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# LABOUR MARKET RETURNS TO EDUCATION: EVIDENCES FROM BANGLADESH

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## ABSTRACT

*This study estimates the rate of returns to education (RORE) in Bangladesh at the individual level. Adopting the Mincer earnings function, the study attempts to obtain robust and unbiased estimates of RORE by applying both IV 2SLS and Heckman two step procedures. Parents' and spouse's education have been used as IV in two separate models and are found to be strongly related to schooling of individuals. Significant selection and endogeneity bias exists in the OLS estimation. Results indicate RORE is considerably low in Bangladesh.*

***Keywords***: returns to education, endogeneity, sample selection, assortative mating.

## 1. INTRODUCTION

Investments in education have long been considered a fundamental part of any sustainable process of economic development and growth (Barro, 1996; Romer, 1990; Mincer, 1974). The analysis of returns to education is thus useful to assess the effectiveness of education in developing human capital. It also provides incentive for individuals to invest in their own human capital. The findings of this study may be used for overall policy guidelines as well as to design specific reforms or public interventions in the education sector.

The purpose of this paper is to estimate the private rate of returns to education (RORE) in Bangladesh. As establishing a causal relationship between education and earnings is problematic due to a number of possible biases, the paper emphasizes on methodological robustness in estimation. Number of studies in this field is very few in the country due to lack of available data and most studies (Hussain, 2000; Asadullah, 2006; Sen & Rahman, 2015) have used methods that may not produce unbiased or consistent estimates of labour market returns to education. This paper therefore attempts to fill the gap by estimating unbiased estimates of RORE in Bangladesh. A mix of estimation methods has been applied: (i) Ordinary Least Square, (ii) Heckman two-step procedure for selection correction, and (iii) Two-Stage Least Square for endogeneity correction. The study uses nationally representative Household Income and Expenditure Survey (HIES) data for the year 2010 to compute RORE.

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The layout of this paper is planned as follows. The following section discusses related literature. Section 3 describes the methodologies applied in estimation. Section 4 presents a brief explanation of the dataset used and specification of variables. The results are analysed and discussed in Section 5 and the paper conclusion is in Section 6.

## 2. LITERATURE REVIEW

Literature on RORE dates back since late fifties - the decade termed in economics literature as the "human investment revolution in economic thought"(Schultz, 1961; Becker, 1964; Mincer, 1974). Expenditures on education, whether by the state or households, have been treated as investment flows that build human capital. The estimation method used during the first wave of RORE literature applied a net present value (NPV) method. This method calculates RORE by accounting for the expected direct costs of schooling and forgone current income (Psacharopoulos, 1981). The NPV method however is not so popular in calculating RORE, mainly because it does not have a readily understandable interpretation. Moreover, problems related to endogeneity and selection biases cannot be eliminated in this method. Shafiq, (2007) used the NPV method to compute RORE in Bangladesh. In his estimation the author assumed household RORE is the same as individual RORE and used annual expenditure on education as a proxy for direct cost of education. His results therefore may not be accurate firstly in the sense that this method does not account for the selection and endogeneity biases and secondly, because the assumptions and proxies that the author applied may not represent true individual returns to education.

The second wave of the RORE literature started sometime in the early 1970s after Becker's (1964) publication on human capital theory gave prominence to the subject. During this time Mincer's (1974) pioneering estimation technique known as the 'human capital earnings function' became widely acknowledged and still tends to be the dominant RORE estimation procedure. Psacharopoulos for example had computed RORE a number of times with the application of Mincer earnings function and found positive and higher returns for low or medium income countries than higher income countries; higher returns for women than for men; and a declining RORE over the years despite rising school enrollments indicating growing demand for skilled workers in the labour markets (Psacharopoulos & Hinchliffe, 1973; Psacharopoulos, 1989; Psacharopoulos, 1994).

Mincer's approach is popular due to its simplicity and robustness in obtaining marginal labour market returns of attaining one additional year of education. The econometric issues associated with the model occur mainly due to the schooling variable being endogenous meaning that some other factors namely an individual's innate ability or individual heterogeneity may be influencing his or her level of education. The econometric approach for dealing with individual heterogeneity or endogeneity bias involves using instrumental variables (IV) estimation technique. The IV 2 Stage Least Squares (2SLS) estimation approach was originally developed by Theil, (1953). The method replaces the endogenous explanatory variable by a prediction that is asymptotically uncorrelated with the error term.

A valid instrument generally has to satisfy three criteria: (i) relevance to the endogenous variable, (ii) not correlated to error term and (iii) not included in the original model. Family background factors (e.g parents/sibling/spouse education) have been widely used in literature as instrumental variables. Hoogerheide, Block, & Thurik, (2012) for instance showed through a Bayesian approach that family background factors are valid and strong instruments for schooling. Trostel, Walker, & Woolley, (2001) used spouse's and parents' schooling as instruments in estimating RORE for 28 countries and found they are strongly correlated instruments showing that the IV estimates are over 20% higher than OLS estimates.

Studies on assortative mating on the other hand have showed high correlation between education attainment of wives and their husbands implying spouse's education is a valid instrumental variable (Mare, 1991; Pencavel, 1998; Lewis & Oppenheimer, 2000; Behrman & Rosenzweig, 2002; Fernandez, Guner, & Knowles, 2005; McCrary & Royer, 2011; Anderberg & Zhu, 2014). A very recent study by Hahn, Nuzhat, & Yang, (2018) in Bangladesh has presented strong empirical evidence of a positive relationship between couples' educational attainment. The authors have used eligibility for female secondary school stipend programme in Bangladesh as an instrument in estimating causal effects of female education on marital outcomes. Results show prevalence of positive assortative mating in the marriage market implying educated women are inclined to marry more educated men.

Another very common problem in the literature concerning returns to schooling is bias due to sample selection. The problem of sample selection bias arises due to non-random selection into waged work, i.e. estimates are based only on those individuals for whom the wages are observed. In order to avoid this problem, Heckman, (1979) two-step procedure has been applied broadly in literature. Kim, (2011) for example used Heckman's two-step estimation method to correct for possible sample selection bias in the Korean labour market data. He reported significant differences between the results obtained with and without sample selectivity correction. The said two-step estimation has also been used by Arabsheibani & Mussurov, (2007) for Kazakhstan data set. This is one of the studies that corrected for both endogeneity and sample selection biases at the same time. After correcting for sample selectivity, their IV estimates for returns to schooling dropped by 3 percentage points compared to OLS estimates. In this study we also use a similar approach that applies both methods in the same model.

The Heckman approach has been applied by Asadullah (2006) for estimating RORE in Bangladesh by using HIES data for the year 2000. In his estimation the author did not apply IV, but used Heckman in computing RORE for waged workers, and separately for men and women, and rural and urban workers. Interestingly, the author did not find presence of selection bias in the model.

A notable study of RORE in Bangladesh was carried out by Sen and Rahman (2015) for the Planning Commission of the Government of Bangladesh where the authors made a rigorous study including comparisons of RORE among levels of education, gender, location and type of schools. The study however did not account for possible endogeneity or selection biases.

The OLS estimate for RORE is expected to be biased upward due to individual heterogeneity or 'ability' bias. As a result, endogeneity corrected IV estimates of RORE should be lower than the OLS estimates. However, evidences from a number of empirical studies suggest that the IV estimates of returns to schooling are significantly higher than the corresponding OLS estimates (Card, 1999). A number of hypotheses have been offered to explain this puzzling result in Card (1999). Correction of selection bias, on the other, may reduce or increase the size of the OLS estimate depending on the nature of selection. For example, if individuals do not participate in the labour market because of low returns to education, the OLS estimates will be biased upward and thus correcting for selection bias will lower RORE.

## 3. METHODOLOGY

In this study we apply the standard Mincerian approach where education-earnings relationship is explained by a semi-logarithmic equation. In order to circumvent potential endogeneity and selection bias in the model we also adopt 2SLS technique and the Heckman two-step correction method respectively. We start by estimating the Ordinary Least Squares (OLS) regression of the earnings function of the following form:

$$\log (wageph) = \beta_0 + \beta_1 edu + \beta_2 exp + \beta_3 exp^2 + \beta_4 male + \beta_5 muslim + \beta_6 rural + \varepsilon i$$

Here $\beta_1$ is the coefficient of *edu* which is our variable of interest representing the economic rate of returns to an additional year of schooling. The dependent variable is the log of wage per hour. *exp* is years of labour market experience calculated as age-6-schooling years[1]. $exp^2$ is a quadratic term used to allow for a possible decline in the returns to work experience over the individual's lifetime. The additional control variables included in the model are all defined in due course.

OLS estimates are likely to be biased due to the endogeneity of the schooling variable. The coefficient on schooling in the earnings function can only be interpreted as the causal effect of education on earnings if earnings differentials between individuals with varying years of schooling do not reflect differences in unobserved ability. Due to the presence of the unobserved factor 'ability' which may be correlated with education, the RORE estimate is expected to be biased. This issue is addressed by applying 2SLS method.

[1]It is assumed that individuals have immediately started work after stopping or finishing school (Mincer, 1974).

The instrumental variables chosen to carry out the 2SLS process are mother's, father's and spouse's education. Since data for mother's and father's education are only available for 1204 observations, we estimate a separate OLS on this reduced sample for comparison. Data for spouse's education is available for the full sample of 6008 married individuals; so we also estimate OLS separately for the married sample.

The study also accounts for possible bias of selection into waged work. Selection bias can exist as we are including only waged workers in the sample. The non-waged workers (e.g. day labourers, informal sector workers) who do not earn a fixed stream of income are excluded from the sample. We are also omitting the unemployed whose potential wage offers are unobservable. The Heckman's correction method, also known as the Heckit two step method is therefore applied to account for the possibility of selection bias by estimating probabilities of waged work participation.

As exclusion restrictions in the first stage of Heckman, variables for household size and remittances received are included as determinants of waged work participation. Inverse Mills ratio (IMR) computed from the first stage estimation is inserted into the second stage equation to obtain estimates free of selection bias.

Additionally, as we estimate the wage equation for the sample of married people taking spouse's education as instrument, we also estimate a third equation to correct for both the biases.

$$\log(wageph) = \beta_0 + \beta_1 \widehat{edu} + \beta_2 exp + \beta_3 exp^2 + \beta_4 male + \beta_5 muslim + \beta_6 rural + \beta_7 invmills + u$$

Here *eduhat* is estimated from the first stage of 2SLS and *invmills* is the IMR obtained from the first stage of Heckman. The coefficient $\beta_1$ now gives us the estimate for RORE after eliminating both endogeneity and selectivity biases. We therefore see 3 steps involved in this Heckman-IV combined method:

**Step 1:** Estimate first step Probit equation for Heckman and obtain the inverse Mill's ratio (IMR)

**Step 2:** Estimate the first stage IV regression with instruments and obtain $\widehat{edu}$

**Step 3:** Estimate the second stage IV regression including $\widehat{edu}$ obtained from Step 2 and IMR obtained from Step 1

Table 1 demonstrates the steps involved and variables used in the Heckman-IV combined method for estimating RORE[1].

**Table 1: Steps Involved in the Heckman-IV Combined Method**

| Explanatory Variables | 1st Step | 2nd Step | 3rd Step |
|---|---|---|---|
| | ( Probit for | 1st Stage IV | 2nd Stage IV |
| | Heckman) | Dependent | Dependent |
| | Dependent | Variable: *edu* | Variable: *lwageph* |
| | Variable: *lfp* | | |
| *edu* | ✓ | | |
| *exp* | ✓ | ✓ | ✓ |
| *exp2* | ✓ | ✓ | ✓ |
| *male* | ✓ | ✓ | ✓ |
| *muslim* | ✓ | ✓ | ✓ |
| *rural* | ✓ | ✓ | ✓ |
| *spousedu* | | ✓ | |
| *remitt* | ✓ | | |
| *hhsize* | ✓ | | |
| *eduhat* | | | ✓ |
| *invmills* | | | ✓ |

## 4. DATA AND VARIABLE SPECIFICATION

This paper uses data from the national level Household Income and Expenditure Survey HIES 2010, conducted by Bangladesh Bureau of Statistics (BBS). The dataset includes 12240 households selected according to a stratified random sampling method from across the country.

After cleaning, merging and limiting the sample to individuals aged between 16 to 64 we have a total of 14472 individuals in our sample comprising of 8360 wage workers. For computation of labour market returns to education only wage workers have to be selected.

Wage data in the sample is given in terms of net monthly take home and average daily wages from which hourly wages have been computed for use in this study. The dependent variable has been constructed by taking log of wage per hour.

Data on education is provided in the sample according to the highest class passed by each individual. Since the observations for education levels are coded and not recorded as years of schooling, we have taken the schooling variable for individuals with years of schooling ranging from 0 to 16 where 16 indicates four years Bachelor's degree and 12 indicates two year higher secondary level of schooling. We therefore only take a maximum of 16 years of schooling in this study. The classification of the schooling variable used is described in Table 2 and all variables in this study are defined in detail in Table 3.

[1]See next section for definition of variables.

**Table 2: Description of Schooling Variable**

| Education Level | Years of Schooling |
|---|---|
| No class passed | 0 |
| Class 1 | 1 |
| Class 2 | 2 |
| Class 3 | 3 |
| Class 4 | 4 |
| Class 5 | 5 |
| Class 6 | 6 |
| Class 7 | 7 |
| Class 8 | 8 |
| Class 9 | 9 |
| SSC/equivalent | 10 |
| HSC/equivalent | 12 |
| Bachelors Degree | 16 |

**Table 3: Variable Definition and Summary Statistics**

| Variable | Description | N | Mean | Std. Dev. |
|---|---|---|---|---|
| *lwageph* | log of wage per hour | 8360 | 2.8567 | .6646 |
| *edu* | level of education (=number of schooling years) | 14472 | 4.4896 | 4.7178 |
| *exp* | years of work experience (=age - 6 - schooling years) | 14472 | 26.2490 | 13.5413 |
| *exp2* | *exp* squared | 14472 | 872.3665 | 781.6948 |
| *male* | male=1, 0 otherwise | 14472 | .8806 | .3243 |
| *muslim* | muslim=1, 0 otherwise | 14472 | .8532 | .3539 |
| *rural* | 1 if working in the rural sector, 0 if working in urban sector | 14472 | .6039 | .4891 |
| *dadedu* | father's schooling years | 6157 | 3.2290 | 3.9510 |
| *momedu* | mother's schooling years | 4881 | 1.2688 | 2.6658 |
| *spousedu* | spouse's schooling years | 11065 | 3.9144 | 4.2494 |
| *lfp* | wage participation=1, 0 otherwise | 14472 | .5774 | .4941 |
| *married* | married=1, 0 otherwise | 14472 | .7835 | .4119 |
| *remitt* | remittance received in the last 12 months | 14472 | 7366.819 | 45003.21 |
| *hhsize* | number of members in the household | 14472 | 5.1224 | 2.1287 |

## 5. RESULTS AND DISCUSSION

Results from OLS estimates of the full sample indicate a 5.8% returns to additional year of education (see Table 4). Heckman estimates of the full sample show a 5.4% returns, which is slightly lower, but results show significant presence of selection bias in the sample . Male workers earn higher than their female counterparts with the same level of education. However, as female workers in the sample have comparatively lower levels of education, no conclusion can be made regarding wage discrimination. All variables are significant including the exclusion restrictions. Married individuals have a higher probability of getting into waged work, while those receiving remittances and living in larger family sizes display lower probability. Higher participation of married individuals and remittance recipients is understandable. However lower participation for those living in larger household size may be an indication of too large households where most members are dependent on others income or are day labourers.

Table 4 also reports the results of separate estimates for married sample and sample with parents education. The instruments *momedu* and *dadedu* are strongly significant with positive coefficients as shown in the first stage equation of IV 2SLS in the sample with parents ducation. Results imply parents level of education have positive influence on an individual's educational attainment. We also run an endogeneity test for robustness of results that confirms *edu* is endogenous in OLS. The RORE estimate in the second stage equation (4.8%) however is not substantially different from the one in OLS (4.3%).

In the model where we have included spouses' education as an instrument, the IV *spousedu* is found to be strongly significant having a positive impact on an individual's education level. This evidence is consistent with literature implying that more educated women are likely to be married to more educated men. We also run a test of weak instruments that indicate validity of the instrument. Results of the second stage of 2SLS show coefficient of *eduhat* (7.4%) is higher than the coefficient of *edu* (5.5%) in OLS indicating a substantial downward bias. All other coefficients have expected signs and are highly significant. Test of endogeneity also confirms that *edu* is endogenous in OLS.

[1]The dummy variable for married people is also included as an exclusion restriction in the full sample model in addition to variables for household size and remittances.

**Table 4: OLS, IV 2SLS and Heckman Estimates of RORE**

| | Full Sample | | | Sample with Parents Education | | | Married Sample | | | Heckman-IV |
|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | Probit | Heckman | OLS | 2SLS- 1st Stage | 2SLS- 2nd Stage | OLS | 2SLS- 1st Stage | 2SLS- 2nd Stage | |
| *edu/eduhat* | .0588 (.0016)* | -.0381 (.0026)* | .0540 (.0021)* | .0434 (.0051)* | | .0483 (.0075)* | .0553 (.0018)* | | .0746 (.0028)* | .0567 (.0036)* |
| *exp* | .0392 (.0020)* | -.0205 (.0040)* | .0368 (.0021)* | .0389 (.0068)* | -.2660 (.0360)* | .0408 (.0071)* | .0335 (.0031)* | -.1418 (.0159)* | .0400 (.0032)* | .0311 (.0034)* |
| *exp2* | -.0005 (.00004)* | .00004 (.00006) | -.0005 (.00003)* | -.0006 (.0001)* | .0037 (.0008)* | -.0006 (.0001)* | -.0004 (.00005)* | .0017 (.0002)* | -.0005 (.00005)* | -.0005 (.00005)* |
| *male* | .5528 (.0224)* | .4913 (.0366)* | .4926 (.0260)* | .4847 (.0818)* | .4861 (.3346) | .4845 (.0814)* | .5302 (.0262)* | .7456 (.1148)* | .5159 (.0260)* | .2755 (.0336)* |
| *muslim* | .19400 (.0224)* | .0716 (.0307)** | .2009 (.0182)* | .2697 (.0498)* | .1725 (.3039) | .2716 (.0493)* | .1725 (.0235)* | -.4561 (.1218)* | .1892 (.0238)* | .2404 (.0256)* |
| *rural* | -.0672 (.0132)* | -.5109 (.0232)* | -.1265 (.0231)* | .0197 (.0395) | -.9547 (.2082)* | .0271 (.0394) | -.1157 (.0137)* | -1.149 (.0903)* | . -.0700 (.0145)* | -.3198 (.0253)* |
| *dadedu* | | | | | .3994 (.0319)* | | | | | |
| *momedu* | | | | | .4876 (.0519)* | | | | | |
| *spousedu* | | | | | | | | .7353 (.0134)* | | |
| *married* | .0876 (.0352)** | | | | | | | | | |
| *remitt* | -2.08e-06 (3.08e-07)* | | | | | | | | | |
| *hhsize* | -.0640 (.0052)* | | | | | | | | | |
| *_cons* | 1.4649 (.0401)* | 1.9817 (.0723)* | 1.4840 (.0351)* | 1.4999 (.1130)* | 5.8051 (.4989)* | 1.4506 (.1220)* | 1.6211 (.0562)* | 4.0566 (.3240)* | 1.3854 (.0601)* | 1.4074 (.0746)* |
| *lambda/invmills* | | | .2167 (0.002)* | | | | | | | .8861 (.0761)* |
| $R^2$ | 0.2866 | | | 0.1709 | | 0.1699 | 0.2886 | | 0.2705 | 0.2783 |
| *N* | 8360 | | 14472 | 1204 | 1204 | 1204 | 6008 | 6008 | 6008 | 6008 |
| *Censored* | | | 6112 | | | | | | | |
| *Uncensored* | | | 8360 | | | | | | | |

Cluster-robust standard errors in parentheses; bootstrapped cluster-robust standard errors in parentheses for Second Stage Heckman-IV; *significant at 1%; **significant at 5%

Lastly, we compute the combined Heckman-IV estimates to eliminate problems of both endogeneity and sample selection biases. In the selection equation, *hhsize* and *remitt* are taken as exclusion restrictions and are found to be significant with negative signs (similar to results in full sample). The final stage results of Heckman-IV presented on the table shows all variables are strongly significant and coefficients have the expected signs. Returns to education for married individuals is found to be 5.7%. Although it is not greatly different from OLS results (5.5%), the selectivity term lambda is highly significant indicating presence of selection bias in OLS.

It is found that wages increase with years of experience and the earnings-experience relationship is quadratic. The positive coefficient for *muslim* cannot indicate presence of bias in wages based on religion as majority of the sampled individuals are Muslims. Married men earn 27% higher wages than married women with the same level of education and experience. This again cannot be generalised as most females in the nationally representative sample have lower educational attainment in comparison to males implying that investments made on female education is low. It can however be argued that discrimination exists in occupations that require lower levels of education.

We therefore find that education is a highly significant driver of an individual's earnings capacity in Bangladesh. The estimate is however quite low in comparison to other studies. The RORE estimates from both the full sample models and combined Heckman-IV models are close to 5%. The estimate is lower than the RORE estimate found in Asadullah (2006) which was 7%. This is persistent with literature that RORE is projected to decline over the years, nevertheless we cannot confirm this as variations in sampling can affect results. It is also argued that returns to education is likely to be low where human resources are relatively abundant. The estimated RORE is also comparatively lower than that in other regions (see Table 5). The figure is below South Asian average of 7%.

**Table 5: Regional Comparison of RORE Estimates**
**(latest available year between 2000-2011)**

| Region | Returns to Schooling (%) | Years Schooling | GDP / pc (PPP 2005) | N |
|---|---|---|---|---|
| Middle East and North Africa | 5.6 | 9.6 | 4,813 | 9 |
| South Asia | 7.0 | 6.5 | 2,661 | 7 |
| Eastern and Central Europe | 8.2 | 12.8 | 8,704 | 16 |
| East Asia and Pacific | 10.3 | 10.5 | 4,996 | 13 |
| Latin America and Carribean | 10.3 | 9.8 | 8,098 | 20 |
| Sub-Saharan Africa | 12.8 | 8.8 | 2,684 | 28 |

Source: (Montenegro & Patrinos, 2013)

## 6. CONCLUSION

We attempted to provide estimates of the average rate of returns to education in Bangladesh by correcting for endogeneity and selection biases. Our findings suggest presence of both endogeity and selection biases in the model. The selection and endogeneity corrected estimate of RORE for the married people (with undergraduate degree as the highest education level) is found to be 5.7%, which is not significantly different from the OLS estimate (5.5%).

This suggests that an additional year of education is expected to provide an individual with an average of 5.7% increment in wages earned. This estimate is lower compared to earlier studies of RORE in Bangladesh as well as in South Asia.

It is important to note that this estimate is for private returns to schooling and does not have any implications on wider economic returns. The positive private returns imply that participation in education has positive effects on the earnings of individuals but does not explain effects of education on economic or social outcomes. Given that the country is experiencing rapid growth in GDP, the low rate of private returns is puzzling. However, the estimate is likely to vary for different subgroups of the population.

The relatively low private returns to education may imply poorer quality of education and/or higher level of skills mismatch compared to other developing countries. Given the increase in supply of educated workers with higher levels of education in Bangladesh, there is a growing concern that overeducation may exist in the workforce if these workers are not matched with jobs requiring such qualification. This phenomenon would lower returns to education on average. Future studies therefore can investigate the reasons for low (and perhaps falling) private rate of returns to education in Bangladesh.

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