Returns to Technical and Vocational Education and Training in the Philippines[1]

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Estimating the returns to TVET is important for individuals, businesses, and policymakers.[3] For individuals it is particularly helpful in deciding between pursuing vocational training or employment. There are financial costs to pursuing vocational training, as well as opportunity costs for the time spent in training. The high costs of tertiary education may discourage its pursuit, with the lower cost and shorter duration of TVET making it a viable alternative. In the Philippines, a large majority of tertiary school-age population does not pursue post-secondary or tertiary education. Only one-third is enrolled in tertiary, largely academic education, while only 10% is enrolled in post-secondary non-tertiary education. To understand the low enrollment in post-secondary education, it is helpful to determine its profitability.

This paper aims to determine the private rates of return to TVET at the upper secondary, post-secondary, and tertiary levels. The paper is structured as follows: Section I provides an overview of the methodological approach and data sources; Section II presents the main findings from the assessment; and Section III concludes.

I. Methodological approach

This assessment uses the human capital earnings function, or Mincerian equation[4] as the benchmark model. It relates the logarithm of current earnings to years of schooling and years of work experience, where the coefficient of schooling approximates the rate of return to a year of schooling. The basic model is augmented by controlling for observed characteristics including sex, urbanity, region, industry, occupation, class of work and nature of employment. Rates of return to various levels of education, various tracks of upper secondary education, various fields of post-secondary non-tertiary and short-cycle tertiary education, and various levels of higher education are also estimated.[5] Notwithstanding the correction of bias due to the omission of observable characteristics, estimated rates of return may still suffer from

[1] Chapter 9: Asian Development Bank. (2021). Technical and Vocational Education and Training in the Philippines in the Age of Industry 4.0. Mandaluyong City: Asian Development Bank. For presentation to the 15th National Convention on Statistics, 3-5 October 2022, Crown Plaza Manila Galleria, Ortigas Center, Quezon City. **Not for Publication.**

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[3] UNESCO-UNEVOC (2016)

[4] Mincer (1974)

[5] The April 2019 LFS round identifies highest educational attainment by level, broad field and specific qualification including TESDA National Certificate following the Philippine Standard Classification of Education.

selection bias as wages are only observed among those in the labor force, those who are employed, and those in particular classes of work.[6]

To correct for selection bias, a Heckman (1979) model is fitted on the various equations to account for factors that affect labor force participation, employment and work for pay. Given the correction for selection bias, the Heckman model is the preferred model among the three approaches. The Appendix elaborates on the various models. The key variables in these models are as follows:

- **Earnings** (in logarithm) is the dependent variable and is measured in terms of hourly wage. Hourly wage is computed as basic pay per day divided by the normal number of hours worked per day.
- **Education** represents the level of education and **Schooling** is the total number of years of schooling for various education levels: 0 for no education, 1 for early childhood, 6 for primary, 10 for lower secondary, 12 for upper secondary, 11 for post-secondary non-tertiary, 12 for short-cycle tertiary, 14 for bachelor's, 16 for master's and 18 for doctoral. Incomplete schooling at various levels is also accounted for. The interaction between education level and years of schooling allows the estimation of rates of return across levels of education.
- **Work experience** is approximated by age minus years of schooling and age at start of schooling. Using experience is preferable to age as the latter would lead to a partial omission of schooling and therefore an underestimate of the rate of return.[7]
- **Upper secondary education** includes Grade 11 and Grade 12. It has four **tracks**: academic, arts and design, sports, and technology and livelihood.
- **Post-secondary non-tertiary education** includes TESDA National Certificate (NC) qualifications, other TVET courses, and incomplete qualifications.
- **Short-cycle tertiary education** includes complete and incomplete cycles. Both of these have the following **broad fields:** generic programs and qualifications, education, arts and humanities; social sciences, journalism and information; business, administration and law; natural sciences, mathematics and statistics; information and communication technologies; engineering, manufacturing and construction; agriculture, forestry, fishery and veterinary; health and welfare, and services.
- **Tertiary or higher education** includes complete or incomplete bachelor, master's and doctoral degrees.

The data used in this study are from the April 2019 round of the LFS. The LFS is a quarterly nationwide survey of households conducted by the Philippine Statistics Authority aimed at gathering demographic and socio-economic data on the population. The April 2019 survey round has a sample size of 117,728 individuals, representing a total population of 107,856,526.

[6] Wages are observed only for workers in government, private establishments, private households, and workers with pay in family-owned businesses. Wages are not observed for the self-employed, employers and workers without pay in family-owned businesses.

[7] Mincer (1974)

II. The returns to TVET

This section highlights the returns to TVET at the upper secondary, post-secondary, and tertiary levels. This study uses the Mincer equation[8] as benchmark, and then accounts for observed characteristics, and finally corrects for selection bias using the Heckman model.[9] The first section presents descriptive statistics (Section A), followed by estimates of returns to average schooling (Section B) and the Heckman selection model results (Section C). Then, the rates of return are estimated by education level (Section D), at upper-secondary level and by track (Section E), for post-secondary TVET (Section F), for post-secondary TVET by field (Section G), for short-cycle tertiary education (Section H), for short-cycle tertiary education by broad field (Section I), and for tertiary education by level (Section J).

A. Descriptive statistics

Of the 107 million population (as of the April 2019 LFS), over 69 million are economically active. The distribution of educational attainment among the economically active is shown in Table 1. Of special interest for this study are those whose highest educational attainment pertains to TVET, i.e., upper secondary (particularly those in technology and livelihood track), post-secondary non-tertiary, and short-cycle tertiary. Together, this group comprises one-eighth of the economically active population.

Table 1: Sample and Population Distribution by Education Level

Education Level	Sample	Population	Share
No schooling	1,587	872,241	1.3%
Early childhood	31	16,012	0.0%
Primary	22,548	13,500,000	19.5%
Lower secondary	46,745	30,100,000	43.6%
Upper secondary	6,470	4,065,496	5.9%
Post-secondary non-tertiary	3,492	2,021,633	2.9%
Short-cycle tertiary	3,646	2,479,076	3.6%
Bachelor	24,795	15,700,000	22.7%
Master	450	225,038	0.3%
Doctoral	138	86,676	0.1%
Total	**109,902**	**69,066,172**	**100.0%**

Source: Philippines Labor Force Survey, April 2019

Almost 6% of the economically active population have upper secondary education. Among these, almost 14% took TVET (Technology and Livelihood track), close to 8% completing Grade 12 and a little over 6% completing Grade 11. The large majority (over 80%) took the academic track, a little over half of whom completed Grade 11 and the other half completing Grade 12. Almost 5% took the Arts and Design track, 3% completing Grade 12 and almost 2% completing

[8] Mincer (1974)
[9] Heckman (1979)

Grade 11. The remaining 1% took the Sports track, 0.6% completing Grade 12 and 0.4% completing Grade 11.

Almost 3% of the economically active have post-secondary, non-tertiary education. Of these, over 21% have completed TESDA NCs, almost 38% have completed other TVET courses, and 41% have incomplete TVET courses. Among those with TESDA NCs, almost two-thirds (65.3%) took engineering, manufacturing, and construction, followed by services (17.8%), and business administration and law (9.6%). The least-represented qualifications are health and welfare (1.7%), arts and humanities (2.6%), and agriculture, forestry, fisheries, and veterinary (2.9%).

Almost 4% of the economically active have short-cycle tertiary education. These are dominated by graduates (89.4%) with the remaining 10.6% being undergraduates. Among the graduates, the largest group (28.7%) took the engineering, manufacturing, and construction field; followed by those who took up services (19%), business, administration and law (18.6%), and information and communication technologies (16.8%). Health and welfare was taken by 9.4%, while the rest of the fields have less than 3% shares, with natural sciences, mathematics and statistics; generic programs, and arts and humanities having the lowest shares.

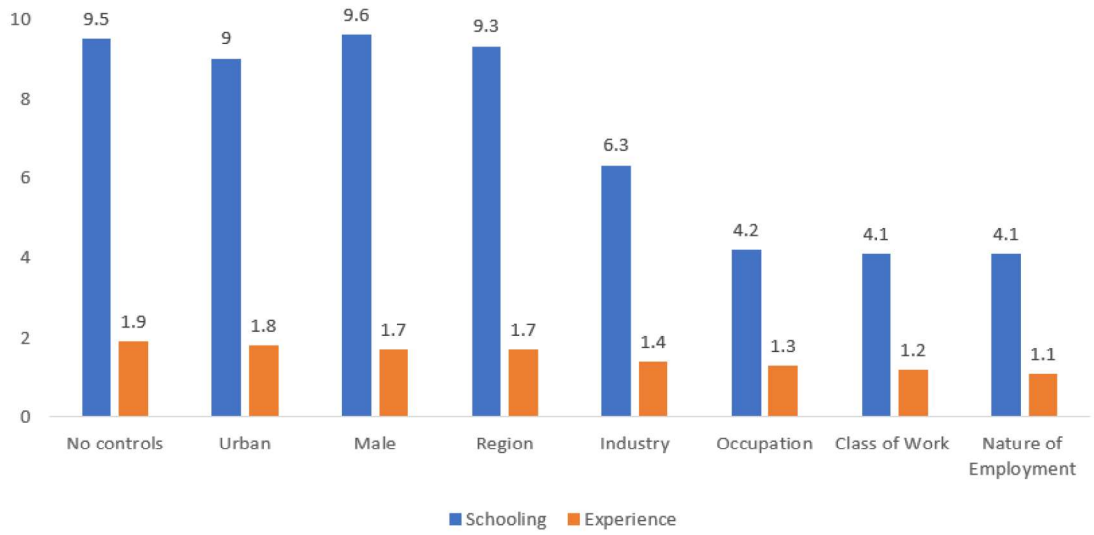
B. Returns to average schooling

The basic Mincerian model puts the average rate of return to schooling for the Philippines at 9.5%. This average rate of return is somewhat higher than the world average of 8.8% as well as that for East Asia and the Pacific (8.7%) for 1950–2014.[10] It is also a bit higher than the averages for low-income countries (9.3%) and middle-income countries (9.2%). This may be attributed to the larger variation in earnings and schooling in the country, especially across industries and occupations. This is confirmed by the large reduction in returns when controlling for industry and occupation. Variations by urbanity, region, and class of work also help account for the high returns in the basic Mincerian model.

Controlling for urbanity, region, industry, occupation and class of work decreases the average return to schooling. Results of OLS regression with stepwise inclusion of controls are presented in Figure 1. The chart shows the coefficient for schooling (and experience) with the cumulative addition of the various control variables. For all models, the coefficient of schooling is significant at 0.1%. The goodness of fit of the model improves with the addition of each control, with the adjusted R-squared increasing from 24.5% to 47.9%.

[10] Psacharopoulos & Patrinos (2018)

Figure 1. Stepwise Regression Coefficients, Returns to Education



Source: ADB estimates.

The addition of controls lowers the average rate of return significantly. Adding the urban dummy decreases the rate of return to 9%. This means that the omission of the urban dummy overestimates returns to schooling as it captures the higher wages and higher schooling in urban areas. On the other hand, adding a dummy variable for males increases the rate of return to schooling to 9.6%. This means that omitting sex underestimates the rate of return, as it captures the lower schooling among males, although males have higher wages. Including regional dummies decreases returns to 9.3%, meaning that the omission of region overestimates the rate of return, as it captures the higher wages and schooling in NCR.

Including industry dummies accounts for the greatest decrease in the rate of return, by almost a third. The omission of industry, in particular, overestimates the rate of return as this variable captures the higher wages and schooling in most industries relative to agriculture, forestry and fishing. Including occupational dummies further decreases the rate of return to schooling by over 1 percentage point. This means that the omission of occupation overestimates returns as it captures the higher schooling in the armed forces compared to most occupations. The inclusion of class of work only slightly decreases the rate of return, while including nature of employment does not change the rate of return.

C. Correcting for selection bias in labor force participation, employment and paid employment

Estimated rates of return may suffer from selection bias as wages are only observed among those in the labor force, those who are employed, and those in particular classes of work. To correct for selection bias, a two-stage Heckman (1979) model is fitted on the various equations to account for factors that affect labor force participation, employment and work for pay. The first stage is a probit model relating the probability of labor force participation, employment and working for pay to sex, age, marital status, and number of children. The second stage is the wage equation including the inverse mills ratio (derived from the first

stage) whose significance indicates selection bias the least squares estimates. The regression results of the Heckman selection models are given in (Table A. 1.). The coefficient of the inverse mills ratio (lambda) is significant in all three models, indicating the presence of selection bias in the OLS estimates.

Older men and women, and women with more children are less likely to participate in the labor force. Accounting for selection in labor force participation increases returns to schooling. In the first model, the first stage relates labor force participation to sex, age, marital status, number of children and interactions between the first variable with the latter three.[11] The results show that males are more likely than females to participate in the labor force. However, older individuals are less likely than younger individuals to participate, both for males and females. Married individuals are more likely to participate in the labor force; this is true for both sexes. Males with more children are more likely to participate in the labor force while females with more children are less likely to participate. The second stage shows higher returns to schooling (9.9%) compared to the OLS model. This means that the OLS regression underestimates returns to schooling because of the selection of certain individuals out of the labor force, namely older men and women, and women with more children.

For those in the labor force, older men and women with more children are less likely to be employed. Accounting for employment selection decreases returns to schooling. The first stage of second model relates employment to the same independent variables as in the first model. The results are very similar to the first model, except that older females tend to be employed more than younger females. The second stage shows lower returns to schooling (9.3%) compared with the OLS estimate. This suggests that OLS regression overestimates returns to schooling as it captures the higher employment of older men.

Among those employed, younger men, older women, married women and women with more children are less likely to work with pay. Accounting for selection in paid employment shows the highest returns to schooling. The first stage of the third model relates whether an employee receives wages/works for pay to the same independent variables as in the previous models. Young men are less likely to be paid than young women for their work. However, older men are more likely to be paid than younger men, while older women are less likely to be paid than younger women. Married men are more likely to work for pay than unmarried men, while married women are less likely to work for pay than unmarried women. Men with more children are more likely to work for pay than men with less children, whereas women with more children are less likely to work for pay. The second stage shows the highest returns to schooling (10.1%), indicating that the OLS estimate is downward biased given the unreported earnings of younger men, older women, married women, and women with more children.

Selection bias is reduced when accounting for various observed characteristics. Using the Heckman selection model with controls yields the results in Table A. 2. The coefficient of the inverse mills ratio is significant only for the models selecting for labor force participation and employment. There is no selection bias based on reported earnings, after controlling for the various observed characteristics. The first model accounting for labor force participation

[11] This follows from the U.S. Congressional Budget Office (2018).

yields the same returns as the OLS. The second and third models accounting for employment and reported earnings, respectively, show only slightly lower returns than the OLS. This means that after accounting for observed characteristics, there is little bias left.

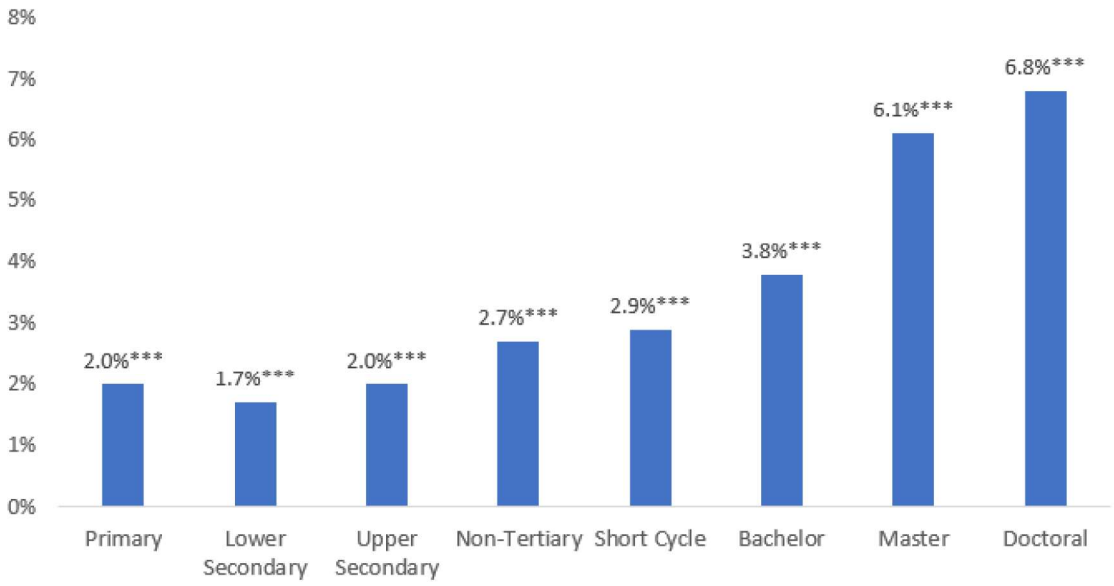
D. Returns by Education Level

Returns to various levels of education are mostly positive and generally increasing. Returns to education are positive for most levels except for early childhood education where the rate of return is insignificant. The preferred Heckman selection model estimates (Figure 2) show returns to education decreasing from 2% for primary education to 1.7% for lower secondary level. Returns rise back to 2% for upper secondary education (including technology and livelihood track), and increase further to 2.7% for post-secondary non-tertiary TVET and to 2.9% for short-cycle tertiary TVET. Returns to tertiary education are highest at 3.8% for bachelor, 6.1% for master and 6.8% for doctoral degrees. Selection bias correction puts the Heckman estimates somewhat higher for primary education and master's education and lower for lower secondary education, post-secondary non-tertiary education, bachelor and doctoral degrees, than the least square estimates (see Table A. 3).

The trends are consistent with global trends of higher returns to primary over secondary education and the recent increase in returns to higher education. Private returns to primary education levels have been the highest until recently.[12] Private returns to higher education have been increasing in recent decades.[13] Considering public subsidy of education, however, may lower social returns to higher education below those of secondary education, revealing diminishing returns to education.[14] The high returns to primary education are due to the jump in productivity from literacy and numeracy and its relatively low cost. On the other hand, the cost of education increases in secondary and tertiary education.

[12] Psacharopolous (1985)
[13] Psacharopoulos & Patrinos (2018)
[14] Psacharopolous (1985)

Figure 2. Returns to Education by Level (No Schooling as reference)



* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

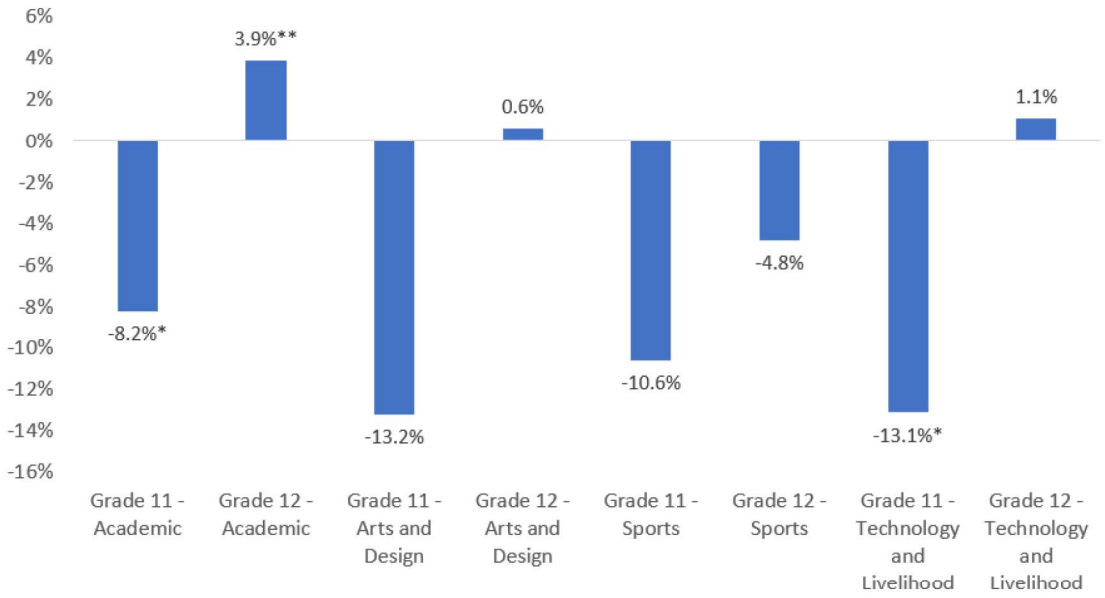
The likelihood of participating in the labor force depends on age, whether the person is studying, marital status, relationship to the household head, number of children and educational attainment. The first stage of the Heckman selection model (Table A9.4) shows that those in their golden years (age 50-64) and especially those of old age (age 65 up) are less likely to participate in the labor force than young adults (ages 15-29). Those studying are less likely to participate in the labor force than those not studying. Those who are married and widowed are less likely to participate in the labor force than those who are single. Household heads are more likely to participate in the labor force than other members of the family. Those with more children are less likely to participate in the labor force. Those with more schooling / higher education levels are more likely to participate in the labor force than those with no education.

E. Returns to upper secondary education

Returns to upper secondary education are positive for the completion of academic track, negative for incomplete academic track and technology and livelihood track, and insignificant for others. The results of the Heckman selection model are shown in Figure 3. The rate of return to complete upper secondary education is only significant for the academic track with returns of 3.9%. The rates of return to completion of the technology and livelihood, arts and design and sports tracks are insignificant. The rates of return to incomplete secondary education are only significant for the academic and technology and livelihood tracks. However, the returns are negative, -8.2% for the academic track and -13.1 for the technology and livelihood track. These mean that those who do not complete the academic and technology and livelihood tracks earn 8.2% and 13.1%, respectively, less than those who

only completed lower secondary education. Returns to incomplete arts and design and sports track are insignificant. The insignificance of returns to arts and design, and sports tracks may be due to the limited samples for these. Comparative returns using the basic Mincerian model and the augmented model with controls are given in Table A. 5.

Figure 3. Returns to Upper Secondary Education by Track (Lower High School Graduate as reference)



* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

F. Returns to post-secondary TVET

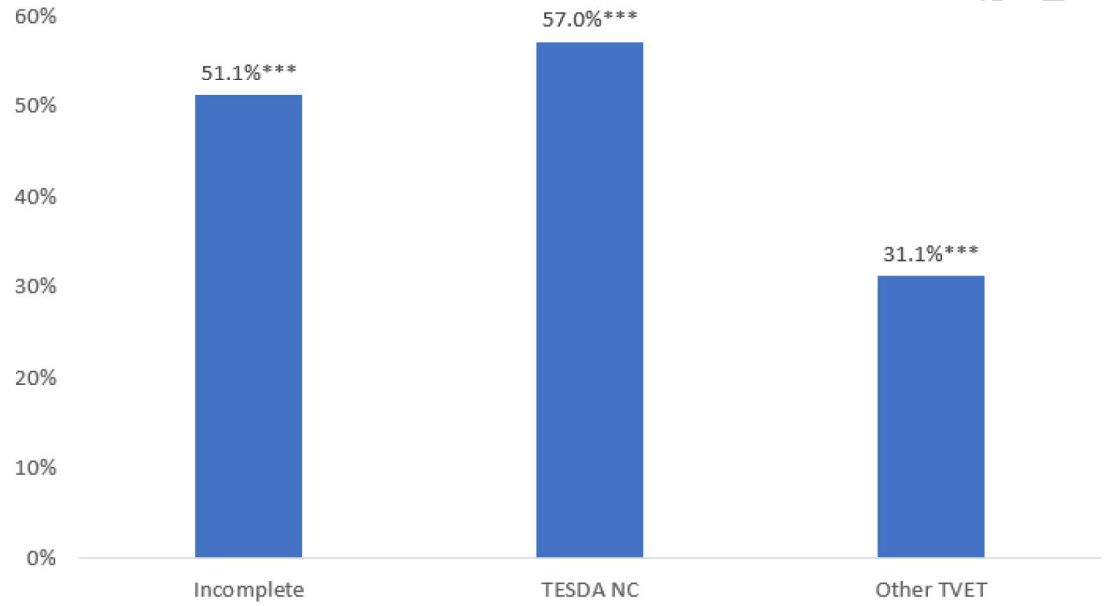
Returns to post-secondary, non-tertiary TVET can vary depending on the duration of the training. Assuming 1 year to complete a qualification[15] and half a year for incomplete participation, returns to post-secondary TVET are estimated at 15.9% with the preferred Heckman model and is comparable to returns at the tertiary level, even at the post-graduate level (see Section J). Using actual duration for each qualification, the estimated returns increase to 40%. This is comparable to that estimated by Sakellariou (2006) for Singapore (39% for males, 49% for females). Given the substantial returns to post-secondary non-tertiary TVET, there is arguably a gross private underinvestment in this education in terms of attendance, considering that enrollment at this level is less than a third of that in tertiary education. As for public investment, this will be assessed in the subsequent chapter on the TESDA scholarship.

There are substantial returns to TVET at the post-secondary non-tertiary level, both for complete and incomplete participation (Figure 4). Among TVET graduates, returns are higher

[15] UNESCO-UNEVOC (2016)

for TESDA NCs compared to other TVET courses. The Heckman selection model yields returns to TESDA NCs of 57%, while returns to other TVET courses are 31%. Returns to incomplete participation decrease to 51%. Returns to TESDA NCs are higher while the returns to other TVET courses and incomplete participation are lower than the least squares estimates with controls (see Table A. 6). These suggests negative selection bias for TESDA NCs and positive selection bias for other TVET courses and incomplete participation.

Figure 4. Returns to Post-Secondary Non-Tertiary Education (Lower Secondary Graduates as reference)



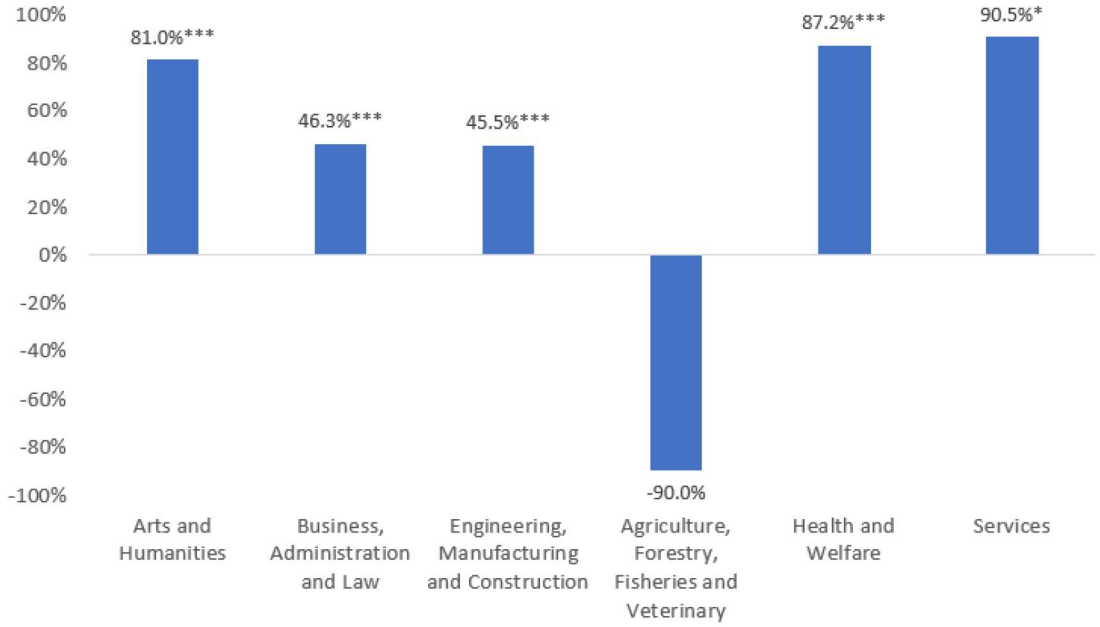
TESDA NC = Technical Education and Skills Development Authority National Certification; TVET = technical and vocational education and training.
* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

G. Returns to post-secondary TVET by field

Returns to TESDA National Certificates vary by field and are highest for services, health and welfare, and arts and humanities. The preferred Heckman model reveals that returns to TESDA NCs are highest for services (90.5%), followed by education and welfare (87.2%), and arts and humanities (81%). Engineering, manufacturing, and construction have the lowest returns (45.5%) followed by business, administration, and law (46.3%). The low returns to these courses might indicate oversupply of graduates at post-secondary and tertiary levels, given that most post-secondary TVET graduates took these courses. Engineering, manufacturing, and construction alone comprises almost two-thirds of the qualifications of TESDA NC holders. Returns to TVET in agriculture, forestry, fisheries, and veterinary are not significantly different from those of high school graduates. The Heckman estimates are mostly lower than the least squares estimates with controls suggesting positive selection bias in the latter. However, the estimates for arts and humanities and agriculture, forestry, fisheries and

veterinary are higher than the least squares estimate indicating negative selection bias. Comparative returns using the Mincerian and with controls are given in Table A. 7.

Figure 5. Returns to TESDA National Certificates by Field (Lower Secondary Graduates as reference)

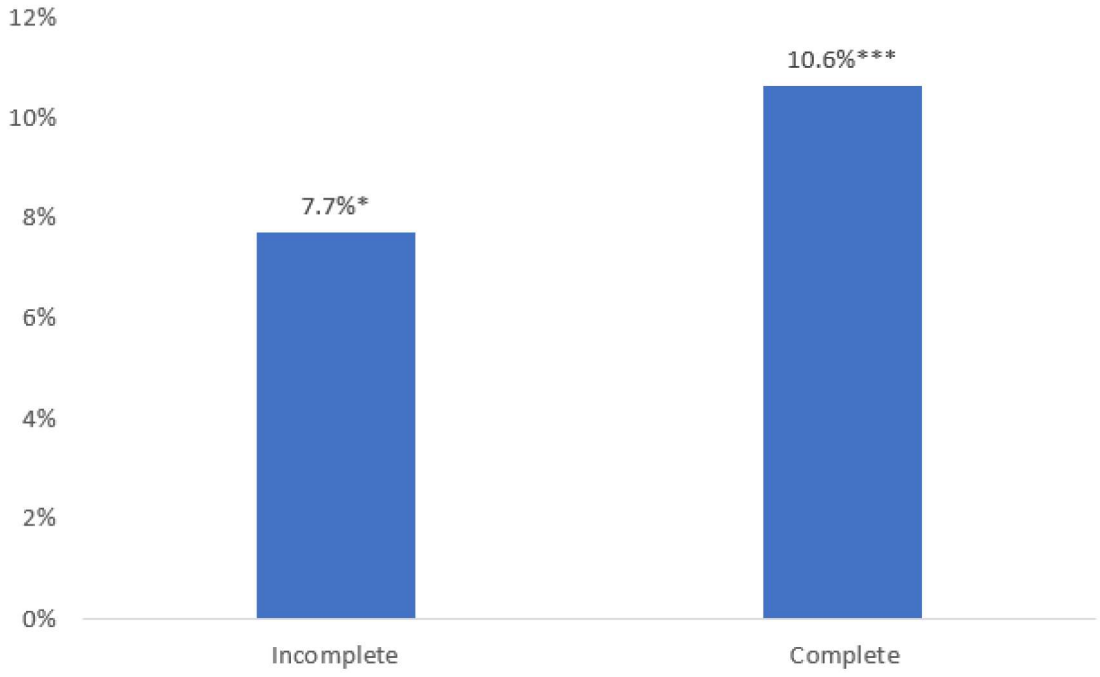


TESDA = Technical Education and Skills Development Authority.
* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

H. Returns to short-cycle tertiary TVET

There are respectable returns to short-cycle tertiary TVET, both for completion and incomplete participation. Figure 6 shows the Heckman model estimates of returns to short-cycle tertiary TVET. Accounting for selection bias reveals returns to short-cycle tertiary education graduates of almost 11%. This is higher than the returns to tertiary-level TVET estimated by Sakellariou (2006) for females in Singapore (8.4%) but way below that for males (33.9%). It is comparable to, even somewhat higher, than the rate of return to a bachelor's degree (10.5%, see Section J). The estimate for incomplete participation is also significant (at 5% confidence level) with estimated return of 7.7%. The estimated returns are higher than those in least squares model with controls suggesting that negative selection in the least squares estimates.

Figure 6. Returns to Short-Cycle Tertiary Education (Lower Secondary Graduate as reference)

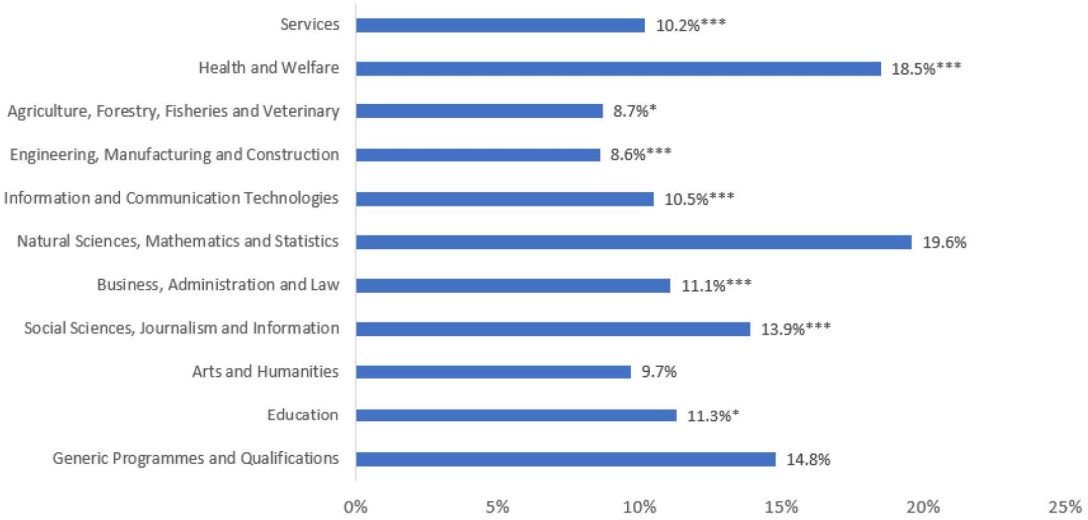


* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

I. Returns to short-cycle tertiary education by broad field

Returns to short-cycle tertiary education vary by field. Significant estimates range between 9% and 19% in the Heckman selection model (Figure 7). Returns are highest for Health and Welfare (18.5%); Social Sciences, Journalism, and Information (13.9%); and Education (11.3%). Returns are lowest for Engineering, Manufacturing, and Construction (8.6%); Agriculture, Forestry, Fisheries, and Veterinary (8.7%); and Services (10.2%). Returns to Generic Programmes and Qualifications and Arts and Humanities are insignificant.

Figure 7. Returns to Short-cycle Tertiary Education by Field (Lower Secondary Graduate as reference)



* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

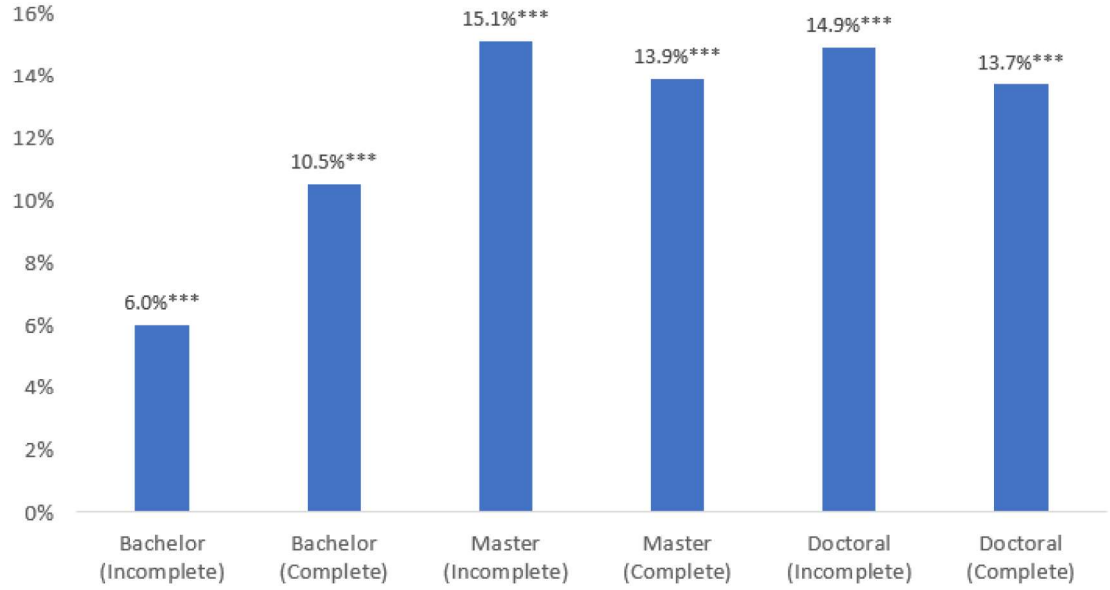
J. Returns to tertiary education

Returns to tertiary education are significantly positive for bachelor's, master's, and doctoral levels, both for completion and incomplete participation[16]. Returns generally increase by level, being lowest for incomplete bachelor and increasing with completion and advanced studies. Returns to incomplete bachelor's education are at 6% and those for complete bachelor's rising to 10.5% (

[16] Incomplete participation is defined as not having completed the course, and applies to current students and those who dropped out.

Figure 8). Returns increase with master's education to 15.1% for incomplete master's and 13.9% for complete master's education. Returns for doctoral education are 14.9% for incomplete and 13.7% for complete. Comparative estimates for the Mincerian model and the augmented model with controls are given in Table A. 9. The Heckman model estimate for incomplete bachelor is slightly lower than the estimate from least squares model with controls, suggesting positive selection bias in the latter. On the other hand, the Heckman model estimate for complete bachelor is slightly higher and for master's education is substantially higher than the OLS estimate, suggesting negative selection bias in the least squares estimate.

Figure 8. Returns to Tertiary Education (Lower Secondary Graduate as reference)



* p<0.05, ** p<0.01, *** p<0.001
Source: ADB estimates.

III. Conclusions

The basic estimate of average rate of return to schooling in the Philippines is comparable to the world average and that of the region. In fact, it is slightly higher, which may be due to larger variation in earnings and schooling in low-income countries, especially across industries and occupations. This is confirmed by the large reduction in the rate of return when controlling for industry and occupation. Variations by urbanity, region, and class of work also help account for the high returns in the basic Mincerian model.

Notwithstanding the relatively high returns to schooling in the country, returns appear to be underestimated due to selection bias, with some older men and women, and women with more children selected out of the labor force, older men and women with more children selected out of employment, and as young men, older women and married women and women with more children are selected out of paid work. Had they not been constrained from joining the labor force or from paid work, these groups would earn higher earnings than average and drive up the returns to schooling. The selection bias in labor force participation remains even after accounting for the effect of locational and occupational characteristics. The bias in paid work/reported earnings, however, disappears when including the controls. This means that particular industries, occupations, and classes of work are prone to experiencing unpaid work, such as agriculture/farming and family-owned business.

Returns to various levels of education are mostly positive and generally increasing. While returns to early childhood education is insignificant, returns to most levels of education are

significantly positive. Returns to education decrease from primary to lower secondary levels but increase at upper secondary level up to tertiary level.

Returns to TVET at the upper secondary level are not significant for completion and even negative for incomplete participation (i.e., non-completion the full duration of the course), while the return to upper secondary academic track completion is around 4% (the first-ever evaluation of returns to the K to 12 program).

Nevertheless, there are substantial returns to TVET at post-secondary non-tertiary level. Assuming a 1-year duration for a certificate places average returns at 16%, comparable to returns to tertiary education even at post-graduate level. Moreover, given the shorter actual training durations, average returns to post-secondary TVET are even higher at 40%, with returns to TESDA national certificates at 57% and to other TVET courses at 31%. Given the substantial returns to post-secondary non-tertiary TVET, there is arguably a gross private underinvestment in this education in terms of attendance, considering that enrollment at this level is less than a third of that in tertiary education.

Across TESDA qualifications, returns are highest for services, education and welfare and arts and humanities; lowest for engineering, manufacturing and construction, and business, administration, and law; and insignificant for agriculture, forestry, fisheries and veterinary. The low returns to engineering, manufacturing and construction, and business, administration, and law might indicate oversupply of graduates at post-secondary as well as tertiary levels, given that most post-secondary TVET graduates took these courses. Engineering, manufacturing, and construction alone comprises almost two-thirds of the qualifications of TESDA NC holders.

There are also respectable returns to short-cycle tertiary level TVET, both for completion and incomplete participation. Across fields, returns are highest in health and welfare followed by Social Sciences, Journalism and Information and education. Engineering, manufacturing and construction has the lowest positive returns followed by agriculture, forestry, fisheries and veterinary and services. Between these are Business, Administration and Law, and Information and Communication Technologies. Returns to generic programs and arts and humanities are not significant.

To our knowledge, this is the first study to estimate returns to TVET in the Philippines and to estimate returns at various levels and for various fields. It has done so by accounting for various observed characteristics, as well as correcting for unobserved selection bias, thereby providing reasonably unbiased estimates. Nevertheless, further analysis can be done in the future to address other issues such as the endogeneity of schooling and unobserved ability bias. The former can be addressed by using instrumental variable regression while the latter can be addressed by comparing returns between twins/siblings using fixed effects estimation.

Appendix

The approach begins with the basic human capital earnings function that relates wage to schooling and experience; this serves as a benchmark model. We then add controls in a stepwise manner to determine how returns to schooling changes with each control, from demographic, to geographic and occupational characteristics. This model is as follows:

$$lnwage = \beta_1 + \beta_2 Sch + \beta_3 Exp + \beta_4 Exp^2 + X\beta + \varepsilon \qquad (1)$$

Where $lnwage$ log hourly wage, Sch is years of schooling, Exp is years of work experience, and X is a vector for various control variables namely urbanity, sex, region, industry, occupation, class of work, and nature of employment. The coefficient of schooling, β_2, is the coefficient of interest and represents the rate of return to schooling.

For the control variables, dummy variables are created for male, urban, 17 regions with reference to NCR, 19 industries (2009 PSIC Sections) with reference to agriculture, forestry and fishing; nine occupations (2012 PSOC Major Groups) with reference to the armed forces, six classes of work[17] with reference to government employees, and nature of employment[18] with reference to permanent job.

Notwithstanding the correction of bias due to the omission of observable characteristics, the estimated rate of return may still be suffering from selection bias as wages are only observed among a subset of those in the labor force and those who are employed. To address selection bias, we use a two-stage Heckman (1979) selection model. The first stage fits a probit model that relates the probability of participating in the labor force to a vector of independent variables *w* which includes sex, age, marital status, and number of children.[19]

$$P(LFP) = \Phi(\alpha_1 + \alpha_2 w_i + u_i) \qquad (2)$$

The second stage is the wage equation plus a new variable known as the inverse mills ratio (λ_i) derived from the first stage. The inverse mills ratio allows the wage equation to account for factors that influence labor force participation, employment, and reported earnings so that conditioning on it makes the sample approximate a randomly selected sample.

$$lnwage = \beta_1 + \beta_2 Sch + \beta_3 Exp + \beta_4 Exp^2 + X\beta + \beta_\lambda \lambda_i + \varepsilon \qquad (3)$$

A significant coefficient for the inverse mills ratio means that there is selection bias in the least squares results. Given the focus on TVET, return to schooling is then estimated for TVET graduates relative to high school graduates by relating wage to years of schooling in TVET.

$$lnwage = \beta_1 + \beta_2 TVETSch + \beta_3 Exp + \beta_4 Exp^2 + X\beta + \varepsilon \qquad (4)$$

[17] Includes private households, private establishments, self-employed, employer, family-owned business with pay, and family-owned business without pay.
[18] Short-term and different employer.
[19] This follows from the U.S. Congressional Budget Office (2018).

Where $TVETSch$ is years of schooling for TVET qualifications. An extended earnings function is then fitted by interacting TVET schooling with specific qualifications (National Certificates) to determine returns to schooling for various TVET courses.

$$lnwage = \beta_1 + \sum_{i=2}^{i=20} \beta_i (Qualif_i * Sch) + \beta_{21} Exp + \beta_{22} Exp^2 + X\beta + \varepsilon \qquad (5)$$

Where $Qualif$ is a series of dummy variables for various TVET qualifications with secondary education as reference.

Table A. 1. Heckman Selection Model, without controls

	(1)	(2)	(3)
SECOND STAGE	**Ln Wage**	**Ln Wage**	**Ln Wage**
Schooling	0.0987	0.0934	0.101
	(108.74)***	(99.24)***	(95.67)***
Experience	0.0152	0.0153	0.0267
	(20.69)***	(16.08)***	(27.05)***
Experience Squared	-0.000162	-0.000194	-0.000249
	(-11.83)***	(-12.88)***	(-18.45)***
Constant	2.853	2.826	2.803
	(196.01)***	(117.75)***	(171.02)***
FIRST STAGE	**Labor force**	**Employed**	**With pay**
Male	0.5	0.419	-0.412
	(20.36)***	(6.74)***	(-11.60)***
Age	-0.006	0.0258	-0.029
	(-15.96)***	(16.66)***	(-48.18)***
Male*Age	-0.00885	-0.0171	0.00668
	(-14.32)***	(-8.94)***	(8.44)***
Married	0.153	0.379	-0.251
	(11.50)***	(10.65)***	(-14.32)***
Male*Married	1.091	0.181	0.248
	(48.81)***	(3.96)***	(10.58)***
Number of children	-0.0855	-0.0387	-0.0832
	(-17.97)***	(-3.43)***	(-13.59)***
Male*Number of children	0.0939	0.0325	0.0378
	(13.28)***	(2.27)*	(4.95)***
Constant	-0.264	0.399	1.495
	(-15.44)***	(8.07)***	(52.13)***
mills			
lambda	-0.194	-0.319	-0.449
	(-24.62)***	(-6.10)***	(-11.19)***
N	82547	39857	68260

* p<0.05, ** p<0.01, *** p<0.001
Note: t statistics in parentheses.
Source: ADB estimates.

Table A. 2. Heckman Selection Model, with controls

	(1)	(2)	(3)
SECOND STAGE	**Ln Wage**	**Ln Wage**	**Ln Wage**
Schooling	0.0405	0.0389	0.0403
	(40.07)***	(37.45)***	(36.88)***
Experience	0.0102	0.0071	0.0108
	(15.87)***	(8.75)***	(12.95)***
Experience Squared	-0.000125	-0.000101	-0.000144
	(-10.68)***	(-7.90)***	(-12.47)***
Constant	3.799	3.836	3.695
	(78.02)***	(76.31)***	(77.52)***
FIRST STAGE	**Labor force**	**Employed**	**With pay**
Male	0.5	0.419	-0.412
	(20.36)***	(6.74)***	(-11.60)***
Age	-0.006	0.0258	-0.029
	(-15.96)***	(16.66)***	(-48.18)***
Male*Age	-0.00885	-0.0171	0.00668
	(-14.32)***	(-8.94)***	(8.44)***
Married	0.153	0.379	-0.251
	(11.50)***	(10.65)***	(-14.32)***
Male*Married	1.091	0.181	0.248
	(48.81)***	(3.96)***	(10.58)***
Number of children	-0.0855	-0.0387	-0.0832
	(-17.97)***	(-3.43)***	(-13.59)***
Male*Number of children	0.0939	0.0325	0.0378
	(13.28)***	(2.27)*	(4.95)***
Constant	-0.264	0.399	1.495
	(-15.44)***	(8.07)***	(52.13)***
Mills			
Lambda	-0.0826	-0.369	0.0283
	(-8.28)***	(-8.27)***	-0.89
N	82,547	39,857	68,260

* p<0.05, ** p<0.01, *** p<0.001
Note: t statistics in parentheses.
Source: ADB estimates.

Table A. 3: Returns to Education by Level

	Mincerian		With Controls		Heckman	
	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
Early Childhood	0.202	0.111	0.063	0.082	0.143	0.18
Primary	0.052	0.004***	0.019	0.004***	0.02	0.003***
Lower Secondary	0.047	0.002***	0.018	0.002***	0.017	0.002***
Upper Secondary	0.04	0.003***	0.02	0.003***	0.02	0.002***
Non-Tertiary	0.062	0.003***	0.028	0.002***	0.027	0.002***
Short Cycle	0.063	0.002***	0.029	0.002***	0.029	0.002***
Bachelor	0.08	0.002***	0.038	0.002***	0.038	0.001***
Master	0.104	0.002***	0.055	0.003***	0.061	0.002***
Doctoral	0.111	0.005***	0.07	0.005***	0.068	0.003***
Experience	0.02	0.001***	0.012	0.001***	0.013	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant	3.035	0.024***	4.48	0.083***	4.356	0.047***
lambda					0.028	0.008***
N		36462		36462		82508
Adj. R-sq	0.2973781			0.4903848		

* p<0.05, ** p<0.01, *** p<0.001
Note: t statistics in parentheses.
Source: ADB estimates.

Table A. 4: First Stage Probit Regression: Heckman model with labor force participation selection

	Coef.	Std. Err.
Studying	-2.027	0.022***
30-49	0.255	0.015***
50-64	-0.33	0.020***
65 up	-1.81	0.029***
Male	0.816	0.013***
Married	-0.104	0.020***
Widowed	-0.308	0.032***
Divorce/Separate	0.012	0.038
Wife/Spouse	-0.72	0.018***
Son/daughter	-0.373	0.022***
Brothers/sisters	-0.43	0.040***
Son/daughter in law	-0.411	0.031***
Grandchildren	-0.565	0.042***
Father/Mother	-0.704	0.065***
Other Relative	-0.42	0.033***
Boarder	-0.37	0.26
Domestic Helper	7.948	.
Non-Relative	0.056	0.074
Number of children	-0.028	0.004***
ECE	0.05	0.307
Primary	0.858	0.048***
Lower Secondary	0.874	0.048***
Upper Secondary	0.783	0.056***
Non-Tertiary	0.99	0.055***
Short Cycle	0.961	0.055***
Bachelor	1.231	0.048***
Master	1.94	0.090***
Doctoral	1.823	0.146***
Constant	-0.606	0.053***
Mills		
Lambda	0.028	0.008***
N	82508	

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

Table A. 5: Returns to Upper Secondary Education by Track

	Mincerian		With Controls		Heckman	
	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
Grade 11 - Academic Track	-0.136	0.058*	-0.098	0.055	-0.082	0.032*
Grade 12 - Academic Track	0.014	0.023	0.035	0.02	0.039	0.014**
Grade 11 - Arts and Design Track	-0.2	0.137	-0.09	0.134	-0.132	0.131
Grade 12 - Arts and Design Track	-0.058	0.094	-0.034	0.073	0.006	0.062
Graded 11 - Sports Track	-0.134	0.156	-0.102	0.075	-0.106	0.228
Grade 12 - Sports Track	-0.089	0.186	-0.041	0.095	-0.048	0.088
Grade 11 - Technology and Livelihood Track	-0.1	0.123	-0.082	0.094	-0.131	0.066*
Grade 12 - Technology and Livelihood Track	0.013	0.036	0.04	0.027	0.011	0.022
Experience	0.019	0.002***	0.013	0.002***	0.012	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant	3.542	0.022***	4.439	0.222***	4.304	0.092***
Lambda					0.031	0.011**
N	11555		11555		57611	
Adj. R-sq	0.0278222		0.3342931			

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

Table A. 6: Returns to Post-Secondary Non-Tertiary TVET

	Mincerian		With Controls		Heckman	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
TESDA NCs	0.842	0.122***	0.542	0.099***	0.57	0.080***
Other TVET	0.753	0.160***	0.543	0.132***	0.511	0.095***
Incomplete	0.397	0.105***	0.353	0.087***	0.311	0.051***
Experience	0.02	0.002***	0.013	0.002***	0.011	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant					-7.486	0.051***
Lambda					0.041	0.012***
N	12086		12086		58141	
Adj. R-sq	0.0310402		0.3443393			

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

Table A. 7: Returns to Post-Secondary Non-Tertiary TVET by Field

	Mincerian		With Controls		Heckman	
	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
Arts and Humanities	0.685	0.296*	0.709	0.334*	0.81	0.225***
Business, Administration and Law	0.959	0.216***	0.541	0.182**	0.463	0.134***
Engineering, Manufacturing and Construction	0.864	0.165***	0.533	0.118***	0.455	0.129***
Agriculture, Forestry, Fisheries and Veterinary	-2.036	0.886*	-1.433	0.722*	-0.9	0.541
Health and Welfare	1.142	0.213***	1.155	0.261***	0.872	0.264***
Services	1.047	0.375**	0.904	0.306**	0.905	0.380*
Experience	0.019	0.002***	0.013	0.002***	0.012	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant	3.541	0.023***	4.503	0.217***	4.346	0.090***
Lambda					0.044	0.012***
N	11299		11299		57355	
Adj. R-sq	0.0278941		0.3402357			

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

Table A. 8: Returns to Short-Cycle Tertiary TVET

	Mincerian		With Controls		Heckman	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Incomplete	0.098	0.062	0.064	0.05	0.077	0.033*
Complete	0.144	0.010***	0.099	0.010***	0.106	0.006***
Experience	0.02	0.002***	0.013	0.002***	0.011	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant					-7.47	0.041***
Lambda					0.038	0.012**
N	12394		12394		58449	
Adj. R-sq	0.0492257		0.3475828			

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

Table A. 9: Returns to Tertiary Education by Level

	Mincerian		With Controls		Heckman	
	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
Bachelor (Incomplete)	0.116	0.007***	0.064	0.007***	0.06	0.005***
Bachelor (Complete)	0.179	0.003***	0.104	0.004***	0.105	0.002***
Master (Incomplete)	0.2	0.020***	0.108	0.016***	0.151	0.011***
Master (Complete)	0.199	0.006***	0.124	0.006***	0.139	0.005***
Doctoral (Incomplete)	0.209	0.023***	0.15	0.019***	0.149	0.019***
Doctoral (Complete)	0.191	0.012***	0.14	0.012***	0.137	0.006***
Experience	0.025	0.002***	0.017	0.001***	0.016	0.001***
Experience Squared	0	0.000***	0	0.000***	0	0.000***
Constant	3.473	0.016***	4.733	0.101***	4.58	0.054***
Lambda					0.041	0.011***
N	22162		22162		68213	
Adj. R-sq	0.3154061		0.5153823			

* p<0.05, ** p<0.01, *** p<0.001

Source: ADB estimates.

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