 1976, but China had already lagged behind Korea, Malaysia, Thailand and other Asian countries in terms of age cohort participation rates in higher education. Moreover, the urban focussed short-cycle courses in vocational universities, supported by municipal governments became more popular than provincial universities' 4-year academic programs that typically lead to prefecture and county level jobs.

(b) **Structural Equity:** In Table 1, the data show the shape of the enrollment pyramid which reflects the access to various levels of education and determines the distribution of educational attainment of a generation. While public expenditure by level of education is another structural dimension of equity as it influences the distribution of resources in the sector. But, structural equity alone does not necessarily imply that people from all socio-economic backgrounds and from all geographic regions have equal access to schooling. Therefore, accessibility to education and educational achievements by different income groups and across all provinces are examined on the basis of both time-series and survey data later.

¹ For empirical evidence in a number of countries see, Jere Behrman and Nancy Birdsall, "The Quality of Schooling: Quantity Alone is Misleading" *American Economic Review*, 1983. Jere behrman, Donald Ross and Richard Sabot, "Improving the Quality Versus Increasing Quantity of Schooling" 1992, *Colby College (Mimeo)*, Waterville, MA

² Higher education was perceived very inegalitarian, creating an exclusive elite group. See Julia Kwong, "Chinese Education in Transition: Prelude to the Cultural Revolution" Montreal: McGill Queens University Press, 1979.

Figure 3

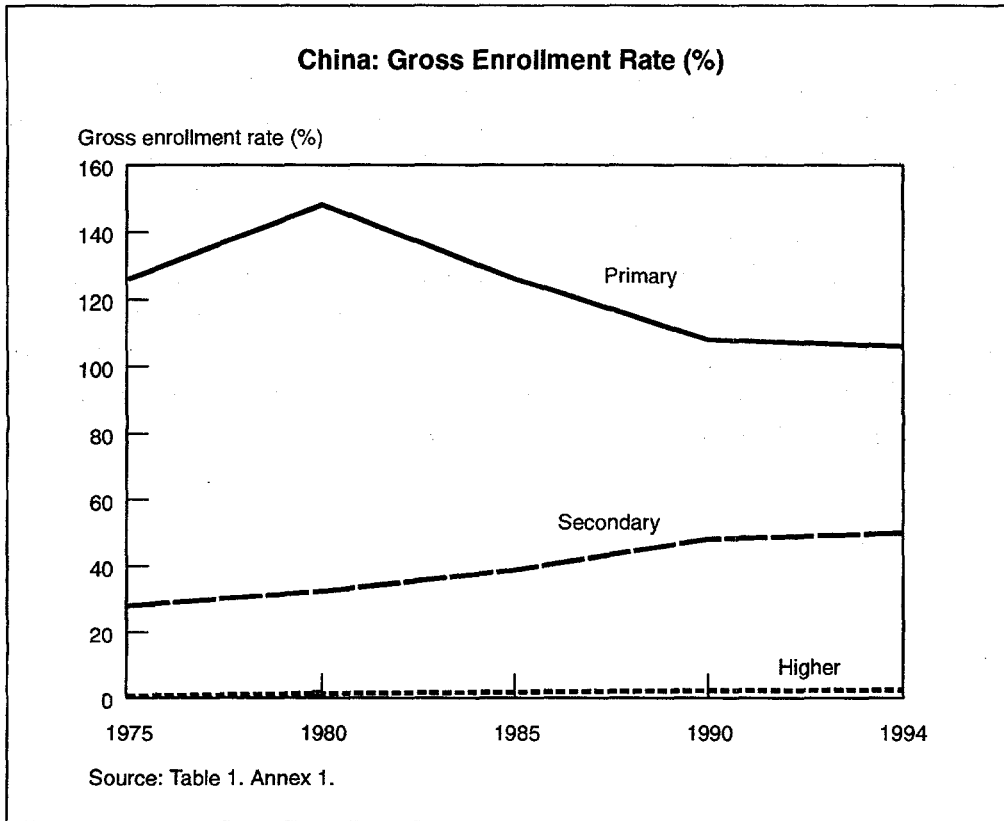
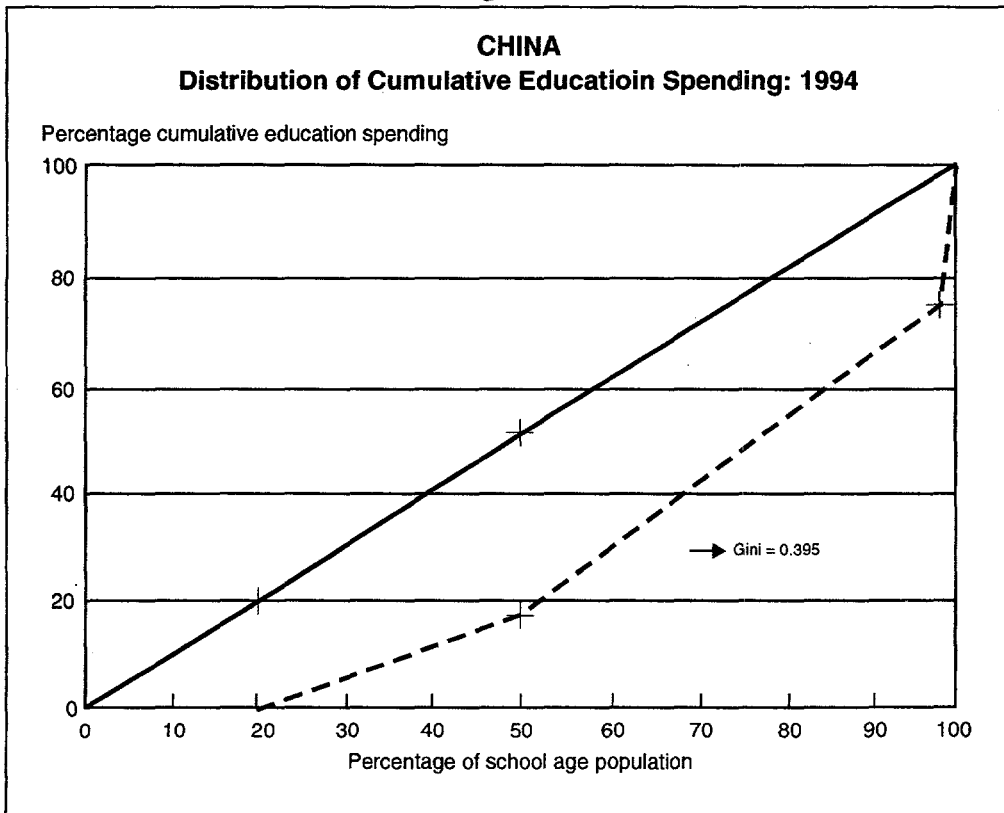


Figure 4



At least three important characteristics have shaped a structurally equitable educational system in China; a flatter enrollment pyramid--nearly universal entry into primary education and lower enrollments in higher education; and, more instructive, a pattern of government spending by educational level that conforms equitable distribution of resources. From 1982 to 1993, more than 60 percent of public educational spending was allocated to basic education--primary and junior secondary levels--so that the poor can get wider access to it. Another feature, although not yet very significant, is the growing private enrollments in higher education, suggesting that the proportion of fees being used to finance post-primary levels of education is increasing, allowing greater subsidies to basic education.

Table 1: Structure of Enrollment and Public Expenditure on Education

	1980	1985	1993
Gross enrollment ratio (percentage)			
Primary	148.0	126.0	104.0
Secondary	32.0	39.0	48.0
Higher	1.1	1.6	2.0
Public expenditure on education			
As a percentage of GNP			
Primary	0.95	0.79	0.75
Secondary	1.00	0.79	0.74
Higher	0.55	0.58	0.51
As a percentage of public expenditure			
Primary	3.4	3.6	4.7
Secondary	3.6	3.5	4.3
Higher	1.9	2.8	3.1
As a percentage of education expenditure			
Primary	38	36	40
Secondary	40	36	39
Higher	22	27	21
Percentage of cumulative public spending received by best educated decile a/		29	27

a/ Staff estimates

Source: State Education Commission and SSB.

A single summary indicator of structural equity is provided by the share of cumulative public expenditure received by the best educated decile in a generation. Overall, 10 percent get 27 percent of cohort resources and 90 percent receives the balance, reflecting an egalitarian distribution of public subsidy in education. This is also well below the regional Asian average of 39 percent. Normally, the best educated decile in developing countries receives more than its population share of the cumulative public expenditure on education. The cutoff at 10 percent is an arbitrary one, but it

provides an indicator of the concentration of public resources on education.³ The relative extent of structural equity is captured by a Lorenz curve and the corresponding gini concentration ratio (fig 4). The Lorenz curve for China is close to the line of equality and the gini coefficient is quite low (0.39). It is useful to note that the gini coefficient is smaller than it was in 1985 (0.43), reflecting that the distribution of public spending on education has become much more equitable in the past seven years.

Table 2: Gross Enrollment Rates by Quintile of Provincial Per Capita Income
1993

Quintile	Age group of children								
	7-11 years old			12-14 years old			14 and above		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
I	90.2	83.2	86.7	28.5	24.0	26.2	3.8	1.9	2.8
II	92.0	90.3	91.1	38.1	33.0	35.5	5.2	2.3	3.7
III	93.1	91.0	92.0	39.2	37.1	76.3	6.8	3.0	4.9
IV	95.1	94.8	94.9	66.3	71.4	68.8	7.9	3.3	5.6
V	97.6	97.2	97.4	72.9	78.6	75.8	9.2	3.8	6.5
Rural	92.3	87.6	90.1	34.8	31.0	32.9			
Urban	96.8	96.6	96.7	70.2	75.0	72.5			

Source: Staff estimates from SSB and State Education Commission data.

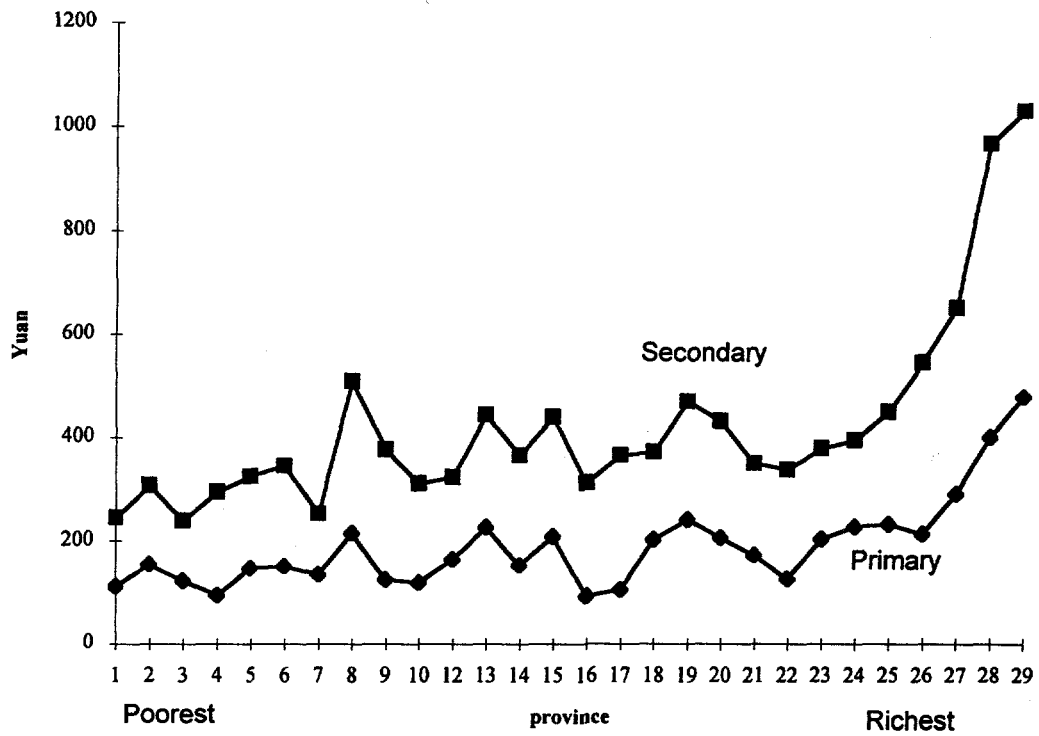
This trend owes much to the increasing enrollments in private universities and introduction of user fees in public higher education. However, the differences in the rates of cost recovery and unit costs within higher education are not captured here. But, it is very unlikely that a more sophisticated calculation would reverse the finding that Chinese system of education is fairly egalitarian in its global structure of access and public expenditure.

Yet, the structural equity has not translated into equitable educational benefits across provinces. While primary education are relatively targeted to poor provinces, accessibility to post-primary education shows marked interprovincial variance. When provinces are ranked by per capita income from poor to rich, the avowed policy of the government to ensure an egalitarian distribution of educational expenditure increasingly vanishes (Fig 5). Per-pupil expenditures are disproportionately higher in rich provinces compared to those in poor provinces. The richest quintile of provinces Shanghai,

³ Cumulative public spending on education refers to the total amount of public resources appropriated to a generation of people passing through their schooling years. It captures the distribution of cumulative benefits (education) among people with different school careers, rather than the distribution of single period benefits at a given level of education. For details on calculation, see Alain Mingat and Jee-Peng Tan, "On Equity in Education Again: An International Comparison" *Journal of Human Resources*, no 2, 1985

Figure 5

Per pupil expenditure by province
1993



Beijing, Tianjin, Guangdong and Liaoning spent almost 1.5 times more than the poorest provinces such as Guizhou, Guangxi, or Henan.

Table 3 : Drop out Rates by Area and by Gender, 1992

<i>Grade</i>	<i>Rural</i>			<i>Urban</i>		
	<i>Male</i>	<i>Female</i>	<i>Total</i>	<i>Male</i>	<i>Female</i>	<i>Total</i>
<i>Primary level</i>						
1	37.8	31.9	33.8	21.7	42.1	31.0
2	21.1	22.7	22.2	8.7	10.5	9.5
3	17.4	21.4	20.1	43.5	15.8	31.0
4	13.4	13.5	13.4	17.4	21.1	19.0
5	9.4	8.6	8.8	8.7	5.3	7.1
6	1.0	1.9	1.6	0.0	5.3	5.3
<i>Secondary level</i>						
7	29.5	33.4	31.8	23.5	22.5	23.1
8	55.1	53.7	54.3	47.1	65.0	53.7
9	15.4	12.9	13.9	29.4	12.5	23.1

Source: SSB: Situation of Children, 1992.

(c) **Access to education by provinces.** The foregoing is substantiated by the differences in enrollment rates for primary, secondary and higher education by quintile of provinces in Table 2. The attendance rates at the primary level are, by and large, similar irrespective of poor or rich area, confirming the earlier observation from national data of universal entry at this level of education. But the enrollment-rate disparity between rich and poor provinces grows as students move on to secondary and higher levels. Such disparity is particularly acute among the 12-14 and 14 and older age groups--corresponding to post-primary education--than among the 7-11 age group. Urban-rural differentials are also pronounced, and this can be attributable to differences in income and quality. Primary education that corresponds to age range 7-11 is compulsory in China, but attendance is not universal in rural area particularly among the females. Urban children and those from high-income provinces are much more likely to attend secondary school (about 2.2 times) compared to children from rural area and low-income provinces. In the absence of compulsion in the subsequent age groups the gap in attendance rates widens steadily. Higher education is mostly received by households in richer provinces.

What has happened to the access to education by provinces in other years? Similar household surveys are not available, but enrollment rates by provinces, ranked by per capita income from poor to rich, indicate that the importance of income as a correlate of school enrollment has not changed, the richer the province the higher the enrollment rate in post-primary education.

(d) Social selectivity. Chinese educational system suffers from social selectivity. Disparities in drop-out rates at the secondary education level are quite pronounced. Male-female differences in primary education are modest but very significant in secondary education. Drop-out rates also widely vary according to geographic location and level of education: high in poor provinces and secondary education, and vice versa. In secondary education, in rural areas, more females tend to drop out of school than do males (Table 3). The reason is that due to obvious economic difficulties, females from poor families leave the schools earlier to start working at home or to help their families. Inadequate learning environment in poorer provinces is another reason for early exit from school system.

(e) Affordability and Quality. Private costs incurred by the poor are high enough to prevent them from attending schools. The main components of out-of-pocket educational expenditure are tuition, textbooks, stationaries and contribution to schools (Table 9, Annex 1). The figure 6 shows that as a percentage of non-food household expenditure, the poorest quintile spend three times more on education (14.2%) than those in the top quintile (5.5%). The full private cost of school attendance would raise the cost-nonfood expenditure ratio--a measure of affordability--further if the opportunity cost of time in school is considered. For rural area, total private educational expenditures are examined by provinces, ranked by per capita income from poor to rich (Fig 7), and similar conclusion holds--that the prices faced by families in poorest rural provinces are high enough to create an obstacle to raising enrollment rates than those in the wealthy provinces. Infact, figure 8 shows that economic conditions prevent nearly 40 percent of children among the 7-14 age group, corresponding to primary and junior secondary education, from attending schools in the poorest province (quintile I) compared to 14 percent in the wealthiest province (quintile V). Moreover, regarding quality of schooling, one direct measure of the quality gap is the availability of textbooks and teaching materials in schools. The same data confirm that more than 35 percent of the children living in the poorest provinces reported either inadequate supplies of textbooks or other teaching materials as the main reason for not attending schools; corresponding figure for children in the richest province is 21 percent. In higher education, a simple regression with province-level data show that graduation rates are influenced by the

Figure 6

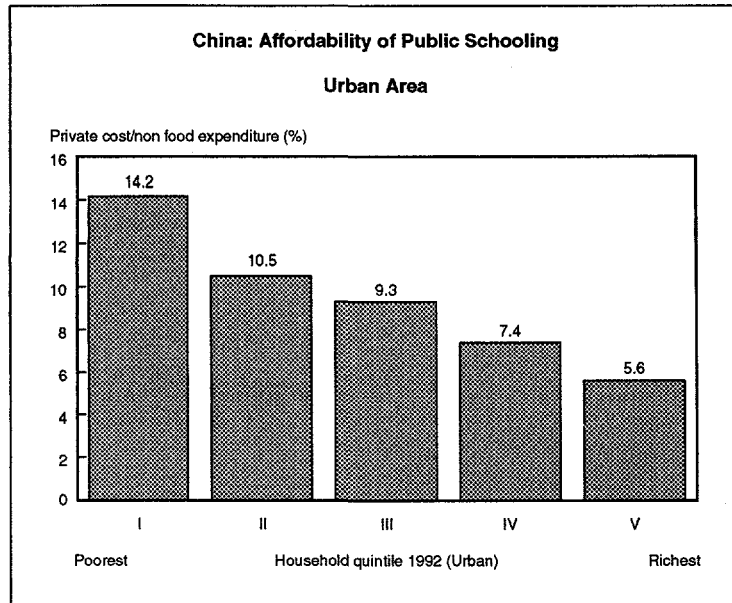


Figure 7

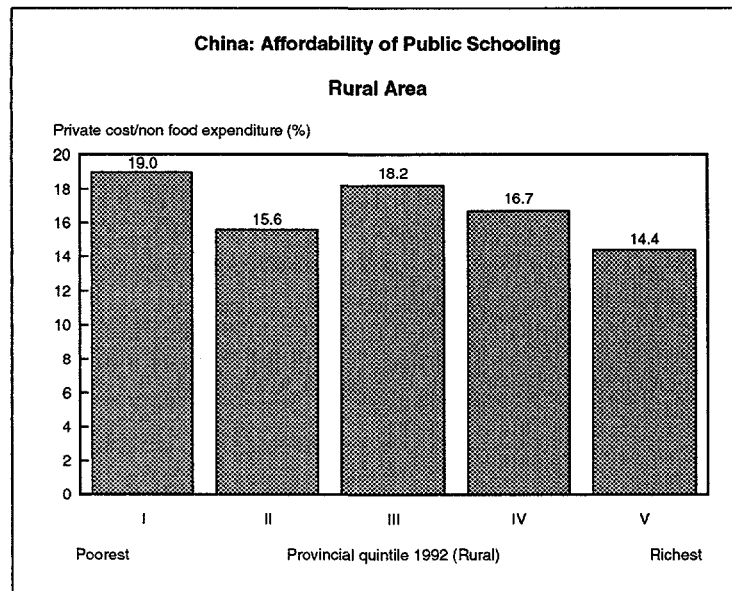
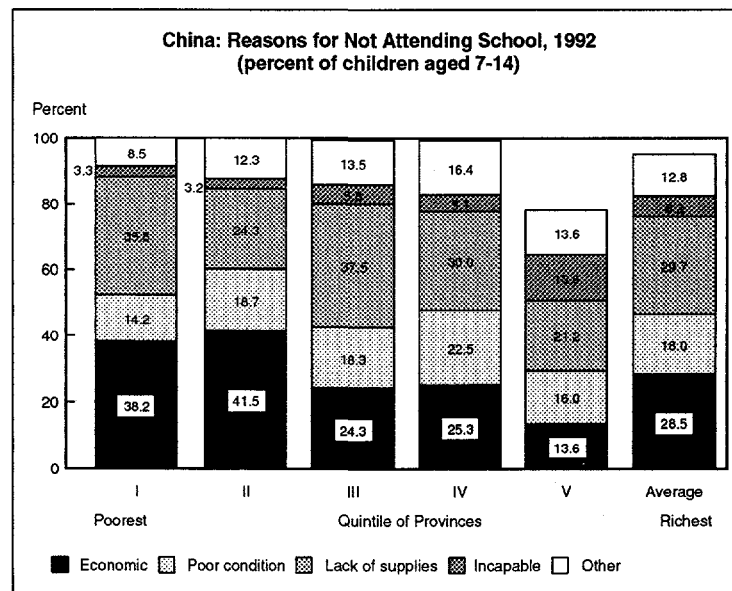


Figure 3



availability of qualified faculty. But the poor provinces are deprived of more qualified faculty. Based on relative faculty ratio (RFR) the richest quintile of provinces--Beijing, Shanghai, Zhejiang, Liaoning clearly have an oversupply of professor and assistant professor, as the value of RFR far exceeds one (1.60 and 1.20); conversely, the poorest quintile of provinces--Guizhou, Xinjiang, Anhui, Henan, Guangxi and Sichuan --have an undersupply of such more qualified faculty (Table 12, Annex 1).

Outcomes and Efficiency

This section focuses on outcomes that are internal to the educational system--specifically, cohort survival rates and transition rates, and outcomes that are external to the system, such as private and social rates of return to educational investments. Both sets of outcomes are critical, since together they help determine the global efficiency of the educational system. Yet, few efforts are made to assess the impact of public policy on these outcomes in China. The dearth of such assessments is due in part to the scarcity of appropriate data and in part to the fact that these outcomes were not important to policymakers under the command economy.

(a) **Internal efficiency.** Conventionally, an education system is internally efficient if it generates the maximum output at minimum cost. Outputs are measured by such indicators as transition rates and cohort survival rates or the proportion of students who start grade 1 and complete each subsequent cycle, students' cognitive and technical skills, scientific knowledge, improved and the like. Ideally, a combination of individual survey and time-series data are used for this analysis. However, in the context of the present study, readily compiled provincial-level time-series data are used to provide results that would be helpful for policy interventions for improving system's internal efficiency which also improves quality.

At the aggregate level, educational outcomes vary directly with income. The transition rates from primary to secondary and secondary to higher level of education are higher in higher income provinces as compared with those in lower income provinces. Other eclectic statistical analysis strengthen the conclusion that public expenditures are important determinants of transition from one level to another. A regression is done in which transition rates are explained on the basis of per capita income, per student educational expenditure and agricultural wages. Agricultural wages are used to measure the opportunity cost of children's' time and to the extend possible the expected value of education. The results clearly suggest that both income and educational spending tend to increase transition rates (Table 4). But more importantly, the results indicate that keeping budgetary allocation to primary education at a high enough level will compensate for the negative effect of low income by making the likelihood of transition to secondary and higher levels of schooling more equal throughout the country.

The transition from junior to senior secondary education is negatively associated with the transition from primary to secondary levels. This reflects that some of the less qualified students from the high-income provinces where transition rates are high, fail to survive the next level or perhaps they go out to work with families or in the labor market due to higher opportunity costs. This is reflected by the opposite signs of income and education expenditure variables and higher negative value of agricultural wage variable in equation (2). Primary education is compulsory and supply-driven, while at post-primary levels, the household choice for extending education can be predicated on the opportunity costs to parents of pupils' time. Transition rates to secondary education are low in poor and more agricultural provinces than in rich provinces that are less agricultural. Thus, equity and better educational outcomes well justify public expenditure at primary education.

It is also important to assess if low transition rates to secondary schooling are a concomitant of poor schooling conditions in primary education or of weak private demand for secondary education. Empirical evidence in several countries suggest that schooling conditions in primary education is critical because they create learning environment for students and motivate them to continue education at post-primary levels. The regression results in Table 4 suggest that the demand for post-primary education is not weak, as transition rate is positively associated with per capita household income--a measure of the strength of private demand. Moreover, mean achievement test score--an indicator of the quality of education--is strongly associated with higher transition rates. Thus, improving the quality of primary schools--an outcome that can be influenced by the government budgetary decisions--would enhance continuation of education to post-primary levels.

Another piece of evidence is the differences in cohort survival rates at the end of primary school by provinces. Higher cohort survival rates are associated with lower per-pupil costs in wealthy provinces relative to low-income provinces, reflecting that the rich provinces have more internally efficient educational systems than their poorer counterparts. Students in high-income provinces including Beijing, Shanghai, Tianjin, Guangdong and Liaoning survive until the end of primary cycle. While in poorer provinces like Guizhou, Guangxi or Anhui about 20 to 25 percent of students do not persist to the end of primary cycle. (Fig 9)

Fig. 9

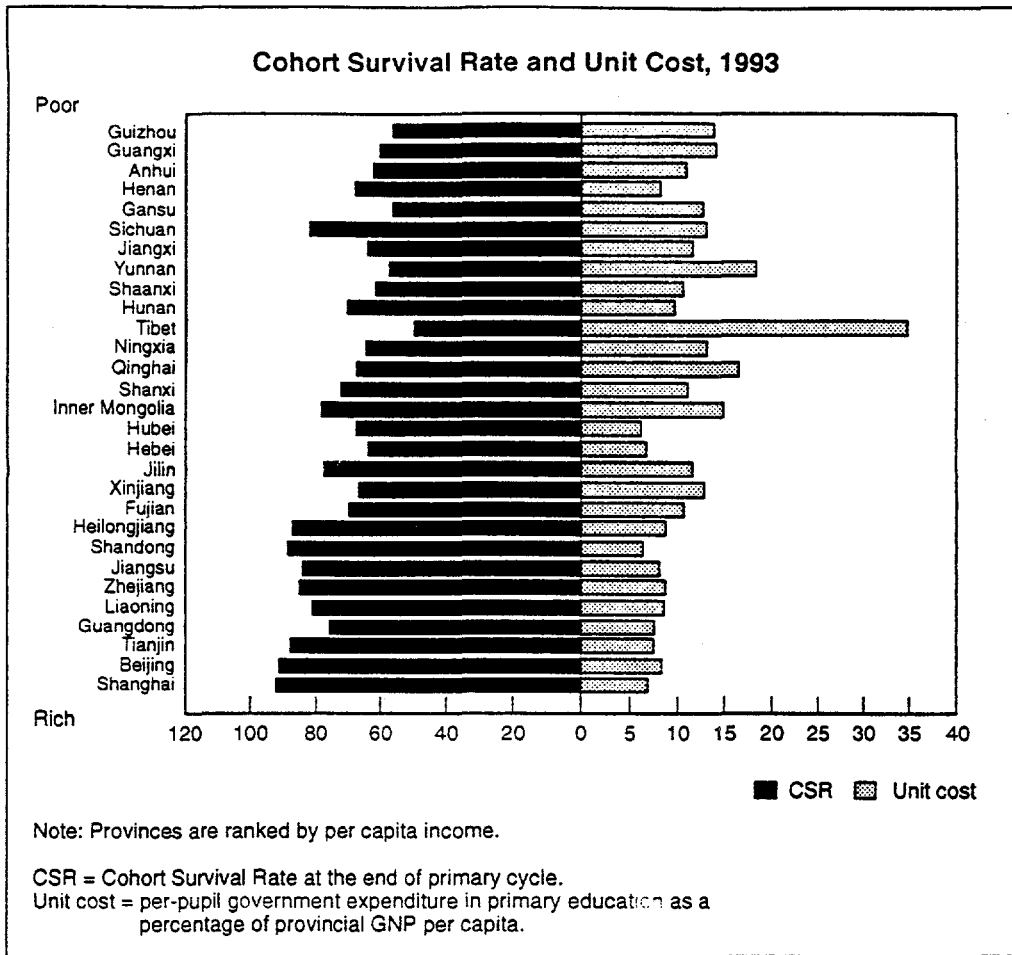


Fig. 10 : Rate Of Return to Education

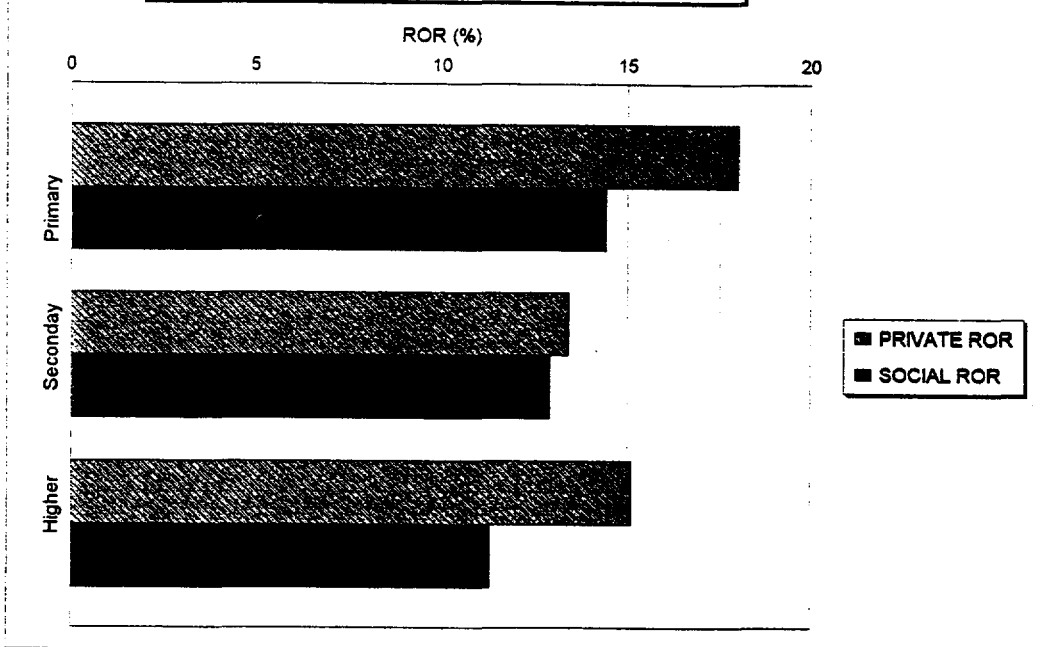


Table 4 Regression Results for Transition Rate, 1992

Dependent
Variable = Transition rate, 1992

<i>Right hand side variables</i>	<i>Primary to Secondary</i>	<i>Junior Secondary to Senior Secondary</i>
constant	-86.4* (-9.23)	-0.17 (-0.77)
log Income per capita	12.91* (2.02)	-0.571* (-2.49)
log Expenditure per pupil	10.33* (3.05)	-0.077 (-0.56)
log Agricultural income	1.69 (0.95)	-0.106 (-1.74)
Deviation of Grade 6 Achievement Score From National Mean	0.112* (2.55)	-NA-
N	29	29
Adj. R ²	0.655	0.305

Note: The T-statistics are in parenthesis.

(*) Significant at 5% level.

(b) External Efficiency. Ascertaining a closer match between the education system's future output and the demand for educated labor requires rate of return analysis. Such analysis also assesses whether educational investment had any impact on household welfare, and where should resources be allocated in the sector so as to make it more externally efficient? A summary of economic rates of return to three levels of education, based on "elaborate" or "complete" method with the data from 1993 Labor Survey by the Ministry of Labor, is presented in Table 5. Both the private and social returns to each level of education were high in 1993, making investments in education socially profitable in China.

The social rates of return is the highest for primary education (14.4%), followed by secondary education (12.9%), implying that investment in these levels of schooling will promote both equity and efficiency objectives. These findings are consistent with those elsewhere that additional years of primary education will increase productivity and income among the poor⁴. In secondary and higher education, the social rates of return are not very high due partly to higher government subsidy in terms of increased operating budget and teachers' salaries. This is also reflected in the index of subsidization particularly for higher education, which indicates the degree to which costs are borne out by the public sector compared to the private sector. In China, the index is only 4 percent for secondary education and 31 percent for higher education. The high private returns to secondary and higher education imply that investment in these levels lead to high wage-paying jobs, an important paradigm in a rapidly growing economy such as China. But, high wages may also reflect institutional pressures (minimum wages) rather than augmented productivity resulting from human capital formation by these levels of education⁵.

Table 5: Rates of Return to Education (Percent), 1993

	<i>Private Rate of Return</i>	<i>Social Rate of Return</i>	<i>Index of Subsidization (a)</i>
Primary	18.0	14.4	1.25
Secondary	13.4	12.9	1.04
Higher	15.1	11.3	1.31

Note: see Technical Annex A for detail

(a) The ratio of private to social rates of return.

Source: Staff calculations from MOL Survey 1993

Table 6 reports the basic Mincerian earnings functions, showing that the overall marginal private rate of return to one year of extra schooling, irrespective of education level, is around 12.5 percent. The marginal returns to education for three levels of education are displayed in the last column. These rates are consistent with the earlier

⁴ See for example, Lockheed, Jamison and Lau, 1980, "Farmer Education and Farm Efficiency: A Survey in Education and Income" *World Bank Staff Working Paper* No 402. Authors found that on average, farmers with four years or more of primary education were at least 7 percent more productive than those with no primary schooling.

⁵ Labor productivity improved slowly until 1987. See I.J. Singh, "Industrial productivity in Socialist Economies", 1991.

findings as they are close to those based on the "complete" method in Table 5. One exception to findings found in other developing countries is the positive coefficient on the squared term for schooling (S^2). Thus, contrary to the common pattern of diminishing returns to spending in additional years of schooling, there is slightly increasing return in China. The results perhaps reflect the changing economy in which large agricultural sector is utilizing labor inputs of mostly less educated workers, and a rapidly growing modern sector that is demanding more highly educated and qualified labor.

Overall, three important conclusions emerge from foregoing analysis. First, the high social rates of return to primary and secondary education suggest that the demand for labor with these educational levels still exists. The government may allocate more resources to these levels of education in order produce more graduates, but such allocations should be selective at the secondary level; since costs vary significantly by fields of study, as does the demand. Second, the social rate of return to higher education investments is below the returns to investment in alternative forms of capital, casting doubt whether further public expenditures in this subsector are justifiable. But if externalities are considered then social ROR to tertiary education would be much higher than the quoted social ROR and reducing expenditures may jeopardize the already very narrow access to higher education, particularly among the poor. The attendance rates in higher education are very low, capturing only one fifth of secondary school graduates. The students who exit from education system create an oversupply of labor with senior secondary schooling, thereby affecting their wages and eventually dampening returns on investment. It would be prudent to target governmental resources to those fields of study where the demand in labor market is high. Third, the access to higher education should be enhanced by introducing alternate methods of financing higher education, such as scholarships and student loans that eventually would help reduce the differences in rates of return.

Table 6: Returns to Education (Mincerian Earning Function), 1993

	<i>Basic</i>	<i>Dummy</i>	<i>Rate of Return (Percent)</i>
constant	10.12	12.03	
Schooling(s)	12.20		
Schooling (S ²) squared	0.005		
Experience (E)	0.031	0.034	
Experience squared (E ²)	-0.0002	-0.0001	
No education (Base)	0.000		
Primary		0.303	18.2
Secondary		0.517	13.6
University		1.488	18.9
R ²	0.274	0.268	

Note: See Technical Annex A for detail.

Source: Staff calculations from MOL survey 1993.

Finally, one important issue concerning the social rate of return is that it is based on monetary earnings (or productivity) and excludes any "externalities" associated with education. These are benefits of education that go beyond what the individual investor realizes in terms of increasing earnings, such as effects on others by having more literate people around, or better nourished and health children if a mother is educated. However, this is not really a critique of the rate of return analysis. It is a possible addition to education benefits that are unmeasured, as for any other investment in a country.⁶ Assessing education system's future output goals also need tracking labor market development that are not captured by the ROR analysis. Table 13 (Annex 1) presents some relevant market signals, such as job vacancy rates by educational qualification. From 1990 to 1995, while the demand for all types of labor has increased, but the growth in the demand for secondary and university graduates is particularly high, justifying expansion of these subsectors.

⁶For recent attempts to quantify education externalities, see P. Romer, "Increasing Returns and Long Run Growth" *Journal of Political Economy* 94, 1986, and R. Lucas, "On the Mechanics of Economic Development" *Journal of Monetary Economics* 21, 1988.

Strategic Direction :

Education

China's demographic and economic conditions appear remarkably conducive to future educational development, and preceding analyses reinforce the justification for further investments and policy changes in basic education--primary and secondary -- mainly to improve its capacity to enroll and retain poor students in economically disadvantaged areas, and in higher education mainly for diversifying its structure in tune with labor market signals . As such, the following strategies deserve urgent attention.

Basic Education: One emerging problem that may become critical in the education system is its weak capacity to retain students in primary and secondary levels. Significant selection occurs within cycles of education through dropping out in several poor provinces, particularly among the girls. This results in adverse selectivity in the sector. To prevent the emergence of a disenfranchised social underclass, fundamental policies should aim to lower the private costs by reforming prices, and raise the private benefits by fostering quality of education. Most of the costs are determined by public expenditure policies---the volume of recurrent subsidies determines how much individuals are asked to pay, and investment expenditures determine the density of school placement. The benefit side is influenced by how much the government spends on subsidizing such inputs as training for teachers, textbooks, equipment and classroom supplies.

Pricing Reforms: To reduce the private cost of education for the poor children the government should adopt pricing reform. Lessons of three successful measures can be adopted to increase affordability depending on area and household characteristics in China. First, elimination of tuition and fees, second, introduction of voucher, covering fees plus costs related to school attendance, and third, introduction of *augmented* subsidy that covers fees, related costs for school attendance plus opportunity costs foregone. The third measure will improve enrollment prospects among the poor the most. In Asia, *augmented* subsidy was first introduced in Sri Lanka by the government, and later became popular in other countries. Recently, through World Bank projects, such subsidy has been introduced in Bangladesh and Guatemala for girls only, while vouchers were introduced in Colombia and Pakistan. In each project, students must maintain a certain grade average to continue to receive both subsidy and voucher. Another step involves food for education in primary and secondary schools only for the poor children as done in Bangladesh. So far, these measures have proved successful at enhancing enrollment and

retention rates among poor as well as female students.⁷ Since disparity in enrollment and survival in basic education occurs across region, gender and ethnic minority, the means of targeting above subsidies should be based on geographic region that is the so-called 8-7 poverty counties, gender and ethnic minority.

Improving Quality : To increase the private benefits of basic education among the poor its quality must be improved. One indication of quality gap is the variation across income levels in the amount of private spending on public schooling, much of which is devoted to such quality-enhancing inputs as textbooks. Given our regression analysis finding that government expenditure tends to improve survival prospects among students the central government should seek to allocate more resources for teachers' training, textbooks and other classroom materials in poorer areas. In this respect, schools should be targeted, because high dropouts, repetition and low achievement scores are more prevalent in poorer regions, serving low-income households.

Special Measures: The government should also consider relocating schools closer to communities, changing the content of curricula, and recruiting more female teachers from local community to augment girls' participation and enable them to continue successive grades in a particular education cycle. Cross-country evidence of a strong and positive association between girls' enrollment and female teachers are abound, and evidence for China will be available when Bank- financed projects are completed.⁸

Secondary Education: Enrollment and survival rates in secondary education are lower in China than in other Asian countries at similar income levels. Our analysis suggest that this is mainly due to the lack of demand stemming from cultural factors rather than the lack of spaces. But the dynamics of China's new labor market should increase demand for secondary school graduates, necessitating some forms of governmental interventions. Although the present policy of 9-year compulsory education that extends the junior secondary level does enhance coverage, yet additional intervention via financial incentives for school attendance covering direct and foregone earnings particularly in less developed areas would be needed with the caveat that this incentive could be reversed when further justification no longer applies⁹. Currently, the underlying assumption for such intervention is not inconsistent with the empirical findings of transition rates from primary to junior secondary education. But empirical support for higher government subsidy for senior secondary education to promote attendance and stimulate survival prospects is apparently weak. However, this conclusion does not nullify the case for more narrowly targeted subsidy and financial incentives such as scholarships for poor but meritorious students in senior secondary education.

⁷ See, Shaikh I. Hossain, "Education Finance: Public Private Interface" (mimeo), Paper Presented at the National Institute of Educational Policy, New Delhi, India, 1995

⁸ G. Psacharopoulos and H.A. Tzannatos 1992, "Case Studies on Women's Employment and Pay in Latin America" Regional and Sectoral Study, World Bank, Washington D.C

⁹ Malaysia and Sri Lanka incorporated reversibility in their compensation design. The specific circumstances justifying their initial introduction did not continue when attendance and cohort survival rates improved markedly.

Higher Education: In higher education the transition from the existing highly elite system catering only 2 percent of the age cohort to a mass system has been slow relative to its several East Asian comparators, and the system is projected to cover only 5 percent of the age cohort in 2000¹⁰. Although social rate of return from higher education is low, yet future demand in China's expanding labor market argues for finding ways to enable universities to expand current enrollments. Once the demand for secondary school graduates rises, which is a likely prospect in itself, this pool will be enlarged from which only an expanded tertiary

Adequate but not excessive vocational and technical education

Vocational and Technical Education (VTE) plays a major role in preparing young Chinese to be productive labor market entrants, and thereby, to contribute to sustained national economic growth. But calculations from the 1993 Labor Force Survey data yield very low private rates of return to vocational and technical education—5 and 9.9 percent respectively. Such low returns can be ascribed to high unit costs rather than to a lack of demand for technically skilled labor. Since VTE is highly differentiated across specialization and provinces in China, future skill mix demanded by employers cannot be predicted precisely. Therefore, the issue of VTE planning is how best to frame a strategy for the 21 st century that provides adequate, but not excessive, capacity for training young labor market entrants. Owing to the need for trainable workers able to acquire new skills as technology changes and SOEs restructured, two governmental measures are advisable: augmenting internal efficiency mainly by improving use of teachers' time, training for trainers, and utilizing physical facilities more intensively, and modifying government's recognition process to promote greater institutional flexibility and elective options for students. These measures would reduce unit costs, foster mobility and eventually raise returns to investments in VTE.

Augmented Subsidy, Vouchers and Scholarships in Basic Education.

Enabling the poor to become educated, requires not only that they have access to basic education, but also that they survive through primary education and make the transition to post-primary education. Results from several studies and Bank-financed projects find that elimination of fees in Bangladesh and Guatemala, introduction of vouchers in Colombia and Pakistan, have increased students' participation and transition to the next cycle of education. Vouchers have enabled the poor to gain access to selected private schools that have excess capacity. To retain these financial incentives throughout primary or secondary cycles, students were required to maintain certain grade point

¹⁰ State Issues New Development Program, no 1, Beijing, Xinhua Domestic Services in Chinese, in Foreign Broadcast Information Service (March 3, 1993)

averages. Recently, simulations from survey data of Mongolia and Indonesia showed that introduction of augmented subsidy that compensates families for fees, related costs for school attendance plus foregone opportunity costs would enhance enrollment prospects among the poorest groups the most.

Hossain (1995), *op cit*

Mongolia: Poverty Assessment In a Transition Economy (15723-MOG), 1996

Indonesia: Public Expenditures, Prices and the Poor (11293-IND), 1993

education can absorb the intake. Moreover, the current ease and speed with which graduates find jobs and the brain drain of skilled people from the interior to coastal belt could create a wide gap in the skills required by the expanding labor market; in turn, this gap could reduce the country's attractiveness to foreign investment in medium and high technology areas, undermine institutional capacity, and fuel income inequality when the labor market becomes more liberalized in the future. The following broad measures should be considered.

Diversify structure. Ensuring a more diverse, inclusive population of prospective students and responding to the new dynamics of China's rapidly evolving labor market demand calls for three specific measures: moving toward a multiversity system, recasting and expanding the menu of courses, and providing flexible regulations governing how the private education system operates.

The 1993 reform document envisions some form of multiversity system, but the main question now is how rapidly and by what processes the transition to a multiversity system can be made. One option would be to merge several currently underutilized campuses and facilities and then upgrade the lower-level institutions. All universities including those in the coastal belt should be encouraged to expand their student base, opening them up to more nonresidential students. These arrangements would raise pupil-faculty ratios, thus lowering the equality gap between the higher and lower-level institutions. By way of illustration, a simulation based on regression analysis and data on size distribution show that these equality-enhancing measures would yield savings of more than 20 percent of the current operating costs of institutions with an enrollments of 2,000 students¹¹. One other option would be to create more distance learning institutions (open universities) that would be accessible to adults, disabled, and geographically dispersed students. Of course, the standards of these long distance, open systems would have to be regulated carefully by the SEdC to ensure that their graduates can productively perform in the labor market.

The second element of structural diversification would entail expanding menu of courses and recasting them with greater applicability to and inclusiveness in the new labor market. Such courses would include new approaches to engineering, management, finance and economics, whose enrollment rates have risen sharply since 1980 and whose applicability to professional employment has become more focused. Traditional subjects such as history and literature could be broadened to include new interdisciplinary and applied fields of study. With SEdC as the central oversight body, universities can form panels of teachers, scholars, and employers from public and private sectors to make the academic market more adaptive to the labor market. The content and form of the courses

¹¹ For corroborative evidence see also W. Min, (1990), "Chinese Higher Education: Mode of Expansion and Economies of Scale" *Jiaoyu Yanjiu*, October, Beijing.

should be reviewed on a regular basis and modified as feedback from the panel and institutions warrants.

The third element of diversification would be to expand the private sector in order to promote competition. Equity considerations, a weak legal framework and the absence of quality control have inhibited the expansion of private higher education.¹² The government should encourage healthy growth by adopting a binary policy: *regulations* that control quality and quantity and *incentives* that complement these. *Regulations* on entry conditions, input-output mixes, teaching technology, and student enrollment qualifications through national examinations are advisable. But, strict restrictions particularly those that mimic the requirements applied to public institutions, may hamper the private sector from operating efficiently and limit its ability to expand educational options for a diverse population of students in a rapidly evolving labor market. Accreditation on a differentiated scale of academic excellence should continue, and could well become the sole public policy tool, much as it has in OECD and many Asian countries, when private education matures. This policy will provide incentives to both private and public institutions to regulate themselves, as well as encourage consumers to make intelligent choices about institutions. To mitigate against lax quality standards, the government should consider establishing an independent national oversight committee to review the consistency of accrediting standards periodically. *Incentives* to promote the growth of private education may include tax advantages and grants. The government may exempt private institutions from paying income tax on their tuition revenues, related services, portfolio income and donation. But it must first pass legislation that defines the conditions not only for tax exemption but also for the access to preferential foreign exchange, credit or land grants. Selective grants for R&D can be provided when public institutions lack that facility and expertise.

Improving Quality: Faculty development is pivotal to improving the quality of higher education. The main problem is the paucity of qualified faculty in poor provinces. The government's commendable steps to upgrade the quality of faculty by improving remuneration, enhancing training, and adopting preferential housing and social welfare policies, have had little impact. Hence, the government should adopt a policy of deploying well-qualified teachers in poorer provinces, complemented with ongoing in-service training that promotes a more inclusive grasp of subject matter and more effective pedagogical practices. Indeed, evidence from several countries shows that teachers' in-service training has a positive impact on student achievement.¹³ To increase the number of highly qualified teachers, the faculty positions should be made competitive with other industrial jobs, primarily by raising salary levels and expanding benefit packages. The government should also consider granting scholarships for overseas studies and training, providing greater rewards for academic excellence, and encouraging part-time jobs. Raising qualification or introducing teachers' examinations for specific fields of study may be required as the ability of entering students changes.

¹² See Wu Zhongkui, "Overview of Current Chinese Private Schools" Chinese Education Journal, no 3 (1994).

¹³ Marlaine E. Lockheed ed, 1993 "Effective Schools In Developing Countries" London: Falmer Press.

Selective Increase in User fees. Private tuition and fee contribute only 5 percent to total recurrent university expenditures, and in recent years cost-of-living subsidies have captured 20 percent of total public higher education spending. Both areas could be improved by reducing the burden of subsidization on the public sector. Given the high private rate of returns to higher education, government subsidy may limit private spending that students and their parents want to make. Indeed, there are two indications that the private sector is able and willing to pay: the existence of excess demand for education i.e more applicants than available places, and donations. Rising enrollments reflect that increasing user fees selectively would not reduce the demand for higher education but instead allow government to mobilize private contributions for expanding access and thus improving equity. However, setting tuition and fees according to costs per student, rather than in absolute amount would be desirable so that charges could be raised in accordance with inflation. The government should further reduce subsidies for the cost of living that students would incur whether or not they are enrolled. These non-instructional subsidies are still high relative to many Asian comparators and should not be a substitute for private spending that could be made anyway by many households. Such step can significantly alleviate crowding-out problem, freeing-up government resources for expanding enrollments in other levels of education.

Student Finance Schemes. The foregoing indicates that high subsidies and low user fees in public higher education tantamount to a blanket scholarship and student loan schemes that support a limited part of the entire system, which not only creates adverse impact on equity but also thwarts the efficacy of public expenditure. As discussed below such outcomes can be redressed by reconfiguring the existing mechanisms for student finance. It is clear that priority fields of study will be offered mostly in public universities. But in future private (*Minban*) universities will continue to grow not only in response to increasing demand but also as a result of limited places in public universities. In such situation, there will be more pressure to expand the access to public universities. But given the high unit cost in public relative to private universities, such expansion may cause further inefficiency and greater social selectivity because the better-off students will get more opportunities who would otherwise have gone to private institutions.

Scholarship scheme targeted to poor and qualified students can avoid such perverse outcomes. Although such scheme is already in place in China, such as poor rural students provide national services instead of paying tuition and fees; yet, public universities are still guaranteed a captive clientele and thus insulated from the competitive pressures of having to justify the quality and cost-effectiveness of their educational services to users and communities. So scholarships should be untied students should be allowed to select institution of their choice, public or private. Thus spurring competition and promoting efficiency. The student loan schemes are also available in 37 public universities. However, to avoid re-emergence of blanket subsidy and higher default rates in future, loans should be given only to students who do not qualify for scholarships but who cannot fund studies from their own sources. Repayment programs should be made

into income-contingent payment systems where loans are repaid according to the post-graduate earnings of the borrower¹⁴.

Finally, although ample scope exists for cost savings and revenues from the sales of services to SOEs, donations, too much dependence on these sources may be counterproductive. Experience shows that the advantage in these cases may diminish beyond a revenue recovery rate of 15 percent, and educational institutions may turn into profit-making organizations. Evidence shows that in several OECD countries these sources do not contribute more than 10 percent of total university revenues¹⁵. University-run enterprises played an important role in income generation and may continue to do so. But institutions should undertake investments on the basis of comparative advantage and the demand for their products, sale and marketing of new technologies.

Concluding Remarks

As China consolidates the momentum of its rapid economic gains and drives more openly into the market environment, the quality of human resources will be an important determinant of the country's competitiveness. China has made impressive gains in human resource development in the past two decades, and continuing its strides will help redress poverty, both indirectly by increasing the productivity and efficiency of its labor force and directly by fostering the earning capacity of the poor. Eventually an enhanced human resources will spur economic growth and welfare. Yet, its progress has slowed steadily in recent years, mainly because of two broad problems. First, the distribution of educational services continues to discriminate against the poor, largely because they have not benefited from the recent gains in economic growth and are being choked off from service access. Second, some current mechanisms and arrangements for devolving services have created targeting inefficiencies. As such, this paper argues that the government's priorities are to enhance financing and improve the equity, efficiency and quality of social services

¹⁴ In countries where credit culture and discipline within the student population is relatively weak, early preparation for income-contingent deferred payment scheme is better. Such schemes have led to low default rates in Tunisia, Australia, Sweden, and Quebec Province of Canada.

¹⁵ For evidence see OECD, "Financing Higher Education" Paris, OECD 1990.

ANNEX 1

Table 1: School Age Dependency Ratios and Employment Trends

	1980	1985	1990	1995	Projected		
					2000	2010	2020
A. Dependency Ratio a/							
Male				48	47	44	37
Female				47	46	43	35
B. Employment By Sector (Percentage)							
Agriculture	74	60	59	53	46		
Industry	14	22	21	23	25		
Service	12	18	20	24	29		
C. Employment By Educational Qualification (Mil)							
Primary		72	92 ^b	35 ^c			
Post-primary		88	187 ^b	193 ^c			
Annual Average Growth Rate of Educated Labor							
Primary			5.0	-6.1			
Post-primary			17.1	0.6			

^aSchool-age population (5-19) relative to population aged 20 and above.

^b1992.

^c1993.

Table 2: Overall Indicators of Educational Development, 1993

	<i>Public Expenditure in Education as a Percentage of:</i>		Gross Enrollment Ratio (Percent)			<i>Grade Attendance</i>	<i>Cohort Survival Rate^{a/}</i>
	GNP	Public Spending	Primary	Secondary	Higher	(Year)	(%)
Bangladesh	1.9	11.3	59	18	5	4.0	25
Bhutan	3.8	8.6	31	5	0.1	1.6	16
China	2.0	12.1	104	51	2	5.6	68
India	3.3	13.9	99	41	10	5.2	39
Indonesia	3.6	14.8	119	48	9	7.5	61
Korea	3.4	16.7	105	87	38	11.8	97
Lao PDR	9.6	9.5	110	27	2	4.9	41
Malaysia	7.4	18.5	102	58	7	9.5	97
Mongolia	5.3	11.8	82	50	15	6.5	80
Myanmar	2.1	11.0	103	24	6	6.8	NA
Nepal	1.6	10.4	86	31	5	3.7	35
Pakistan	2.8						
Philippines	1.8	13.2	101	70	28	9.4	67
Papua New Guinea	7.0	15.3	72	14	3	4.5	67
Sri Lanka	3.2	10.7	107	71	6	10.0	87
Thailand	3.9	16.6	87	28	16	7.2	83
Viet Nam	1.3	5.6	105	40	5	7.1	60
Mean	3.6	12.6	93.1	41	10	6.4	60.2

^{a/} End of primary level.

Source: World Bank Data Base, unesco

Table 3: Enrollment Rates By Level of Education

Year	Primary	Secondary	Higher
1980	148	34	1.3
1985	118	39	1.7
1990	107	47	1.9
1995	104	50	2.2

Source: World Bank Data Base.

Table 4 : Public Expenditure on Education, 1983-93
(billion yuan)

Year	<u>Current prices</u>			<u>1987 Prices</u>			<u>As a percentage of</u> <u>Public</u>	
	<u>Recurrent</u>	<u>Capital</u>	<u>Total</u>	<u>Recurrent</u>	<u>Capital</u>	<u>Total</u>	<u>GNP</u>	<u>expenditure</u>
1983	10.38	2.41	12.79	8.03	1.87	9.90	2.2	9.9
1984	11.66	3.16	14.82	9.49	2.57	12.06	2.1	9.6
1985	14.02	4.38	18.40	12.66	3.96	16.62	2.1	10.0
1986	22.47	4.00	26.47	21.26	3.78	25.04	2.7	11.4
1987	24.21	3.56	27.77	24.21	3.56	27.77	2.5	11.3
1988	24.58	3.43	28.01	21.95	3.06	25.01	2.0	10.3
1989	24.68	3.64	28.32	20.06	2.96	23.02	1.8	9.3
1990	27.79	3.41	31.19	21.05	2.58	23.63	1.8	9.0
1991	30.17	3.47	33.64	21.44	2.47	23.91	1.7	8.8
1992	36.19	4.00	40.19	24.58	2.72	27.30	1.7	9.2
1993	55.11	4.48	59.60	38.27	3.11	41.39	2.0	12.1
Average	25.57	3.63	29.20	20.27	2.97	23.24	2.0	10.1
Annual average growth (%) ^a	12.4	10.6	12.2	4.7	3.0	4.5		

Note: Includes central and local government expenditures.

^aOLSQ growth rate.

Source: State Education Commission and Staff Estimate

Table 5 : Sources of Financing Total Education
(Percentage)

Sources	1991	1992	1993
Government Budget	68.4	67.2	65.7
Education Levy	10.1	10.5	9.4
Tuition & Fees	4.8	5.1	8.2
School Enterprise	5.4	5.4	6.1
Community Fund Raising	8.6	8.8	6.6
Other	2.7	3.0	4.0

Source: SEdC

Table 6: Public Expenditure on Education by Category

	<u>(Billion Yuan)</u>		<u>Percentage</u>	
	Personnel	Non- Personnel	Personnel	Non- Personnel
1990	24845	10807	69.7	30.3
1991	27100	11770	69.7	30.3
1992	33889	12515	73.0	27.0
1993	39951	11911	77.0	23.0

Source: SEdC

Table 7 : Public Expenditure by Level of Education

Year	-Current Prices (bil Yuan)-			----(Percentage)-----		
	Primary	Secondary	Higher	Primary	Secondary	Higher
1984	4.23	4.2	3.27	36.2	35.9	27.9
1985	5.26	5.21	4.02	36.3	36.0	27.7
1986	6.11	6.05	4.69	36.3	35.9	27.8
1987	8.03	7.75	6.06	36.8	35.5	27.7
1988	8.13	7.06	6.15	38.1	33.1	28.8
1989	10.30	9.53	8.46	36.4	33.7	29.9
1990	11.77	10.58	8.84	37.7	33.9	28.3
1991	12.64	11.35	9.63	37.6	33.8	28.6
1992	15.42	13.69	11.06	38.4	34.1	27.5
1993	21.33	20.03	18.22	35.8	33.6	30.6

Source: SEdC

Table 8: Expenditure on Education By Level of Government
(Percentage)

Year	Central	Local ^a	Total
1987	12.9	87.1	100
1988	14.1	85.9	100
1989	13.0	87.0	100
1990	13.7	86.3	100
1991	12.9	87.1	100
1992	13.2	86.8	100
1993	12.8	87.2	100

^aLocal Government Provincial+County+Municipality

Source: SEdC

Table 9: Urban Area: Affordability of Public Education: Private Educational Expenditure
By Quintile, 1992
(As a percentage of Non-food Expenditure)

Item	Poorest				Richest	
	I	II	III	IV	V	China
Textbook	1.28	1.02	0.89	0.73	0.52	0.81
Tuition						
Basic	8.47	6.98	5.91	4.55	3.34	5.24
Secondary	1.22	1.14	0.91	0.81	0.57	0.83
Higher	0.53	0.41	0.51	0.65	3.61	0.56
Stationaries	0.61	0.63	0.53	0.43	0.29	0.45
Others ^a	0.49	0.44	0.63	0.31	0.28	0.41
Total	14.24	10.52	9.34	7.41	5.56	8.21

^aAllowance, Contributions

Source: SSB: Urban Household Survey, 1992

Table 10: Rural Area: Affordability of Public Education: Private Expenditure By Quintile
of Province, 1992
(As a percentage of Non-food Expenditure)

Quintile of Province	Education	Health
Poorest I	19.0	15.1
II	15.6	14.0
III	18.2	14.6
IV	16.7	12..3
Richest V	14.4	11.5

Source: SSB: Rural Household Survey, 1992

Table 11: Quality of Basic Education: Reasons For Not Attending Schools, 1992
(Proportion of Children aged 7-14)

	Econo- mic	Poor Condition	Lack of Text book	Disabled	Other	Average
Quintile						
I	38.2	14.2	35.8	3.3	8.5	28.5
II	41.5	18.7	24.3	3.2	12.3	18.0
III	24.3	18.3	37.5	5.8	13.5	29.7
IV	25.8	22.5	30.0	5.1	16.4	16.2
V	13.5	16.0	21.2	13.8	13.6	12.8

Source: SSB: Situation Of Children 1992

Table 12: Quality of Higher Education: Relative Faculty Ratio (RFR), 1993
(By Quintile of Province)

Faculty	I	II	III	IV	V
Professor	0.66	0.61	0.84	0.83	1.61
Asst Prof	1.04	0.88	0.87	0.97	1.20
Lecturer	1.12	3.12	1.20	1.09	0.99
Assistant	0.92	1.29	1.07	0.92	0.88

RFR: (Provincial Faculty/Provincial Students)/(National Faculty/National Students) in Higher Education. RFR exceeding one indicates oversupply and less than one indicates undersupply of faculty.

Source: Staff Estimates From SEdC data.

Table 13: Vacancies by Educational Qualification ('000)

	1990	1995
Primary	24.5	21.0
Secondary	31.2	38.3
University	06.1	12.4

Source: MOL

CALCULATION OF THE RATE OF RETURN TO INVESTMENTS IN EDUCATION

Two main methods for estimating rate of return to investments in education were considered, namely (a) Elaborate method and (b) earning function method. The following sections illustrate these methods.

(a) *Elaborate Method*: Following Psacharopoulos (1973, 1985), the basic equation for this method is given by,

$$\begin{aligned} & \sum_{t=1}^N (Y_H - Y_S)_t (1+r) \\ & = \sum_{t=1}^c (Y_S)_t (1+r)^t \end{aligned} \tag{1}$$

Where, Y = labor earnings, H = higher education, S = secondary education and r = rate of return which is obtained by solving the above equation. The estimated rates of return for 1988 showed in the text were derived from an iterative computer program that begins with an arbitrary value of r and keeps modifying it by small increments until the left-hand side equalizes the right-hand side. For private rate of return, the only cost of education under evaluation is the opportunity cost of staying on in school beyond the age 18 instead of working in the labor market. Conventionally, this opportunity cost is measured by the earnings of labor with secondary school qualifications. For social rate of return, public unit costs of education are included in the right-hand side of equation (1).

In this respect, the earnings should be before-tax, whereas in the private rate of return, earnings should be net of tax. But, as Psacharopoulos (1985) points out, the post versus pre-tax treatment of earnings does not make any significant difference in the calculation of the rate of return. It is the added cost (unit costs) of schooling that chiefly explains the difference between these two rates of return. As a result, a social rate of return remains lower than a private rate of return.

The earning function method: The earning function starts with a regression equation of the following form:

(2)

Where Y is income and S is the level of schooling. This semilog equation is an inflexible functional form. The implication is one of increasing returns to education, unless second-order regressors are included. The parameters of a semilog equation are:

(3)

If b is constant, as Y increases aY/aS also increases. This imposes an inflexibility on the coefficients, which can be resolved by incorporating a higher-order terms in the regression equation. (3)

In tune with equation (3) the Mincerian model specifies a relation of the form

$$\ln Y = \alpha + \beta S + \beta_2 EX + \beta_3 EX^2 \quad (4)$$

where Y is income, S is schooling, E is experience and $S \times E$ is the schooling-experience interaction variable. As noted before, this function as the disadvantage of being inflexible but, if squared terms are included, the inflexibility is largely overcome.

The estimated regression coefficient b is interpreted as the average private rate of return to one extra year of schooling. Mincer also proved that

$$\beta = \frac{\partial \ln Y}{\partial S} = \tau$$

i.e., the rate of return is nothing but the relative change in earnings ($a \ln Y$) as a result of a change in schooling (aS). It is more appealing if one adds an educational level dimension to this average rate of return. The first way is to add an $e.s^2$ term in equation (4) where e is the estimated coefficient on years of schooling squared. A differentiation with respect to S yields

$$r = \beta + 2eS \quad (5)$$

By substituting different values of S in the RHS of equation (5), a regression-derived rate of return corresponding to different levels of schooling can be computed. Thus, for elementary education ($S=6$), secondary education ($S=12$) and higher education ($S=16$) can be assigned. Another way is to specify different levels in the earnings function by means of a series of dummy variables (as reported in Table 6), viz. ELEM, SEC and HIGH having a value of 1 if the person belongs to the particular educational level and 0 else:

$$\ln Y = \alpha + \beta_1 ELEM + \beta_2 SEC + \beta_3 HIGH + \beta_4 EX + \beta_5 EX^2 \quad (6)$$

From this equation, the return to different levels of education are derived from the estimated coefficients

$$\begin{aligned} \tau(\text{Elementary vs. illiterate}) &= \frac{\beta}{S_E} \\ \tau(\text{Secondary vs. elementary}) &= \frac{\beta_2 - \beta_1}{S_s - S_E} \\ \tau(\text{High vs. secondary}) &= \frac{\beta_3 - \beta_2}{S_H - S_s} \end{aligned}$$

Where, S_E = elementary schooling
 S_s = secondary schooling
 S_H = higher schooling

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