

# The Value of Vocational Education

## High School Type and Labor Market Outcomes in Indonesia

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## Abstract

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 very timely, given the government's recent decision to dramatically expand vocational enrollment. The analysis controls for an unusually rich set of predetermined characteristics, and exploits longitudinal data spanning 14 years to separately identify cohort and age effects. There are four main findings. First, students are sorted into different school types largely on the basis of their entering exam score. Public schools attract the highest-scoring students, while private vocational schools serve the lowest-scoring students. Second, after controlling for

a variety of characteristics, including test scores, male public school graduates earn a substantial premium over their privately schooled counterparts. Third, private vocational school graduates fare at least as well as private general graduates, despite coming from more disadvantaged socioeconomic backgrounds. Finally, the returns to public vocational education have declined sharply for the most recent cohort of men. This raises important concerns about the current expansion of public vocational education, and the relevance of the male vocational curriculum in an increasingly service-oriented economy.

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This paper—a product of the Social Protection and Labor Division, Human Development Network—is part of a larger effort in the network to understand the relationship between training and labor market outcomes. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at [dnewhouse@worldbank.org](mailto:dnewhouse@worldbank.org).

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# **The value of vocational education: High school type and labor market outcomes in Indonesia**

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## **I. Introduction**

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 (Kahyarara and Teal, 2008), and South Korea followed suit 30 years later, both in response to a perceived shortage of skilled workers. In both cases, the expansion policy failed, primarily because parents continued to prefer general to vocational education. (KRIVET, 2008).<sup>1</sup>

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 share of high school students, 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.

One study that we know of 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

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<sup>1</sup> Some studies use the term academic education. In this paper, we use the term general education.

on dubious assumptions.<sup>2</sup> Because of the small sample size, the estimated effects of vocational education in this study are insufficiently precise to rule out large returns.<sup>3</sup> Finally, the analysis does not distinguish between men and women, despite important gender differences in the vocational education curriculum and labor force participation rates.

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 likely confounds 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.<sup>4</sup>

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. Unlike the Indonesian labor force survey, retrospective information is available for all levels of school attendance. In addition, 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. This is important because unobserved determinants of school type may confound the estimates, both through spurious correlations to outcomes and, for some measures, through correlation to the probability of employment. 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.

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<sup>2</sup> The Heckman selection equation is identified by excluding parental education, lagged household income, and junior high test score from the earnings equation.

<sup>3</sup> 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.

<sup>4</sup> The one 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. This technique is intended to mitigate the estimated vocational penalty on test scores, assuming that vocational students are less academically able in unobserved ways. The use of this instrument, however, nearly triples the estimated negative effect of vocational school on test scores, suggesting that the instrument is negatively correlated to unobserved determinants of test scores and is therefore not valid. 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.

Evidence from this cohort suggests 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 distinguished between public and private vocational education at the high school level.<sup>5</sup> The second main contribution is estimating heterogeneous effects of school type, across scholastic ability, age, and family background, for both men and women. The final main contribution is the use of a household panel, covering 14 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, students are primarily sorted into school type based on their entering test scores. Public vocational and general schools attract high-scoring students, while the lowest-scoring students tend to choose private vocational school. Second, male public school graduates enjoy a substantial wage premium, amounting to approximately 20 percent, suggesting that they benefit from a combination of higher school quality, peer effects, and signaling. Third, private vocational graduates enjoy outcomes that are at least as favorable as private general graduates, despite coming from more disadvantaged backgrounds. Finally, in recent years, the returns to public vocational school for men have plummeted, and male vocational graduates now face a large wage penalty.

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

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<sup>5</sup> 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.

## II. Secondary Education in Indonesia

The secondary education system in Indonesia is divided into junior and senior high school, each taking three years to complete. The country has two different school systems, secular and Islamic, and in this paper we focus exclusively on the former.<sup>6</sup> In the secular school system, children graduating from junior high school must choose whether to enroll in a vocational or general high school.<sup>7</sup> These school types are distinct, and only a small portion of the curriculum used by these school types overlap, mostly with regards to subjects such as English and Indonesian. In addition, general high schools do not usually offer vocational subjects, such as carpentry or machinery.

With regards to specialization, the general stream offers three majors: natural science, social science, and language. On the other hand, the vocational stream offers many vocations. A vocational school usually focuses on just one or two majors. The available majors are business management; technical, which includes machinery and information technology; agriculture and forestry; community welfare; tourism; arts and handicraft; health; and marine studies. In addition, there are very specialized vocational high schools that focus on aviation and shipbuilding. Of all of these choices, the first two, business management and technical, are the most popular.<sup>8</sup>

The public cost of vocational education is at least as high as general education. As shown in Figure 1, Ghozali (2006) finds that a public vocational student is 28% more costly for the government to educate, annually, than a public general student.<sup>9</sup> Meanwhile, the amount of per student public funds spent in private schools is lower, and private vocational schools receive the same amount of public funds as private general schools. With regards to household out of pocket costs, meanwhile, private schools are more expensive than public 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.

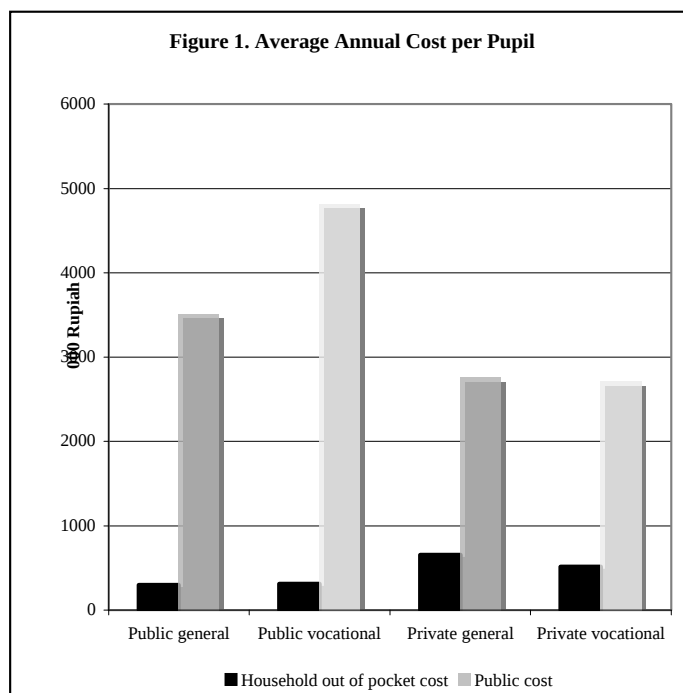
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<sup>6</sup> In 2007, the National Socioeconomic Survey (*Susenas*) shows that only 8.4% school-age children are enrolled in the Islamic system.

<sup>7</sup> Better senior secondary schools also select applicants based on their test scores.

<sup>8</sup> Information on vocational majors is taken from the National Labor Force Survey (*Sakernas*). Unfortunately, the Indonesian Family Life Survey (IFLS), which is used for the analysis presented below, does not collect data on high school major.

<sup>9</sup> Public cost is defined as the amount of government spending on each school type.



*Note: household cost is calculated from IFLS 3, while public cost is calculated by Ghozali (2006).*

### *Vocational school expansion plan*

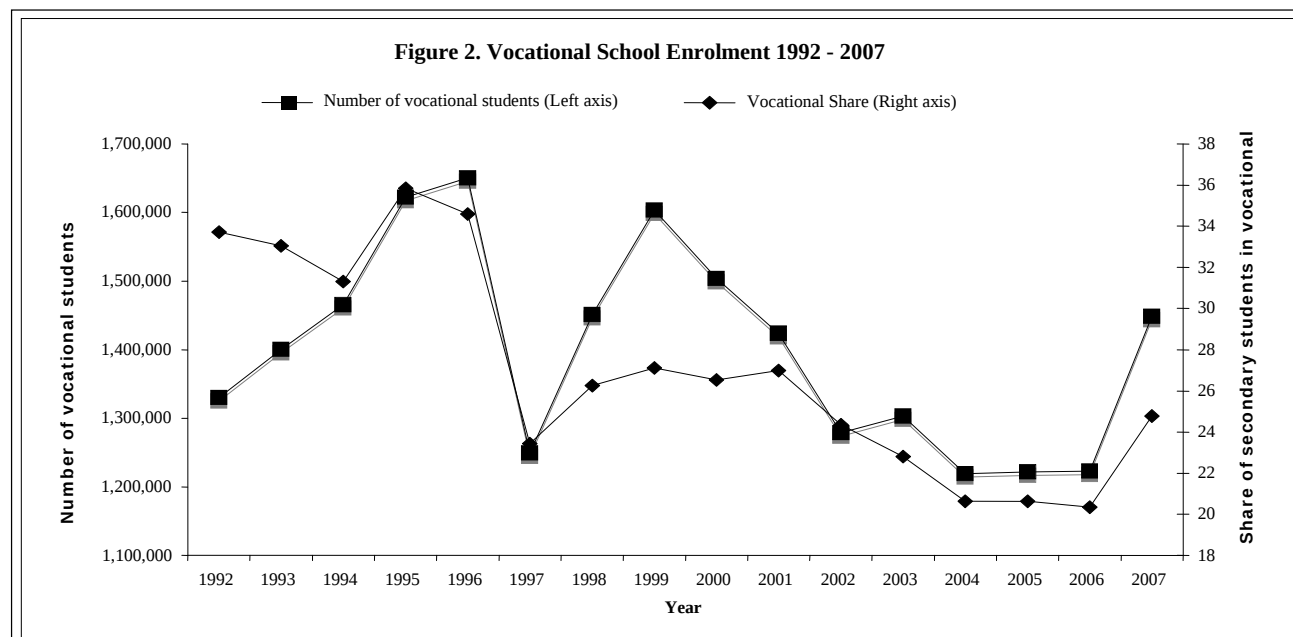
In 2006, the Ministry of National Education began expanding vocational schools. According to their strategic plan (Ministry of National Education, 2006), the main reason for this policy is to increase the size of the labor force that is ready-to-work, especially among those who do not continue to tertiary 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 2 shows below, the ratio was 24:76 in 2007. In order to achieve this target, the ministry has instituted a moratorium on building new general schools. Instead, the government will construct new vocational schools and convert some general schools into vocational schools.

### *Enrollment trends*

Enrollment in vocational high school has been steadily declining. As shown in Figure 2, the number of vocational students has declined from about 1.6 million in 1999 to about 1.2 million in 2006. Over the same period, the proportion of high school students in vocational schools declined from 27% to just 20%, 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 is extremely unlikely that the ministry will meet either the 50:50 target in 2010 or the 70:30 goal five years later.



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

### III. 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% of Indonesia's 1993 population, and covered 13 of the nation's 27 provinces. This initial wave 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 household are lost each wave. Overall, 87.6% 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

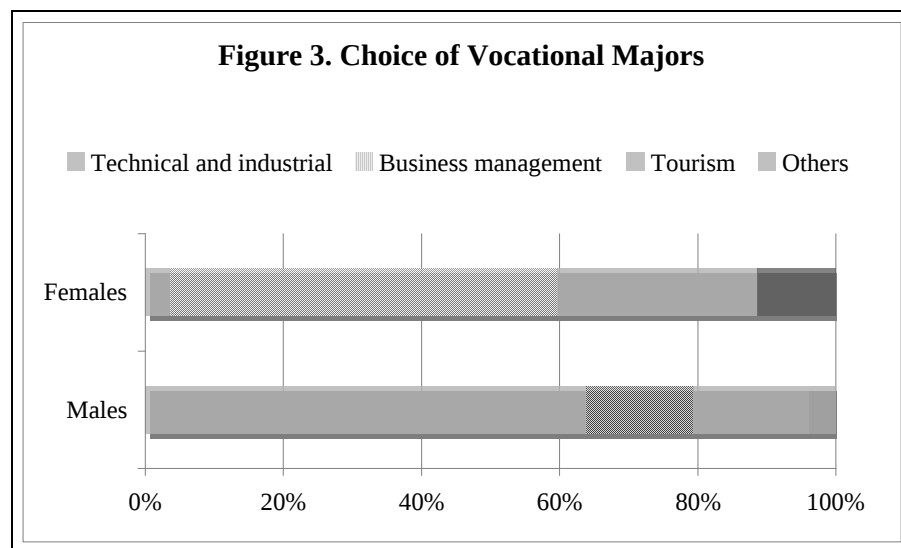
interviewed after they graduated senior secondary, as well as those who were full-time students when interviewed. Those that did not report complete school information were also dropped. Finally, to avoid identification based on functional form assumptions, we restrict the sample to the region of common support (Heckman and Vytlačil, 2001; Tobias, 2003). To do this, we estimated the probability that each person 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 replaced wages that fell in the bottom or top percentile with missing values, in order to avoid distorted estimated wage effects due to outliers. Table 1 shows the number of observations that were dropped during each stage of this process.

Table 1. Sample Construction

|                                                           | Persons | Men<br>Labor<br>market<br>observations | Persons | Women<br>Labor<br>market<br>observations |
|-----------------------------------------------------------|---------|----------------------------------------|---------|------------------------------------------|
| Main respondents age $\geq 18$                            | 16776   | 36827                                  | 17712   | 41847                                    |
| Of which interviewed when under 50 at least once          | 13710   | 28600                                  | 13679   | 30584                                    |
| Of which born between 1940 and 1980                       | 10918   | 25328                                  | 10448   | 26828                                    |
| Of which completed senior secondary and are out of school | 2891    | 6449                                   | 2430    | 5662                                     |
| Of which reported school information and district         | 2699    | 6133                                   | 2282    | 5384                                     |
| <u>Of which satisfy overlapping support</u>               | 2675    | 6084                                   | 2260    | 5330                                     |
| In labor force                                            | 2621    | 5934                                   | 1753    | 3456                                     |
| Employed                                                  | 2460    | 5439                                   | 1516    | 2875                                     |
| Formal                                                    | 2022    | 3369                                   | 1120    | 1817                                     |
| Reported wage or profit per hour                          | 2352    | 5066                                   | 1427    | 2681                                     |
| <u>Of which satisfy overlapping support</u>               | 2675    | 6084                                   | 2260    | 5330                                     |
| Old cohort (born 1940-1963)                               | 923     | 2594                                   | 574     | 1730                                     |
| Middle cohort (born 1964-1972)                            | 935     | 2034                                   | 819     | 1929                                     |
| Recent cohort (born 1973-1980)                            | 866     | 1456                                   | 934     | 1671                                     |
| Recent cohort and reported test score                     | 737     | 1245                                   | 766     | 1366                                     |

After dropping observations outside the region of common support, the final sample consists of 6,084 total labor market observations on 2,675 men, and 5,330 observations on 2,260 women. 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.<sup>10</sup> Hence, for this most recent cohort, a direct measure of scholastic ability is available. Descriptive statistics for all variables are given in Appendix 1.

All estimates are separated by sex, because men and women exhibit different labor market participation patterns and they select different vocational education majors. As shown in Figure 3, 63.8% of men choose a technical or industrial major, while 56.0% and 28.9% of women are enrolled in business management and tourism majors, respectively.



*Note: calculated from the National Labor Force Survey (Sakernas)*

<sup>10</sup> 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.

#### IV. Understanding School Choice

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

$$T_i = \beta_z Z_i + \beta_{pi} P_i + \beta_{pd} P_d + \varepsilon_{id} \quad (1)$$

where  $T_i$  is a four-category variable indicating high school type,  $Z_i$  is a vector of predetermined characteristics,  $P_i$  is parental education, and  $P_d$  is district-level parental education shares. Table 2 provides the estimated marginal effects of selected independent variables, estimated using equation (1).

The changing estimates of cohort effects, shown at the top of table 2, show that the reduction in vocational enrollment observed in Figure 2 is caused by movement from public vocational schools to private schools. Men in the middle and recent cohorts are 13.4 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 8.8 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 probabilities of attending public vocational school declined by 15.6 percentage points for the middle cohort, and this decreased popularity of public vocational school persisted for the youngest cohort.

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 less strong for females, although maternal education decreases the likelihood of attending public vocational schools. Finally, higher parental education strongly and increasingly reduces the chance of the child enrolling in private vocational schools.

Table 2: Marginal Effects of School Type Determinants: selected variables, full sample

|                                       | Men               |                      |                    |                       | Women             |                      |                    |                       |
|---------------------------------------|-------------------|----------------------|--------------------|-----------------------|-------------------|----------------------|--------------------|-----------------------|
|                                       | Public<br>general | Public<br>vocational | Private<br>general | Private<br>vocational | Public<br>general | Public<br>vocational | Private<br>general | Private<br>vocational |
| <u>Personal characteristics</u>       |                   |                      |                    |                       |                   |                      |                    |                       |
| Middle Cohort                         | 4.2<br>(2.6)      | -13.4***<br>(1.8)    | 8.8***<br>(2.5)    | 0.3<br>(2.0)          | -1.6<br>(2.9)     | -15.6***<br>(2.3)    | 10.0***<br>(3.2)   | 7.1**<br>(3.0)        |
| Recent cohort                         | -2.5<br>(2.5)     | -13.4***<br>(1.9)    | 3.0<br>(2.5)       | 12.9***<br>(2.8)      | 1.3<br>(2.8)      | -18.4***<br>(1.9)    | 7.7**<br>(3.1)     | 9.4***<br>(3.1)       |
| Repeated grade in junior<br>secondary | -4.3<br>(6.2)     | -3.8<br>(5.1)        | 5.5<br>(5.3)       | 2.6<br>(4.7)          | 3.6<br>(9.1)      | -11.1<br>(10.1)      | 1.8<br>(10.7)      | 5.8<br>(6.1)          |
| Lived in small town at age 12         | 2.2<br>(2.4)      | -0.9<br>(2.1)        | -2.7<br>(2.1)      | 1.3<br>(2.3)          | 4.2<br>(2.7)      | -2.7<br>(2.2)        | -1.7<br>(2.4)      | 0.2<br>(2.2)          |
| Lived in big city at age 12           | 7.4**<br>(2.9)    | -2.0<br>(2.5)        | -6.5***<br>(2.4)   | 1.1<br>(2.7)          | 6.4*<br>(3.3)     | -0.1<br>(2.8)        | 3.3<br>(3.0)       | -9.7***<br>(2.2)      |
| Height                                | 0.0<br>(0.1)      | -0.1<br>(0.1)        | 0.2*<br>(0.1)      | -0.2**<br>(0.1)       | 0.0<br>(0.2)      | -0.0<br>(0.2)        | 0.1<br>(0.2)       | -0.1<br>(0.2)         |
| <u>Parental education</u>             |                   |                      |                    |                       |                   |                      |                    |                       |
| Father graduated elementary           | 4.2<br>(4.5)      | -1.3<br>(3.9)        | 4.1<br>(4.2)       | -7.0*<br>(4.2)        | -6.5<br>(6.2)     | -4.6<br>(5.3)        | 5.8<br>(6.2)       | 5.3<br>(6.5)          |
| Father graduated junior secondary     | 6.2<br>(5.4)      | -3.9<br>(4.1)        | 7.4<br>(5.2)       | -9.8**<br>(4.5)       | -5.6<br>(6.6)     | -8.8*<br>(5.3)       | 8.0<br>(6.9)       | 6.4<br>(7.1)          |
| Father graduated senior secondary     | 6.0<br>(5.9)      | -6.8<br>(4.5)        | 13.0**<br>(6.1)    | -12.2**<br>(4.8)      | -1.5<br>(7.8)     | -8.5<br>(5.5)        | 11.0<br>(7.6)      | -1.0<br>(6.1)         |
| Father graduated university           | 18.7**<br>(7.7)   | -12.2***<br>(4.4)    | 12.4*<br>(7.3)     | -18.9***<br>(4.5)     | 6.1<br>(9.0)      | -11.3*<br>(5.9)      | 7.0<br>(7.4)       | -1.8<br>(7.0)         |
| Father attended vocational school     | 3.5<br>(5.0)      | 7.0<br>(5.5)         | -5.2<br>(4.2)      | -5.3<br>(4.4)         | 1.5<br>(5.4)      | 0.2<br>(4.6)         | -8.9**<br>(4.2)    | 7.2<br>(5.3)          |
| Mother graduated elementary           | 0.1<br>(3.2)      | -4.6*<br>(2.5)       | 5.8*<br>(3.2)      | -1.3<br>(3.1)         | 6.7<br>(4.5)      | 6.6*<br>(3.5)        | -4.6<br>(3.6)      | -8.7***<br>(3.2)      |
| Mother graduated junior<br>secondary  | 3.0<br>(4.4)      | -4.5<br>(3.7)        | 7.1<br>(4.7)       | -5.6<br>(3.8)         | 13.2**<br>(5.6)   | -2.0<br>(3.4)        | 1.9<br>(4.9)       | -13.1***<br>(3.4)     |
| Mother graduated senior<br>secondary  | 5.2<br>(6.9)      | -8.8*<br>(5.0)       | 2.0<br>(6.0)       | 1.5<br>(6.9)          | 10.0<br>(6.7)     | 4.7<br>(5.9)         | -2.2<br>(6.6)      | -12.5**<br>(5.4)      |
| Mother graduated university           | 18.6*<br>(11.3)   | -5.3<br>(10.6)       | -4.7<br>(5.7)      | -8.7<br>(7.8)         | 17.2*<br>(10.1)   | 7.3<br>(10.1)        | -11.4<br>(7.2)     | -13.1**<br>(6.7)      |
| Mother attended vocational<br>school  | -0.9<br>(6.5)     | 7.1<br>(7.9)         | -3.5<br>(5.5)      | -2.7<br>(5.7)         | 3.9<br>(6.1)      | -2.6<br>(5.3)        | -5.1<br>(6.0)      | 3.9<br>(7.4)          |
| Base case probability                 | 12.8              | 30.8                 | 18.4               | 38.0                  | 50.6              | 19.8                 | 17.7               | 11.9                  |
| Observations                          |                   |                      | 2,675              |                       |                   |                      | 2,260              |                       |
| R-Squared                             |                   |                      | 0.099              |                       |                   |                      | 0.116              |                       |

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 Appendix 1; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

Test score data are 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 3 provides the estimation results for males, while Table 4 shows the results for females.

For both sexes, students with test scores in the top tercile are far more likely to attend public schools. 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.

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 schools, as high scoring students are still more likely to attend public schools. Most likely this is caused by an increase in the number of private schools, which have responded to the continued high demand for highly educated workers (World Bank, forthcoming).

Choice of school type is driven by two main factors: scholastic ability and parental education. With regards to the former, higher test scores are associated with the largest increase in the probability of attending public schools, followed by private general school. With regards to parental education, private general schools attract the sons of better-educated fathers, followed by public general and public vocational schools. Private vocational schools therefore act as a last resort; students who enroll in these schools are disproportionately likely to have scored in the bottom tercile and to have poorly-educated parents.

Table 3: Determinants of School Enrollment: male youngest cohort, with and without test scores

|                                     | With test scores  |                      |                    |                       | Without test scores |                      |                    |                       |
|-------------------------------------|-------------------|----------------------|--------------------|-----------------------|---------------------|----------------------|--------------------|-----------------------|
|                                     | Public<br>general | Public<br>vocational | Private<br>general | Private<br>vocational | Public<br>general   | Public<br>vocational | Private<br>general | Private<br>vocational |
| <u>Junior secondary test scores</u> |                   |                      |                    |                       |                     |                      |                    |                       |
| Middle third                        | 13.7***<br>(4.8)  | 8.3*<br>(4.2)        | -3.4<br>(4.6)      | -18.6***<br>(4.2)     |                     |                      |                    |                       |
| Top third                           | 23.6***<br>(6.5)  | 16.4***<br>(5.6)     | -17.4***<br>(3.9)  | -22.7***<br>(4.8)     |                     |                      |                    |                       |
| <u>Personal characteristics</u>     |                   |                      |                    |                       |                     |                      |                    |                       |
| Repeated grade in junior high       | 13.3<br>(12.4)    | -9.6<br>(6.0)        | -0.4<br>(11.8)     | -3.4<br>(11.7)        | 9.7<br>(12.1)       | -11.4**<br>(5.0)     | 0.6<br>(13.2)      | 1.1<br>(13.9)         |
| Lived in small town at age 12       | 5.4<br>(4.2)      | -0.0<br>(3.2)        | -9.0**<br>(4.1)    | 3.6<br>(4.5)          | 4.8<br>(4.4)        | 0.7<br>(3.5)         | -9.4**<br>(4.2)    | 3.9<br>(4.8)          |
| Lived in big city at age 12         | 4.3<br>(5.6)      | 4.6<br>(5.2)         | -9.1**<br>(4.6)    | 0.2<br>(5.8)          | 1.1<br>(5.0)        | 5.2<br>(5.2)         | -7.9*<br>(4.7)     | 1.6<br>(5.7)          |
| Height                              | -0.5<br>(0.3)     | 0.2<br>(0.3)         | 0.0<br>(0.3)       | 0.3<br>(0.3)          | -0.4<br>(0.4)       | 0.2<br>(0.3)         | -0.0<br>(0.3)      | 0.2<br>(0.3)          |
| <u>Parental education</u>           |                   |                      |                    |                       |                     |                      |                    |                       |
| Father graduated elementary         | -7.2<br>(9.2)     | 11.9<br>(11.0)       | -9.2<br>(7.6)      | 4.5<br>(9.0)          | -0.4<br>(0.4)       | 0.2<br>(0.3)         | -0.0<br>(0.3)      | 0.2<br>(0.3)          |
| Father graduated junior secondary   | -2.5<br>(10.7)    | 7.9<br>(10.0)        | -7.2<br>(9.1)      | 1.8<br>(9.4)          | -1.9<br>(9.9)       | 7.5<br>(11.4)        | -6.6<br>(8.2)      | 1.0<br>(10.5)         |
| Father graduated senior secondary   | -8.7<br>(10.3)    | 6.6<br>(9.4)         | 5.4<br>(11.5)      | -3.3<br>(10.2)        | -1.9<br>(11.6)      | 7.5<br>(10.3)        | -6.6<br>(9.5)      | 1.0<br>(10.8)         |
| Father graduated university         | -1.6<br>(11.4)    | 4.1<br>(9.4)         | 3.4<br>(13.7)      | -5.9<br>(10.6)        | -7.2<br>(11.7)      | 7.4<br>(10.4)        | 6.0<br>(12.3)      | -6.2<br>(10.7)        |
| Father attended vocational school   | 6.3<br>(8.8)      | 8.6<br>(8.1)         | -12.8**<br>(5.4)   | -2.1<br>(7.9)         | 0.1<br>(12.7)       | 4.3<br>(10.1)        | 3.1<br>(14.3)      | -7.5<br>(10.9)        |
| Mother graduated elementary         | 4.9<br>(5.4)      | -1.5<br>(5.2)        | 3.8<br>(5.7)       | -7.2<br>(6.1)         | 5.7<br>(9.2)        | 8.5<br>(8.4)         | -12.8**<br>(5.6)   | -1.4<br>(8.6)         |
| Mother graduated junior high        | 0.5<br>(6.5)      | -4.3<br>(5.3)        | 12.5<br>(8.7)      | -8.7<br>(7.9)         | 0.9<br>(6.8)        | -4.0<br>(5.6)        | 11.5<br>(9.0)      | -8.4<br>(7.9)         |
| Mother graduated senior high        | 13.7<br>(9.6)     | -4.9<br>(7.0)        | -2.6<br>(8.4)      | -6.1<br>(9.8)         | 14.7<br>(10.8)      | -4.9<br>(7.2)        | -3.1<br>(8.7)      | -6.7<br>(10.4)        |
| Mother graduated university         | 22.8<br>(15.3)    | -8.0<br>(7.8)        | -5.8<br>(9.8)      | -9.0<br>(16.9)        | 29.0**<br>(14.0)    | -6.2<br>(9.1)        | -8.8<br>(8.1)      | -14.0<br>(13.8)       |
| Mother attended vocational          | 0.9<br>(7.8)      | -10.2*<br>(5.4)      | 5.3<br>(11.6)      | 4.0<br>(10.2)         | 1.7<br>(8.4)        | -9.7<br>(5.9)        | 4.2<br>(12.0)      | 3.7<br>(10.4)         |
| Base case probability               | 28.4              | 0.3                  | 46.1               | 25.3                  | 44.1                | 0.7                  | 39.2               | 15.9                  |
| Observations                        |                   |                      | 745                |                       |                     |                      | 737                |                       |
| R-Squared                           |                   |                      | 0.199              |                       |                     |                      | 0.158              |                       |

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 Appendix 1; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

Table 4: Determinants of School Enrollment: female youngest cohort, with and without test scores

|                                     | With test scores  |                      |                    |                       | Without test scores |                      |                    |                       |
|-------------------------------------|-------------------|----------------------|--------------------|-----------------------|---------------------|----------------------|--------------------|-----------------------|
|                                     | Public<br>general | Public<br>vocational | Private<br>general | Private<br>vocational | Public<br>general   | Public<br>vocational | Private<br>general | Private<br>vocational |
| <u>Junior secondary test scores</u> |                   |                      |                    |                       |                     |                      |                    |                       |
| Middle tercile                      | 4.7<br>(5.3)      | 8.9**<br>(4.3)       | -2.5<br>(5.0)      | -11.2***<br>(4.3)     |                     |                      |                    |                       |
| Top tercile                         | 19.6***<br>(5.9)  | 12.9***<br>(4.9)     | -9.7**<br>(4.6)    | -22.8***<br>(4.2)     |                     |                      |                    |                       |
| <u>Personal characteristics</u>     |                   |                      |                    |                       |                     |                      |                    |                       |
| Repeated grade in junior high       | 65.5***<br>(2.4)  | -16.1***<br>(1.7)    | -26.4***<br>(2.4)  | -23.0***<br>(4.4)     | 65.3***<br>(2.8)    | -16.2***<br>(2.0)    | -26.4***<br>(2.4)  | -22.8***<br>(4.9)     |
| Lived in small town at age 12       | -0.9<br>(4.3)     | 2.0<br>(3.3)         | -2.5<br>(3.6)      | 1.4<br>(3.9)          | -0.1<br>(4.2)       | 2.6<br>(3.5)         | -3.0<br>(3.6)      | 0.5<br>(4.1)          |
| Lived in big city at age 12         | -2.8<br>(5.6)     | 3.8<br>(5.5)         | 11.5*<br>(6.1)     | -12.5***<br>(4.5)     | -1.7<br>(6.0)       | 4.9<br>(5.7)         | 10.2*<br>(6.0)     | -13.4***<br>(4.6)     |
| Height                              | 0.5<br>(0.3)      | -0.3<br>(0.3)        | 0.3<br>(0.3)       | -0.5<br>(0.3)         | 0.4<br>(0.3)        | -0.3<br>(0.3)        | 0.3<br>(0.3)       | -0.4<br>(0.4)         |
| <u>Parental education</u>           |                   |                      |                    |                       |                     |                      |                    |                       |
| Father graduated elementary         | -8.1<br>(10.4)    | -3.5<br>(12.1)       | -5.2<br>(9.7)      | 16.8<br>(12.7)        | -11.6<br>(10.8)     | -2.6<br>(10.2)       | -5.0<br>(10.6)     | 19.1<br>(13.5)        |
| Father graduated junior high        | -4.4<br>(10.3)    | -14.2*<br>(7.7)      | 1.4<br>(12.0)      | 17.2<br>(13.8)        | -8.2<br>(11.4)      | -12.7**<br>(6.4)     | 1.5<br>(13.1)      | 19.4<br>(14.5)        |
| Father graduated senior high        | 0.2<br>(11.8)     | -12.7<br>(9.1)       | 0.6<br>(12.9)      | 11.9<br>(13.2)        | 1.3<br>(13.2)       | -9.9<br>(8.7)        | -1.1<br>(13.2)     | 9.7<br>(12.1)         |
| Father graduated university         | 8.4<br>(13.1)     | -17.0**<br>(7.1)     | 4.1<br>(14.8)      | 4.5<br>(10.7)         | 8.8<br>(14.3)       | -14.9**<br>(6.8)     | 2.0<br>(15.2)      | 4.1<br>(10.0)         |
| Father attended vocational school   | 1.6<br>(8.1)      | 2.5<br>(7.2)         | -8.6<br>(6.4)      | 4.5<br>(6.6)          | -0.6<br>(8.0)       | 1.6<br>(7.1)         | -8.1<br>(6.7)      | 7.1<br>(7.0)          |
| Mother graduated elementary         | 1.4<br>(8.2)      | 8.5<br>(8.7)         | 7.6<br>(7.2)       | -17.5***<br>(6.2)     | 2.5<br>(8.3)        | 8.0<br>(8.5)         | 7.9<br>(7.5)       | -18.5***<br>(6.4)     |
| Mother graduated junior high        | 8.6<br>(9.0)      | 1.5<br>(6.7)         | 6.7<br>(8.5)       | -16.8**<br>(7.1)      | 11.5<br>(9.7)       | 2.1<br>(6.9)         | 5.9<br>(8.5)       | -19.6***<br>(7.1)     |
| Mother graduated senior high        | 2.2<br>(10.9)     | 9.2<br>(11.9)        | 4.6<br>(11.0)      | -15.9<br>(9.7)        | 4.0<br>(11.6)       | 10.1<br>(13.0)       | 4.3<br>(11.4)      | -18.4*<br>(10.2)      |
| Mother graduated university         | 13.2<br>(14.2)    | -1.3<br>(6.9)        | -2.2<br>(11.0)     | -9.6<br>(12.7)        | 13.4<br>(13.6)      | -1.5<br>(6.7)        | -2.6<br>(11.1)     | -9.2<br>(13.1)        |
| Mother attended vocational          | -0.9<br>(8.1)     | -3.8<br>(6.7)        | 5.8<br>(10.1)      | -1.1<br>(9.2)         | -0.1<br>(9.1)       | -3.7<br>(7.3)        | 5.2<br>(10.5)      | -1.5<br>(10.0)        |
| Base case probability               | 40.2              | 10.7                 | 30.3               | 18.8                  | 44.4                | 9.6                  | 28.1               | 17.9                  |
| Observations                        |                   |                      | 771                |                       |                     |                      | 766                |                       |
| R-Squared                           |                   |                      | 0.218              |                       |                     |                      | 0.186              |                       |

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 Appendix 1; standard errors in parentheses, they are robust to heteroskedasticity and clustered at subdistrict level.

## V. Labor Market Effects of Vocational Education

This section turns 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.<sup>11</sup> The reduced form model estimated is:

$$Y_{it} = \beta_z Z_i + \beta_{pi} P_i + \beta_d D_d + \beta_t D_t + \beta_s T_i + \varepsilon_{id} \quad (2)$$

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.  $D_t$  is a vector of interview year dummies, and  $T_i$  is a vector of categorical dummies of the four school types, with public general excluded.<sup>12</sup>

The equation is estimated using double robust regression, which rebalances the sample by reweighting observations according to the inverse estimated probability of attending the type of school that they 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. Reweighting considerably reduces the average normalized difference with public general graduates, by 66 percent for public vocational graduates, 80 percent for private general graduates, and 95 percent for private vocational graduates.<sup>13</sup> This indicates that the reweighting was effective.

To the best of our knowledge, a plausible instrument for school choice is not available.<sup>14</sup> As a result, the OLS results reported will be biased to the extent that school

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<sup>11</sup> 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.

<sup>12</sup> We do not control for university attendance, which is partially determined by choice of school type.

<sup>13</sup> 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.

<sup>14</sup> We have tried several instruments, including the share of schools of each type and the leave-out mean of enrollment 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 difficult to assess its validity, 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

choice is based on unobserved determinants of labor market outcomes. Non-random selection into employment can 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. Finally, 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 districts.<sup>15</sup>

Table 5 shows the estimated labor market effects of different school types relative to public general, while the full estimation results are in Appendix 2. For robustness, the fourth and fifth columns give the estimates of average and median returns.<sup>16</sup> For men, public vocational attendance raises the chance of working in a formal job, while graduating from private general lowers it. Furthermore, the wage results show a substantial public school premium. In contrast, there is no statistically significant difference between general and vocational schools. The estimates are sufficiently precise to rule out a public vocational premium, relative to public general, exceeding 12 percent. For private schools, the average wage penalty is similar for vocational and general graduates, although vocational graduates face a lower median wage penalty. This is notable, since private vocational graduates tend to have lower parental education levels and, in the most recent cohort, test scores.

Among women, private general schools are associated with reduced labor force participation and formality rates, compared with graduates of other three school types. With regards to wage, meanwhile, public vocational graduate earns a moderate wage premium of 8 percent, although this is not statistically significant. The wage estimates for females are less precise but can nonetheless rule out a public vocational wage premium that is greater than 25

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unavailable, and the village censuses (*Podes*) show little change in the local prevalence of different types across time. Therefore, we elected to abandon the instrumental variables approach.

<sup>15</sup> 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.

<sup>16</sup> 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.

Table 5. The Effect of School Types on Labor Market Outcomes: Full sample pooled

|                                        | <b>Men</b>        |                     |                    |                      |                      | <b>Women</b>        |                     |                    |                   |                      |
|----------------------------------------|-------------------|---------------------|--------------------|----------------------|----------------------|---------------------|---------------------|--------------------|-------------------|----------------------|
|                                        | LFP<br>LPM        | Unemployment<br>LPM | Formal<br>LPM      | Wage<br>OLS          | Wage<br>LAD          | LFP<br>LPM          | Unemployment<br>LPM | Formal<br>LPM      | Wage<br>OLS       | Wage<br>LAD          |
| Public Vocational                      | 0.013*<br>(0.007) | -0.006<br>(0.011)   | 0.036**<br>(0.017) | 0.009<br>(0.056)     | 0.032<br>(0.044)     | 0.023<br>(0.029)    | -0.017<br>(0.012)   | 0.032<br>(0.025)   | 0.087<br>(0.075)  | 0.133***<br>(0.049)  |
| Private general                        | 0.013*<br>(0.007) | -0.003<br>(0.008)   | -0.042*<br>(0.025) | -0.171***<br>(0.062) | -0.278***<br>(0.045) | -0.076**<br>(0.032) | 0.016<br>(0.010)    | -0.052*<br>(0.028) | -0.047<br>(0.076) | -0.202***<br>(0.064) |
| Private vocational                     | 0.005<br>(0.008)  | 0.010<br>(0.012)    | 0.019<br>(0.020)   | -0.203***<br>(0.064) | -0.188***<br>(0.057) | -0.032<br>(0.034)   | 0.004<br>(0.013)    | 0.007<br>(0.029)   | -0.014<br>(0.081) | -0.048<br>(0.058)    |
| Average among public general graduates | 0.971             | 0.051               | 0.575              |                      |                      | 0.693               | 0.045               | 0.566              |                   |                      |
| R-squared                              | 0.090             | 0.171               | 0.559              | 0.230                |                      | 0.175               | 0.232               | 0.584              | 0.314             |                      |
| Observations                           | 6084              | 5931                | 5642               | 5065                 | 5065                 | 5330                | 3452                | 3288               | 2681              | 2681                 |

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.

percent. Private general graduates earn the least, compared to observable similar graduates of the other three schools.

*Including test scores for the youngest cohort*

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, we re-estimate the labor market effects of school type for the youngest cohort, both with and without test scores. Table 6 shows that the inclusion of test scores does not significantly alter the estimated effects of school types. This reflects the very weak correlation between test scores with labor market outcomes, conditional on the included observables. Assuming these results can be generalized to the older cohorts, this evidence suggests that the omission of test scores is a negligible source of bias.

Table 6. Labor Market Outcomes of Recent Cohort, with and without test scores

|                                                                                                                                                                                       |                    | <b>LFP</b>        |                   | <b>Unemployment</b> |                   | <b>Formality</b>    |                     | <b>Wage</b>          |                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|---------------------|-------------------|---------------------|---------------------|----------------------|----------------------|
|                                                                                                                                                                                       |                    | With score        | Without score     | With score          | Without score     | With score          | Without score       | With score           | Without score        |
| <u>Men</u>                                                                                                                                                                            |                    |                   |                   |                     |                   |                     |                     |                      |                      |
|                                                                                                                                                                                       | Public Vocational  | 0.011<br>(0.030)  | 0.009<br>(0.030)  | -0.055<br>(0.050)   | -0.055<br>(0.051) | 0.039<br>(0.040)    | 0.039<br>(0.040)    | -0.328***<br>(0.101) | -0.322***<br>(0.101) |
|                                                                                                                                                                                       | Private general    | 0.017<br>(0.026)  | 0.010<br>(0.027)  | 0.002<br>(0.045)    | -0.005<br>(0.044) | 0.023<br>(0.047)    | 0.023<br>(0.046)    | -0.180<br>(0.114)    | -0.205*<br>(0.114)   |
|                                                                                                                                                                                       | Private vocational | -0.014<br>(0.027) | -0.025<br>(0.026) | 0.013<br>(0.046)    | 0.006<br>(0.045)  | 0.067<br>(0.051)    | 0.068<br>(0.045)    | -0.134<br>(0.106)    | -0.153<br>(0.104)    |
| Average among public general graduates                                                                                                                                                |                    | 0.938             | 0.938             | 0.178               | 0.178             | 0.495               | 0.495               |                      |                      |
| R-squared                                                                                                                                                                             |                    | 0.262             | 0.260             | 0.338               | 0.338             | 0.647               | 0.647               | 0.395                | 0.393                |
| Number of observations                                                                                                                                                                |                    | 1,244             | 1,244             | 1,156               | 1,156             | 979                 | 979                 | 803                  | 803                  |
| <u>Women</u>                                                                                                                                                                          |                    |                   |                   |                     |                   |                     |                     |                      |                      |
|                                                                                                                                                                                       | Public Vocational  | -0.027<br>(0.057) | -0.031<br>(0.057) | -0.009<br>(0.038)   | -0.011<br>(0.038) | -0.042<br>(0.053)   | -0.037<br>(0.053)   | -0.175<br>(0.142)    | -0.122<br>(0.159)    |
|                                                                                                                                                                                       | Private general    | -0.080<br>(0.064) | -0.092<br>(0.061) | 0.072<br>(0.050)    | 0.065<br>(0.048)  | -0.122**<br>(0.054) | -0.109**<br>(0.052) | -0.063<br>(0.137)    | -0.049<br>(0.149)    |
|                                                                                                                                                                                       | Private vocational | -0.052<br>(0.057) | -0.069<br>(0.058) | 0.079**<br>(0.039)  | 0.068*<br>(0.035) | -0.098**<br>(0.042) | -0.077**<br>(0.039) | -0.222<br>(0.164)    | -0.145<br>(0.157)    |
| Average among public general graduates                                                                                                                                                |                    | 0.656             | 0.656             | 0.134               | 0.134             | 0.573               | 0.573               |                      |                      |
| R-squared                                                                                                                                                                             |                    | 0.275             | 0.272             | 0.385               | 0.384             | 0.678               | 0.676               | 0.501                | 0.481                |
| Number of observations                                                                                                                                                                |                    | 1,363             | 1,363             | 864                 | 864               | 752                 | 752                 | 578                  | 578                  |
| Notes: *** 1% significance, ** 5% significance, * 10% significance; econometric specification is in Equation 2; robust standard errors in parentheses clustered at subdistrict level. |                    |                   |                   |                     |                   |                     |                     |                      |                      |

## VI. 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 more rapidly 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 a person's career.

In this section, we examine age effects for different cohorts, which enable us to separate age effects from cohort effects. As discussed in Section III, the sample is divided 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:

$$(3) Y_{it} = \beta_z + \beta_{pi} P_i + \beta_D D_d + \beta_t T_i + \beta_{td} (T_i * D_t) + \varepsilon_{it}$$

In this specification,  $\beta_{td}$  is a 1 X 12 vector, containing the estimated effect of each of the three school types, relative to public general, for each of the four waves. In the figures that follow, we graph the estimated effects for public vocational school, separately for each cohort, on the vertical axis.<sup>17</sup> 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.<sup>18</sup>

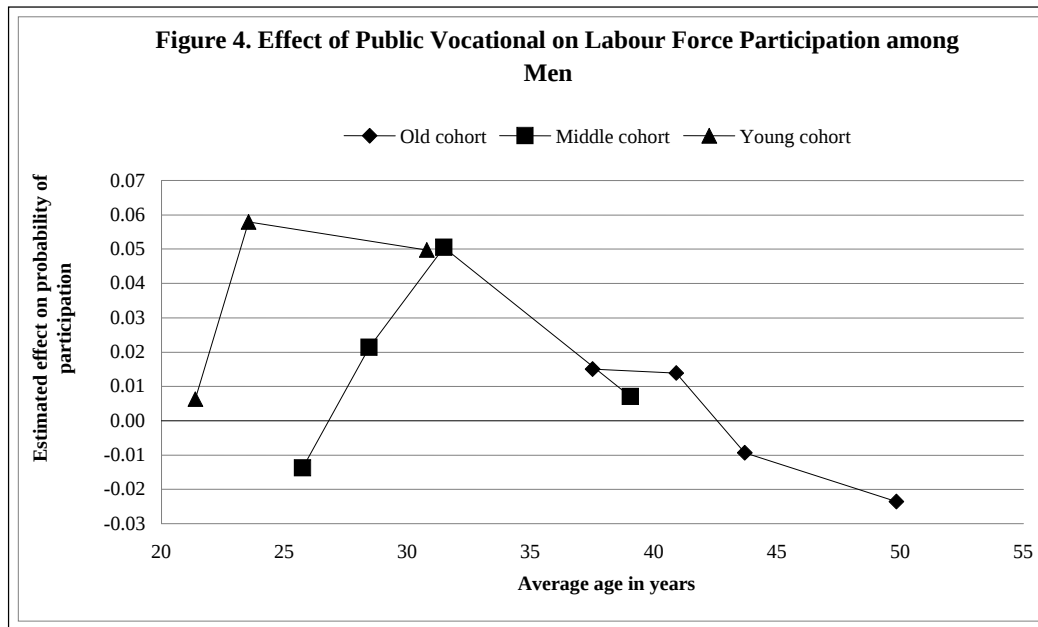
We begin by examining the effect of public vocational school on labor force participation. Figure 4 provides the results for men. The effect of public vocational on early-career participation has increased for the most recent cohort, although the difference is not statistically significant and disappears by age thirty. In general, public vocational education raises participation by up to five percentage points, which is large considering that only 3 percent of male public general graduates, on average,

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<sup>17</sup> We report the effect of public vocational school only because the current vocational expansion in prioritizing public vocational over public general.

<sup>18</sup> 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.

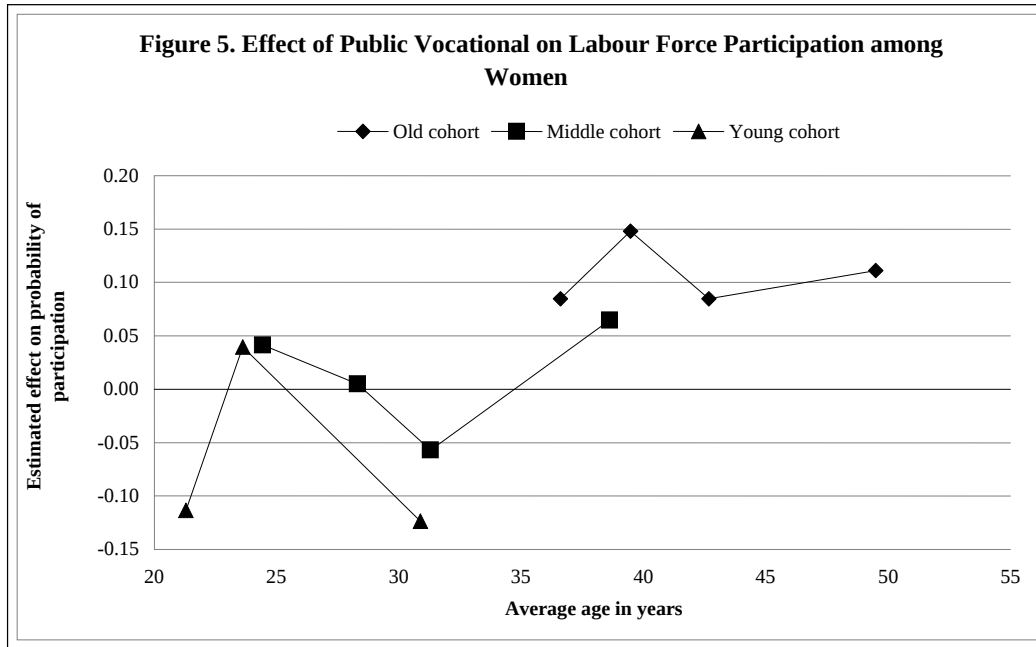
do not participate in the labor force. The positive effect of public vocational school on participation begins to decline at age 30 and becomes negative around the age of 40.



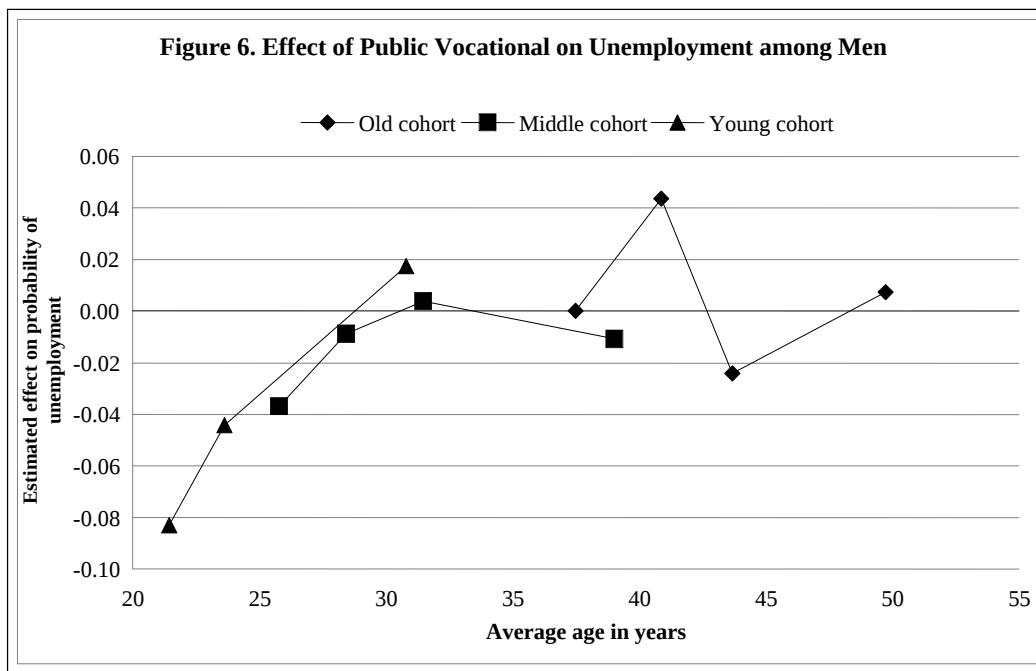
Notes: Each point shows the estimated effect of public vocational relative to public general obtained from equation (3), for a particular cohort and year. The horizontal axis indicates the average age of that cohort in that year.

The effect of public vocational over the life-cycle is different for women, as shown in Figure 5. Public vocational raises participation at age 25 by about 5 percentage points, declines to a bottom of negative 10 percentage points in the early 30s, and then increases to ten percentage points for older women. There are no significant cohort effects.

Turning to the probability of unemployment, the difference in unemployment between public general and public vocational graduates is shown in Figure 6 for men and Figure 7 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.

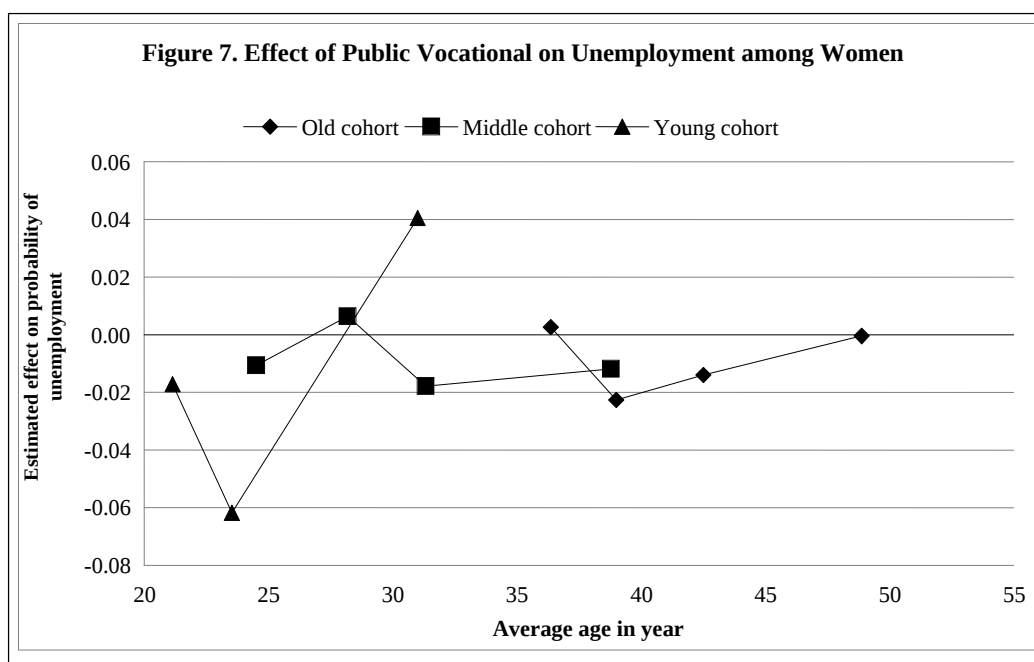


Notes: See notes to figure 4



Notes: See notes to figure 4

For females, meanwhile, figure 7 there is a sizeable cohort effect between the young and the middle cohorts. At the age of about 25 , vocational graduates in the young cohort enjoys lower unemployment rate compared to 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.

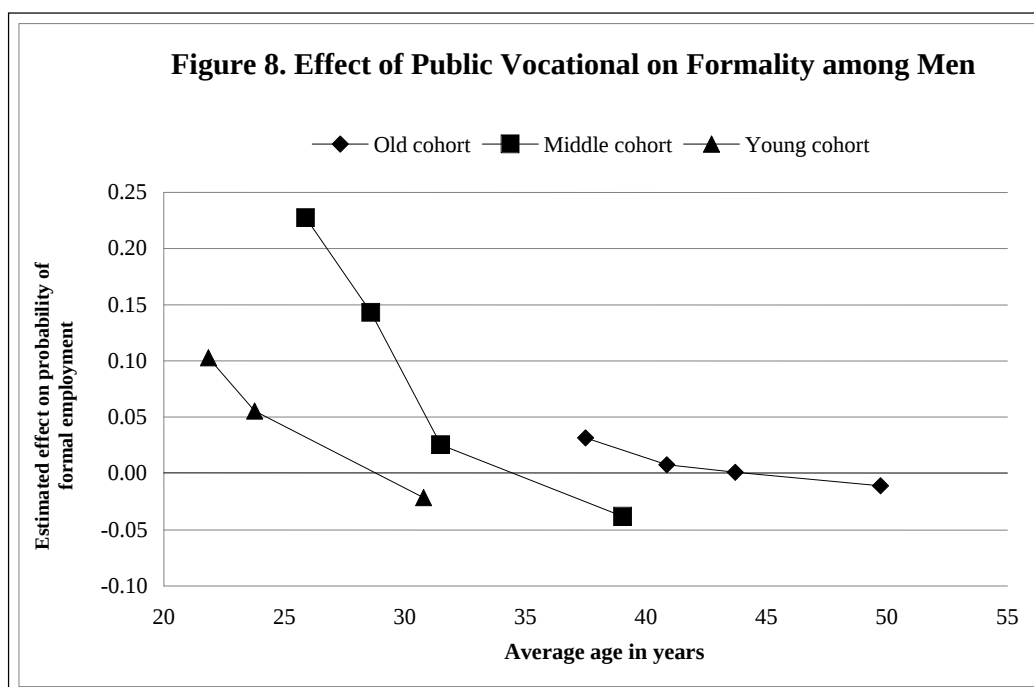


Notes: See notes to figure 4

The next two figures examine the effect of public vocational education on the probability of holding a formal job, conditional on being employed. 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.<sup>19</sup> Formal employees tend to earn higher wages and express greater job satisfaction than informal employees, particularly casual informal workers (World Bank, forthcoming). Figure 8 shows that public vocational increases formality early in one's career, but that the positive effect declines sharply with age. In addition, each succeeding cohort

<sup>19</sup> 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.

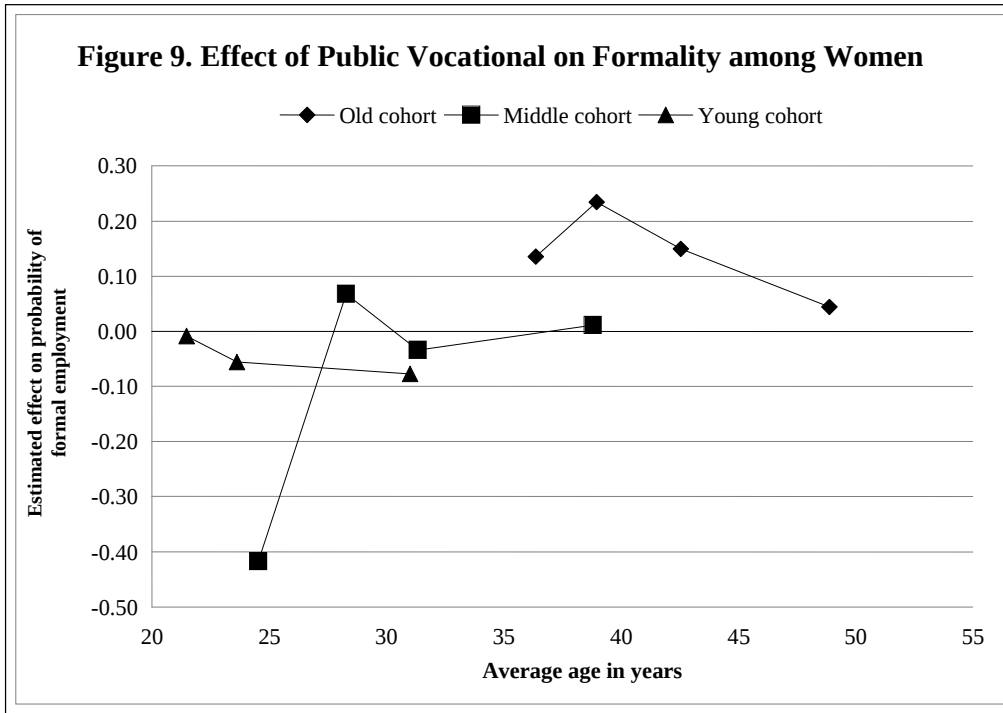
has enjoyed a smaller beneficial effect. For the youngest cohort, the effect of public vocational education on formality rate becomes negative by age 30.



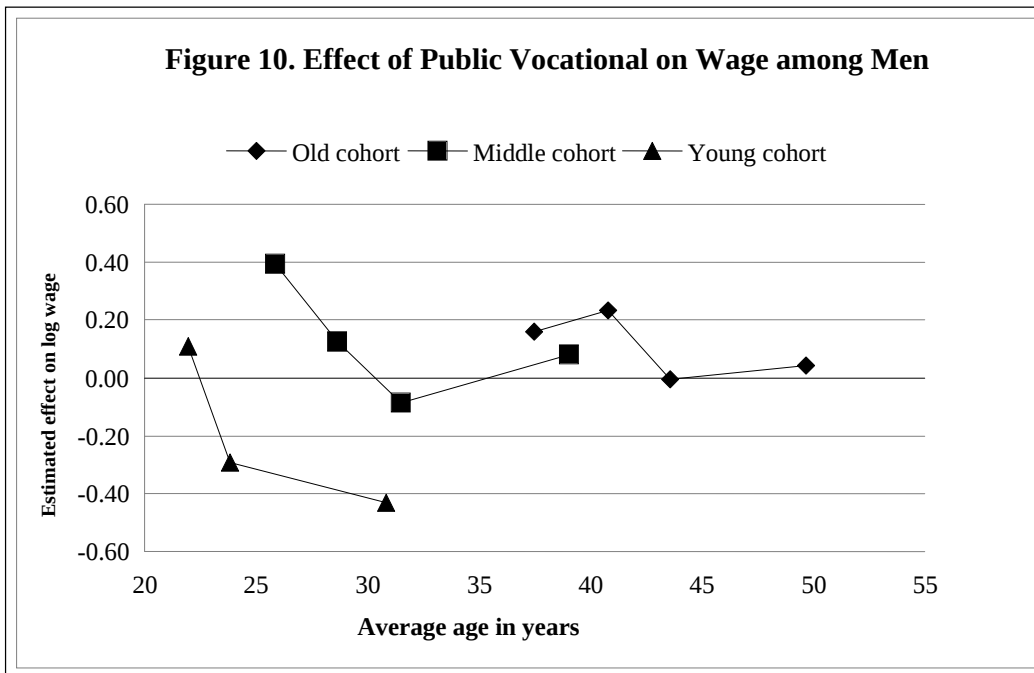
Notes: See notes to figure 4

In contrast to men, Figure 9 shows that the effect of public vocational education on formality increases with age for women. The cohort effects are also different for women, as the youngest cohort shows little sign of the informality penalty. Finally, Figure 9 also shows some sign that the benefits of public vocational for older women have declined, as the premium enjoyed by the oldest cohort around the age of 40 is no longer apparent in the middle cohort.

The last labor market outcome that we examine is wage. Comparing the young and the middle cohorts, Figure 10 shows a dramatic decline in the wage premium of vocational education among young men. At the age of twenty-five, the individuals in the middle cohort enjoy a substantial wage premium, while the individuals in the young cohort face a considerable wage penalty at the same age. As graduates age, the higher wage enjoyed by public vocational graduates peaks in the early forties, then becomes zero afterwards.

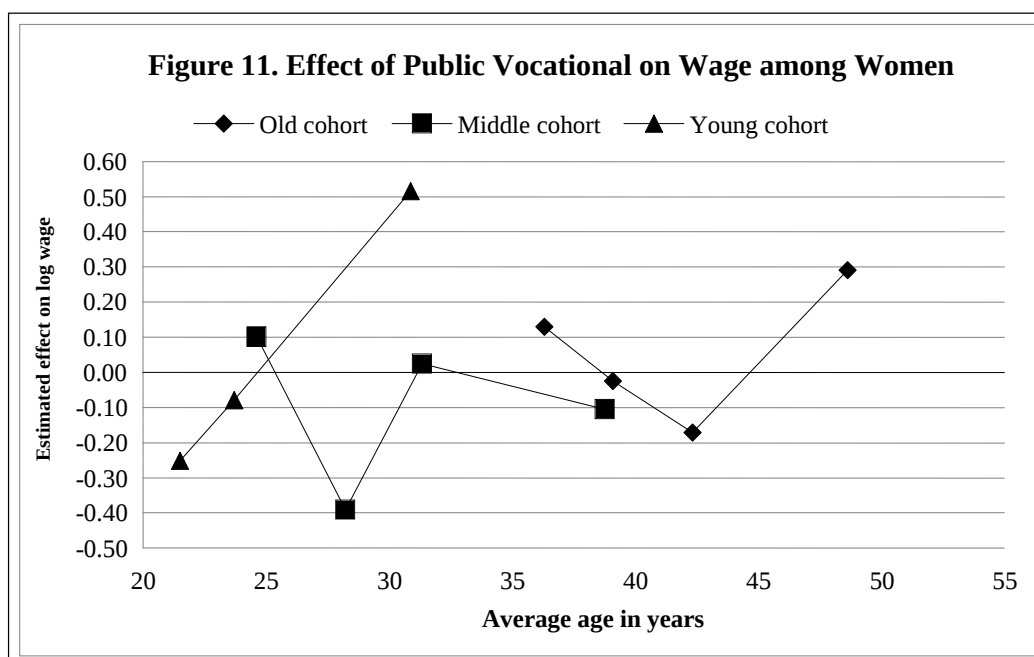


Notes: See notes to figure 4



Notes: See notes to figure 4

In contrast to men, Figure 11 shows that the youngest cohort of women has experienced a substantial increase in women's vocational wage premium at 30 years of age. This is the only noticeable cohort effect. Looking at the age profile, there is no wage difference between vocational and general graduates when an individual is between 35 and 40 years old. The pattern develops into a U-shape afterwards, bottoming at early 40s. However, none of the age effects for women are statistically significant in the underlying regression.



Notes: See notes to figure 4

In summary, this section highlights the importance of disaggregating estimated effects by age and cohort. In general, the strongest effects of vocational education are experienced early in life, between the ages of 20 and 35. For example, while table 5 shows a mild negative effect of vocational education on unemployment over the entire sample, figures 6 and 7 show that this effect is concentrated among young graduates in their twenties. The same is true of higher formality rates.

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.

Examining recent changes in the returns of young male vocational graduates, particularly those between 25 and 35 who have generally completed their education, paint a more pessimistic picture. For example, while Table 5 shows a higher formality rate among all male vocational graduates, Figure 8 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 shown in Figure 10. After enjoying a smaller wage premium at the age of 21, individuals in the youngest cohort face an increasingly large wage penalty. Estimates of the wage penalty for the youngest cohort of men reached 30 percent in 2000 and an 43 percent in 2007, both of which are statistically significant.<sup>20</sup> These results indicate a steep decline in returns for recent male public vocational graduates.

One possible explanation for this decline 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 has fallen dramatically, from 9 percent from 1990 to 1997, to 4.3 from 1999 and 2007. During the same two periods, annual service sector growth remained strong, falling slightly from 7.0 to 6.3. More recently, employment in the service sector has grown rapidly. From 2003 to 2007, service sector employment grew at roughly 4 percent per year while industrial sector employment grew at 2.5 percent per year (World Bank, forthcoming). The increasing prominence of the service sector could disproportionately affect vocationally trained males because they tend to choose technical majors, as shown in Figure 3. Women, on the other hand, tend to choose to study business management or tourism skills, for which demand may have remained stronger.

Another potential explanation for the recent decline in male vocational returns is deterioration in the quality of vocational training for men. For example, technical

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<sup>20</sup> Significance is at the 95 percent level. The penalty in 2000 is robust to the use of median regression, although the estimated penalty in 2007 is not robust. The OLS estimates are preferred, however, as they are trimmed to reduce the influence of outliers and because they include controls at the district level for location of lower secondary school.

vocational training may require large investments to maintain facilities and their relevance to new advances in technology. Unfortunately, it is difficult to obtain empirical evidence on trends in the quality of industrial education facilities.

## **VII. 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 7 shows the estimation results for men. Comparing the results with the ones in Table 5 shows that the effects of school types on labor market outcomes are limited to students from a disadvantaged background. Different school types have no effect on labor market outcomes for individuals whose fathers have a senior secondary or university degree.

Among disadvantaged male workers, public vocational graduates 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. Therefore, men from disadvantaged backgrounds obtain the largest benefits from public vocational education, and the largest wage penalties from private schools.

The estimation results for women are shown in Table 8. The results are similar to those for men. The labor market effects of school types are only significant among those coming from a disadvantaged background. Among these individuals, 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 rate.

Table 7. Estimated Effect of School Type on Employment and Job Quality, Men, by father's education

|                                        | Junior secondary or below |                     |                     |                      | Senior secondary or above |                     |                  |                   |
|----------------------------------------|---------------------------|---------------------|---------------------|----------------------|---------------------------|---------------------|------------------|-------------------|
|                                        | LFP<br>LPM                | Unemployment<br>LPM | Formal<br>LPM       | Wage<br>OLS          | LFP<br>LPM                | Unemployment<br>LPM | Formal<br>LPM    | Wage<br>OLS       |
| Public Vocational                      | 0.003<br>(0.007)          | -0.014<br>(0.009)   | 0.060***<br>(0.021) | -0.001<br>(0.062)    | 0.023*<br>(0.013)         | 0.023<br>(0.030)    | 0.036<br>(0.047) | -0.034<br>(0.142) |
| Private general                        | 0.008<br>(0.008)          | -0.011<br>(0.009)   | -0.047*<br>(0.027)  | -0.223***<br>(0.061) | 0.043**<br>(0.018)        | 0.003<br>(0.028)    | 0.015<br>(0.054) | -0.129<br>(0.164) |
| Private vocational                     | 0.004<br>(0.008)          | 0.008<br>(0.015)    | 0.012<br>(0.024)    | -0.287***<br>(0.076) | -0.009<br>(0.027)         | 0.058<br>(0.041)    | 0.009<br>(0.064) | -0.167<br>(0.137) |
| Average among public general graduates | 0.971                     | 0.045               | 0.586               |                      | 0.960                     | 0.068               | 0.611            |                   |
| R-squared overall                      | 0.089                     | 0.163               | 0.571               | 0.252                | 0.156                     | 0.323               | 0.661            | 0.434             |
| Observations                           | 4,389                     | 4,285               | 4,106               | 3,698                | 1,037                     | 999                 | 917              | 799               |

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

Table 8. Estimated Effect of School Type on Employment and Job Quality, Women, by father's education

|                                        | Junior secondary or below |                     |                     |                   | Senior secondary or above |                     |                   |                   |
|----------------------------------------|---------------------------|---------------------|---------------------|-------------------|---------------------------|---------------------|-------------------|-------------------|
|                                        | LFP<br>LPM                | Unemployment<br>LPM | Formal<br>LPM       | Wage<br>OLS       | LFP<br>LPM                | Unemployment<br>LPM | Formal<br>LPM     | Wage<br>OLS       |
| Public Vocational                      | 0.064*<br>(0.033)         | -0.014<br>(0.013)   | 0.022<br>(0.034)    | 0.125<br>(0.102)  | 0.043<br>(0.061)          | -0.032<br>(0.027)   | 0.005<br>(0.048)  | -0.053<br>(0.146) |
| Private general                        | -0.065*<br>(0.038)        | 0.009<br>(0.014)    | -0.089**<br>(0.037) | -0.200<br>(0.146) | -0.053<br>(0.056)         | -0.006<br>(0.033)   | -0.037<br>(0.045) | 0.174<br>(0.140)  |
| Private vocational                     | 0.010<br>(0.040)          | 0.010<br>(0.017)    | -0.027<br>(0.041)   | -0.019<br>(0.099) | -0.069<br>(0.084)         | -0.008<br>(0.033)   | -0.002<br>(0.047) | 0.170<br>(0.165)  |
| Average among public general graduates | 0.642                     | 0.049               | 0.532               |                   | 0.700                     | 0.074               | 0.654             |                   |
| R-squared overall                      | 0.176                     | 0.260               | 0.550               | 0.332             | 0.292                     | 0.329               | 0.710             | 0.432             |
| Observations                           | 3,513                     | 2,238               | 2,142               | 1,713             | 1,370                     | 930                 | 875               | 739               |

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

## VIII. 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. Do higher entering test scores mitigate or magnify the labor market effects of school types?<sup>21</sup> Since test scores are only available for the youngest cohort, the relevant benchmarks are given in Table 6, which shows that recent male private general and public vocational graduates experience a substantial wage penalty.

Table 9 provides the estimated effects for men that scored above and below the median on their junior high exit exam. Those scoring below the median face a smaller wage penalty of 25 percent, compared with 33 percent for the full sample, which is no longer statistically significant. Interestingly, the results show that low-scoring public vocational graduates have significantly lower unemployment rates compared to graduates of the other three school types. However, the wage penalty for vocation education is highest – 41 percent – for men scoring above the median. There is also a high penalty for private vocational graduates that score high on exams. It is these high scoring men who stand the most to lose from investing in vocational education in an economy that increasingly values broadly educated and cognitively skilled workers.

Table 9. Estimated Effect of School Type on Employment and Job Quality, Men, by test score

|                                           | Low scores       |                     |                  |                   | High scores      |                     |                   |                      |
|-------------------------------------------|------------------|---------------------|------------------|-------------------|------------------|---------------------|-------------------|----------------------|
|                                           | LFP<br>LPM       | Unemployment<br>LPM | Formal<br>LPM    | Wage<br>OLS       | LFP<br>LPM       | Unemployment<br>LPM | Formal<br>LPM     | Wage<br>OLS          |
| Public Vocational                         | 0.028<br>(0.049) | -0.176*<br>(0.092)  | 0.089<br>(0.098) | -0.235<br>(0.191) | 0.023<br>(0.041) | -0.047<br>(0.063)   | 0.026<br>(0.066)  | -0.409***<br>(0.157) |
| Private general                           | 0.031<br>(0.048) | -0.041<br>(0.080)   | 0.010<br>(0.082) | -0.163<br>(0.150) | 0.014<br>(0.041) | -0.066<br>(0.050)   | -0.018<br>(0.093) | -0.330**<br>(0.153)  |
| Private vocational                        | 0.030<br>(0.048) | -0.037<br>(0.082)   | 0.062<br>(0.097) | -0.127<br>(0.150) | 0.002<br>(0.067) | 0.021<br>(0.076)    | 0.067<br>(0.099)  | -0.492***<br>(0.187) |
| Average among public<br>general graduates | 0.924            | 0.208               | 0.427            |                   | 0.944            | 0.133               | 0.539             |                      |
| R-squared overall                         | 0.282            | 0.309               | 0.650            | 0.419             | 0.282            | 0.327               | 0.653             | 0.482                |
| Observations                              | 717              | 667                 | 570              | 484               | 705              | 664                 | 581               | 477                  |

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.

<sup>21</sup> The 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.

The results for women are shown in Table 10. In the full sample estimation results in Table 6, public school graduates have a greater chance of obtaining a formal job, while private vocational attendance is associated with a higher likelihood of unemployment. The positive association between public schools and formality holds for low scoring women as well. With respect to unemployment, low scoring women that attend public general are far less likely to be unemployed.

Table 10. Estimated Effect of School Type on Employment and Job Quality, Women, by test score

|                                           | Low scores       |                     |                     |                  | High scores       |                     |                   |                    |
|-------------------------------------------|------------------|---------------------|---------------------|------------------|-------------------|---------------------|-------------------|--------------------|
|                                           | LFP<br>LPM       | Unemployment<br>LPM | Formal<br>LPM       | Wage<br>OLS      | LFP<br>LPM        | Unemployment<br>LPM | Formal<br>LPM     | Wage<br>OLS        |
| Public Vocational                         | 0.075<br>(0.092) | 0.149**<br>(0.076)  | 0.017<br>(0.104)    | 0.213<br>(0.321) | -0.025<br>(0.064) | -0.026<br>(0.047)   | -0.040<br>(0.086) | -0.155<br>(0.183)  |
| Private general                           | 0.054<br>(0.072) | 0.118*<br>(0.069)   | -0.132*<br>(0.069)  | 0.154<br>(0.259) | -0.109<br>(0.103) | 0.029<br>(0.066)    | -0.086<br>(0.084) | 0.093<br>(0.232)   |
| Private vocational                        | 0.075<br>(0.073) | 0.195***<br>(0.070) | -0.193**<br>(0.079) | 0.167<br>(0.160) | -0.040<br>(0.072) | 0.019<br>(0.066)    | -0.023<br>(0.074) | -0.328*<br>(0.193) |
| Average among public<br>general graduates | 0.551            | 0.069               | 0.574               |                  | 0.706             | 0.157               | 0.554             |                    |
| R-squared overall                         | 0.317            | 0.509               | 0.733               | 0.649            | 0.357             | 0.463               | 0.701             | 0.522              |
| Observations                              | 770              | 443                 | 394                 | 287              | 726               | 495                 | 430               | 350                |

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

Most striking are the different effects of school type on wages for low and high scoring women. The differences are not statistically significant, but they are large in magnitude. For women as a whole, Table 6 shows that public vocational is associated with a wage penalty of 12 percentage points (without test scores) and the private vocational penalty is about 15 percentage points. For low scoring women, however, Table 10 shows that women who attend vocational public and private vocational school earn approximately a 20 percent and 17 percent wage premium, respectively. Meanwhile, high scoring public and private vocational graduates earn a 16 and 32 percent wage penalty, respectively. Higher scoring women, like higher scoring men, appear to suffer the largest penalty for vocational education.

## **IX. 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 schools. This is the first paper to our knowledge from a developing country that distinguishes between public and privately provided vocational education. Another key contribution is carefully examining heterogeneity in effects. We examine effects separately by age, cohort, parental education, and entering test score. 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.

With regard to labor market outcomes, the most striking distinction is between publicly and privately schooled men. Male private school graduates, compared to their public school counterparts, suffer an average wage penalty of approximately 20 percent. This large wage penalty is robust to median regression.

The labor market advantages enjoyed by public vocational graduates, compared to public general graduates, are at most small. For the full sample of men, attending public vocational school attendance has a mild, positive, and statistically insignificant effect on wages, and the estimates are sufficiently precise to rule out wage effects greater than 12 percent. Public vocational schools increase the probability of obtaining a formal job, as defined by the Indonesian Bureau of Statistics, by 3 percentage points for men. This premium, however, has disappeared for the youngest cohort. For women, median regressions suggest a positive effect of public vocational public vocational education. The OLS specification, however, includes additional controls for district of lower secondary school. In these estimates, public vocational attendance has a weaker and statistically insignificant association

with both formality and wages. In contrast to men, however, the outcomes for female public vocational graduates in recent years have, if anything, improved.

For private school graduates, private general education is associated with the worst labor market outcomes, despite attracting students with the highest levels of parental education. This inferior performance is especially puzzling when comparing these graduates to private vocational graduates, who tend to have the lowest entering test scores and least educated parents. Both male and female private general students are 5 percentage point less likely to hold a formal job if they are employed, and earn roughly the same wage, as private vocational students. In the median regression specifications, the wage of private vocational graduates is considerably higher.

For students with high entering test scores, the effect of public general attendance on subsequent wages is particularly strong. For men with high test scores, the wage penalties for attending vocational or private general school range from 33 to 50 percent. For low-scoring men, the penalties are much smaller, ranging from 13 to 24 percent. There is weaker evidence of a similar pattern for women, although the estimates are not statistically significant. Public vocational education is associated with decreased wages for high scoring women but increased wages for low-scoring women. Therefore for women as well as men, students with higher test scores appear to suffer more from attending public vocational school.

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 particularly strong returns to public school for children 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. 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. This decline has occurred as Indonesia's industrial sector has sharply slowed and the service sector has become increasingly important to economic growth. This suggests that it may be worthwhile to review, and possibly reform, vocational and technical education in male-dominated subjects.

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Appendix 1. Mean and Standard Deviation of Variables, Main sample

|                                           | Men       | Women     | All       |
|-------------------------------------------|-----------|-----------|-----------|
| <u>Outcome variables</u>                  |           |           |           |
| LFP                                       | 0.978     | 0.653     | 0.828     |
|                                           | 0.003     | 0.010     | 0.005     |
| Unemployment                              | 0.048     | 0.046     | 0.048     |
|                                           | 0.004     | 0.005     | 0.003     |
| Formal                                    | 0.583     | 0.567     | 0.577     |
|                                           | 0.009     | 0.012     | 0.007     |
| Monthly wage or profit (2007 rp)          | 1,420,568 | 1,053,419 | 1,292,482 |
|                                           | 51,960    | 27,315    | 35,222    |
| <u>Senior secondary type</u>              |           |           |           |
| Public Vocational                         | 0.265     | 0.251     | 0.259     |
|                                           | 0.008     | 0.008     | 0.006     |
| Private general                           | 0.231     | 0.244     | 0.237     |
|                                           | 0.007     | 0.008     | 0.005     |
| Private vocational                        | 0.258     | 0.270     | 0.263     |
|                                           | 0.008     | 0.010     | 0.006     |
| <u>Personal characteristics</u>           |           |           |           |
| Female                                    | 0.000     | 1.000     | 0.459     |
|                                           | 0.000     | 0.000     | 0.007     |
| Height                                    | 116.606   | 108.593   | 112.925   |
|                                           | 1.244     | 1.380     | 0.927     |
| Height missing                            | 0.286     | 0.285     | 0.285     |
|                                           | 0.008     | 0.009     | 0.006     |
| Age in 1993                               | 28.590    | 26.132    | 27.461    |
|                                           | 0.149     | 0.147     | 0.106     |
| Share in middle cohort (born 1962-1972)   | 0.328     | 0.378     | 0.351     |
|                                           | 0.008     | 0.009     | 0.006     |
| Share in youngest cohort (born 1973-1980) | 0.202     | 0.259     | 0.228     |
|                                           | 0.006     | 0.008     | 0.005     |
| Small town at age 12                      | 0.272     | 0.287     | 0.279     |
|                                           | 0.007     | 0.009     | 0.006     |
| Big city at age 12                        | 0.178     | 0.239     | 0.206     |
|                                           | 0.006     | 0.009     | 0.005     |
| Attended public junior secondary          | 0.633     | 0.638     | 0.635     |
|                                           | 0.008     | 0.010     | 0.006     |
| Repeated grade in junior secondary        | 0.046     | 0.013     | 0.031     |
|                                           | 0.006     | 0.002     | 0.003     |
| Repeated grade in elementary              | 0.239     | 0.131     | 0.189     |
|                                           | 0.009     | 0.007     | 0.006     |
| Worked in junior secondary                | 0.101     | 0.030     | 0.068     |
|                                           | 0.006     | 0.003     | 0.003     |
| Worked in elementary                      | 0.053     | 0.022     | 0.039     |
|                                           | 0.004     | 0.003     | 0.003     |
| <u>Parental characteristics</u>           |           |           |           |
| Father graduated elementary               | 0.483     | 0.425     | 0.456     |
|                                           | 0.008     | 0.010     | 0.006     |
| Father graduated junior secondary         | 0.137     | 0.179     | 0.156     |
|                                           | 0.006     | 0.008     | 0.005     |
| Father graduated senior secondary         | 0.131     | 0.228     | 0.176     |
|                                           | 0.006     | 0.009     | 0.005     |

Appendix 1. Mean and Standard Deviation of Variables, Main sample

|                                                              | Men   | Women | All    |
|--------------------------------------------------------------|-------|-------|--------|
| Father graduated university                                  | 0.039 | 0.056 | 0.047  |
|                                                              | 0.004 | 0.005 | 0.003  |
| Father graduated other                                       | 0.117 | 0.076 | 0.098  |
|                                                              | 0.006 | 0.005 | 0.004  |
| Father attended vocational senior secondary                  | 0.076 | 0.120 | 0.097  |
|                                                              | 0.004 | 0.007 | 0.004  |
| Share of fathers in district that graduated elementary       | 46.7  | 45.0  | 45.9   |
|                                                              | 0.3   | 0.3   | 0.2    |
| Share of fathers in district that graduated junior secondary | 14.7  | 16.0  | 15.3   |
|                                                              | 0.1   | 0.2   | 0.1    |
| Share of fathers in district that graduated senior secondary | 16.2  | 17.5  | 16.8   |
|                                                              | 0.2   | 0.2   | 0.1    |
| Share of fathers in district that graduated university       | 5.0   | 5.0   | 5.0    |
|                                                              | 0.1   | 0.1   | 0.1    |
| Share of fathers in district that graduated other            | 10.0  | 10.0  | 10.0   |
|                                                              | 0.2   | 0.1   | 0.1    |
| Mother graduated elementary                                  | 0.492 | 0.526 | 0.508  |
|                                                              | 0.008 | 0.010 | 0.006  |
| Mother graduated junior secondary                            | 0.095 | 0.148 | 0.119  |
|                                                              | 0.005 | 0.007 | 0.004  |
| Mother graduated senior secondary                            | 0.078 | 0.124 | 0.099  |
|                                                              | 0.005 | 0.008 | 0.004  |
| Mother graduated university                                  | 0.011 | 0.013 | 0.012  |
|                                                              | 0.002 | 0.002 | 0.002  |
| Mother graduated other                                       | 0.108 | 0.053 | 0.083  |
|                                                              | 0.006 | 0.003 | 0.003  |
| Mother attended vocational senior secondary                  | 0.040 | 0.073 | 0.055  |
|                                                              | 0.003 | 0.006 | 0.003  |
| Share of mothers in district that graduated elementary       | 51.2  | 50.4  | 50.8   |
|                                                              | 0.3   | 0.4   | 0.2    |
| Share of mothers in district that graduated junior secondary | 11.4  | 12.6  | 12.0   |
|                                                              | 0.1   | 0.2   | 0.1    |
| Share of mothers in district that graduated senior secondary | 8.8   | 9.9   | 9.3    |
|                                                              | 0.1   | 0.2   | 0.1    |
| Share of mothers in district that graduated university       | 1.2   | 1.3   | 1.3    |
|                                                              | 0.0   | 0.0   | 0.0    |
| Share of mothers in district that graduated other            | 8.9   | 8.4   | 8.7    |
|                                                              | 0.2   | 0.1   | 0.1    |
| <u>Survey year</u>                                           |       |       |        |
| 1997                                                         | 0.261 | 0.260 | 0.261  |
|                                                              | 0.007 | 0.009 | 0.006  |
| 2000                                                         | 0.372 | 0.363 | 0.368  |
|                                                              | 0.008 | 0.009 | 0.006  |
| 2007                                                         | 0.238 | 0.256 | 0.246  |
|                                                              | 0.007 | 0.009 | 0.006  |
| Total number of observations                                 | 6,084 | 5,330 | 11,414 |

Appendix 2. Estimated Effect of School Type on Outcomes, Full Results

|                                        | Men       |              |           |           | Women     |              |           |           |
|----------------------------------------|-----------|--------------|-----------|-----------|-----------|--------------|-----------|-----------|
|                                        | LFP       | Unemployment | Formality | Wage      | LFP       | Unemployment | Formality | Wage      |
| <u>Senior secondary type</u>           |           |              |           |           |           |              |           |           |
| Public Vocational                      | 0.013*    | -0.006       | 0.036**   | 0.009     | 0.023     | -0.017       | 0.032     | 0.087     |
|                                        | (0.007)   | (0.011)      | (0.017)   | (0.056)   | (0.029)   | (0.012)      | (0.025)   | (0.075)   |
| Private general                        | 0.013*    | -0.003       | -0.042*   | -0.171*** | -0.076**  | 0.016        | -0.052*   | -0.047    |
|                                        | (0.007)   | (0.008)      | (0.025)   | (0.062)   | (0.032)   | (0.010)      | (0.028)   | (0.076)   |
| Private vocational                     | 0.005     | 0.010        | 0.019     | -0.203*** | -0.032    | 0.004        | 0.007     | -0.014    |
|                                        | (0.008)   | (0.012)      | (0.020)   | (0.064)   | (0.034)   | (0.013)      | (0.029)   | (0.081)   |
| <u>Personal characteristics</u>        |           |              |           |           |           |              |           |           |
| Height                                 | 0.000     | 0.001        | 0.001     | 0.005**   | 0.004*    | 0.001        | 0.007***  | 0.017***  |
|                                        | (0.000)   | (0.001)      | (0.001)   | (0.002)   | (0.002)   | (0.001)      | (0.002)   | (0.005)   |
| Height missing                         | 0.039     | 0.131        | 0.146     | 0.857**   | 0.631*    | 0.142        | 1.179***  | 2.723***  |
|                                        | (0.062)   | (0.092)      | (0.174)   | (0.412)   | (0.364)   | (0.158)      | (0.380)   | (0.777)   |
| Middle cohort (born 1962-1972)         | -0.000    | 0.020**      | -0.037*   | -0.419*** | -0.131*** | 0.010        | -0.038    | -0.581*** |
|                                        | (0.005)   | (0.009)      | (0.020)   | (0.049)   | (0.030)   | (0.008)      | (0.023)   | (0.068)   |
| Young cohort (born 1973-1980)          | -0.040*** | 0.146***     | -0.044*   | -0.742*** | -0.107*** | 0.116***     | -0.030    | -0.847*** |
|                                        | (0.009)   | (0.016)      | (0.023)   | (0.051)   | (0.038)   | (0.017)      | (0.031)   | (0.082)   |
| Junior secondary in city or small town | -0.005    | -0.010       | 0.015     | -0.060    | 0.012     | 0.013        | 0.029     | 0.062     |
|                                        | (0.009)   | (0.009)      | (0.017)   | (0.050)   | (0.033)   | (0.012)      | (0.021)   | (0.087)   |
| Junior secondary location missing      | -0.005    | 0.010        | -0.006    | -0.035    | -0.033    | -0.007       | -0.013    | 0.237**   |
|                                        | (0.008)   | (0.013)      | (0.022)   | (0.072)   | (0.047)   | (0.014)      | (0.034)   | (0.094)   |
| Attended public junior secondary       | -0.043    | 0.004        | -0.105    | -0.103    | -0.079    | -0.046       | -0.206    | -0.290    |
|                                        | (0.055)   | (0.041)      | (0.069)   | (0.378)   | (0.129)   | (0.076)      | (0.183)   | (0.231)   |
| Repeated grade in junior secondary     | -0.001    | 0.005        | 0.008     | 0.060     | 0.013     | 0.023*       | 0.008     | 0.032     |
|                                        | (0.005)   | (0.010)      | (0.018)   | (0.046)   | (0.023)   | (0.012)      | (0.019)   | (0.061)   |
| Repeated grade in elementary           | -0.007    | 0.069        | -0.033    | 0.067     | -0.024    | 0.081        | -0.080    | -0.146    |
|                                        | (0.013)   | (0.042)      | (0.064)   | (0.102)   | (0.103)   | (0.071)      | (0.097)   | (0.156)   |
| Worked in junior secondary             | -0.013**  | 0.007        | -0.013    | -0.134*** | -0.068*   | 0.017        | -0.048**  | -0.222**  |
|                                        | (0.007)   | (0.008)      | (0.016)   | (0.043)   | (0.035)   | (0.014)      | (0.024)   | (0.109)   |
| Worked in elementary                   | 0.004     | -0.024       | -0.065    | -0.054    | -0.005    | -0.024*      | -0.062    | 0.288     |
|                                        | (0.010)   | (0.019)      | (0.043)   | (0.088)   | (0.090)   | (0.014)      | (0.082)   | (0.238)   |
| <u>Parental characteristics</u>        |           |              |           |           |           |              |           |           |
| Father graduated elementary            | 0.000     | -0.003       | 0.083     | 0.128     | 0.052     | -0.012       | -0.069    | -0.434    |
|                                        | (0.012)   | (0.018)      | (0.067)   | (0.123)   | (0.110)   | (0.015)      | (0.100)   | (0.344)   |
| Father graduated junior secondary      | 0.021     | 0.004        | 0.005     | 0.017     | 0.132**   | -0.005       | 0.070     | 0.345     |
|                                        | (0.020)   | (0.015)      | (0.038)   | (0.092)   | (0.066)   | (0.024)      | (0.086)   | (0.229)   |
| Father graduated senior secondary      | 0.027     | 0.026        | -0.016    | -0.065    | 0.161**   | -0.013       | 0.087     | 0.332     |
|                                        | (0.023)   | (0.018)      | (0.043)   | (0.117)   | (0.081)   | (0.026)      | (0.080)   | (0.227)   |

Appendix 2. Estimated Effect of School Type on Outcomes, Full Results

|                                                                    | Men                  |                      |                    |                     | Women               |                     |                   |                    |
|--------------------------------------------------------------------|----------------------|----------------------|--------------------|---------------------|---------------------|---------------------|-------------------|--------------------|
|                                                                    | LFP                  | Unemployment         | Formality          | Wage                | LFP                 | Unemployment        | Formality         | Wage               |
| Father graduated university                                        | 0.015<br>(0.026)     | 0.017<br>(0.027)     | -0.030<br>(0.047)  | 0.068<br>(0.133)    | 0.181**<br>(0.085)  | 0.005<br>(0.031)    | 0.107<br>(0.084)  | 0.175<br>(0.230)   |
| Father graduated other                                             | 0.003<br>(0.032)     | 0.037<br>(0.034)     | 0.004<br>(0.053)   | 0.210<br>(0.164)    | 0.247***<br>(0.091) | 0.018<br>(0.031)    | 0.145*<br>(0.085) | 0.492*<br>(0.261)  |
| Father attended vocational<br>senior secondary                     | 0.009<br>(0.020)     | 0.033*<br>(0.019)    | 0.019<br>(0.038)   | -0.077<br>(0.103)   | 0.164**<br>(0.071)  | -0.013<br>(0.024)   | 0.124*<br>(0.070) | 0.178<br>(0.214)   |
| Share of fathers in district<br>that graduated elementary          | 0.022<br>(0.015)     | -0.005<br>(0.024)    | 0.003<br>(0.039)   | -0.053<br>(0.100)   | -0.050<br>(0.051)   | -0.048**<br>(0.023) | 0.051<br>(0.042)  | 0.201<br>(0.140)   |
| Share of fathers in district<br>that graduated junior<br>secondary | -0.003<br>(0.004)    | -0.005*<br>(0.003)   | -0.014<br>(0.009)  | -0.006<br>(0.020)   | -0.015<br>(0.022)   | 0.005<br>(0.015)    | -0.017<br>(0.031) | 0.057<br>(0.074)   |
| Share of fathers in district<br>that graduated senior<br>secondary | -0.000<br>(0.004)    | -0.004<br>(0.005)    | -0.023*<br>(0.012) | -0.031<br>(0.032)   | -0.009<br>(0.023)   | 0.005<br>(0.015)    | -0.013<br>(0.028) | 0.031<br>(0.073)   |
| Share of fathers in district<br>that graduated university          | -0.005<br>(0.005)    | -0.010<br>(0.007)    | -0.004<br>(0.012)  | 0.027<br>(0.036)    | -0.001<br>(0.024)   | 0.005<br>(0.016)    | -0.002<br>(0.030) | -0.013<br>(0.075)  |
| Share of fathers in district<br>that graduated other               | -0.007<br>(0.011)    | 0.022**<br>(0.009)   | 0.010<br>(0.019)   | 0.052<br>(0.057)    | -0.032<br>(0.024)   | 0.036<br>(0.024)    | -0.059<br>(0.049) | -0.069<br>(0.119)  |
| Mother graduated elementary                                        | -0.022*<br>(0.013)   | -0.000<br>(0.012)    | 0.035<br>(0.024)   | 0.015<br>(0.072)    | -0.054<br>(0.053)   | 0.020<br>(0.021)    | 0.037<br>(0.034)  | 0.109<br>(0.098)   |
| Mother graduated junior<br>secondary                               | -0.039***<br>(0.015) | -0.019<br>(0.017)    | 0.062<br>(0.038)   | 0.257***<br>(0.084) | 0.015<br>(0.061)    | 0.030<br>(0.027)    | 0.039<br>(0.041)  | 0.155<br>(0.130)   |
| Mother graduated senior<br>secondary                               | -0.009<br>(0.021)    | 0.079**<br>(0.038)   | 0.031<br>(0.059)   | 0.008<br>(0.152)    | 0.007<br>(0.079)    | 0.021<br>(0.038)    | -0.029<br>(0.063) | 0.149<br>(0.173)   |
| Mother graduated university                                        | -0.034<br>(0.045)    | -0.001<br>(0.058)    | -0.024<br>(0.103)  | 0.234<br>(0.164)    | -0.020<br>(0.160)   | 0.014<br>(0.042)    | -0.037<br>(0.085) | 0.032<br>(0.853)   |
| Mother graduated other                                             | -0.019<br>(0.016)    | -0.011<br>(0.014)    | 0.006<br>(0.030)   | 0.049<br>(0.101)    | -0.029<br>(0.067)   | 0.001<br>(0.023)    | -0.062<br>(0.062) | 0.380**<br>(0.169) |
| Mother attended vocational<br>senior secondary                     | -0.047<br>(0.028)    | -0.073*<br>(0.041)   | -0.011<br>(0.053)  | 0.043<br>(0.127)    | -0.037<br>(0.064)   | 0.053<br>(0.035)    | 0.079<br>(0.052)  | 0.136<br>(0.168)   |
| Share of mothers in district<br>that graduated elementary          | -0.005<br>(0.005)    | 0.000<br>(0.005)     | 0.002<br>(0.010)   | -0.009<br>(0.031)   | 0.012<br>(0.019)    | 0.001<br>(0.010)    | 0.045*<br>(0.027) | 0.076<br>(0.052)   |
| Share of mothers in district<br>that graduated junior<br>secondary | -0.006<br>(0.005)    | -0.006<br>(0.007)    | 0.010<br>(0.012)   | 0.007<br>(0.033)    | 0.007<br>(0.022)    | 0.002<br>(0.012)    | 0.045<br>(0.028)  | 0.110*<br>(0.062)  |
| Share of mothers in district<br>that graduated senior<br>secondary | 0.002<br>(0.013)     | 0.005<br>(0.014)     | -0.016<br>(0.016)  | -0.084*<br>(0.048)  | -0.006<br>(0.025)   | 0.009<br>(0.016)    | 0.007<br>(0.034)  | 0.069<br>(0.073)   |
| Share of mothers in district<br>that graduated university          | 0.013<br>(0.026)     | -0.027***<br>(0.008) | -0.017<br>(0.022)  | 0.015<br>(0.056)    | 0.087<br>(0.091)    | 0.016<br>(0.018)    | -0.042<br>(0.049) | -0.098<br>(0.372)  |

Appendix 2. Estimated Effect of School Type on Outcomes, Full Results

|                                                   | Men                 |                      |                      |                     | Women              |                     |                      |                     |
|---------------------------------------------------|---------------------|----------------------|----------------------|---------------------|--------------------|---------------------|----------------------|---------------------|
|                                                   | LFP                 | Unemployment         | Formality            | Wage                | LFP                | Unemployment        | Formality            | Wage                |
| Share of mothers in district that graduated other | -0.006<br>(0.007)   | -0.002<br>(0.005)    | -0.010<br>(0.009)    | 0.014<br>(0.030)    | 0.020<br>(0.025)   | 0.004<br>(0.013)    | 0.033<br>(0.031)     | 0.250***<br>(0.083) |
| <u>Survey year</u>                                |                     |                      |                      |                     |                    |                     |                      |                     |
| 1993                                              | 0.005<br>(0.007)    | 0.053***<br>(0.014)  | -0.023<br>(0.020)    | 0.197***<br>(0.041) | 0.053**<br>(0.025) | 0.070***<br>(0.014) | -0.028<br>(0.028)    | 0.150**<br>(0.071)  |
| 2000                                              | -0.017**<br>(0.008) | -0.029***<br>(0.011) | -0.020<br>(0.020)    | 0.152***<br>(0.050) | 0.058**<br>(0.025) | -0.027*<br>(0.014)  | -0.055*<br>(0.032)   | 0.097<br>(0.071)    |
| 2007                                              | 0.006<br>(0.011)    | -0.033*<br>(0.018)   | -0.829***<br>(0.033) | 0.415***<br>(0.087) | 0.030<br>(0.049)   | -0.062<br>(0.040)   | -0.871***<br>(0.064) | 0.144<br>(0.116)    |
| R-squared                                         | 0.090               | 0.171                | 0.559                | 0.230               | 0.175              | 0.232               | 0.584                | 0.314               |
| Observations                                      | 6,084               | 5,931                | 5,642                | 5,065               | 5,330              | 3,452               | 3,288                | 2,681               |

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