# Rate of Return to Education[1]

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## I. Introduction

The purpose of this study is to update the rates of return to education in Thailand previously estimated by the World Bank (2000, Table 1). This paper mainly follows the World Bank's methodology with some minor changes in definitions and calculations for the accuracy of results. Some of the preceding rates are also revised in this paper, and new rates are estimated based on the latest Labour Force Survey (2000).

## II. Framework and Methodology

The rates of return to education can be estimated by using the *human capital function*. Though the function has been utilized by many economists and has slightly changed its structure from case to case, the very underlying concept has hardly been altered. The earnings in logarithmic form is used as the dependent variable, and a set of human capital variables, including compelling terms such as experience and education, are the independent variables in the model. The function used in this study is specified as follows:

$$\ln(EARN_i) = \beta_0 + \beta_{1j}Ed_{ij} + \beta_2 Ex_i + \beta_3 Ex_i^2 + \beta_{4j}A_{ij} + \beta_{5j}R_{ij} + \beta_{6j}M_{ij} + \beta_{7j}W_{ij} + \beta_{8j}O_{ij} + u_i \quad \text{(Eq. 1)}$$

where; $EARN_i$ = Monthly earnings (including bonus, OT and income from other sources) of person i in 1994 baht,
$Ed_{ij}$ = Dummy variable for educational level j of person i,
$Ex_i$ = Years of experience of person i = age – (years of education + 6),
$A_{ij}$ = Dummy variable for residential area j of person i,
$R_{ij}$ = Dummy variable for residential region j of person i,
$M_i$ = Dummy variable for marital status j of person i,
$W_{ij}$ = Dummy variable for employment sector j of person i (public or private), and
$O_{ij}$ = Dummy variable for occupation j of person i.

Coefficients in the equation above are estimated using the ordinary least square method, and the functions for men and women are estimated separately.

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Then, we can estimate the percentage difference in earnings of two people who hold different educational credentials. Let us assume that person A and person B graduate in educational level A and B, respectively. Therefore, percentage difference in earnings of person A and B would be:

$$\text{Percentage difference in earnings} = \frac{EARN_A}{EARN_B} - 1 \quad \text{, or}$$

$$= \frac{e^{(\beta_0 + \beta_{1A}Ed_A + \ldots\ldots\ldots)}}{e^{(\beta_0 + \beta_{1B}Ed_B + \ldots\ldots\ldots)}} - 1 \qquad \text{(Eq. 2)}$$

By holding other characteristics of the two people equal except the level of education, we receive:

$$\text{Percentage difference in earnings} = e^{(\beta_{1A} - \beta_{1B})} - 1 \qquad \text{(Eq. 3)}$$

To simplify the equation, the analysis would mention the educational level B as the level whose dummy variable is excluded in the regression model, the upper primary. Thus, the term $\beta_{1B}$ in the equation above would disappear and we have:

$$\text{Percentage difference in earnings} = e^{(\beta_{1A})} - 1 \qquad \text{(Eq. 4)}$$

A figure from Eq. 4 would mean an increase in earnings as a result of prolonging education from the upper primary level up to level A.

This percentage difference in earnings was referred as the "private rate of return" in the study made by the World Bank. Though it is not completely incorrect to interpret such way, it would be appropriate to add another step in the calculation because the result from Eq. 4 is not yet considered the unequal years of education invested by graduates from different levels. Taking the years of education into account, we would receive the private rate of return as the following equation.

$$\text{Private Rate of Return} = \frac{e^{(\beta_{1A})} - 1}{S_A} \qquad \text{(Eq. 5)}$$

The term $S_A$ refers to the years of education after completed the upper primary level until graduated in level A. The private rate of return in Eq. 5 could be described in other words as the average percentage increase in earnings per year of education after the upper primary level up to level A. Our analysis would emphasize heavily on our private rate of return from Eq. 5. In addition, some discussions on the percentage difference in earnings from Eq. 4 (the private rate of return mentioned by the World Bank) would also be presented in order to compare with the study made by the World Bank.

In using this interpretation, one must accept the basic assumption of the human capital function that the foregone earnings are the only costs occurred during the years of education. How the foregone earnings are included internally in the model would need a lengthy theoretical explanation and, therefore, shall not be discussed here. By this assumption, it means that the out-of-pocket cost, the direct cost of education such as tuition and expenses on books, is equal to zero. As a result of dropping the out-of-pocket expenses, the rate of return estimated here tends to be exaggerated. Although it is

possible to introduce the out-of-pocket spending into the model, it is not intended to do so because of the time-constraint of the study and the lack of reliable data. The reason why this rate of return is called the "private rate of return" is because it counts the foregone earnings, borne by individual, as the only cost.

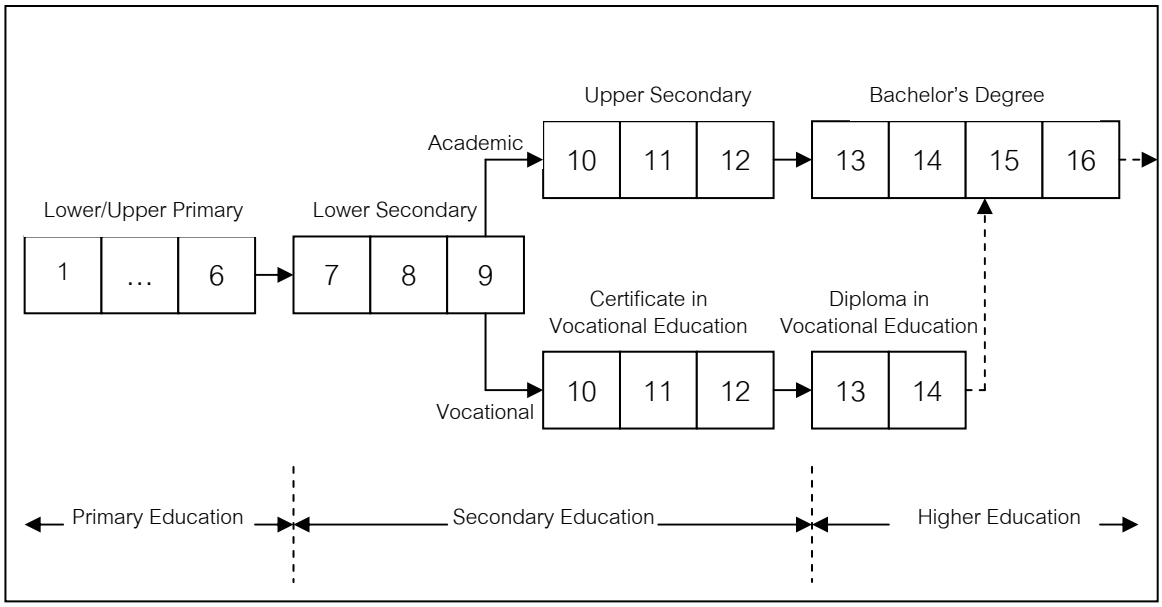
Some costs of education, however, are not paid by individuals but by the government through subsidies, scholarships, teacher's salary, etc. Thus, the costs of educating a person accrued to the society must include the government spending on education as well. The benefit occurred to the whole society is still the rise in earnings of that person[2] that would ultimately lead to an increase in the national income. By using this social cost and social benefit, we receive the "social rate of return", which can be calculated as follows:[3]

$$\text{Social Rate of Return} = \frac{\text{Private Rate of Return}}{\left(1 + \frac{\text{Government Spending on Education per Student}}{\text{Foregone Earnings of Each Student}}\right)} \quad \text{(Eq. 6)}$$

# III. Education in Thailand

In order to understand the return to education in Thailand, it is important to know about the education system in Thailand as well. This part of the study will explain the system briefly. It would count only the formal education, but social programs such as short-course vocational training will be taken aside.

**Figure 1 Structure of Education System in Thailand**




[2] The idea of externalities from schooling as a kind of benefit, raised by many arguments, is taken aside in this analysis.

[3] Theoretically, the term "foregone earnings" in the equation 6 should be referred as the "potential earnings" of a student, but since it is equal to the foregone earnings, it may be simpler to refer as above.

Figure 1 shows the structure of the Thai education system, which can be divided into 3 levels: primary education, secondary education and higher education. The primary education requires 6 years of study, which is compulsory for children between 6 to 11 years old. Students are free to leave the system at any time after completing the compulsory level. The secondary education also requires 6 years of study, and it can be divided into 2 parts—lower secondary education and upper secondary education—each of which requires 3 years of education. At the end of the lower secondary education, students can choose to enroll in either academic or vocational area. If they select to stay in the academic area, they will go through 3 years of the upper secondary education and 4 years of the Bachelor's degree level (and maybe some more years in the Graduate level). On the other hand, if they decide to study in the vocational area, they will go through 3 years of the certificate in vocational education level (which shall be called "certificate" from now on) and 2 years of the diploma in vocational education level (in short, "diploma")[4]. This pattern of education is not universally true since students may not follow the course as presented in the figure. For instance, students may switch their areas between academic and vocational before entering the higher education level. Or, after obtaining the diploma in vocational education, they may pursue in academic area for another 2 years to gain a Bachelor's degree.

# IV. Data

Ideally, this study should use a time-series data on earnings of particular individuals over their lifetimes, but unfortunately such data are not known anywhere. Thus, we utilize a cross-sectional survey as an alternative to such non-existing data in our study. Using cross-sectional data, however, is similar to assume that the future real earnings of currently young people will resemble to those of currently aged people.

The data used in this study are mainly from the Labour Force Survey (LFS) conducted by the National Statistical Office (NSO). The focus periods are 1985, 1990, 1995 and 2000. In addition, the survey during the 3rd quarter[5] in each year is used in order to avoid any effect of labour mobility on earnings. Apart from the theoretical grounds, the LFS during the 3rd quarter contains the largest sample size to any survey in the same year. Following the World Bank sampling strategy, the sample is limited to those who are employed full-time[6] between the age of 24 to 35, have certain period of payment received, and unambiguously reveal their levels of education.

The focus on full-time workers is because part-time workers in Thailand, especially while in school, may view the job as a channel to increase their capacities rather than a way to ripe a reward from using them and, as a result, willing to receive low payments. This could lead to a distortion in earnings profile; thus, the part-time workers should not be taken into account. The certain period of payment received, another sampling limitation, does not only exclude employers, the self-employed and the unpaid

[4] Sometimes, the certificate in vocational education is called "Por-vor-chore" and the diploma in vocational education is called "Por-vor-sor", which are originated from the Thai abbreviation of those levels.

[5] Before 1998, the NSO conducted the LFS 3 times a year, but since 1998 the NSO has collected the data quarterly.

[6] Individuals who work 30 or more hours a week combining every jobs are considered full-time workers.

family workers but also rules out those private, government and state enterprise employees who do not properly specify the period of payment received.

# V. Estimation

Table 2 and 3 presents the means and standard deviations of all variables used in this study for young men and women. A general increase in the level of real earnings and the level of education can be observed over the period of study. In particular, the average year of education rises from 7.9 years in 1985 to 9.2 years in 2000 for male and 8.7 years to 9.9 years for female. It is important to remind that the sample is limited to young labour (age 24-35) working for wages. Therefore, the average year of education for the whole population, including farmers and non-wage workers with the age over 35 years old, could be well below those figures. Other aspect that can be deduced from this information is that the average year of experience falls over the time due to the fact that students stay longer in schools.

Table 4 shows estimated regression coefficients in the model. Most of them are statistically significant at 5% level, and the adjusted $R^2$ ranges from 53% to 65%.

The percentage differences in monthly earnings between those who complete particular educational levels and those who finish upper primary level are shown in Table 5. The estimated rates are mostly consistent with those provided by the World Bank (Table 1). The only incongruous results are at the highest educational level in each study—"Post-Secondary Academic" by the World Bank and "University" by TDRI—that arises from the difference in definitions. The "Post-Secondary Academic" refers to the university dropouts, but "University" counts only the university graduates.[7] Hence, as one may expect, the rates of return of the "Post-Secondary Academic" are lower than the rates of the "University".

As mentioned earlier, the percentage difference in earnings does not take the years of education into account, so the numbers presented in Table 5 can be compared only within a level of education through time but not between levels. For a discernable example, it could be said that in 2000 an average female who holds a certificate in vocational education receives 69.43% higher earnings than an average upper primary female graduate does. It could also be stated that in the same year an average female who hold a diploma has 89.17% higher earnings than an average upper primary female graduate does. However, it can never be concluded that the diploma level is more profitable than the certificate level because of the different years required for each level. The diploma level usually needs 2 additional years of education from the certificate level, and at this point we can only conclude that the extra 2 years would add to a total of 20% increase in monthly earnings or approximately 10% increase per extra year. If the diploma level is to be lucrative, each year of education between the upper primary and the certificate level should increase earnings less than 10%, otherwise adding the 2 additional years would give a diminishing rate of return and basically not worth investing.

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[7] Also, The World Bank's "Post-Secondary Vocational" includes those who take a few years in the level of diploma in vocational education but do not finish that level, while TDRI counts only those who graduate. However, the effect of different definitions is not distinct in this case.

By dividing the percentage difference in earnings by the years of schooling required for each level after completing the upper primary education, we receive proper rates of return to education as shown in Table 6. Unlike the rates in Table 5, the results in Table 6 are now comparable between levels of education. Let us reconsider the case previously discussed, the female graduates between the certificate and diploma levels in 2000. The private rate of return to the certificate level for female in 2000 is equal to 11.57%, which means that each additional year of education during the 6 years after the upper primary level to the certificate level results in 11.57% increase in monthly earnings. For the same sample, the private rate of return to the diploma level is equal to 11.15%. So, the additional 2 years of education in diploma level (10% as mentioned earlier) not only yield less benefit than the prior 6 years (11.57%) but reduce the average rate of the prior 6 years (11.57% to 11.15%) as well. Thus, prolonging education from the certificate level to the diploma level in vocational education may not cause a favorable result in earnings. Further discussion on these rates will be presented in the next topic.

In estimating the social rate of return, two important sets of data are needed: the government spending on each student and the foregone earnings. The real government spending on each student in each year is computed and presented in Table 7. These numbers are based on the assumption that the government spends equally to all students, no matter what gender or level of education they are. This assumption may lead to an inaccurate result of social rate of return, but with the time constraint of this study and the lack of reliable data these assumption should be acceptable. The result shows that the government spending on a student, adjusted by the consumer price index (CPI), has continually increased since 1985, especially between 1990 and 1995 when the numbers were almost doubled. In 2000, it is estimated that the government spends approximately 10,888 baht (1994 baht) per student.

Foregone earnings of a person during his years in school are equal to the sum of annual earnings of an upper primary graduate over the same period. The annual earnings of the upper primary graduate, shown in Table 8, can be calculated by using the regression result in Table 4 and plug in mean values of the related variables from Table 2 and 3. It is obvious that the foregone earnings of a graduate in a higher level are greater than a lower level. Also, the foregone earnings of an upper secondary graduate and a person holding certificate in vocational education are equal because the two levels evenly need 6 years of education after the upper primary level.

After that, we divide the expenditure per student from Table 7 by the foregone earnings in Table 8, and we receive the ratio of government spending to foregone earnings as shown in Table 9. It is noted that numbers in Table 7 is per annum, while numbers in Table 8 is per all years of education (excluding the primary level), so multiplying numbers in Table 7 by years of education is needed before finding the ratio. Following the Eq. 6, the results in Table 9 are used to adjust the percentage difference in earnings and the private rate of return to the social ones as presented in Table 10 and 11, respectively

Similarly to Table 5 and 6, results in Table 10 are not yet concerned the unequal years of education and should not be compared between levels of education, while results in Table 11 have already been adjusted by the years of education. In comparison to the

social rates of return estimated by the World Bank (Table 1), our rates in Table10 seems to be higher, but without better information how those rates were calculated by the World Bank we can not explain the differences in findings.

# VI. Rate of Return to Education

In general, those who graduate at higher levels apparently receive greater returns from their investments in education. It is needed to say "in general" because the return to schooling differs greatly between genders. Also, the return to education seems to be changing over the time depending heavily on the demand in the labour market.

The private rates of return for male finishing upper secondary, certificate, diploma and university levels in 2000 are 8.46%, 9.56%, 13.74% and 17.46%, respectively. In other words, each year of schooling after the upper primary level of a person who completes upper secondary, certificate, diploma university level would yield 8.46%, 9.56%, 13.74% and 17.46% increase in his earnings. This means that every additional year of education for male would lead to an increase in earnings.

When looking at changes of the return to education over the time, it is noted that rates of return of most levels for male are on the wane, except the university level. The rate of return of the university level increased enormously from 15.12% in 1985 to 20.45% in 1995, but it drops to 17.46% in 2000, which is still a considerably high rate. The reduction of the rate in 2000 is mainly the consequence of the economic crisis in Thailand. The rate of return of the certificate level, on the other hand, has reduced largely from 14.35% in 1985 to 9.56% in 2000. Also, the rates of return of the upper secondary and diploma levels have decreased over the same period, but the magnitude of reduction is rather small in comparison to the certificate level.

For female, the rate of return of upper secondary, certificate, diploma and university levels in 2000 are 7.35%, 11.57%, 11.15% and 13.66%, respectively. One major concern is on the return to education of the diploma level. The result shows that taking 2 additional years in diploma level after finishing in certificate level is not a fruitful decision to them. Although they would certainly receive higher amount of monthly earnings (as result from Table 5 shows that female graduate in certificate level receives 69.43% higher earnings than female upper primary graduate, while female graduate in diploma receives 89.17% higher), the return per year of education for them would diminish from 11.57% to 11.15%.

The unproductiveness in diploma in vocational education has been found since 1995. This is not only the effect of reducing rate of return to education of the diploma level but the effect of increasing return of the certificate level as well. The rate of return of the diploma level has reduced from 13.23% in 1985 to 11.15% in 2000, while the rate of return of the certificate level has increased from 10.24% in 1985 to 11.57% in 2000. For female, the level that has the most prominently increasing rate of return is the upper primary level. It has risen from a miserable rate of 4.10% in 1985 to 7.35% in 2000. Lastly, the university level has rather constant rate of return through time for female.

Turning to the social rate, it is commonly viewed as a net benefit of the government spending on education. Though we do not wholeheartedly concur with such

explanation because the costs of education are not merely the government spending but also include private costs, the analysis shall follow this mainstream explanation for the sake of simplicity.

In this study, the social rate of return is different from the private rate of return only in term of magnitude, but the trends over the studied period are the same. This happens because of the assumption that government spends equally to all levels of education. Realistically, the government may subsidize largely in some levels of education and rather small in others, and those subsidies may have altered over the time. If so, the social rate of return of each level would not differ in parallel from the private rate as in this study. An intensive study should, therefore, capture data of expenditure on each level of education separately. However, due to the difficulty in collecting data from 2 agencies[8], we decide to use data from the Office of Prime Minister, which have no details of educational levels. This would lead us no choice but to assume as mentioned. The social rate of return to education in upper secondary, certificate, diploma and university levels in 2000 are 6.33%, 7.16%, 10.42% and 13.40% for male and 5.60%, 8.80%, 8.57% and 10.58% for female, respectively. Further discussion on the change of social rate of return over the time shall not be made, or it would be a reiteration of the case of the private rate of return.

# VII. Conclusion and Suggestion

The rate of return to schooling is a powerful tool to any decision-maker relating to education today since it gives a rough idea of how much the net benefit one would get in return after invested in education. In general, the rate of return differs greatly between levels of education and genders. The higher level of education seems to have greater returns, and male usually receives higher returns than female. The most striking finding, which may lead to a controversy, is that the education in diploma level is not a beneficial decision for female since it reduces the rate of return she would have earned from graduating just the certificate level. This can be substantiated by the fact that employers especially in manufactures prefer male to female for a technician, a position commonly required a diploma graduate. After all, the rate of return appears to depend on the economic situation since it fluctuates with the economic growth.

As stated in the introduction, the purpose of this study is to update the rate of return to education in Thailand initially calculated by the World Bank. We do not intend to build a new technique nor correct the previous mistakes in this paper. Only modification done here is to adjust the rate of return by years of education of each level as presented in Table 6 and 11. So, virtually all problems of the estimation by the World Bank, if there are, are also presented in these latest results. Also, the ignorance of the out-of-pocket expenses mainly due to the time constraint of the study would certainly lead to an exaggeration of those presented rates. It would surely need an in-depth and lengthy study to cope with those problems, but the rates of return calculated in this paper should, to some extent, be a valuable information to many people.

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[8] In Thailand, there are two separated ministries, the Ministry of Education (MOE) and the Ministry of University Affairs (MUA), responsible for the management of education. The MUA are solely responsible for the university level, while the MOE supervises the rests.

**Table 1 Rates of return to education estimated by the World Bank**

Unit : percent

| | 1985 | | 1995 | | 1998 | |
|---|---|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **Private Rate of Return** | | | | | | |
| Upper Secondary | 56.80 | 27.90 | 46.50 | 43.00 | 48.40 | 45.90 |
| Certificate in Vocational Education | 84.30 | 64.30 | 78.60 | 83.80 | 58.50 | 62.70 |
| Post-secondary vocational | 111.30 | 103.20 | 107.60 | 90.10 | 98.50 | 98.10 |
| Post-secondary academic | 87.60 | 93.10 | 91.20 | 71.80 | 89.60 | 96.30 |
| **Social Rate of Return** | | | | | | |
| Upper Secondary | 20.20 | 14.00 | 22.90 | 22.90 | 25.40 | 26.50 |
| Certificate in Vocational Education | 20.20 | 16.20 | 25.90 | 23.20 | 25.90 | 23.20 |
| Post-secondary vocational | 15.80 | 14.80 | 22.90 | 18.60 | 25.30 | 22.00 |
| Post-secondary academic | 27.20 | 18.30 | 25.10 | 17.70 | 21.50 | 20.70 |

Source: World Bank

**Table 2 Sample descriptive for young Male (age 24-35) in 1985, 1990, 1995 and 2000**

| Male | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| **1. Outcome Measures** | | | | | | | | |
| Monthly earnings | 4,210.2 | 3,252.5 | 4,650.9 | 5,230.8 | 5,769.4 | 5,611.7 | 6,306.7 | 5,542.9 |
| Log of monthly earnings | 8.1436 | 0.6268 | 8.2177 | 0.6229 | 8.4411 | 0.6063 | 8.5528 | 0.5758 |
| **2. Education Predictors** | | | | | | | | |
| Years of education | 7.8722 | 4.6725 | 8.3096 | 4.5799 | 8.2447 | 4.1167 | 9.1631 | 4.0783 |
| Years of education-squared | 83.804 | 87.850 | 90.025 | 87.103 | 84.922 | 78.715 | 100.59 | 81.265 |
| No school | 0.0174 | 0.1308 | 0.0107 | 0.1030 | 0.0106 | 0.1023 | 0.0106 | 0.1025 |
| Some lower primary | 0.0097 | 0.0981 | 0.0082 | 0.0900 | 0.0075 | 0.0864 | 0.0093 | 0.0960 |
| Lower primary | 0.0052 | 0.0719 | 0.0088 | 0.0934 | 0.0062 | 0.0784 | 0.0030 | 0.0549 |
| Some upper primary | 0.4506 | 0.4976 | 0.3493 | 0.4768 | 0.2266 | 0.4186 | 0.0952 | 0.2935 |
| Upper primary (Excluded in model) | 0.0690 | 0.2535 | 0.1467 | 0.3538 | 0.2920 | 0.4547 | 0.3336 | 0.4715 |
| Some lower secondary | 0.0092 | 0.0952 | 0.0057 | 0.0750 | 0.0062 | 0.0785 | 0.0036 | 0.0598 |
| Lower secondary | 0.1259 | 0.3318 | 0.1258 | 0.3316 | 0.1463 | 0.3535 | 0.1625 | 0.3689 |
| Some upper secondary | 0.0042 | 0.0643 | 0.0022 | 0.0470 | 0.0017 | 0.0417 | 0.0007 | 0.0264 |
| Some vocational education | 0.0070 | 0.0834 | 0.0026 | 0.0507 | 0.0005 | 0.0225 | 0.0004 | 0.0201 |
| Upper secondary | 0.0376 | 0.1901 | 0.0584 | 0.2346 | 0.0685 | 0.2525 | 0.1183 | 0.3229 |
| Vocational education | 0.0868 | 0.2815 | 0.0856 | 0.2798 | 0.0736 | 0.2611 | 0.0576 | 0.2330 |
| Some level of diploma in voc. | 0.0004 | 0.0208 | 0.0003 | 0.0160 | 0.0007 | 0.0273 | 0.0014 | 0.0371 |
| Diploma in vocational education | 0.0726 | 0.2594 | 0.0669 | 0.2499 | 0.0514 | 0.2209 | 0.0757 | 0.2646 |
| Some level in university | 0.0060 | 0.0772 | 0.0028 | 0.0525 | 0.0079 | 0.0886 | 0.0092 | 0.0954 |
| University graduate | 0.0913 | 0.2880 | 0.1216 | 0.3268 | 0.0984 | 0.2978 | 0.1111 | 0.3143 |
| Graduate school | 0.0071 | 0.0842 | 0.0044 | 0.0662 | 0.0019 | 0.0434 | 0.0077 | 0.0876 |

**Table 2 Sample descriptive for young male (age 24-35) in 1985, 1990, 1995 and 2000 (Cont'd)**

| Male | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| **3. Control Variables** | | | | | | | | |
| Years of experience | 15.411 | 5.8831 | 14.766 | 5.7700 | 14.829 | 5.3211 | 14.031 | 5.4984 |
| Years of experience-squared | 272.11 | 177.20 | 251.33 | 173.26 | 248.23 | 162.83 | 227.10 | 159.31 |
| Rural | 0.4357 | 0.4958 | 0.4704 | 0.4991 | 0.5226 | 0.4995 | 0.5172 | 0.4997 |
| Sanitary | 0.1248 | 0.3305 | 0.1300 | 0.3363 | 0.1342 | 0.3409 | 0.1256 | 0.3314 |
| Urban (Excluded) | 0.4395 | 0.4963 | 0.3996 | 0.4898 | 0.3432 | 0.4748 | 0.3572 | 0.4792 |
| Northern | 0.2082 | 0.4060 | 0.1805 | 0.3846 | 0.1739 | 0.3790 | 0.1786 | 0.3830 |
| Northeastern | 0.1538 | 0.3608 | 0.1564 | 0.3633 | 0.1956 | 0.3967 | 0.1846 | 0.3880 |
| Southern | 0.1022 | 0.3029 | 0.1101 | 0.3130 | 0.1200 | 0.3249 | 0.1016 | 0.3021 |
| Central | 0.2329 | 0.4227 | 0.2810 | 0.4495 | 0.2895 | 0.4535 | 0.3101 | 0.4625 |
| Bangkok (Excluded) | 0.3028 | 0.4595 | 0.2720 | 0.4450 | 0.2210 | 0.4149 | 0.2252 | 0.4177 |
| Married | 0.7099 | 0.4538 | 0.6782 | 0.4672 | 0.6832 | 0.4652 | 0.6322 | 0.4822 |
| Single, Divorced, Widow (Excluded) | 0.2901 | 0.4538 | 0.3218 | 0.4672 | 0.3168 | 0.4652 | 0.3678 | 0.4822 |
| Public employee | 0.3493 | 0.4768 | 0.2617 | 0.4396 | 0.1989 | 0.3992 | 0.1904 | 0.3926 |
| Private employee (Excluded) | 0.6507 | 0.4768 | 0.7383 | 0.4396 | 0.8011 | 0.3992 | 0.8096 | 0.3926 |
| Professional | 0.1334 | 0.3400 | 0.1243 | 0.3299 | 0.1127 | 0.3162 | 0.1178 | 0.3224 |
| Executive | 0.0307 | 0.1725 | 0.0234 | 0.1513 | 0.0106 | 0.1024 | 0.0197 | 0.1391 |
| Clerk | 0.0873 | 0.2823 | 0.1035 | 0.3045 | 0.0887 | 0.2844 | 0.0720 | 0.2585 |
| Commercial worker (Excluded) | 0.0322 | 0.1764 | 0.0402 | 0.1963 | 0.0471 | 0.2119 | 0.0443 | 0.2057 |
| Agricultural worker | 0.1465 | 0.3536 | 0.1182 | 0.3228 | 0.1176 | 0.3222 | 0.1415 | 0.3486 |
| Mining worker | 0.0015 | 0.0392 | 0.0005 | 0.0226 | 0.0031 | 0.0555 | 0.0012 | 0.0340 |
| Transportation worker | 0.0978 | 0.2971 | 0.1199 | 0.3248 | 0.1100 | 0.3129 | 0.0918 | 0.2888 |
| Craftsman | 0.3456 | 0.4756 | 0.3770 | 0.4846 | 0.4178 | 0.4932 | 0.4063 | 0.4911 |
| Service worker | 0.1249 | 0.3307 | 0.0931 | 0.2906 | 0.0923 | 0.2894 | 0.1053 | 0.3069 |

Source: Labour Force Survey, National Statistical Office

**Table 3 Sample descriptive for young female (age 24-35) in 1985, 1990, 1995 and 2000**

| Female | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| **1. Outcome Measures** | | | | | | | | |
| Monthly earnings | 3,634.4 | 2,681.3 | 3,956.0 | 5,068.4 | 5,167.8 | 3,951.2 | 6,273.6 | 5,226.4 |
| Log of monthly earnings | 7.9688 | 0.6879 | 8.0229 | 0.6868 | 8.3287 | 0.6597 | 8.5454 | 0.5957 |
| **2. Education Predictors** | | | | | | | | |
| Years of education | 8.7107 | 5.3645 | 9.0082 | 5.2315 | 9.0647 | 4.8543 | 9.8987 | 4.6701 |
| Years of education-squared | 104.65 | 101.74 | 108.51 | 99.514 | 105.73 | 94.686 | 119.79 | 95.943 |
| No school | 0.0389 | 0.1933 | 0.0342 | 0.1817 | 0.0227 | 0.1488 | 0.0161 | 0.1259 |
| Some lower primary | 0.0142 | 0.1182 | 0.0111 | 0.1048 | 0.0069 | 0.0827 | 0.0060 | 0.0772 |
| Lower primary | 0.0080 | 0.0893 | 0.0050 | 0.0706 | 0.0044 | 0.0665 | 0.0054 | 0.0734 |
| Some upper primary | 0.3923 | 0.4883 | 0.3333 | 0.4714 | 0.2425 | 0.4286 | 0.1026 | 0.3035 |
| Upper primary (Excluded in model) | 0.0571 | 0.2321 | 0.1083 | 0.3107 | 0.2175 | 0.4125 | 0.2948 | 0.4559 |
| Some lower secondary | 0.0031 | 0.0560 | 0.0017 | 0.0416 | 0.0041 | 0.0643 | 0.0026 | 0.0510 |
| Lower secondary | 0.0557 | 0.2294 | 0.0614 | 0.2400 | 0.0896 | 0.2856 | 0.1256 | 0.3314 |
| Some upper secondary | 0.0022 | 0.0466 | 0.0007 | 0.0265 | 0.0008 | 0.0287 | 0.0003 | 0.0165 |
| Some vocational education | 0.0113 | 0.1058 | 0.0053 | 0.0725 | 0.0037 | 0.0606 | 0.0002 | 0.0126 |
| Upper secondary | 0.0260 | 0.1592 | 0.0379 | 0.1910 | 0.0538 | 0.2255 | 0.0763 | 0.2655 |
| Vocational education | 0.1208 | 0.3259 | 0.0942 | 0.2921 | 0.0684 | 0.2524 | 0.0474 | 0.2125 |
| Some level of diploma in voc. | 0.0007 | 0.0268 | 0.0026 | 0.0508 | 0.0002 | 0.0130 | 0.0003 | 0.0182 |
| Diploma in vocational education | 0.1074 | 0.3097 | 0.1052 | 0.3069 | 0.0858 | 0.2801 | 0.0666 | 0.2493 |
| Some level in university | 0.0044 | 0.0664 | 0.0030 | 0.0543 | 0.0067 | 0.0813 | 0.0083 | 0.0906 |
| University graduate | 0.1481 | 0.3552 | 0.1915 | 0.3935 | 0.1890 | 0.3915 | 0.2344 | 0.4236 |
| Graduate school | 0.0096 | 0.0974 | 0.0047 | 0.0681 | 0.0039 | 0.0624 | 0.0131 | 0.1139 |

**Table 3 Sample descriptive for young female (age 24-35) in 1985, 1990, 1995 and 2000 (Cont'd)**

| Female | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| **3. Control Variables** | | | | | | | | |
| Years of experience | 14.082 | 6.5300 | 13.922 | 6.3054 | 13.944 | 6.1686 | 13.226 | 6.1445 |
| Years of experience-squared | 240.95 | 188.94 | 233.59 | 185.00 | 232.49 | 181.82 | 212.68 | 173.30 |
| Rural | 0.3740 | 0.4839 | 0.4481 | 0.4973 | 0.4778 | 0.4995 | 0.4548 | 0.4980 |
| Sanitary | 0.1348 | 0.3415 | 0.1172 | 0.3217 | 0.1387 | 0.3456 | 0.1254 | 0.3312 |
| Urban (Excluded) | 0.4912 | 0.4999 | 0.4347 | 0.4957 | 0.3836 | 0.4863 | 0.4198 | 0.4935 |
| Northern | 0.1608 | 0.3673 | 0.1733 | 0.3785 | 0.1706 | 0.3761 | 0.1486 | 0.3557 |
| Northeastern | 0.1624 | 0.3688 | 0.1220 | 0.3273 | 0.1768 | 0.3815 | 0.1545 | 0.3614 |
| Southern | 0.0692 | 0.2538 | 0.0837 | 0.2770 | 0.0899 | 0.2860 | 0.0877 | 0.2828 |
| Central | 0.2479 | 0.4318 | 0.3133 | 0.4638 | 0.3191 | 0.4661 | 0.3236 | 0.4678 |
| Bangkok (Excluded) | 0.3598 | 0.4799 | 0.3076 | 0.4615 | 0.2436 | 0.4293 | 0.2856 | 0.4517 |
| Married | 0.5898 | 0.4919 | 0.5744 | 0.4944 | 0.6286 | 0.4832 | 0.5992 | 0.4901 |
| Single, Divorced, Widow (Excluded) | 0.4102 | 0.4919 | 0.4256 | 0.4944 | 0.3714 | 0.4832 | 0.4008 | 0.4901 |
| Public employee | 0.3329 | 0.4712 | 0.2678 | 0.4428 | 0.2067 | 0.4050 | 0.1888 | 0.3914 |
| Private employee (Excluded) | 0.6671 | 0.4712 | 0.7322 | 0.4428 | 0.7933 | 0.4050 | 0.8112 | 0.3914 |
| Professional | 0.2560 | 0.4364 | 0.2299 | 0.4208 | 0.2230 | 0.4163 | 0.2362 | 0.4247 |
| Executive | 0.0236 | 0.1517 | 0.0119 | 0.1085 | 0.0041 | 0.0638 | 0.0199 | 0.1398 |
| Clerk | 0.1661 | 0.3722 | 0.1861 | 0.3892 | 0.1860 | 0.3891 | 0.1496 | 0.3566 |
| Commercial worker (Excluded) | 0.0296 | 0.1696 | 0.0359 | 0.1860 | 0.0396 | 0.1950 | 0.0594 | 0.2364 |
| Agricultural worker | 0.2035 | 0.4026 | 0.1561 | 0.3630 | 0.1325 | 0.3391 | 0.1103 | 0.3133 |
| Mining worker | 0.0004 | 0.0207 | 0.0003 | 0.0170 | 0.0000 | 0.0055 | 0.0000 | 0.0000 |
| Transportation worker | 0.0077 | 0.0872 | 0.0068 | 0.0821 | 0.0107 | 0.1030 | 0.0084 | 0.0914 |
| Craftsman | 0.1943 | 0.3956 | 0.2612 | 0.4393 | 0.3082 | 0.4617 | 0.3010 | 0.4587 |
| Service worker | 0.1188 | 0.3235 | 0.1118 | 0.3151 | 0.0958 | 0.2943 | 0.1151 | 0.3192 |

Source: Labour Force Survey, National Statistical Office

**Table 4 Regression results of log of monthly earnings on explanatory variables in 1985, 1990, 1995 and 2000 for male and female**

| | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|
| | **1985** | **1990** | **1995** | **2000** | **1985** | **1990** | **1995** | **2000** |
| Constant | 7.4289 | 7.5015 | 8.0689 | 7.8461 | 7.3132 | 7.3958 | 7.9253 | 7.9055 |
| **Experience** | | | | | | | | |
| Experience | 0.0608 | 0.0708 | 0.0232 | 0.0656 | 0.0550 | 0.0442 | 0.0348 | 0.0555 |
| Experience-squared | -0.0010 | -0.0014 | -0.0004 | -0.0015 | -0.0013 | -0.0008 | -0.0008 | -0.0015 |
| **Area of Residence** | | | | | | | | |
| Rural | -0.0348 | -0.0159 | -0.0525 | -0.0919 | -0.0203 | -0.0460 | -0.0963 | -0.0735 |
| Sanitary | 0.0370 | 0.0205 | 0.0295 | -0.0119 | 0.0333 | 0.0116 | -0.0091 | -0.0516 |
| **Region of Residence** | | | | | | | | |
| Northern | -0.2737 | -0.3204 | -0.4321 | -0.3264 | -0.2401 | -0.3636 | -0.4196 | -0.3141 |
| Northeastern | -0.3006 | -0.3827 | -0.3830 | -0.3769 | -0.3102 | -0.3922 | -0.3698 | -0.3401 |
| Southern | -0.1542 | -0.2216 | -0.2892 | -0.1904 | -0.2126 | -0.2405 | -0.2863 | -0.2270 |
| Central | -0.1449 | -0.1205 | -0.2072 | -0.1190 | -0.1251 | -0.1347 | -0.1114 | -0.0678 |
| **Marital Status** | | | | | | | | |
| Married | 0.1394 | 0.0499 | 0.0786 | 0.0580 | 0.1051 | 0.0552 | 0.0080 | 0.0084 |
| **Private/Public Employment** | | | | | | | | |
| Public employee | 0.0095 | 0.0158 | 0.0199 | -0.1333 | 0.0634 | 0.1813 | -0.0264 | -0.1696 |
| **Occupation** | | | | | | | | |
| Professional | 0.0713 | 0.0625 | 0.1055 | 0.2807 | 0.2363 | 0.3022 | 0.2555 | 0.3222 |
| Executive | 0.1730 | 0.0166 | 0.4698 | 0.2219 | 0.2619 | 0.4955 | 0.5599 | 0.4178 |
| Clerk | 0.0976 | 0.0069 | 0.2314 | 0.1998 | 0.2062 | 0.2100 | 0.1485 | 0.1427 |
| Agricultural worker | -0.5794 | -0.5251 | -0.1643 | -0.2152 | -0.3269 | -0.2626 | -0.2518 | -0.1595 |
| Mining worker | -0.1832 | 0.2065 | 0.6465 | 0.0335 | 0.0223* | -0.0840 | -0.2405 | |
| Transportation worker | 0.1342 | 0.0628 | 0.1948 | 0.0997 | 0.2876 | 0.2405 | 0.2408 | 0.0319 |
| Craftsman | -0.0079 | -0.0549 | 0.1115 | 0.0492 | 0.1483 | 0.0934 | 0.0213 | 0.0455 |
| Service worker | -0.0702 | 0.0015* | 0.1214 | 0.1471 | -0.2108 | -0.1448 | -0.1173 | -0.0588 |
| **Education** | | | | | | | | |
| No school | -0.4644 | -0.4005 | -0.3595 | -0.1701 | -0.3972 | -0.3054 | -0.1484 | -0.1240 |
| Some lower primary | -0.4435 | -0.2141 | -0.2461 | -0.2059 | -0.4140 | -0.2004 | -0.1514 | -0.1533 |
| Lower primary | -0.3123 | -0.2127 | -0.0877 | -0.0429 | -0.1956 | -0.0969 | -0.2032 | -0.1159 |
| Some upper primary | -0.1710 | -0.1372 | -0.0440 | -0.0520 | -0.1897 | -0.1422 | -0.0593 | -0.0687 |
| Some lower secondary | 0.0921 | -0.0498 | 0.0683 | 0.1162 | 0.2485 | 0.1792 | -0.1794 | 0.0570 |
| Lower secondary | 0.2301 | 0.2022 | 0.2183 | 0.1761 | 0.2420 | 0.2479 | 0.2204 | 0.2009 |
| Some upper secondary | 0.2357 | 0.3494 | -0.0259 | 0.1000 | 0.7903 | 0.4281 | 0.2049 | 0.0386 |
| Some vocational education | 0.5811 | 0.3127 | 0.0895 | 0.0468 | 0.4843 | 0.4761 | 0.1772 | 0.0051 |
| Upper secondary | 0.4686 | 0.3330 | 0.3701 | 0.4106 | 0.2219 | 0.2778 | 0.3540 | 0.3655 |
| Vocational education | 0.6210 | 0.5471 | 0.5934 | 0.4535 | 0.4791 | 0.4646 | 0.6030 | 0.5273 |
| Some level of diploma in voc. | 0.7877 | 0.9383 | 0.5959 | 0.5038 | 0.4143 | -0.006* | 0.4893 | 0.2171* |
| Diploma in vocational education | 0.7852 | 0.8029 | 0.7129 | 0.7416 | 0.7220 | 0.6289 | 0.6145 | 0.6375 |
| Some level in university | 0.6137 | 0.8869 | 0.6908 | 0.5677 | 0.4489 | 0.7934 | 0.5862 | 0.5118 |
| University graduate | 0.9212 | 1.0521 | 1.1134 | 1.0103 | 0.8803 | 0.7867 | 0.9286 | 0.8610 |
| Graduate school | 1.2291 | 1.3476 | 1.4441 | 1.5159 | 1.0030 | 1.0726 | 1.3931 | 1.1923 |
| **Adj.R-square** | **0.5721** | **0.5334** | **0.5441** | **0.5789** | **0.6854** | **0.6437** | **0.6501** | **0.6217** |

Source: Labour Force Survey and Calculation

Note: * statistically insignificant at 5% level

**Table 5 Estimated percentage difference in average monthly earnings between upper primary graduate and particular educational credentials**

Unit: percent

| | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 59.78 | 24.84 | 39.52 | 32.02 | 44.79 | 42.48 | 50.77 | 44.12 |
| Certificate in Vocational Education | 86.08 | 61.46 | 72.82 | 59.14 | 81.01 | 82.75 | 57.38 | 69.43 |
| Diploma in Vocational Education | 119.29 | 105.85 | 123.20 | 87.55 | 104.00 | 84.88 | 109.93 | 89.17 |
| University | 151.24 | 141.17 | 186.36 | 119.62 | 204.46 | 153.10 | 174.63 | 136.56 |

Source: Calculation using results from Table 4

**Table 6 Private rate of return to particular educational levels using upper primary as opportunity cost**

Unit: percent

| | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 9.96 | 4.14 | 6.59 | 5.34 | 7.46 | 7.08 | 8.46 | 7.35 |
| Certificate in Vocational Education | 14.35 | 10.24 | 12.14 | 9.86 | 13.50 | 13.79 | 9.56 | 11.57 |
| Diploma in Vocational Education | 14.91 | 13.23 | 15.40 | 10.94 | 13.00 | 10.61 | 13.74 | 11.15 |
| University | 15.12 | 14.12 | 18.64 | 11.96 | 20.45 | 15.31 | 17.46 | 13.66 |

Source: Calculation using results from Table 5

**Table 7 Average government expenditure per student in 1985, 1990, 1995 and 2000**

| Year | Gov't Expenditure in Education Sector (1994 baht) | Number of Students in All Levels (persons) | Average Expenditure per Student per Year ( 1994 Baht/person) |
|---|---|---|---|
| 1985 | 57,707,127,430 | 10,066,507 | 5,733 |
| 1990 | 72,426,714,371 | 10,900,052 | 6,645 |
| 1995 | 128,696,961,197 | 12,788,662 | 10,063 |
| 2000 | 159,492,431,193 | 14,648,633* | 10,888 |

Source: (1) The Bureau of the Budget, Office of the Prime Minister
(2) Office of the Permanent Secretary, Ministry of Education
(3) Office of the National Education Commission, Office of the Prime Minister

Note: * Using number of students in 1999 as an approximation of that in 2000, since data in 2000 has not been released yet.

**Table 8 Foregone earnings of an average person with particular educational credential using upper primary as opportunity cost**

Unit: 1994 baht

| Annual Foregone Earnings | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 131,443 | 126,925 | 133,446 | 131,637 | 221,876 | 183,237 | 194,525 | 207,847 |
| Certificate in Vocational Education | 131,443 | 126,925 | 133,446 | 131,637 | 221,876 | 183,237 | 194,525 | 207,847 |
| Diploma in Vocational Education | 184,862 | 176,746 | 188,921 | 182,122 | 301,627 | 251,083 | 273,443 | 289,013 |
| University | 243,183 | 229,959 | 249,894 | 235,724 | 384,022 | 321,871 | 358,967 | 375,269 |

Source: Calculation using results from Table 1, 2 and 4

**Table 9 Ratio of average government spending to foregone earnings**

| | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 0.2617 | 0.2710 | 0.2988 | 0.3029 | 0.2721 | 0.3295 | 0.3358 | 0.3143 |
| Certificate in Vocational Education | 0.2617 | 0.2710 | 0.2988 | 0.3029 | 0.2721 | 0.3295 | 0.3358 | 0.3143 |
| Diploma in Vocational Education | 0.2481 | 0.2595 | 0.2814 | 0.2919 | 0.2669 | 0.3206 | 0.3185 | 0.3014 |
| University | 0.2357 | 0.2493 | 0.2659 | 0.2819 | 0.2621 | 0.3127 | 0.3033 | 0.2901 |

Source: Calculation using results from Table 7 and 8

**Table 10 Estimated percentage differences in total social returns between upper primary graduate and particular educational credentials**

Unit: percent

| | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 47.38 | 19.55 | 30.43 | 24.58 | 35.21 | 31.95 | 38.00 | 33.57 |
| Certificate in Vocational Education | 68.22 | 48.35 | 56.07 | 45.39 | 63.68 | 62.24 | 42.96 | 52.82 |
| Diploma in Vocational Education | 95.58 | 84.04 | 96.15 | 67.77 | 82.09 | 64.27 | 83.37 | 68.52 |
| University | 122.39 | 113.00 | 147.21 | 93.32 | 162.00 | 116.63 | 133.99 | 105.85 |

Source: Calculation using results from Table 5 and 9

**Table 11 Social rate of return to particular educational level using upper primary level as opportunity cost**

Unit: percent

| | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Upper Secondary | 7.90 | 3.26 | 5.07 | 4.10 | 5.87 | 5.33 | 6.33 | 5.60 |
| Certificate in Vocational Education | 11.37 | 8.06 | 9.34 | 7.57 | 10.61 | 10.37 | 7.16 | 8.80 |
| Diploma in Vocational Education | 11.95 | 10.51 | 12.02 | 8.47 | 10.26 | 8.03 | 10.42 | 8.57 |
| University | 12.24 | 11.30 | 14.72 | 9.33 | 16.20 | 11.66 | 13.40 | 10.58 |

Source: Calculation using results from Table 10

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