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Household Rates of Return to Education in Rural Bangladesh: Accounting for Direct Costs, Child Labour, and Option Value

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ABSTRACT *This study estimates the returns to boys' education for rural Bangladeshi households by accounting for some conventionally neglected items: direct costs of education, foregone child labour earnings, and option value. The estimated returns are 13.5% for primary education, 7.8% for junior-secondary education, 12.9% for higher-secondary education, and 9.7% for higher education; the resulting option value from primary education is 5.3%. These results suggest that there is economic rationale for non-poor rural households to invest in boys' education, especially at the primary level.*

KEY WORDS: Bangladesh; child labour; direct costs; option value; rate of return to education

Introduction

Economists traditionally use the rate of return to education (RORE) to understand household decisions on the education of its children (Becker, 1981). A negative RORE implies that education is an unattractive investment for the household, possibly resulting in the household not enrolling its children in school. Conversely, a positive RORE encourages household investment in education. A positive RORE, however, is a necessary but insufficient condition for investment in education because the household may also desire for a RORE to exceed the returns from alternative investments (e.g., physical capital), bank interest rates on educational loans (in case the household needs to borrow for financing education; Loury, 1981), and household discount rates (indicating the preference for current consumption over future consumption); if a RORE is less than these alternative returns, interest rates, and discount rates, then the household may not enrol children in school, and instead have them work. In this study, I conduct a RORE analysis that reflects the plight of rural Bangladeshi households towards the education of their boys; despite the tremendous private and social significance of educating girls, I avoid the analysis of girls because the

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22.8% labour force participation rate of females in Bangladesh raises severe sample selection issues that cannot be adequately corrected in RORE estimation (Salmon, 2002).

The contribution of this study is its consideration of conventionally neglected costs and benefits in the RORE estimation, which can have implications on educational investment decisions of households in a developing economy. Conventional RORE analyses consider the indirect cost of education in the form of foregone adult earnings (usually incurred at post-secondary levels of education) and benefits in the form of adult earnings (after a person no longer pursues an education); see Psacharapoulos and Patrinos (2004) for an extensive review of international RORE studies. I further consider three other items in the analysis: direct costs, foregone child labour earnings, and option value. Direct costs refer to tuition, fees, books, supplies, transportation, and private tutoring costs that are paid by the household. There is considerable evidence that total direct costs of education in developing countries are a heavy financial burden for many households, and a cause of low school enrolment and educational attainment (Tsang, 1994). Foregone child labour earnings are indirect costs (or opportunity costs) that arise because of the time spent at school and studying rather than working, and may discourage households from investing in education (Bennell, 1996).

The third item, 'option value' is perhaps the most neglected in RORE analysis. Weisbrod (1962) introduced the idea of option value from educational investment, describing it as 'the value of obtaining further education and the rewards accompanying it'. Weisbrod's description implies that option value is distinct from the conventionally accepted educational benefit of standard expected wage gain. In the case of primary education, there is option value arising from the fact that completion of primary education provides a benefit other than RORE: the option to invest in post-primary levels of education, which are not available to those who do not complete primary education. Later, Comay *et al.* (1973) and Eide and Waehrer (1998) broadly describe option value as the opportunity to obtain further education, measured as the additional benefits accompanying more education after factoring in the uncertainty concerning both acceptance into the next level and its successful completion. Appleton *et al.* (1996) measure option values from primary education for Cote d'Ivoire and Uganda (although they use the term 'neglected benefit' instead of option value), using the RORE for each level of education and the probabilities of a person completing each level of education. Following Appleton *et al.* (1996), I consider the option value arising from primary education, such that investment in primary education provides an option to invest and benefit from potentially lucrative RORE from post-primary level(s) of education, which would not be available if the household instead chooses to invest in physical capital or enjoy current consumption. The option value from primary education, therefore, is the total returns from post-primary (i.e., the total benefits after accounting for direct costs and foregone child labour earnings) weighted by the probability of finishing each level of education. The total benefit from primary education (i.e., RORE plus option value) can be compared with the typical expected rate of return on physical capital in Bangladesh or the household discount rate to understand whether education is a profitable investment in rural Bangladesh.

The goal of this study, therefore, is to understand the economic rationale for households in rural Bangladesh to invest in their sons' education by accounting for direct costs, foregone child labour earnings, and option value—each of which are conventionally neglected items in the RORE literature. This raises the

following question: Is there reason to suspect that these items may matter in the decision of rural Bangladeshi households (and hence household RORE)? The answer, as reported by rural Bangladeshi households, is affirmative at least for direct costs and foregone child labour earnings (Bangladesh Bureau of Statistics, 2003). In the next section, I present a background on Bangladesh. The third section describes the data and methodology for estimating household RORE and option values. The fourth section presents the results, and the subsequent section discusses the limitations of my analysis. Finally, I conclude with a summary and policy implications.

Background

Bangladesh is small and densely populated country in South Asia. Average annual growth rates in per-capita income accelerated from about 1.6% per annum in the first half of the 1980s to 3.6% by the latter half of the 1990s, and to 5.0% from the late 1990s to the 2000s (Mahmud, 2003). A slowdown in population growth and a sustained increase in the rate of Gross Domestic Product growth are cited as the main reasons for improvements in economic growth rates. Poverty, however, remains a major concern in Bangladesh. Of the over 135 million people in Bangladesh, 62.7 million are poor, of whom 53.5 million reside in rural areas (World Bank and Asian Development Bank, 2003, p. 6).

Poverty is a major reason behind household underinvestment in children's education in rural Bangladesh (Maitra, 2003). Rural Bangladeshi households, however, often invest more than rural households of neighbouring South Asian countries (World Bank and Asian Development Bank, 2003). Among children in the 6–10 age group, the school enrolment rate in rural Bangladesh is over 80% (for both boys and girls)—greater than the enrolment rates in rural India (73% for boys and 60% for girls) and rural Pakistan (65% for boys and 45% for girls; World Bank, 2000). These relatively impressive enrolment rates and gender parity are partly attributable to government and non-government campaigns on reducing direct costs and encouraging enrolment among the poor and girls (Chowdhury *et al.*, 2002). Investment in post-primary education, however, is a difficult decision for many rural households. Enrolment rates among children in the 11–15 age group is less impressive in rural Bangladesh (61% for boys and 66% for girls) compared with rural India (69% for boys and 50% for girls), and rural Pakistan (72% for boys and 67% for girls).

There is evidence that the direct costs of education and foregone child labour earnings are strong determinants of underinvestment in boys' education among rural Bangladeshi households. According to the 2002–2003 National Child Labour Survey (Bangladesh Bureau of Statistics, 2003, p. 42), 17.5% of households report that direct costs of education are the main reason for not sending their child to school, while 39.4% of households cite foregone child labour activities (either household work or wage work) as the main reason.

Another (related) reason for household underinvestment in boys' education in rural Bangladesh is that the RORE may not exceed the returns from alternative investments and the household's own discount rate (especially for the poor). A benchmark for returns from alternative interest rates is 12% (in real terms)—which was the prevailing bank lending rate interest in Bangladesh in 2000 (and therefore reflects a lower-bound expected rate of return on physical capital). According to Mincerian estimation techniques, the annual RORE for males in

Bangladesh has varied from 9.2% in 1996 (World Bank, 2000) to 6.2% in 2000 (Asadullah, 1996); the RORE for females are reportedly larger. Given that each level of education involves multiple years, these RORE estimates suggest that rural Bangladeshi households have had some incentive to invest in their children's education. These RORE estimates, however, do not consider the direct costs of education or foregone child labour earnings, and are therefore likely to be upwardly biased. Since there are reports that these costs are prohibitively large, I incorporate them in my estimation to assess the conclusion that education is an attractive investment for rural Bangladeshi households.

Data and Methodology

Data

The Bangladesh Household Income and Expenditure Survey (HIES) 2000 is the data source for the empirical analysis in this study. The HIES 2000 was a joint project of the Bangladesh Bureau of Statistics (a government organization) and the World Bank. The HIES 2000 contains detailed person-level, household-level, and rural community-level data, such as household composition, education, health, employment, asset-ownership, consumption, and expenditure from both urban and rural communities. It fulfils the data requirements for this study because of its data on educational attainment, child and adult labour market earnings, and direct costs of education. The survey strategy of the HIES 2000 is stratified and clustered, so that each household in the population has an equal probability of inclusion. The HIES 2000 sample consists of 7440 households and 38 512 people, and the subsample of males in the 6–60 age group is 15 833.

RORE Estimation Methodology

In terms of estimation methodology, I opt for the Full Method because it allows the incorporation of both the direct cost of education and foregone child labour earnings (Levin and McEwan, 2001), unlike the popular Mincerian Method (Mincer, 1974). While the Full Method offers the convenience of capturing more cost items, it raises at least two serious estimation concerns. The first concern is that the Full Method estimates cannot account for ability bias. Indeed, it is plausible that rational households invest more in the education of children with greater ability (relative to the other siblings). However, the child attributes that are observable to households are not observable in the data. Had households invested in less able children, the RORE estimates would have been lower. Therefore, by not accounting for ability bias, the Full Method RORE estimates are likely to be upwardly biased.

The second estimation concern with the Full Method is that it cannot account for selection bias. In the Bangladeshi labour force, the central selection bias issue among male workers arises from the fact that wage work is more desirable than self-employment and unpaid work (around 40% of all male workers engage in waged work, 45.6% engage in self-employment, and 14.8% engage in unpaid work; Salmon, 2003, p. 25). Presumably, waged workers enjoy certain unobservable attributes that make them attractive for wage employment; moreover, the same attributes also determine their wages. Since the Full Method is incompatible with selection-correction techniques, it is likely to yield upwardly biased estimates

(Card, 2001). In comparison with the Full Method, the Mincerian Method is superior in addressing selection bias—through the two-step correction method introduced by Heckman (1979) . In the results section, I consider selectivity-corrected Mincerian estimates for Bangladeshi males from Asadullah (2006), who also uses the HIES 2000. However, Asadullah finds no evidence of sample selection bias between waged work and other forms of work.[1]

Before proceeding to the methodology, it is necessary to address some basic characteristics of the sample. I assume that a household begins making its child activity decision when the child reaches the age of six because it is when children are socially encouraged to start primary education in Bangladesh. The education structure of Bangladesh involves five years of primary education, five years of junior-secondary education, two years of higher-secondary education, and typically four years of higher education. There are national level examinations at the end of junior-secondary and higher-secondary levels. Those who complete 10 years of education and the junior-secondary examinations receive a Secondary School Certificate (SSC), and those who successfully complete 12 years of education and the higher-secondary examinations receive the Higher-secondary School Certificate (HSC). Assuming household decisions are based on earnings from both the child labour and adult labour markets, the sample for the analysis consists of full-time male wage and salary workers aged 6–60 age group, who no longer pursue an education.

Using the Full-Method, the RORE for a level of education (r) equalizes the stream of discounted benefits to the stream of discounted costs, such that:

$$r_{primary} \Rightarrow \sum_{t=1}^{49} \frac{(W_{primary} - W_{none})_t}{(1+r_{primary})^t} = \sum_{t=1}^{5} (W_{none} + C_{primary})_t (1+r_{primary})^t \quad (1)$$

$$r_{ssc} \Rightarrow \sum_{t=1}^{44} \frac{(W_{ssc} - W_{primary})_t}{(1+r_{ssc})^t} = \sum_{t=1}^{5} (W_{primary} + C_{ssc})_t (1+r_{ssc})^t \quad (2)$$

$$r_{hsc} \Rightarrow \sum_{t=1}^{42} \frac{(W_{hsc} - W_{ssc})_t}{(1+r_{hsc})^t} = \sum_{t=1}^{2} (W_{ssc} + C_{hsc})_t (1+r_{hsc})^t \quad (3)$$

$$r_{higher} \Rightarrow \sum_{t=1}^{38} \frac{(W_{higher} - W_{hsc})_t}{(1+r_{higher})^t} = \sum_{t=1}^{4} (W_{hsc} + C_{higher})_t (1+r_{higher})^t \quad (4)$$

where the RORE (r) for a given level of education is estimated using the mean earnings (W), and mean annual direct cost of education (C) at the subscripted educational level. For example, in equation (3), ($W_{hsc} - W_{ssc}$) is the earnings differential between a person with completed higher-secondary education (subscript *hsc*) and a person with only junior-secondary education (subscript *ssc*); the time values (t) represent the year(s) from which the child begins earning after completing higher-secondary education, which in this case is 42 years (since the child completes higher-secondary education at age 17, and works from the age of 18 to 60). The numerator on the left-hand side of equation (3) shows the costs of pursuing higher-secondary education ($W_{ssc} + C_{hsc}$) after junior-secondary education: the

direct costs of higher-secondary education and the foregone child labour earnings of a child with junior-secondary education; these costs occur for two years (the length of higher-secondary education). For simplicity, I assume that the household RORE is the same as the private RORE in terms of the estimation technique, even though in reality households bear all of the costs of children's education but capture only a proportion of the children's future earnings (because children ultimately outlive their parents and provide for their own spouses and children; Barham *et al.*, 1995).

I use earnings data from both rural and urban adult labour market in the RORE estimation because there is evidence from neighbouring India that both rural and urban earnings influence the educational investment decisions of rural households (Kochar, 2004). Moreover, educated rural people usually migrate to urban areas. Labour market earnings of household members in the HIES 2000 are expressed in 2000 Bangladeshi Takas (when US$1 = Takas 52.40), and in some cases as in-kind quantities (which I value at the village-market price of the good, obtained from the community-level survey). The relevant subsample for estimating earnings are obtained from 5241 rural and urban male wage and salary workers in the 6–60 age group. I follow Basu *et al*. (2002), who exclude earnings of self-employed workers in their study of rural Bangladesh on the basis that farm or business profits are not attributable to a single household member and are instead accruing to the entire household; also, I exclude unpaid workers, the disabled, those pursuing an education, and the disabled. This subsample includes earnings data for 545 workers in 6–15 age group (this is consistent with the report that only 7.7% of all male child labourers in Bangladesh engage in wage work; Bangladesh Bureau of Statistics, 2003). Thus, I assume that households are open to sending their boys to urban areas for work; moreover, the evidence supports this assumption (Giani, 2006).

The direct costs at each level of education are estimated using the data on annual education-related expenses for each household member. I assume that household *expenditure* on tuition, fees, books and supplies, uniforms, private tutoring, transportation, and donations is a proxy for the direct *costs* of education. The relevant subsample for estimating direct costs consists of 2354 observations of rural males pursuing an education; rural households report not incurring costs for 3066 boys (none of whom are pursuing an education). For the 6–15 age-group, household report incurring costs for 1885 boys, and not incurring costs for 1939 boys.

Estimating Option Value

The method of estimating option value comes from Appleton *et al.* (1996). The household's option value from investing in primary education comes from the difference between the primary and post-primary RORE and the probability of completing each level of education. The RORE, however, need to be expressed in terms of wage premia (R), such that:

$$R_{primary} = r_{primary} \tag{5}$$

$$R_{ssc} = r_{primary} + r_{ssc} \tag{6}$$

$$R_{hsc} = r_{primary} + r_{ssc} + r_{hsc} \tag{7}$$

$$R_{higher} = r_{primary} + r_{ssc} + r_{hsc} + r_{higher} \tag{8}$$

The other component of estimating option value is the uncertainty of a child completing each level of education. The first step to estimating probabilities is to estimate the transition rates (τ), using the HIES 2000 sample of rural and urban males in the 16–25 age group who no longer pursue an education. The underlying assumption is that rural households make decisions based on educational and labour market outcomes of a recent cohort; also, both the rural and urban sample of males are used because educated people have a tendency to migrate to urban areas.[2] The transition rates for each level are as follows:

$$\tau_{primary} = \Pr(primary) = \frac{\text{Number with educational attainment of primary or greater}}{\text{Number with education attainment of all levels}} \tag{9}$$

$$\tau_{ssc} = \Pr(ssc \mid primary) = \frac{\text{Number with educational attainment of secondary or greater}}{\text{Number with educational attainment greater than primary}} \tag{10}$$

$$\tau_{hsc} = \Pr(hsc \mid ssc) = \frac{\text{Number with educational attainment of higher - secondary or greater}}{\text{Number with educational attainment greater than secondary}} \tag{11}$$

$$\tau_{higher} = \Pr(higher \mid hsc) = \frac{\text{Number with educational attainment of higher education}}{\text{Number with educational attainment greater than higher - secondary}} \tag{12}$$

I assume that every child who completes a certain level of education attempts to complete the next level of education (i.e., a person does not drop out immediately after finishing a level of education). The reasons behind a child not completing a level of education can be either household-related or education system-related. A child may not complete a certain level of education if his household faces an emergency (e.g., the death of the principal income earner), forcing it to pull the child out of school. The education system can also prevent a child from completing a level of education by providing low-quality education, keeping direct costs high, and using stringent testing methods.

Using these transition rates, I measure the uncertainty of a child completing a level of education by calculating the probabilities:

$$p_{primary} = (1 - \tau_{ssc}) \tag{13}$$

$$p_{ssc} = (1 - \tau_{hsc})\tau_{ssc} \tag{14}$$

$$p_{hsc} = (1 - \tau_{hsc}) \times \tau_{ssc} \times \tau_{primary} \tag{15}$$

$$p_{higher} = (1 - \tau_{higher}) \times \tau_{hsc} \times \tau_{ssc} \times \tau_{primary} \tag{16}$$

where the probabilities (p) indicate the child's chances of progressing to the subscripted level of education and all others before it. These probabilities must sum to unity, or:

$$p_{primary} + p_{ssc} + p_{hsc} + p_{higher} = 1 \tag{17}$$

Prior to investing in a child's primary education, the household considers the economic rationale for investing in a child's education based on:

$$R^* = R_{primary}p_{primary} + R_{ssc}p_{ssc} + R_{hsc}p_{hsc} + R_{higher}p_{higher} \tag{18}$$

where the expected benefits (R^*) is a function of wage premia (and therefore RORE) at each level and the probability of completing a level of education and all other before it. The last step in determining the option value involves calculating the difference between the expected RORE (from all levels of education) and the RORE from completing primary education, such that:

$$\begin{aligned} R^* - R_{primary} &= R_{primary}p_{primary} + R_{ssc}p_{ssc} + R_{hsc}p_{hsc} + R_{higher}p_{higher} - R_{primary} \\ &= (R_{ssc} - R_{primary})p_{primary} + (R_{hsc} - R_{primary})p_{hsc} + (R_{higher} - R_{primary})p_{higher} \end{aligned} \tag{19}$$

The total expected benefits of primary education (i.e., conventional RORE plus option value) can be compared with the benchmark value of 12%.

Before proceeding to the results, I must emphasize that the transition rates and probabilities are illustrative and should be treated with caution for several reasons. First, a number of educational interventions are in place (Chowdhury *et al.*, 2002), which the age 16–25 cohorts did not benefit from. Therefore, the transition rates and probabilities of today's children are likely to be higher. Second, school participation rates in urban areas are greater than rural areas of Bangladesh, implying that an averaging procedure yields upwardly biased transition rates and probabilities. Unfortunately, I cannot address this issue because the HIES does not collect information on the location of education for those who no longer pursue an education. Third, the derivation of probabilities from transition rates is arbitrary because different households face different transition rates and probabilities. A poor household, for example, faces a lower transition rate than a middle-income household; conversely, the transition rates may understate the transition rates facing middle-income households.[3]

Results

Descriptive Statistics

Figure 1 illustrates the age–earnings profiles of child and adult male wage and salary workers in Bangladesh; Appendix 1 presents the means, standard deviations, and sample sizes. The age–earnings profile for the 6–60 age group shows that there are benefits from greater educational attainment. Workers without primary education face bleak labour market prospects, with earnings remaining

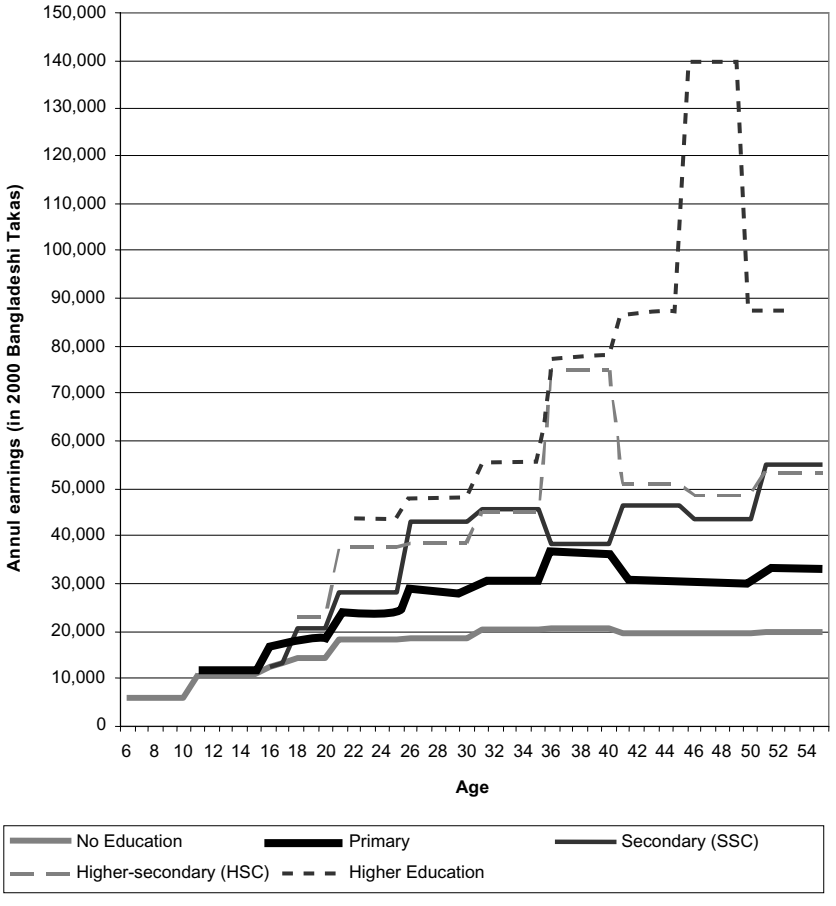

Figure 1. Age–earnings profiles for male workers in Bangladesh. *Source:* Author's calculations using HIES 2000; the values are based on weighted data. *Note:* (1) Sample size is 5241 males in the 6–60 age group; sample consists of rural and urban wage and salary workers, who are no longer pursuing an education. (2) Monetary values are expressed in 2000 Bangladeshi Takas (US$ 1 = Takas 52.40).

flat throughout their working lives. Primary education completers enjoy comparatively greater earnings than workers without primary education do. The age–earnings profiles of junior-secondary and higher-secondary education completers intersect at some points, but higher-secondary education completers typically earn more. Workers with higher education degrees earn substantially more than other workers (except when compared with higher-secondary completers in the 35–40 age group). Appendix 1 presents the summary statistics for this sample of earnings by age group.

Figure 2 presents the average annual direct costs that a typical rural Bangladeshi household faces for educating a boy at primary, junior-secondary, higher-secondary, and higher education levels; Appendix 1 presents the means, standard deviations, and sample sizes. With average annual per-capita expenditure in rural Bangladesh of Tk. 8964, the direct costs of post-primary education appear prohibitive especially for households enrolling two or more children in school (average household size is 4.9). Average annual primary education costs are

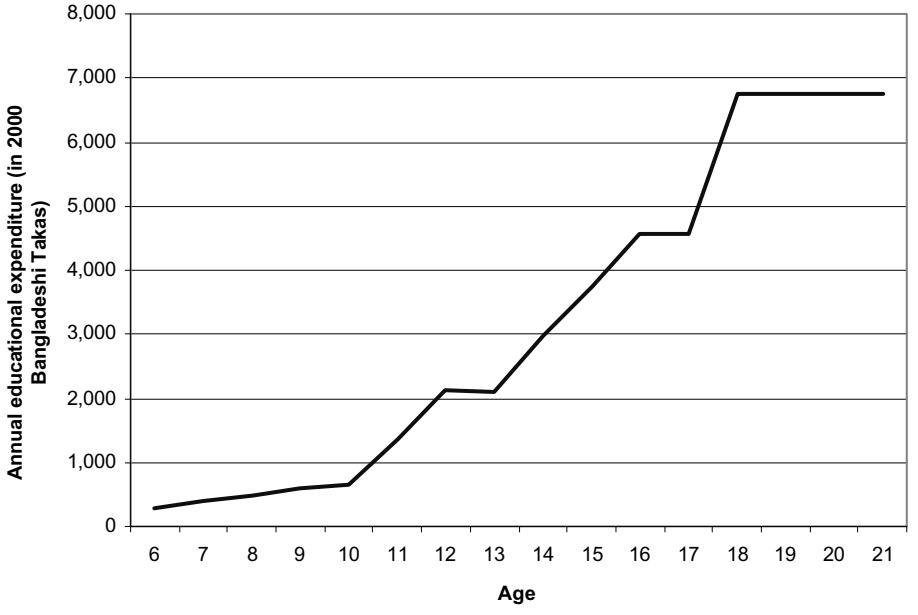

Figure 2. Average annual direct cost of education for males by age. *Source:* Authors calculations using HIES 2000; the values are based on weighted data. *Notes:* (1) Calculated using a sample of the 2796 rural boys pursuing an education. (2) Monetary values are expressed in 2000 Bangladeshi Takas (when US$ 1 = Takas 52.40).

comparatively low at Tk. 517 (corresponding to 5.8% of average per-capita expenditure in rural Bangladesh), reflecting government policies of eliminating compulsory schooling fees (although households still incur some fees, private tutoring, books, supplies, and transportation costs). Direct costs at the junior-secondary and higher-secondary education levels jump to Tk. 2515 and Tk. 4559 (i.e., 28.0% and 50.9% of average rural per-capita expenditure). For higher education, direct costs rise to Tk. 6761 (i.e., 75.4% of average rural per-capita expenditure), partly because of increased transportation, room, and board costs (since higher education institutions are usually not located near villages).

RORE and Option Value Estimates

Table 1 presents the RORE and probabilities for all education levels. After accounting for both direct costs and foregone child labour and adult earnings, the RORE are as follows: 13.5% for primary education (versus below primary education), 7.8% for junior-secondary education (versus primary education), 12.9% for higher-secondary education (versus junior-secondary education), and 9.7% for higher education (versus higher-secondary education). The household faces, however, considerable uncertainty because the child may or may not complete a level of education. This uncertainty is partly captured by the transition rates. For example, there is a 48.7% chance of completing primary education, 33.4% of junior-secondary completion, 44.4% chance of completion of higher-secondary, and 55.0% chance of completing higher education. The transition rates (using equations (13)–(16)) provide the probabilities. For example, the probability of a

Table 1. Estimates of RORE and option value from primary education for rural boys

	Rate of return to education (r)	Wage premium (R)	Transition rate (τ)	Probability of completion
Full Method (with all costs)				
Primary	0.1354	0.1354	0.4872	0.6660
Junior-secondary	0.0778	0.2132	0.3340	0.1858
Higher-secondary	0.1291	0.3423	0.4437	0.0668
Higher	0.0974	0.4397	0.5495	0.0814
Option value	0.0530			
Full Method (direct costs only)				
Primary	0.3058	0.3058	0.4872	0.6660
Junior-secondary	0.2406	0.5464	0.3340	0.1858
Higher-secondary	0.0980	0.6444	0.4437	0.0668
Higher	0.0906	0.7350	0.5495	0.0814
Option value	0.1023			
Full Method (foregone child labour earnings only)				
Primary	0.1430	0.1430	0.4872	0.6660
Junior-secondary	0.0812	0.2242	0.3340	0.1858
Higher-secondary	0.1656	0.3898	0.4437	0.0668
Higher	0.1044	0.4942	0.5495	0.0814
Option value	0.0602			
Mincerian method				
Primary	0.3100	0.3100	0.4872	0.6660
Junior-secondary	0.3100	0.6200	0.3340	0.1858
Higher-secondary	0.1240	0.7440	0.4437	0.0668
Higher	0.2480	0.9920	0.5495	0.0814
Option value	0.1421			

Notes: (1) Based on author's estimates from HIES 2000; the values are based on weighted data. The subsample of child and adult earnings comes from 5241 urban and rural male waged workers in the 6–60 age group who no longer pursuing an education. (2) The direct costs come from 2796 observations on average annual expenditure on rural males by level of education. See Appendix 1 for details. (3) Mincerian estimations are from Asadullah (2006); these RORE estimates are corrected for sample selection bias. (4) Option values refer to the additional benefit from primary education. For example, under the Full Method, the option value for primary education, assuming that the household only foregoes child labour earnings (but no direct costs) is: $(0.1430 \times 0.6660) + (0.2242 \times 0.1858) + (0.3898 \times 0.0688) + (0.4942 \times 0.0814) = 0.0622$ or 6.2%.

child completing all levels of education is 0.0814. Since the option value of completing primary education is the weighted wage premia of all levels of education, the resulting option value is 5.3%, implying a total benefit of 18.8%. If there are physical capital investments with expected returns of at least 12%, then net benefit of primary education (over physical capital investment) is 6.8% at the most. In reality, however, imperfect capital markets for the poor imply that the relevant borrowing interest rate for most rural Bangladeshis is much higher than the 12% benchmark. Another benchmark, therefore, is the household's discount rate. Since estimates from other developing countries suggest average household discount rates of 15% (Tzannatos, 2003; Anderson *et al*., 2004), the conclusion on economic rationale in household investment in primary education of boys in rural

Bangladesh remains unchanged. Of course, the discount rates for the poorest households are greater, implying that the poorest households may prefer current consumption to investment in boys' education.

Sensitivity Analysis

I examine the sensitivity of these conclusions under various other costing and estimation techniques, without changing the transition rates and probabilities. These alternative estimates are also shown in Table 1. Estimating RORE with direct costs (and adult foregone earnings) but without foregone child labour earnings increases RORE values to 30.6% for primary education, 24.1% for junior-secondary education, 9.8% for higher-secondary education, and 9.1% for higher education; the resulting option value from primary education increases to 10.2%. In contrast, assuming a household incurs foregone child labour earnings but no direct costs of education changes RORE estimates to 14.3% for primary education, 8.1% for junior-secondary education, 16.6% for higher-secondary education, and 10.4% for higher education; the resulting option value from primary education increases to 6.0%. Finally, I consider the Mincerian returns to education in Bangladesh (corrected for sample selection bias arising from the entering wage work versus other types of work) obtained from Asadullah (2006); as discussed earlier, Asadullah does not find evidence of selection bias (the data source is also HIES 2000). The annual RORE of 6.2% yields level returns of 31.0% for primary education, 31.0% for junior-secondary education, 12.4% for higher-secondary education, and 24.8% for higher education; the resulting option value from primary education is 14.2%. Thus, my RORE and option value estimates are smaller than methods that are more conventional. Nonetheless, all the RORE estimates in Table 1 imply that there is economic rationale for investment in primary education.

Limitations of the Analysis

The analysis in this paper suffers from number of limitations, in addition to the exclusion of females, ability bias, selection bias (from excluding self-employed workers and unpaid workers), and random estimates of transition rates and probabilities. Under each of the RORE estimation techniques in the previous section, the total benefits from primary education (i.e., RORE plus option value) exceed the 12% bank interest rate and 15% household discount rate (although discount rates for poor households are much larger). There are also reasons to suspect that my RORE estimates are biased. Having upwardly biased RORE estimates implies that investment in education is actually less profitable for rural Bangladeshi households than my estimates suggest. As discussed earlier, households bear the cost of education but retain only some of the benefits of investment because children outlive their parents and ultimately share their earnings with their spouses and children. Another reason for upward bias in the RORE estimates is the inability to capture labour market imperfections. The presence of nepotism and social networks in Bangladesh's labour markets entails that educational attainment by itself is often inadequate to secure employment (Opel, 2000). The scenario that education may not necessarily lead to a corresponding level of employment and earnings is likely to determine the educational investment decisions of most rural households—since they are at a

distinct disadvantage in terms of nepotism and social networks. I cannot incorporate nepotism and social networks in the RORE estimation because it violates the perfect labour markets assumption. Thus, actual RORE are likely to be lower than my estimates suggest.

In contrast, having downwardly biased RORE estimates implies that investment in education is more profitable than my estimates suggest. As commonly encountered in RORE analyses, data and measurement difficulties prevent the inclusion of non-pecuniary benefits such as improved health, nutrition, family planning, home production, and human capabilities (Behrman *et al.*, 1999; Sen, 1999). Rural households may even benefit from some non-pecuniary 'option value' from the child, such as job options, income–leisure–security options, additional schooling options, on-the-job learning options, and way-of-life options (Weisbrod, 1962). Indeed, a household may value such non-pecuniary benefits sufficiently to invest in education. Another reason for actual RORE being greater than my estimates is that households opt to have their children combine schooling and child labour—in effect lowering foregone child labour earnings.

Finally, there are factors with an ambiguous effect on my RORE estimates. I use cross-sectional labour market earnings data for a cohort of workers, based on the assumption that households use the earnings of older cohorts to form expectations on future earnings. However, this assumption is invalid for households that have more optimistic earnings expectations or pessimistic earnings expectations. In addition, RORE estimates assume market equilibrium, and to say that households base their decisions on RORE implies that the demand for educated workers always equals the supply of educated workers, leaving the equilibrium earnings for educated workers unchanged. If the pace of job creation, however, is slower than the number of workers entering the labour force, then the market-clearing earnings will fall, in turn reducing RORE and making investment in education less attractive to a household. In the opposite case (of the job creation exceeding the number of workers available), the equilibrium earnings and RORE rise, thus making education more attractive to the household. Therefore, while households may anticipate these labour market changes and incorporate them into their RORE, it is complicated to consider the changes in RORE estimation.

Summary and Policy Implications

After accounting for direct costs and foregone child labour earnings, I find that household RORE for rural boys is 13.5% for primary education, 7.8% for junior-secondary education, 12.9% for higher-secondary education, and 9.7% for higher education. Investing in boys' primary education, however, also provides the household with the possibility of benefiting from RORE to higher levels of education. The value of this option—referred to here as the 'option value'—is an additional 5.3% to the RORE to primary education. Thus, rural Bangladeshi households whose expected returns to physical capital, bank interest rates for educational loans, and household discount rates are less than 18.8% have economic rationale to invest in the primary education of boys. There are, however, a number of issues that affect my RORE estimates but are not incorporated in this study. These issues arise from the following: ability bias; selection bias; unreliable transition rates and probabilities; inability to value the earnings of

self-employed workers and non-pecuniary benefits; uncertainty over the share of RORE captured by boys' households; and not incorporating changing household expectations on education sectors and labour markets.

Given the high incidence of poverty in rural Bangladesh, however, discount rates for most rural Bangladeshi households are likely to exceed 18.8%. In terms of policy implications, therefore, this study draws attention to the risk of household underinvestment in boys' education in rural Bangladesh. The methodology and results of this study offer the following educational policy directions for increasing the attractiveness of investment in boys' education: increasing labour market earnings of educated workers; reducing direct costs; lowering foregone child labour earnings; improving transition rates; decreasing household discount rates; and offering favourable interest rates and conditions on educational loans. Increasing labour market earnings may be possible through improving the quality (in terms of teachers and facilities) of rural and national educational institutions (CAMPE, 1999). Reducing the direct costs of education involves rural educational institutions charging less, particularly at post-primary levels; this may be achieved through increased government subsidization or more equitable education financing mechanisms where households pay (or receive reimbursement) according to their socio-economic status. Lowering foregone child labour earnings can involve schools adopting hours of operation that allow children to combine work and education, or compensating households by providing cash transfers in exchange for school enrolment. Transition rates may be increased through campaigns encouraging rural parents to keep children in school, and (again) by improvements in the quality of educational institutions. Decreasing household discount rates is challenging and complex, as it involves improvements in economic conditions, expectations, and tastes; such measures are typically beyond the scope of education policy-makers, and require broad economic development and growth. The final policy recommendation on increasing the attractiveness of education as an investment to rural households involves lowering interest rates for educational loans, and allowing lengthy periods to payoff the loans (thereby allowing the child to become an adult and assist his household with loan repayments).

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Notes

1. In the first step, Asadullah estimates a probit for waged work participation, which produces the sample selectivity term. In the second step, he includes the selectivity term as a dependent variable in the ordinary least squares regression. In identifying the sample selectivity term, he measures non-labour income using both direct measures (e.g., income from sales and output of assets, remittances, rents, and intrahousehold transfers) and indirect measures (i.e., land ownership) to determine participation in waged work.

2. It may appear inconsistent to use the 16–25 age group's educational attainment (to calculate probabilities), while using the 16–60 age group's earnings (for RORE estimates). The explanation for considering the older cohort is that we cannot observe future wages of the 16–25 age group from a cross-sectional data-set, and therefore have to assume that the earnings of older cohorts reflect future wages of today's children.
3. A more sophisticated analysis would involve estimating transition rates using a probit regression, using family background data (e.g., Eide and Waehrer, 1998 —who use the National Longitudinal Survey from the United States). This approach is ruled out because family background information in the HIES 2000 is only available for the minority of boys who still live with their households despite completing education (and not those who have set up their own households).

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Appendix 1. Summary statistics for earnings and costs of males by age and educational attainment

	Below primary	Primary	Junior-secondary	Higher-secondary	Higher education
Earnings					
6–10 age group	5971	N/A	N/A	N/A	N/A
	(872)				
11–15 age group	10 804	11 916	26 100	N/A	N/A
	(418)	(882)	(900)		
16–20 age group	14 299	18 233	24 261	32 907	N/A
	(438)	(722)	(3399)	(8426)	
21–25 age group	18 181	23 602	27 880	41 315	43 116
	(565)	(970)	(2429)	(11 661)	(6608)
26–30 age group	18 720	28 492	42 780	39 063	48 109
	(526)	(1485)	(3259)	(4868)	(4025)
31–35 age group	20 196	30 610	46 154	47 813	54 460
	(597)	(1662)	(4096)	(11 074)	(6182)
36–40 age group	20 537	36 328	38 243	75 137	77 743
	(4569)	(2259)	(3662)	(16 803)	(8621)
41–45 age group	19 398	30 533	46 436	50 802	87 209
	(774)	(2258)	(4894)	(4474)	(7648)
46–50 age group	19 464	30 829	43 743	48 594	13 9772
	(851)	(2357)	(4770)	(4678)	(22 703)
51–55 age group	19 799	32 976	55 220	53 516	88 595
	(1108)	(3760)	(7520)	(6683)	(8577)
56–60 age group	18 883	20 700	64 124	39 503	14 2867
	(1519)	(3524)	(6745)	(11 604)	(59 819)
Sample size	3191	1219	297	221	313
Direct cost	N/A	517	2515	4559	6761
		(19)	(88)	(340)	(710)
Sample size	N/A	1327	768	171	88

Notes: (1) Earnings sample is obtained from 5241 rural and urban male workers in the 6–60 age group (who are no longer pursuing an education); (2) Direct costs calculated using a sample of the 2796 rural boys pursuing an education; (3) Monetary values are expressed in 2000 Bangladeshi Takas (when US$ 1 = Takas 52.40).