

The Value of Vocational Education: High School Type and Labor Market Outcomes in Indonesia

David Newhouse and Daniel Suryadarma

This paper examines the relationship between the type of senior high school attended by Indonesian youth and their subsequent labor market outcomes. This topic is timely in light of a recent policy shift that aims to dramatically expand vocational education. The analysis controls for an unusually rich set of predetermined characteristics, and exploits longitudinal data spanning fourteen years to separately identify cohort and age effects. There are four main findings. First, the estimated wage premium for vocational graduates, relative to general graduates, is greater for women than men. Second, the returns to public vocational school for men have plummeted for the most recent cohort, and male vocational graduates now face a large wage penalty. Third, the generally favorable outcomes of public school graduates can be partly explained by non-random sorting of students with higher test scores and better-educated parents into public schools. Finally, these peer effects appear to be particularly important for students with above-average test scores, as men with high scores earn a surprisingly small premium from graduating from vocational or private general school. These small returns for high-scoring men, as well as the dramatic fall in the earnings premium for all male vocational graduates, raise important concerns about the current expansion of public vocational education and the relevance of the male vocational curriculum in an increasingly service-oriented economy.

JEL Classifications: I21, J24, O15

Expanding access to vocational education can be an attractive option for policymakers in developing countries seeking to improve labor market outcomes. For example, Tanzania prioritized vocational education in the late 1960s

David Newhouse (corresponding author) is a labor economist in the Social Protection and Labor unit at the World Bank; his email address is dnewhouse@worldbank.org. Daniel Suryadarma is a research fellow at the Arndt-Corden Department of Economics, Australian National University; his email address is daniel.suryadarma@anu.edu.au. This work was supported by a grant from the Netherlands Ministry of Development Cooperation. The views expressed here are personal and do not implicate the World Bank, its management, or executive board. This study is a background paper for the Indonesia Jobs Report. We thank Vivi Alatas and Andrew Leigh for their support and encouragement, and Dandan Chen, Wendy Cunningham, Eric Edmonds, Edgar Janz, Daan Pattinasarany, and seminar participants at World Bank Office Jakarta and the Institute for the Study of Labor for helpful comments. All remaining errors are our own. A supplemental appendix to this article is available at <http://wber.oxfordjournals.org>.

THE WORLD BANK ECONOMIC REVIEW, VOL. 25, NO. 2, pp. 296–322
Advance Access Publication May 18, 2011

doi:10.1093/wber/lhr010

© The Author 2011. Published by Oxford University Press on behalf of the International Bank for Reconstruction and Development / THE WORLD BANK. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com

(Kahyarara and Teal, 2008), and South Korea followed suit thirty years later, both in response to a perceived shortage of skilled workers. In both cases, the expansion policy failed, as parents continued to prefer general to vocational education and refused to send their children to vocational schools (KRIVET, 2008).¹

The Korean and Tanzanian experiences have not deterred the Indonesian Ministry of Education from enthusiastically embracing vocational education. The government, aiming to reduce high unemployment rates among educated youth, pledged to reverse the current ratio of high school graduates, from 70 percent general to 70 percent vocational, by 2015 (Ministry of National Education, 2006). Although this target is likely infeasible, the ministry has frozen the construction of new public general high schools and converted selected general schools to vocational schools, despite scant evidence that vocational education improves labor market outcomes.

Worldwide, empirical evidence on the merits of vocational education is mixed. Vocational graduates earn a wage premium in Egypt (El-Hamidi, 2006), Israel (Neuman and Ziderman, 1991), and Thailand (Moenjak and Worswick, 2003). In contrast, general graduates earn a higher wage in Suriname (Horowitz and Schenzler, 1999) and, for students that continue on to university, in Tanzania (Kahyarara and Teal, 2008). Finally, Lechner (2000), KRIVET (2008), and Malamud and Pop-Eleches (2008) find no significant differences in labor market outcomes between the two educational tracks in East Germany, South Korea, and Romania respectively.

There is one study that we know of that examines the outcomes of vocation high school graduates in Indonesia (Chen, 2009). This study follows a single cohort of students three years after graduation and finds that vocational school graduates, compared with general school graduates, experience similar wage and employment outcomes. Unfortunately, this study suffers from several limitations. First, the sample is restricted to recent high school graduates aged 18 to 21, and therefore only measures very short-run impacts. In addition, two thirds of this young sample is not working, and the econometric technique used to correct for this relies on dubious assumptions.² Because of the small sample size, the estimated effects of vocational education are insufficiently precise to rule out large returns.³ Finally, the analysis does not distinguish between men and women, despite important gender differences in both the nature of the vocational education curriculum and labor market participation.

1. Some studies use the term academic education. In this paper, we use the term general education.

2. The Heckman selection equation is identified by excluding parental education, previous household income, and junior high test score from the earnings equation.

3. In the OLS estimates, the 95 percent confidence interval ranges from 0 to 60 percent of average earnings, while in the IV estimates, the 95 percent confidence interval ranges from -50 to 150 percent of average earnings.

The mixed conclusions of past studies have contributed to a contentious debate on the validity of standard regression estimates, given that selection of students into vocational and general tracks is not random. Attributes that could influence whether a student chooses one track over the other include scholastic ability, parental education, and location of residence. Failure to control for these variables may confound estimates of the returns to vocational education. In developing countries, access to data on these attributes is rare. Although many studies attempt to correct for non-random selection into work, we know of only two studies that address the role of unobserved determinants of school type.⁴

In this paper, we use a rich longitudinal household survey from Indonesia to evaluate the outcome of vocational high school graduates relative to general school graduates along four dimensions: earnings, labor market participation, risk of unemployment, and job quality. This study does not directly address potential bias due to omitted unobserved characteristics that may confound the estimates. Nevertheless, the data contain a rich set of control variables that allow us to control for non-random selection more carefully than the vast majority of existing studies.⁵ The set of control variables include the district where a person graduated from junior high school, whether they lived in a city, town, or village at age twelve, grade repetition and outside employment during elementary and junior high school, adult height, and the level of parental education. Junior high exit exam scores are not included as a control variable, because they are only available for the youngest cohort. Evidence from this cohort indicates that the omission of test scores has minor effects on the estimated effects of school type.

Our paper makes three main contributions to the literature. The first is distinguishing between public and private schools when assessing vocational education. While there has been a resurgence of interest in the efficacy of public versus private schooling in developing countries, this is the first research to our knowledge that explicitly distinguishes between public and private vocational education at the high school level.⁶ The second main contribution is

4. The only study that uses a plausibly exogenous source of variation in vocational school attendance is Malamud and Pop-Eleches (2008), which employs a regression discontinuity design to evaluate a 1973 policy that promoted general education in Romania. Chen (2009) uses the proportion of schools reported by village households that are vocational as an instrument for school type. Other studies control for observables (Kahyarara and Teal (2008), and Lechner (2000)), or model selection into work rather than school type (El-Hamidi (2006) and Moenjak and Worswick (2003)). In a review of several prominent studies between 1980s and 1990s, Bennell (1996) criticizes many studies' failure to correct for bias due to choice of school type and participation in work.

5. Of course, this does not imply that we have controlled for the full set of potentially confounding variables. For example, student motivation and aspirations, and parental income and occupation, are not observed.

6. Newhouse and Beegle (2006) find that public junior secondary school students in Indonesia perform better than private school students in national examinations. In contrast, Jimenez, Lockheed, and Paqueo (1991) and World Bank (2007) find that private primary school students outperform public school students in several other developing countries.

estimating heterogeneous effects of school type, across scholastic ability, age, and family background. The final main contribution is the use of a household panel, covering fourteen years, to distinguish between age and cohort effects and assess changes in the returns to vocational education over time. To the extent that bias due to confounding unobserved characteristics remains constant over time, this provides an accurate estimate in the changes in returns over time.

There are four main findings. First, the estimated return to vocational education, relative to general education, is greater for women than men. Female public vocational graduates enjoy a particularly large wage premium over female graduates of other types of schools, while males benefit from attending public school, whether general or vocational. Second, the returns to public vocational school for men have plummeted for the most recent cohort, and male vocational graduates now face a large wage penalty. In contrast, returns to public vocational school have, if anything, improved for the most recent cohort of women. This decline for men cannot be explained by an increase in supply, as the probability that both men and women graduated from public vocational school has declined over time. Third, the favorable outcomes of public school graduates partly results from the non-random sorting of students with higher test scores and better-educated parents into public schools. In the most recent cohort, public vocational and general schools attracted the highest-scoring students. Finally, the peer effects created by this sorting are particularly important for students with above-average test scores. The estimated wage premium for public general graduates is noticeably larger for high-scoring students than low-scoring students, particularly for men. For males with high entering test scores, the estimated wage premium for high school graduates, compared to non-graduates, is less than ten percent for public vocational school and negative for private schools.

The remainder of this paper is organized as follows. The next section provides background on the Indonesian education system and the mix of vocational versus general education. Section II describes the data. Section III analyses school choice patterns. Section IV investigates the effects of different school types of labor market outcomes. Sections V to VII explore heterogeneity in the effects across different types of people. The final section concludes and provides policy recommendations.

I. SECONDARY EDUCATION IN INDONESIA

The secondary education system in Indonesia is divided into junior and senior secondary school, which each take three years to complete. The country has two different school systems, secular and Islamic, and in this paper we focus exclusively on the former.⁷ In the secular school system, children graduating

7. In 2007, the National Socioeconomic Survey (*Susenas*) shows that only 8.4 percent school-age children are enrolled in the Islamic system.

from junior high school, usually at around 15 years of age, must choose whether to enroll in a vocational or general high school.⁸

These school types are distinct. Only a small portion of the curriculum used in general and vocational schools overlap, mostly in the subjects of English and Indonesian. General schools offer three majors: natural science, social science, and language. On the other hand, the vocational stream provides a choice between many majors. Each vocational school usually focuses on just one or two majors. The available vocations are business management; technical, which includes machinery and information technology; agriculture and forestry; community welfare; tourism; arts and handicraft, and health care. In addition, there are very specialized vocational high schools that focus on aviation and shipbuilding. Of all these choices, the most popular are the first two, business management and technical.⁹

The public cost of providing vocational education is at least as high as general education. Ghozali (2006) finds that a public vocational student costs the public 28 percent more annually than a public general student.¹⁰ Meanwhile, the amount of per student public funds spent in private schools is lower—about 40 percent and 20 percent lower in the vocational and general streams, respectively—and private vocational schools receive the same amount of public funds as private general schools. Households, meanwhile, face higher out of pocket costs expenses in private schools. Comparing the four school types, households report that private general schools are the most expensive, followed by private and public vocational schools respectively, with public general schools being the least expensive.¹¹

Vocational school expansion plan

In 2006, the Ministry of National Education began expanding vocational schools. According to their strategic plan (Ministry of National Education, 2006), the main reason for this policy is to increase the size of the labor force that is ready-to-work, especially among those who do not continue to tertiary education. In addition, the Ministry argues that because the unemployment rate of vocational graduates is lower than general graduates, increasing the share of vocational graduates in the mix would result in a lower overall unemployment rate.

The policy's target is to achieve a 50:50 vocational to general student ratio by 2010, and a 70:30 ratio by 2015. As Figure 1 shows below, the ratio was 24:76 in 2007. In order to achieve this target, the ministry has recommended a moratorium on building new general schools. Instead, the government will

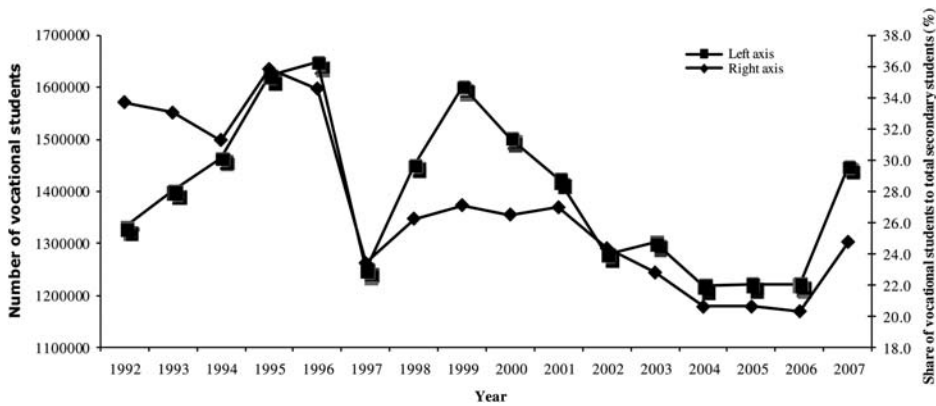
8. Better senior secondary schools also select students based on their test scores.

9. This information is taken from the National Labor Force Survey (*Sakernas*). We cannot separate the labor market effects of different vocational choices in our dataset. Despite this limitation, the dataset of our choice has many more advantages, such as those we list in the introduction.

10. Public cost is defined as the amount of government spending on each school type.

11. Figure S1.1 in the supplemental appendix (available at <http://wber.oxfordjournals.org>) compares school costs between vocational and general schools.

FIGURE 1. Vocational School Enrollment, 1992–2007



Note: figures calculated from the National Socioeconomic Survey (Susenas), various years

construct new vocational schools and convert some general schools into vocational schools.

Enrollment trends

Enrollment in vocational high school has been steadily declining, as the number of vocational students has declined from about 1.6 million in 1999 to about 1.2 million in 2006 (Figure 1). Over the same period, the proportion of high school students in vocational schools declined from 27 percent to just 20 percent, as more students choose general education over vocational education. The share attending vocational school jumped in 2007, as the vocational school expansion policy took effect. In light of the historical trend, it appears extremely unlikely that the ministry will meet either the 50:50 target in 2010 or the 70:30 goal five years later.

II. DATA

The primary data source for this study is the Indonesia Family Life Survey (IFLS), a longitudinal household survey that began in 1993. Three full follow-up waves were conducted, in 1997, 2000, and 2007. The first wave represented about 83 percent of Indonesia's 1993 population, and covered 13 of the nation's 27 provinces. This initial round interviewed roughly 7,200 households. By 2007, the number of households had grown to 13,000 as the survey attempts to re-interview many members of the original sample that form or join new households. Household attrition is quite low, as around 5 percent of households are lost each wave. Overall, 87.6 percent of households that participated in IFLS1 are interviewed in each of the subsequent three waves (Strauss et al., 2009).

The sample is constructed as follows. We began with respondents who were interviewed at least once between the ages of 18 and 50, as a detailed education history is only available for respondents aged 50 or younger. Next, we limited our sample to individuals who were born between 1940 and 1980. We then dropped individuals who were never interviewed after they graduated junior secondary, as well as those who were full-time students when interviewed. We then dropped observations that did not report complete school information. Finally, to avoid identification based on functional form assumptions, we restrict the sample to the region of common support (Heckman and Vytlacil, 2001; Tobias, 2003). To do this, we estimated the probability that each person either leaves the schooling system without graduating from senior secondary or attends each of the four school types using a multinomial logit model, and dropped observations for which the estimated probability of attending public general school falls outside the range of all public general graduates. Finally, we dropped reported wages from the bottom and top percentile from wage regressions to avoid distorted results due to outliers. Table S2.1 in Appendix S2 shows the number of observations that were dropped during each stage of this process.

After dropping observations outside the region of common support, the final sample consists of 17,485 total labor market observations on 7,607 individuals. These individuals are divided into three cohorts. The oldest cohort consists of those born from 1940 to 1963, the middle cohort covers those born from 1964 to 1972, and the youngest cohort contains those born from 1973 to 1980. The IFLS survey asks the youngest cohort to report their performance in the junior secondary final examination.¹² Hence, for this most recent cohort, a direct measure of scholastic ability is available. Descriptive statistics for all variables are given in Table S2.2 in Appendix S2.

All estimates are separated by sex, because men and women exhibit different labor market participation patterns and they select different education majors. According to the 2006 National Labor Force Survey (*Sakernas*), 64 percent of men choose a technical or industrial major, while 56 percent and 29 percent of women are enrolled in business management and tourism majors, respectively.

III. UNDERSTANDING SCHOOL CHOICE

To better understand the determinants of an individual's school choice, we estimate the following multinomial logit regression:

$$T_i = \alpha_Z Z_i + \alpha_i P_i + \alpha_d P_d + \varepsilon_i \quad (1)$$

where T_i is a five-category variable indicating senior secondary school type or

12. The examination is designed to be nationally comparable by the Ministry of National Education. We standardize the scores by year of junior secondary graduation to take into account possible quality changes in the exam over time.

non-graduation, Z_i is a vector of predetermined characteristics, P_i is parental education, and P_d is district-level parental education shares.

Table 1 provides the estimated marginal effects of selected independent variables. It shows that the reduction in vocational enrollment observed in Figure 1 resulted first in an increase in the probability of attending private school, and then decreases in high school attendance. The top rows of the third column show that men in the middle and recent cohorts were 9.6 and 11.4 percentage points less likely to enroll in public vocational schools than those in the oldest cohorts. Men in the middle cohort were more likely to attend general school, by 9.6 percentage points, but private vocational school has become more popular for men in the youngest cohort. Girls have also increasingly turned away from public vocational education. The probability of attending general and vocational private schools both increased by 8.7 and 6.5 percentage points respectively for the middle cohort. This increase in private general persisted for the youngest cohort.

The table also shows that a higher percentage of men in the recent cohort left without completing senior secondary education, compared to men in the old and middle cohort. To a certain extent, we find a similar pattern among the recent cohort of women. We believe that there are two plausible explanations for this pattern. First, the composition of junior high school graduates changed, partly as a result of a nine-year compulsory education program that was enacted by the government in the early 1990s. This program caused some students to graduate from junior high school that would have dropped out in the older cohorts, and these new junior high graduates were less likely to continue on to high school.¹³ Second, the rapid increase in the supply of high school graduates eroded the returns to completing high school. Turning to parental education, the children of highly educated parents are more likely to attend general schools. Increased paternal education raises the probability of attending private general school the most, followed by public general schools. The pattern is similarly strong among women.

The Effect of Test Scores on School Choice

Test score data is available for the most recent cohort (those born between 1973 and 1980). For this cohort, we examine how test scores relate to school choice, and whether including test scores alters the estimated effect of the other independent variables, especially parental education. Table S3.1 in Appendix S3 provides the estimation results for men, while Table S3.2 shows the results for women.

13. This generational shift from dropping out after completing primary school to dropping out after junior secondary school would have been clearer had our sample consisted of all individuals, not just those who completed junior secondary school. However, since our main interest is to describe the choice of senior secondary education, we choose to continue using our current sample.

TABLE 1. Determinants of School Enrollment: selected variables, full sample

	Men					Women				
	No senior secondary	Public general	Public vocational	Private general	Private vocational	No senior secondary	Public general	Public vocational	Private general	Private vocational
<u>Personal characteristics</u>										
Middle Cohort	0.6 (2.1)	2.9* (1.7)	-9.6*** (1.7)	6.7*** (1.7)	-0.7 (1.5)	-9.7*** (2.4)	2.4 (2.2)	-7.9*** (2.0)	8.7*** (2.0)	6.5*** (1.7)
Recent cohort	12.8*** (2.2)	-4.5*** (1.7)	-11.4*** (1.6)	-0.8 (1.7)	4.0** (1.6)	3.9 (2.5)	0.6 (1.8)	-12.2*** (1.8)	2.9* (1.8)	4.7*** (1.5)
Repeated grade in junior secondary	0.1 (4.4)	-3.7 (4.2)	-3.4 (2.9)	6.6 (4.8)	0.3 (3.7)	5.5 (8.2)	-1.4 (6.1)	-5.7 (4.8)	-0.3 (8.0)	1.9 (5.1)
Lived in small town at age 12	-5.1** (2.1)	2.6 (1.7)	0.4 (1.5)	-0.3 (1.6)	2.4 (1.7)	-6.0*** (2.1)	4.6** (1.9)	-0.6 (1.6)	0.4 (1.7)	1.6 (1.5)
Lived in big city at age 12	-6.5** (2.6)	7.2*** (2.2)	-0.2 (1.8)	-3.2* (1.8)	2.7 (2.1)	-5.4** (2.7)	5.8** (2.3)	1.1 (2.1)	4.2** (2.1)	-5.6*** (1.6)
Height	-0.3** (0.1)	0.1 (0.1)	-0.0 (0.1)	0.3** (0.1)	-0.1 (0.1)	-0.5*** (0.2)	0.2 (0.1)	0.1 (0.1)	0.3** (0.1)	-0.1 (0.1)
<u>Parental education</u>										
Father graduated elementary	-13.7*** (3.5)	6.1** (2.4)	1.6 (2.3)	5.7*** (2.1)	0.3 (2.6)	-15.4*** (4.1)	2.3 (3.1)	1.1 (2.8)	6.8*** (2.3)	5.2* (2.7)
Father graduated junior secondary	-24.6*** (4.0)	10.1*** (3.1)	1.6 (2.8)	12.1*** (3.0)	0.9 (3.3)	-28.7*** (4.7)	7.5** (3.6)	1.3 (3.3)	11.3*** (3.0)	8.6*** (3.2)
Father graduated senior secondary	-24.6*** (5.7)	9.5** (3.7)	-0.0 (3.3)	15.8*** (4.0)	-0.6 (3.9)	-42.5*** (5.2)	14.2*** (4.8)	4.2 (3.8)	18.2*** (4.1)	6.0 (3.7)

Father graduated university	-27.6***	19.9***	-4.6	18.1***	-5.8	-40.1***	19.4***	1.7	13.7***	5.3
	(5.5)	(5.0)	(3.5)	(5.1)	(4.0)	(6.1)	(5.7)	(4.6)	(4.8)	(5.0)
Father attended vocational school	-7.7	4.5	6.5	-1.6	-1.8	5.4	-1.1	-1.0	-6.9**	3.6
	(5.6)	(3.9)	(4.2)	(3.3)	(3.7)	(5.9)	(3.6)	(3.0)	(2.8)	(3.7)
Mother graduated elementary	-2.2	1.7	-2.7	3.9*	-0.7	-6.8**	5.8**	4.9***	-0.9	-3.0
	(2.7)	(2.2)	(2.0)	(2.0)	(2.1)	(3.1)	(2.3)	(1.7)	(2.4)	(2.4)
Mother graduated junior secondary	-6.4	4.6	-1.5	5.8*	-2.5	-8.8**	10.9***	-0.7	4.3	-5.7**
	(4.3)	(3.3)	(2.8)	(3.1)	(3.0)	(3.8)	(3.0)	(2.2)	(3.3)	(2.7)
Mother graduated senior secondary	-18.1***	9.5*	-2.7	5.1	6.1	-10.6	9.6**	4.5	1.1	-4.5
	(5.5)	(5.2)	(4.3)	(4.9)	(5.7)	(6.8)	(4.4)	(4.1)	(5.1)	(4.4)
Mother graduated university	-0.8	11.6	-1.9	-4.1	-4.7	-31.1***	21.6**	10.5	-1.7	0.8
	(9.3)	(7.9)	(7.6)	(4.0)	(5.5)	(6.6)	(8.7)	(8.6)	(6.7)	(6.9)
Mother attended vocational school	-0.5	-0.0	4.8	-2.5	-1.8	-3.9	3.2	-1.0	-1.6	3.4
	(8.3)	(4.5)	(6.1)	(4.2)	(4.3)	(7.8)	(4.4)	(4.1)	(5.0)	(5.8)
Base case probability	34.8	19.7	13.3	17.9	14.4	35.9	20.0	13.1	17.5	13.5
Observations	4,040					3,567				
R – Squared	0.103					0.124				

Notes: *** 1% significance, ** 5% significance, * 10% significance; figures are marginal effects in percentage points; estimation includes province of junior secondary graduation fixed effects and all variables listed in Table S2.2; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

For both sexes, students with test scores in the top tercile are far more likely to attend public schools. Moreover, private vocational schools attract the lowest scoring students. Including test scores does not alter the finding above that highly educated parents choose general schools over vocational schools, although the effects are less precisely estimated.

In sum, the probability that students enroll in public vocational schools declined substantially for the middle and youngest cohort. However, this does not seem to be caused by a decline in the quality of public vocational students, as high scoring students are still more likely to attend public schools. The more likely cause is an increase in the number of private schools, particularly private vocational schools, which have responded to the continued high demand for highly educated workers (World Bank, 2011).

Two main household characteristics are associated with choice of school type: scholastic ability and parental education. With regards to the former, high scoring students choose public schools as their first preference, followed by private general school. For parental education, private general schools attract the sons of better-educated fathers, followed by public general schools. Private vocational schools act as a last resort; students who enroll in these schools disproportionately scores in the bottom tercile and their parents are less well educated.

IV. LABOR MARKET EFFECTS OF VOCATIONAL EDUCATION

We turn from the determinants of students' school type to their subsequent labor market experience. We examine four different outcomes: labor force participation (LFP), unemployment conditional on participation, formal sector work, and log of hourly wage.¹⁴ The reduced form model estimated is:

$$Y_{it} = \beta_Z Z_i + \beta_P P_i + \beta_D D_d + \beta_Y Y_t + \beta_T T_i + \varepsilon_{it} \quad (2)$$

where Y_{it} is the labor market outcome of person i in year t . Z_i and P_i , as in equation one, are defined as a vector predetermined individual characteristics and parental education, while D_d is a set of indicators for district of junior secondary school. Y_t is a vector of interview year dummies, and T_i is a vector of categorical dummies of the senior secondary school types, including no senior secondary, with public general excluded given that our main interest is in comparing the returns to general relative to vocational.¹⁵

The equation is estimated using double robust regression, which rebalances the sample by reweighting observations according to the inverse estimated

14. The wage of self-employed individuals is calculated using their average hourly profit. The Statistics Indonesia urban price index is used to deflate 1993 wages, while IFLS price indices are used for subsequent years.

15. We do not control for university attendance, which is partially determined by choice of school type.

probability of attending the type of school that a person graduated from. While this reweighting reduces precision, it makes the estimates more robust to non-linear functional forms.

A key indicator to measure the effectiveness of this reweighting procedure is the normalized difference between means of the observed control variables for different school types, compared to general public graduates (Imbens and Wooldridge, 2009). Reweighting greatly reduces the average of the normalized difference across the 42 control variables. The average normalized difference falls by 66 percent for public vocational graduates, 80 percent for private general graduates, and 95 percent for private vocational graduates.¹⁶ This indicates that the reweighting was effective.

To the best of our knowledge, a plausible instrument for school choice does not exist.¹⁷ As a result, the OLS results reported would be biased to the extent that school choice is based on unobserved determinants of labor market outcomes.¹⁸ Non-random selection into employment will also bias the estimated effects of school type on formality and wages, if unobserved determinants of school type are correlated with the probability that different types of graduates choose to work. It is therefore important to control for as many pre-determined or exogenous characteristics as possible. Fortunately, the survey collects a large amount of data on individual and family characteristics. We include parental education, for both resident and non-co-resident parents; height; self-reported size of residence at age 12; grade repetition in junior high and elementary school; public lower secondary school attendance; working while attending elementary school, or lower secondary, and year of interview. In addition, the youngest cohort was asked to report their lower secondary test score, which can be used to gauge the bias due to omitting this variable. We include district of junior secondary graduation fixed effects to take into account differences in the supply of education, community characteristics, and peer effects that vary across district.¹⁹ Finally, survey year and cohort dummies are included, which captures age as well. Despite the inclusion of several observed characteristics,

16. After rebalancing, the normalized difference between public general and public vocational graduates is 0.006. For private general and vocational, the normalized difference is 0.005 and 0.001 respectively.

17. We have tried several instruments, including the share of schools of each type and the leave-out mean of enrolment in each school type in the district and year where a person graduates from junior secondary school. While the latter is a strong instrument, it is unlikely to be valid, as variation in school attendance patterns across communities is undoubtedly correlated with local labor market conditions. The best candidate instrument would be data on historical school construction, as in Duflo (2001). However, this information is unavailable, and the village censuses (*Podes*) show little change in the local prevalence of different types of high schools across time. Therefore, we elected to abandon the instrumental variables approach.

18. Unfortunately, it is difficult to speculate as to the direction of the bias, given the lack of data on unobserved characteristics such as motivation or aspirations, and the presence of several control variables in the model.

19. District of lower secondary school is highly collinear with district of secondary school, as less than a quarter of the sample attended junior and senior secondary schools in different districts.

however, there are important unobserved characteristics that are omitted and we do not claim that the results are causal.

Table 2 shows the estimated labor market effects of different school types relative to public general, while the full estimation results are in Table S4.2 in Appendix S4. For robustness, the fourth and fifth columns give the estimates of average and median returns.²⁰

For men, the results show a substantial public school wage premium. Private general graduates earn nearly 25 percent less than public general graduates and private vocational students nearly 18 percent less. These penalties are substantial given that non-graduates earn 40 percent less. In contrast, differences between public and vocational schools are much smaller. The estimates are sufficiently precise to rule out a public vocational premium, relative to public general, exceeding 16 percent. Differences between public general and vocational graduates are more apparent, however, when examining formality.²¹ Graduating from a vocational school is associated with about a 6 percentage point greater chance of working in a formal job.

For male graduates of private schools, the average wage penalty is similar for vocational and general graduates, although general graduates face a larger median wage penalty. Private general school graduates are also much less likely to get a formal job than private vocational graduates. Compared to public school graduates, private general graduates are 5 percentage points less likely to work in a formal job, but private vocational graduates are 5 percentage points more likely to. The results for private general graduates are particularly disappointing, since private vocational graduates tend to have lower parental education levels than private general graduates, and in the most recent cohort, lower test scores as well.

Among women, private general schools are also associated with reduced labor force participation and formality rates compared with graduates of the other three school types. With regards to wages, meanwhile, public vocational graduates earn a wage premium of 16 percent. The wage estimates for females are less precise but can nonetheless rule out a public vocational wage premium that is greater than 30 percent. Private general graduates earn the least compared to observable similar graduates of the other three schools, although the difference is not statistically significant. As with men, women with no senior secondary education earn far less than those who attend senior secondary.

20. Although median regression is more robust to outliers, it does not allow for the inclusion of district fixed effects. As a result, we included provincial rather than district effects in the median regression specification.

21. A job is classified as formal if the worker is a salaried employee, is self-employed with permanent workers, or is self-employed with temporary workers outside of agriculture. This definition, which is based on employment status and sector, is 99 percent correlated with the official definition adopted by the Statistics Indonesia, which is based on employment status and occupation. Formal employees tend to earn higher wages and express greater job satisfaction than informal employees, particularly casual workers (World Bank, 2011).

TABLE 2. The Effect of School Types on Labor Market Outcomes: Full sample pooled

	Men					Women				
	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	Wage LAD	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	Wage LAD
No secondary school	-0.001 (0.009)	0.005 (0.009)	-0.096*** (0.027)	-0.404*** (0.053)	-0.481*** (0.037)	-0.147*** (0.027)	-0.015 (0.009)	-0.213*** (0.031)	-0.473*** (0.093)	-0.636*** (0.062)
Public Vocational	0.015** (0.007)	-0.007 (0.012)	0.062** (0.027)	0.041 (0.057)	0.007 (0.037)	0.029 (0.030)	-0.020* (0.011)	0.087*** (0.028)	0.158** (0.072)	0.143*** (0.049)
Private general	0.014* (0.008)	-0.004 (0.009)	-0.050* (0.030)	-0.146** (0.060)	-0.248*** (0.055)	-0.078** (0.031)	0.017 (0.011)	-0.084** (0.041)	-0.138 (0.091)	-0.251*** (0.079)
Private vocational	0.006 (0.008)	0.004 (0.012)	0.048* (0.028)	-0.177*** (0.060)	-0.176*** (0.035)	-0.034 (0.031)	0.007 (0.012)	0.005 (0.041)	-0.039 (0.090)	-0.092 (0.071)
Average among public general graduates	0.971	0.053	0.712			0.698	0.043	0.734		
R-squared	0.069	0.153	0.181	0.219		0.156	0.211	0.239	0.312	
Observations	9,012	8,774	8,342	7,370	7,370	8,473	5,136	4,928	3,801	3,801

Notes: *** 1% significance, ** 5% significance, * 10% significance; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level; LPM stands for Linear Probability Model, OLS stands for Ordinary Least Squares, and LAD for Least Absolute Deviations. In all cases, the sample is rebalanced by reweighting observations by the estimated inverse probability of attending their school type, in addition to standard individual cross-sectional weights. Robust standard errors are reported. All estimates are based on equation (2) in the text. Wage LAD estimates include provincial instead of district fixed effects. Standard errors for LAD estimates are obtained from an unweighted bootstrap procedure.

One potential source of bias stems from the lack of a direct measure of scholastic ability for the entire sample. To assess the extent to which this omission generates biased estimates of the returns to different types of schools, in Table S4.1 in Appendix S4 we include test scores in the estimation results using the youngest cohort and compare them to the results when the variable is excluded. The results show, reassuringly, that the omission of test scores is a negligible source of bias.

V. HETEROGENEITY IN AGE AND COHORT

Returns to vocational education may decline over time. This could occur, for example, if the specific skills taught in vocational schools become obsolete faster than general skills. Vocational graduates' specific skills may also enable them to work immediately at a market wage after graduation, while general graduates need to be trained further by the firms that employ them. Over time, however, general graduates may find it easier to upgrade their skills to cater to employers' demands. In either case, vocational education would confer an initial advantage that would erode over time.

In this section, we examine age effects for different cohorts, which enable us to separate age effects from cohort effects. There has been little research examining how the returns to school type vary by age in developing countries, largely due to the lack of long-running longitudinal datasets. As we discuss in Section III, we divided the IFLS sample into three cohorts: old (those born between 1940 and 1962), middle (1963 – 1972), and young (1973 – 1980). For each cohort, we estimate the following equation:

$$Y_{it} = \beta_Z Z_i + \beta_P P_i + \beta_D D_d + \beta_Y Y_t + \beta_T T_i + \beta_{ty}(T_i * Y_t) + \varepsilon_{it} \quad (3)$$

In this specification, β_{ty} is a 1 X 16 vector, containing the estimated effect of each school type, relative to public general, for each of the four survey waves. We discuss the outcomes in turn below, while the graphic representation and estimation results are in Appendix S5.²²

We begin by looking at the effect of vocational school on labor force participation, starting with men. Comparing the young and the middle cohorts, the recent cohort of men is more likely than the middle cohort to participate early in their career, although the difference is not statistically significant and disappears by age thirty. In general, the effect of public vocational education on

22. We graph these estimated effects, separately for each cohort, on the vertical axis. The horizontal axis represents the average age of each cohort in the relevant year. Therefore, for each cohort and labor market indicator, there are four estimates of the effect, spanning fourteen years of the cohort's life. Since the youngest cohort covers those born from 1973 to 1980, its oldest members were 20 in 1993. Since only a few members of the youngest cohort were working in 1993, these estimates are not reported. We also calculate the effect for private general and private vocational schools. However, because the vocational expansion in prioritising public vocational over public general, in this section we focus on these two school types.

participation is approximately one and a half percentage points, which is sizable given that only three percent of male public general graduates, on average, do not participate in the labor force. The positive effect of public vocational school on participation begins to decline at age thirty and becomes negative around the age of forty.

The pattern for women, shown in Figure S5.2, is the opposite. The positive effect of public vocational on participation starts high, declines, and then recovers. The five percentage premium experienced by 25 year-olds decreases with age, reaches a bottom of negative percentage points in the early 30s, and then increases to ten percentage points for older women. There are no apparent cohort effects.

Turning to the probability of unemployment, the difference in unemployment between public general and public vocational graduates is shown in Figure S5.3 for men and Figure S5.4 for women. Men exhibit no cohort effects, as the graph is continuous across cohorts. Public vocational graduates enjoy lower unemployment from their early twenties until they turn thirty. After that, the effect of vocational education remains close to zero without becoming statistically significant.

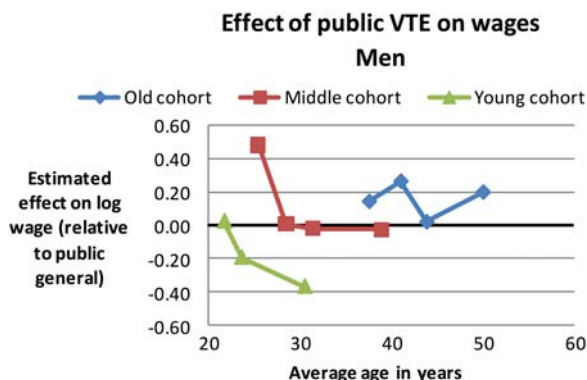
For females, meanwhile, there is a sizeable cohort effect between the young and the middle cohorts. At the age of twenty-five, vocational graduates in the young cohort enjoy lower unemployment rates than general graduates, while vocational graduates in the middle cohort face the same unemployment rate as general graduates. At around thirty, however, the unemployment rate of vocational graduates in the young cohort is higher than general graduates. Looking at the age profile, it appears that general and vocational graduates over thirty years old have similar unemployment rates.

Next, Figure S5.5 examines the effect of public vocational education on the probability of holding a formal job, conditional on being employed. For the middle cohort in 1993, when their average was 26, public vocational graduates enjoyed a large formality premium of nearly 30 percentage points, which gradually declined to 10 percentage points in 2007. That formality premium, disappeared for the younger cohort, however. In the year 2000, when their average age was 23, the formality premium for the youngest cohort was 5 percentage points and seven years later it was essentially zero.

For female public vocational graduates, unlike their male counterparts, there is no evidence of a fall in the formality premium for the youngest cohort. Figure S5.6 shows that female public vocational graduates are no more likely to work in formal jobs than public general graduates from ages 20 to 30. After age 30, public vocational graduates are slightly more likely to be in a formal job, but that formality premium gradually declines.

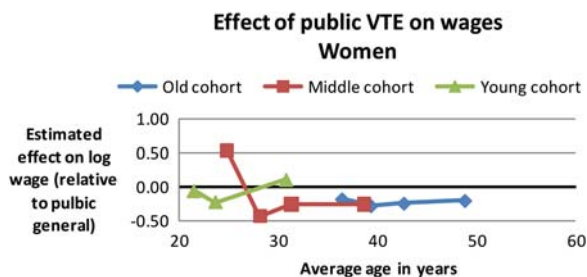
The last labor market outcome that we examine is the reported wage, shown in Figures 2 and 3. The comparison between the middle and youngest cohort is particularly striking. In the middle cohort, public vocational graduates enjoyed an estimated 40 percent wage premium in 1993, when they were 25, which

FIGURE 2. Effect of Public Vocational on Wages, Men



Note: estimation results are in Table S5.4 in Appendix S5

FIGURE 3. Effect of Public Vocational on Wages, Women



Note: estimation results are in Table S5.4 in Appendix S5

declined to essentially zero in 1997, 2000, and 2007. Male public vocational graduates in the youngest cohort, however, experienced a large wage penalty. The estimated penalty was 20 percent in 2000, when the cohort on average was 23, and 40 percent seven years later.

As was the case for informality, there is no clear sign of a cohort effect for women. The public vocational wage premium for the youngest cohort, which was 60 percent for women in 2007, if anything rose compared to the middle cohort. However, the estimates are imprecise and not statistically significant. Overall, the age-wage profile suggests a short-lived benefit for female vocational graduates in their mid to late twenties, which largely disappears in their thirties before picking up again in their forties and fifties. The large public vocational premium for the oldest cohort around the age of fifty is the only estimated effect that is statistically significant.

This section highlights the importance of estimating both cohort and age effects and treating age effects carefully. In general, the strongest effects of

vocational education are experienced early in life, between the ages of 20 and 35. For example, while Table 2 shows an insignificant negative effect of vocational education on unemployment over the entire sample, results in this section show that this effect is concentrated among young graduates in their twenties. Results for graduates younger than 25, however, are contaminated by university enrollment decisions. This is because full time students are not included in the sample, and students typically do not typically graduate from university until age 25. University enrollment could explain part of the negative effect of vocational education on unemployment, for example. General secondary school graduates are more likely to attend university than vocational graduates, and university graduates are more likely to experience spells of unemployment as they search for the best job following graduation. Since the determinants of university enrollment and graduates' job search patterns are not well understood and likely depend on unobserved factors, we focus on results for groups over 25.

The results for recent graduates, particularly those between 25 and 35, suggest that the returns to public vocational school have declined sharply for men. For example, while Table 2 shows a higher formality rate among all male vocational graduates, Figure V.5 shows that the middle cohort drives this positive formality rate in their youth, and that the premium has disappeared for the youngest cohort. This is consistent with the dramatic fall in the effect of vocational education on men's wages. Figure 2 shows that while workers in the middle cohort enjoy a large vocational wage premium before they turn 30, individuals in the youngest cohort enjoy no such benefit. In contrast, after enjoying a smaller wage premium at the age of 21, individuals in this cohort face an increasingly large wage penalty. Although male public vocational graduates face increasingly worse labor market outcomes, there is no sign of a similar deterioration for female public vocational graduates.

One possible explanation for this decline for men relates to recent changes in the structure of the Indonesian economy. Since the financial crisis of 1998, the economy has increasingly relied on the service sector to generate growth. Annual growth in the industrial sector fell dramatically, from nine percent from 1990 to 1997, to four from 1999 to 2007. During the same two periods, annual service sector growth remained strong, falling slightly from seven to six. More recently, employment in the service sector has grown rapidly. From 2003 to 2007, service sector employment grew at roughly four percent per year while industrial sector employment grew at 2.5 percent per year (World Bank, 2011). The increasing prominence of the service sector could disproportionately affect vocationally trained males because they tend to choose technical majors. Women, on the other hand, tend to choose to study business management or tourism skills, for which demand may have remained stronger. In an increasingly service-oriented economy, there may be decreased demand for the industrial and technical majors chosen by most men in vocational schools.

Another potential explanation for the recent decline in male vocational returns is deterioration in the quality of vocational training for men. For example, technical vocational training may require larger investments to remain relevant to new advances in technology. Unfortunately, it is difficult to investigate this further, due to the lack of data on trends in the quality of industrial education facilities.

VI. HETEROGENEITY IN FAMILY BACKGROUND

The second aspect of heterogeneity that we examine is family background, proxied for by father's education. We separate the sample into two categories: those whose father has at most a junior secondary education and those whose father has at least a senior secondary education. Table 3 shows the estimation results for men. Comparing the results with the ones in Table 2, we find that the effects of school types on labor market outcomes are mostly limited to students from a disadvantaged background. Among these individuals, graduates of public vocational schools have a higher formality rate than public general school graduates, while private general graduates face the lowest prospects of a formal job. In addition, private school graduates face a large wage penalty relative to public school graduates. In short, public schools appear to provide the most benefit for children from disadvantaged families.

The estimation results for women, shown in Table 4, give similar conclusions. The labor market effects of school types are for the most part only significant among those coming from a disadvantaged background, except the formality penalty among private general graduates. Among individuals from disadvantaged background, private general graduates fare the worst, facing a lower participation and job formality rate. In contrast, public vocational graduates have the highest labor force participation and formality rate.

VII. HETEROGENEITY IN ACADEMIC ABILITY

The final aspect of heterogeneity in the labor market effects of different school types that we consider pertains to academic ability. Does higher ability mitigate or magnify the labor market effects of school types?²³ Since test scores are only available for the youngest cohort, the relevant benchmarks are given in Table IV.1 in Appendix S4, which shows that recent male private general and public vocational graduates experience a substantial wage penalty.

Table 5 provides the estimated effects of school type for men that scored above and below the median on their junior high exit exam. For men scoring below the mean, public vocational education is much more likely to lead to a formal job, but the average wage is much lower. Interestingly, private

23. Note that our sample is rebalanced and has common support over the test score distribution, which allows for valid comparisons across school types despite large differences in average test scores.

TABLE 3. Estimated Effect of School Type on Employment and Job Quality, Men, by father's education

	Junior secondary or below				Senior secondary or above			
	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS
No senior secondary	-0.001 (0.008)	0.008 (0.008)	-0.131*** (0.029)	-0.481*** (0.052)	-0.026 (0.026)	0.024 (0.042)	-0.008 (0.074)	-0.171 (0.214)
Public vocational	0.002 (0.006)	-0.011 (0.009)	0.062** (0.030)	0.037 (0.059)	0.023 (0.015)	0.016 (0.030)	0.011 (0.053)	0.023 (0.133)
Private general	0.006 (0.008)	-0.009 (0.008)	-0.066** (0.030)	-0.230*** (0.058)	0.045** (0.018)	0.008 (0.027)	0.017 (0.053)	-0.122 (0.156)
Private vocational	-0.002 (0.008)	0.011 (0.013)	0.002 (0.028)	-0.281*** (0.070)	0.002 (0.027)	0.070* (0.039)	0.049 (0.069)	-0.110 (0.135)
Average among public general graduates	0.972	0.044	0.758		0.961	0.067	0.814	
R-squared overall	0.059	0.151	0.186	0.231	0.169	0.318	0.328	0.403
Observations	6,650	6,489	6,201	5,481	1,214	1,164	1,063	928

Notes: *** 1% significance, ** 5% significance, * 10% significance; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

TABLE 4. Estimated Effect of School Type on Employment and Job Quality, Women, by father's education

	Junior secondary or below				Senior secondary or above			
	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS
No senior secondary	-0.119*** (0.029)	-0.024* (0.013)	-0.240*** (0.034)	-0.567*** (0.098)	-0.118* (0.063)	-0.021 (0.039)	-0.050 (0.109)	-0.048 (0.151)
Public vocational	0.069** (0.032)	-0.016 (0.013)	0.057* (0.033)	0.169* (0.090)	0.054 (0.062)	-0.039 (0.027)	0.025 (0.061)	-0.027 (0.132)
Private general	-0.068** (0.033)	-0.001 (0.014)	-0.122*** (0.044)	-0.272** (0.137)	-0.033 (0.054)	0.001 (0.032)	-0.125** (0.062)	0.125 (0.140)
Private vocational	-0.020 (0.037)	0.011 (0.016)	-0.038 (0.042)	-0.030 (0.098)	-0.070 (0.086)	-0.001 (0.033)	-0.072 (0.072)	0.188 (0.164)
Average among public general graduates	0.640	0.050	0.711		0.700	0.073	0.815	
R-squared overall	0.146	0.201	0.257	0.338	0.270	0.325	0.371	0.442
Observations	5,996	3,564	3,435	2,586	1,569	1,030	969	804

Notes: *** 1% significance, ** 5% significance, * 10% significance; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

TABLE 5. Estimated Effect of School Type on Employment and Job Quality, Men, by test score

	Low scores				High scores			
	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS
No senior secondary	0.017 (0.045)	-0.052 (0.059)	0.125 (0.082)	-0.159 (0.148)	0.016 (0.041)	-0.014 (0.040)	0.053 (0.063)	-0.296* (0.156)
Public vocational	0.023 (0.047)	-0.108 (0.097)	0.218** (0.102)	-0.479** (0.242)	0.017 (0.034)	-0.006 (0.049)	-0.027 (0.066)	-0.218* (0.128)
Private general	0.009 (0.046)	-0.096 (0.060)	0.108 (0.100)	0.052 (0.181)	0.012 (0.030)	0.024 (0.043)	-0.064 (0.081)	-0.319** (0.127)
Private vocational	-0.005 (0.043)	-0.085 (0.066)	0.141* (0.081)	-0.024 (0.153)	-0.008 (0.037)	0.043 (0.055)	-0.001 (0.074)	-0.308** (0.151)
Average among public general graduates	0.921	0.184	0.627		0.944	0.145	0.742	
R-squared overall	0.231	0.327	0.420	0.353	0.180	0.324	0.423	0.392
Observations	1,093	1,027	896	750	1,109	1,051	916	747

Notes: *** 1% significance, ** 5% significance, * 10% significance; figures are marginal effects; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level. Low scores are below median.

vocational school is also associated with an increase in formality, and has no associated penalty.

For men scoring above the median, the results illustrate the benefits of attending public general school. Public general graduates earn a 20 percent premium over public vocational students and a 30 percent premium over private school graduates. Remarkably, there appears to be no positive return to attending private school, relative to not graduating, for high scoring men. It is these high scoring men who stand the most to lose from attending vocational or lower-quality private general education in an economy that increasingly values broadly educated and cognitively skilled workers.

The results for women are shown in Table 6. Most striking are the different effects of school type on wages for low and high scoring women. Unlike for men, high-scoring women face no major wage penalty for attending public vocational or private general school. The wage penalty for private vocational school, relative to public general, is 35 percent, and nearly equal to the penalty for not graduating high school. For low scoring women, there is suggestive evidence that vocational school helps. Low scoring women who attend public and private vocational schools earn approximately a 38 percent and 30 percent wage premium, respectively. Although not statistically significant, these are large premiums.

VIII. CONCLUSION

This paper attempts to better understand the determinants of households' choice of senior secondary schools in Indonesia and the labor market consequences of attending different types of high schools. This is the first paper to our knowledge from a developing country that distinguishes between public and privately provided vocational schools, to assess whether private vocational schools impart skills more relevant to a rapidly changing labor market. Another key contribution is a careful examination of heterogeneity in the effects. We examine effects separately by age, cohort, parental education, and ability. The use of longitudinal data allows for cohort effects to be distinguished from age effects. Finally, the estimation utilizes an unusually rich set of predetermined control variables. While the possibility of bias due to unobserved characteristics cannot be dismissed, it is reassuring that for the youngest cohort, the inclusion of test scores – the most important determinant of school type – does not significantly alter the results.

The two most important observed determinants of school choice are test scores and parental education. Students with high test scores are most likely to attend public schools, particularly public general school. In contrast, the children of highly educated parents tend to select general schools, particularly private general, rather than vocational schools. Private vocational school is a last resort, serving students with the lowest test scores and the least educated parents.

TABLE 6. Estimated Effect of School Type on Employment and Job Quality, Women, by test score

	Low scores				High scores			
	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS	LFP LPM	Unemployment LPM	Formal LPM	Wage OLS
No senior secondary	-0.078 (0.071)	0.051 (0.050)	-0.269*** (0.102)	0.051 (0.301)	-0.064 (0.062)	-0.101** (0.050)	-0.155** (0.073)	-0.376** (0.166)
Public vocational	0.008 (0.095)	0.070 (0.070)	-0.208 (0.133)	0.383 (0.389)	-0.016 (0.064)	-0.071* (0.039)	0.070 (0.086)	-0.081 (0.154)
Private general	-0.072 (0.087)	0.102 (0.074)	-0.168 (0.121)	0.148 (0.348)	-0.032 (0.081)	-0.031 (0.059)	-0.120 (0.090)	0.012 (0.160)
Private vocational	0.008 (0.087)	0.117* (0.066)	-0.122 (0.112)	0.301 (0.292)	-0.007 (0.064)	0.037 (0.069)	0.043 (0.071)	-0.351* (0.191)
Average among public general graduates	0.569	0.060	0.672		0.689	0.156	0.767	
R-squared overall	0.239	0.402	0.484	0.548	0.324	0.381	0.434	0.506
Observations	1,219	680	624	437	1,169	774	692	525

Notes: *** 1% significance, ** 5% significance, * 10% significance; figures are marginal effects; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level. Low scores are below median.

With regard to labor market outcomes, we find a striking distinction between publicly and privately schooled men. Male private school graduates, compared to their public school counterparts, suffer an average wage penalty of approximately 16 percent. This large wage penalty is robust to median regression. For men with high test scores, the correlation between public general attendance and subsequent wages is particularly strong. The patterns are somewhat different for women. Public school graduates earn more than private general graduates, but there are important differences between types of graduates.

Among employed public school graduates, vocational graduates have traditionally fared slightly better than general graduates in the labor market, although this is no longer the case among men. In general, attending public vocational school attendance has a mild, positive, and statistically insignificant correlation with wages, and the estimates are sufficiently precise to rule out wage effects greater than 16 percent for men. Public vocational schools increase the probability of obtaining a formal job, as defined by the Indonesian Bureau of Statistics, by six percentage points. For women, the results suggest a positive effect of public vocational education, although this effect is only clearly discernible for the oldest cohort of women. There is suggestive evidence that this positive effect of public vocational school is strongest for women with lower test scores. In contrast to men, the outcomes for female public vocational graduates in recent years have, if anything, improved.

The most dramatic result, which comes from disentangling age and cohort effects, is the large drop in the wage premium for the most recent cohort of male public vocational graduates. This drop is unlikely to be explained by changes in the unobserved characteristics of vocational graduates, as there are no major changes in the observed characteristics of vocational attendance for the youngest cohort. While we cannot directly explore the underlying causes behind this drop, plausible possibilities include a fall in the educational quality of the technical and industrial majors favored by men, as well as the declining relevance of these skills in an increasingly service-oriented Indonesian economy.

In sum, the results suggest that whether high schools are publicly or privately administered and whether the curriculum is vocational or general are both important factors influencing graduates' subsequent labor market outcomes. Male private school graduates earn substantially less than their publicly schooled peers. Private general school graduates perform particularly poorly, despite their parents' higher education levels. This highlights the need for further research to investigate the importance of peer effects, curriculum, teachers, and reputation effects in explaining these results. The current evidence is insufficient to justify a recommendation to rapidly expand access to public schools. Nonetheless, given the especially strong results for men with high test scores, a logical first step would be ensuring access to public general schools for these high-scoring students.

Most importantly, the analysis provides little evidence to support the current expansion of vocational education, especially for men. The results fail to show systematic benefits for public vocational graduates compared to public general graduates, despite reasonably precise estimates. Furthermore, the wage penalty for male vocational graduates, in recent years, has increased dramatically. The decline has occurred as Indonesia's industrial sector has sharply slowed and the service sector has become increasingly important to economic growth. Therefore, the general equilibrium effects of a large increase in the supply of vocational graduates should further magnify the wage penalty that we observe in this partial equilibrium investigation. This suggests that it may be worthwhile to review, and possibly reform, vocational and technical education in male-dominated subjects.

REFERENCES

- Bennell, Paul. 1996. "General versus Vocational Secondary Education in Developing Countries: A Review of the Rates of Return Evidence." *Journal of Development Studies*, 33(2): 230–247.
- Bennell, Paul, and Jan Segerstrom. 1998. "Vocational Education and Training in Developing Countries: Has the World Bank Got it Right?" *International Journal of Educational Development*, 18(4): 271–287.
- Chen, Dandan. 2009. *Vocational Schooling, Labor Market Outcomes, and College Entry*. Policy Research Working Paper 4814. Washington, DC: World Bank.
- Duflo, Esther. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment", *American Economic Review*, 91(4): 795–813
- El-Hamidi, Fatma. 2006. "General or Vocational Schooling? Evidence on School Choice, Returns, and 'Sheepskin' Effects from Egypt 1998." *Journal of Policy Reform*, 9(2): 157–176.
- Ghozali, Abbas. 2006. *Analisis Biaya Satuan Pendidikan Dasar dan Menengah*. Jakarta. mimeo.
- Heckman, James J., and Edward Vytlacil. 2001. "Identifying the Role of Cognitive Ability in Explaining the Level of and Change in the Return of Schooling." *Review of Economics and Statistics*, 83(1): 1–12.
- Horowitz, Andrew W., and Christoph Schenzler. 1999. "Returns to General, Technical and Vocational Education in Developing Countries: Recent Evidence from Suriname." *Education Economics*, 7(1): 5–19.
- Imbens, Guido, and Jeffrey Woolridge, 2009, "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature*, 47(1): 5–86
- Jimenez, Emmanuel, Marlaine E. Lockheed, and Vicente Paqueo. 1991. "The Relative Efficiency of Private and Public Schools in Developing Countries." *World Bank Research Observer*, 6(2): 205–218.
- Kahyarara, Godius, and Francis Teal. 2008. "The Returns to Vocational Training and Academic Education: Evidence from Tanzania." *World Development*, 36(11): 2223–2242.
- KRIVET. 2008. *Pre-employment Vocational Education and Training in Korea*. mimeo.
- Lechner, Michael. 2000. "An Evaluation of Public-Sector-Sponsored Continuous Vocational Training Programs in East Germany." *Journal of Human Resources*, 35(2): 347–375.
- Malamud, Ofer, and Cristian Pop-Eleches. 2008. *General Education vs. Vocational Training: Evidence from an Economy in Transition*. NBER Working Paper 14155. Cambridge, MA: National Bureau of Economic Research.

- Ministry of National Education. 2006. *Rencana Strategis Departemen Pendidikan Nasional Tahun 2005–2009*. Jakarta: Ministry of National Education.
- Moenjak, Thammarak, and Christopher Worswick. 2003. “Vocational education in Thailand: a study of choice and returns.” *Economics of Education Review*, 22:99–107.
- Neuman, Shoshana, and Adrian Ziderman. 1991. “Vocational Schooling, Occupational Matching, and Labor Market Earnings in Israel.” *Journal of Human Resources*, 26(2): 256–281.
- Newhouse, David, and Kathleen Beegle. 2006. “The Effect of School Type on Academic Achievement.” *Journal of Human Resources*, 41(3): 529–557.
- Strauss, John, Firman Witoelar, Bondan Sikoki, and Anna Marie Wattie. 2009. *The Fourth Wave of the Indonesia Family Life Survey: Overview and Field Report Volume 1*. RAND Labor and Population Working Paper WR-675/1-NIA/NICHD. Santa Monica, CA: RAND.
- Tobias, Justin L. 2003. “Are Returns to Schooling Concentrated among the Most Ables? A Semiparametric Analysis of the Ability-earnings Relationships.” *Oxford Bulletin of Economics and Statistics*, 65(1): 1–29.
- World Bank. 2011. *Indonesia Jobs Report*. Jakarta: World Bank.
- . 2007. *Investing in Indonesia’s Education: Allocation, Equity and Efficiency of Public Expenditures*. Jakarta: World Bank.
- . 1995. *Training and the Labor Market in Indonesia: Policies for Productivity Gains and Employment Growth*. Washington, DC: World Bank.