INSTRUMENTING EDUCATION AND RETURNS TO SCHOOLING IN INDONESIA

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Abstrak: Instrumentasi Pendidikan dan Tingkat Pengembalian Investasi Pendidikan di Indonesia. Artikel ini menyajikan estimasi keuntungan investasi pendidikan di Indonesia dengan menggunakan data IFLS-4 (2007-2008). Kajian ini mengeksplorasi pendekatan alternative untuk menghitung present value keuntungan finansial dari tiap tambahan satu tahun pendidikan. Hasil penelitian ini menunjukkan pentingnya mempertimbangkan bias endogeniti melalui metode IV. Ditemukan pula faktor latar belakang keluarga merupakan instrument yang bermakna. Temuan lain yang tidak kalah pentingnya adalah bahwa keuntungan finansial dari tiap tambahan satu tahun pendidikan cukup besar.

Kata kunci: Variabel Instrumen, Pengembalian Investasi Pendidikan, Investasi Pendidikan.

Abstract: Instrumenting Education and Returns to Schooling in Indonesia. This paper provides estimates of the profitability of investment in education in Indonesia, using IV approach and data for IFLS-4 (2007-2008). It also explores an alternative framework for assessing the present value of the financial gains from an extra year of schooling. This study finds that considering endogeneity bias via the IV method is important, and draws attention to family background factors being useful instruments. Another finding from this study that needs to be highlighted is that the benefit of continuing at school for an extra year is quite high.

Keywords: Instrumental Variable, Returns to Schooling, Education Investment

INTRODUCTION

Given the evidence on the apparent role of ability bias for other countries, it is of practical importance to see whether ability bias impacts the estimate of the return to schooling in Indonesia. This issue is considered here by adopting the Instrumental Variable (IV) approach. Following Blackburn and Neumark (1991), Uusitalo (1999), and Levin and Plug (1999), the instruments used in this study are based on parental education. Furthermore, in contrast to previous studies that only examine the benefit of education, this study adopts an alternative perspective - proposed by Oreopoulos (2003) - by taking into account foregone earnings to quantify the opportunity cost of dropping out from school. These estimates are argued to provide a more useful guide for private, and even public, investment in education.

METHODS

It was argued that the OLS estimations of the economic returns to schooling may not be precise, since they are affected by three potentially damaging major biases. Measurement error bias may arise in the case of the schooling variable because the schooling information is provided in levels rather than in

years (Chen and Hamori, 2009). To reduce the potential impact of this source of measurement error, this analysis combines the information on the highest education level and the highest grade completed to obtain the individual's actual years of schooling. The second problem that may lead to an endogeneity problem is simultaneity. However, simultaneity is not of immediate concern in the current study, and will not be pursued further. Omitted ability variable bias is the third of the three problems that may adversely impact the estimate of the return to schooling. The schooling endogeneity problem caused by an omitted ability variable can be remedied by either employing a natural experiment approach or an IV estimation technique. The essence of this 'natural experiment' approach is to find a setting where the explanatory variable of interest (here, schooling) is highly likely to be exogenous. For example, Angrist and Krueger (1991) adopted quarter of birth interacted with year of birth as instruments, Plug (2001), and Lemke and Rischall (2003) employed quarter of birth as instruments, and Leigh and Ryan (2005 and 2008) used month of birth, month of birth interacted with year of birth, and change of compulsory education law as instruments. The basic idea of the IV estimator is to proceed in two stages. First, estimate the effect of the instrumental variable on schooling; then estimate the effect of the instrumental variable on earnings. Since, by assumption, the instrument is correlated with earnings only because it influences schooling, the ratio of the effect of the instrument on earnings to its effect on schooling provides an estimate of the causal effect of schooling on earnings (Ashenfelter *et al.*, 1999).

In order to address potential endogeneity bias, this study adopts an IV approach and uses several instruments. The following two-equation model describing the natural logarithm of monthly earnings (ln(*earnings*$_i$)) and years of schooling (ln(*yrschyr*$_i$)) is commonly applied to handle the endogeneity of schooling:

$$\ln(earnings_i) = \delta X_i + \beta yrschyr_i + \mu_i$$

$$\ln(yrschyr_i) = \varphi Z_i + \varepsilon_i$$

where *X* and *Z* are vectors of observed variables, E($X_i \mu_i$) = E($Z_i \varepsilon_i$) = 0, and β is interpreted as the return to schooling (Card, 1993). The *X* vector consists of age and its square, tenure and its square, marital status, urban area of residence, and gender status.

The data set used in the empirical analysis is the Indonesian Family Life Survey 4 (IFLS4). IFLS4 is a nationally representative sample comprising 13,536 households and 50,580 individuals, spread across provinces on the islands of Java, Sumatra, Bali, West Nusa Tenggara, Kalimantan, and Sulawesi. Together these provinces encompass approximately 83 percent of the Indonesian population and much of its heterogeneity.

For the analysis of the private returns to schooling, the sample is restricted to individuals 15 to 65 years old, who were not full-time students, reported non-missing labour income, provided information on schooling, and supplied information on family background. Persons in the military during the survey week are omitted, as it is generally argued that the wages of those in the armed forces do not necessary reflect market forces. A total of 4596 observations satisfy these criteria and are utilized in the analysis.

RESULTS AND INTERPRETATIONS

Including proxies for ability directly in the earnings function is one way of handling the omitted ability variable problem. Unfortunately, very few datasets contain ability measures that are convincing. The IFLS4 in particular does not provide such data, and therefore this proxy variable approach cannot be adopted in this study. The main alternative approach to tackle the endogeneity problem is the IV method. As discussed previously, the IV approach is based on finding credible instruments that are correlated with schooling and ability but not correlated with the residual in the earnings function. This is the approach pursued in this study.

Following Blackburn and Neumark (1991), Uusitalo (1999), and Levin and Plug (1999), the first set of instruments used in this study are based on parental education. Mother's and father's levels of education have become popular variables in instrumental variables studies of earnings determination. The earlier studies that utilise these variables as instruments assume that parents' levels of education are not correlated with their children's inherent abilities but influence their children's educational achievement (Li and Luo, 2004). The view that more educated parents provide a better environment for their children has been the basis of many investigations. Generally, studies that examine the correlation between parental levels of education and children's educational attainment find that parents' levels of education have a significant influence on the educational achievement of their offspring (see Tansel, 1997; Liu and Lin, 2000; Hudson and Sessions, 2009; Lemke and Rischall, 2003). Much of this research has had a focus on developed countries.

Tabel 1. Summary Statistics

Variables	All	
	Mean	Standard Deviation
Dependent Variable		
Monthly earnings (IDR)	1,339,521	1,961,290
Monthly earnings (log)	5.913	0.4378
Independent Variables		
Years of schooling	10.683	3.744
Age	35.192	9.741
Age squared	1333.327	751.375
Control Variables		
Tenure	7.852	8.116
Tenure squared	127.499	247.153
Female (dummy for gender)	0.333	0.471
Marital status dummy	0.866	0.340
Dummy for urban area	0.676	0.468
Instruments		
Father's years of schooling	7.469	3.400
Mother's years of schooling	6.490	2.963

Tabel 2. Instrumenting Schooling with Parental Education

Variable	Reduced-Form Schooling	IV-Earnings
Constant	3.01790	4.92460
	(0.61297)***	(0.07608)***
Years of Schooling		0.06929
		(0.00351)***
Age	0.16620	0.00834
	(0.03552)***	(0.00437)*
Age^2	-0.00251	-0.00008
	(0.00046)***	(0.00006)
Tenure	0.05169	0.01504
	(0.01687)***	(0.00205)***
$Tenure^2$	-0.00143	-0.00025
	(0.00055)***	(0.00007)***
Marital Status	-0.00564	-0.00221
	(0.15099)	(0.01827)***
Urban	1.48627	0.05677
	(0.10319)***	(0.01464)***
Female	-0.09906	-0.19633
	(0.09977)	(0.01207)***
Father's Schooling	0.34142	
	(0.01862)***	
Mother's Schooling	0.21831	
	(0.02139)***	
R^2	0.2948	
Adjusted R^2	0.2934	
Observations	4596	4596
Test Results		
Quality		
F		593.348
P-Value		0.0000***
Validity (Sargan test)		
Chi^2		0.57412
P-Value		0.4486
Relevance (Hausman test)		
F		52.3454
P-Value		0.0000***

Notes: Standard errors in parentheses. *, ** and *** denote statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

The reduced-form regressions for the determinants of schooling, which is the first stage in the IV technique, and the IV earnings function estimates using parental education as instruments are presented in Table 2. The results reveal that the additional variables to control for job tenure and its square, marital status, urban residence, and gender lift the first stage R^2 to 0.2948. Furthermore, the *F*-statistics in the first stage regressions suggest a good correlation between the instruments and the individuals' years of schooling.

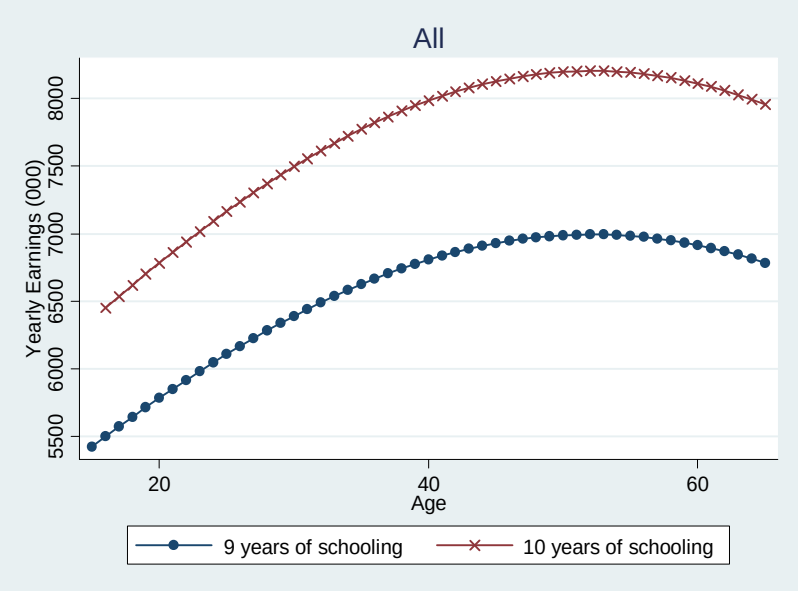

Figure 1. Projected Yearly Earnings Profiles for Individuals Leaving School at Grades 9 and 10 (2007/2008 IDR) (Source: Author's calculation based on Table 2)

Moreover, it seems that the father's and mother's years of schooling are acceptable instruments since the value of the *F*-test allows us to reject the hypothesis that these variables do not determine the years of schooling of the individual. Typical of the pattern established above, father's and mother's years of schooling have significant positive effects on the years of schooling of their children. Also similar to the results discussed above, the effect of father's education exceeds that of the mother. An additional year of schooling for the father (mother) increases the years of schooling of their children by 0.34 (0.22) years. The returns to schooling obtained using IV are 6.9 percent.The Hausman test rejects the null hypothesis of equality of the OLS and IV estimates.

So far the discussion on the rate of return to schooling in this paper has focused only on the benefits of an additional year of schooling, ignoring, other than to the extent that it is implicitly recognised in the theoretical development of the Mincerian model, the costs of schooling. To explore an alternative framework for assessing the present value of the financial gains from an extra year of schooling, this study follows Oreopolous (2003) and Leigh and Ryan (2005, 2008).

First, we need to derive the age-earnings profiles for two individuals with one year difference in their years of schooling over their entire working period.[1] Figure 1 presents the projected earnings of individuals with, respectively, 9 and 10 years of schooling[2] using

[1] Any years of schooling can be chosen, however, this study uses individuals with 9 years of schooling as a baseline and individuals with 10 years of schooling as the comparison group.

[2] Unlike the studies by Oreopolous (2003) and Leigh and Ryan (2005, 2008) that projected the income profiles using a quartic age function, this study utilises the quadratic in age form from the previous regression equations.

"the IV Mincerian model" with parental education as instruments.[3] The monthly earnings used in the regression analysis are converted to annual equivalents for this analysis.[4] Based on the projected earnings, it can be estimated that individuals who left school at age 16 with 9 years of schooling and who work until the age of 65 could expect lifetime earnings of Rp329,085,491. Individuals who left school at age 17 with 10 years of schooling and who work until the age of 65 could expect lifetime earnings of Rp379,558,948. The difference between the lifetime incomes for those with 10 and 9 years of schooling represents the monetary gains from the extra year of schooling.

All these amount are in 2007/2008 IDR. Moreover, they place equal value on amounts received in each year. However, as money received in the future is worth less than money received today, the future benefits need to be discounted. Table 3 (in Appendix) converts the annual earnings differences for each sample (all, males, and females) using discount rates of 3, 5, and 7 percent. This table also uses eight different rates of return to compute the future income gains associated with the extra year of schooling.[5] For example, at the lowest returns in the table, and using a zero discount rate, the monetary gains from the extra year of schooling are Rp21,049,140 (see the first row for column (b)). With the highest annual earnings gains in the table, of 7.96 percent, the average present value gain from leaving school a year later is Rp28,254,832 under a 0 percent discount rate. These monetary benefits decline as higher discount rates are applied. For example, applying a 5 percent discount rate to the highest returns in column (i), the present value of the monetary benefit of the extra year of schooling falls to Rp10,043,753.

Second, we need to find the foregone earnings from staying on at school for an extra year. This study obtains foregone earnings from the initial projected yearly earnings for individuals with 9 years of schooling. Based on the projected yearly earnings the foregone earnings from continuing at school for the extra year are Rp5,499,855. Table 3 includes these figures in the last column. To calculate the financial gain from an additional year of schooling, these foregone earnings should be compared with the discounted increase in future earnings.

CONCLUSION

This study presents evidence on the returns to schooling in Indonesia and highlights some important points. In conventional IV, the corrected estimates of the return to schooling indicate the presence of some downward bias in the OLS estimates, in line

[3] Since the official age to start primary school is 7 years, to derive the projected earnings profile for workers with 9 years of schooling we start at an age of 16 years (7 + 9 = 16). The projected earnings profiles start at 17 years (7 + 10 = 17) for workers with 10 years of schooling.

[4] The earnings data used in this study are monthly earnings, so that to obtain projected yearly earnings we need to multiply each of the projected monthly earnings by 12.

[5] The eight rates of return to schooling used to calculate the financial gain from continuing at school for one extra year are the rates of return to schooling obtained by the IV approach based on the standard and augmented Mincerian models with parental education as well as pre-school attendance and delayed primary school enrolment as instruments.

with a number of recent studies. The estimated coefficients for the preferred equations are precisely estimated, and the differences are statistically significant. In line with Ashenfelter and Zimmerman (1997) and Lemke and Rischall (2003), this study finds that considering endogeneity bias via the IV method is important, and draws attention to family background factors being useful instruments.

Another finding from this study that needs to be highlighted is that the benefit of continuing at school for an extra year is quite high. Based on the alternative scenarios in Table 3, the lifetime gain to staying on at school for an extra year typically exceeds the estimated foregone earnings, even when a high discount rate is used. This result is in agreement with the finding from the study by Oreopolous (2003) for the United States, Canada, and the United Kingdom, and the study by Leigh and Ryan (2005, 2008) for Australia. The results provide a sound basis for evaluating school leaving decisions. Recognising a foregone benefit from dropping out will assist to quantify a cost-benefit analysis of the dropout decision.

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Appendix

Table 3. Discounted Present Value of an Additional Year of Schooling (in 2007/2008 IDR)

All									
Rate of Return to Schooling									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Discount Rate	5.93%	6.24%	6.78%	6.84%	6.93%	7.24%	7.79%	7.96%	Baseline Foregone Earnings
0%	Rp21,049,140	Rp22,149,517	Rp24,066,302	Rp24,279,278	Rp24,598,742	Rp25,699,119	Rp27,651,400	Rp28,254,832	Rp5,499,855
3%	Rp10,680,702	Rp11,239,053	Rp12,211,663	Rp12,319,731	Rp12,481,833	Rp13,040,183	Rp14,030,805	Rp14,373,019	Rp5,499,855
5%	Rp7,482,344	Rp7,873,495	Rp8,554,855	Rp8,630,562	Rp8,744,122	Rp9,135,273	Rp9,829,251	Rp10,043,753	Rp5,499,855
7%	Rp5,583,024	Rp5,874,885	Rp6,383,288	Rp6,439,778	Rp6,524,512	Rp6,816,373	Rp7,334,191	Rp7,494,244	Rp5,499,855

Notes: Projected earnings profile for adults with 9 and 10 years of schooling are shown in Figure 6.16. Foregone earnings are obtained from the initial (age of 16 years) projected annual earnings for workers who have 9 years of schooling.