

RETURN TO EDUCATION IN COMTEMPORARY VIET NAM¹

Dai Duong²

*Lecturer at Faculty of Political and Social Science,
Vietnam National University of Agriculture, Viet Nam*

*PhD Student in Economics at
University of Missouri Kansas City, Missouri, U.S.A*

Abstract

This paper explains two critical problems (endogeneity and censored sample) and suggests reliable solutions (the instrumental variable method and Heckman selection method with maximum likelihood estimation) in estimating return to education in contemporary Viet Nam. The return to education is estimated for Vietnamese employees who were in the labor force in 2010 and 2012. Generally, main findings are found that return to education increases from 6.36 percentage point in 2010 to 7.36 percentage point in 2012 (by instrumental variable method), or 6.06 percentage point in 2010 to 6.65 percentage point (by Heckman selection method). Interestingly, return to education among Vietnamese groups with respect to gender and living location are heterogeneous. Empirical evidence also supports the belief that employees are having higher education are likely to earn better return to education. In which, the highest return to education is observed at those people who studied university level. In terms of the rate of return to education, surprisingly, vocational education, not university level, brings the highest rate. It means that a year at this level helps to increase wage stronger than one year at any other education level. Therefore, this implies that both state investment may be allocated to vocational education in order to benefit more from education while individuals also may consider vocational school not as the “second best” after university when they orient their career.

1. Introduction

In Viet Nam, educated people are usually praised at high ranking in society. Therefore, pursuing high education becomes a desirable strategy for most of Vietnamese people. Since the economic transition from central-planning economy

¹ This paper is a response to the article of Doan and Gibson (2012) “Return to education in Vietnam during the recent transformation” published at *International Journal of Education Economics and Development*, **3**: 314-329

² I would like to thank DEPOCEN deeply for sharing VHLSS data which is the main information source to complete this paper

to market economy, both the government and Vietnamese people pay higher attention on individualistic and social benefit from education. Particularly, Vietnamese employees realize that they can earn higher economic rewards from longer schooling. Meanwhile, the government realizes that human resources can be expanded substantially with education at universal and professional levels in order to maximize the gross national product of Viet Nam. As a response to Vietnamese high needs of education and developmental goals of the government, the education system of Viet Nam has been organized and adjusted with a stable investment of 20% of the state budget. This is one of the highest public expenditure for people's schooling in the world (Can et al., 2001).

This paper is focused on an economic aspect of education achievement on the individual in Viet Nam. General research object is to examine how much Vietnamese employees receive the return to education in recent years. In addition, it is useful to explore whether or not there is the difference in return to education among various Vietnamese groups such as people living in rural-urban areas, people in ethnic majority – minority, and males – females. In the deeper investigation, the rate of return to education is also estimated at five levels of the education system in Viet Nam including primary, secondary, high school, vocational education, and university.

To accomplish such objectives, a number of econometric models will be estimated by instrumental variable method and Heckman selection method combining with maximum likelihood estimation. The data is used from the latest Viet Nam Household Living Standard surveys (VHLSS), which were conducted by the Viet Nam General Statistics Office in 2010 and 2012.

The paper is divided into five parts. After the introduction, a literature review on return to education will be presented in the second part. The third part introduces main aspects of methodology including data, methods, and econometric models.

Results and discussion will be drawn in the fourth part with notable findings and implications. Last but not least, the conclusion summarize remarked answers of research questions which are introduced in the introduction.

2. Literature review on return to education

Since ancient Greek, Socrates, Plato, and Aristotle had recognized the importance of education for individual life and for society (Freeman and Rendall, 1922). From an economic perspective, education is viewed as a significant instrument for economic growth. In *The Wealth of Nation*, Adam Smith emphasized that education productively helps to enlarge production of a nation. Nowadays, economists argue further that economic role of education are increasing in the era of knowledge economy (McCreadie et al., 2009, Tucker and Marshall, 1992). At the micro level of human development, education is also underlined as one of key factors ensuring individual well-beings (UNDP, 1990). This leads to the conventional belief that higher education warrants better earning.

Such belief is modeled as the idea of a return to education in human capital theory by Jacob Mincer and Gary Becker. The human capital theory relies on the neo-classical proposition that “*remuneration is determined by marginal productivity*” (Pyatt, 1966). Mincer and Becker viewed education as an investment to improve human capital which helps to increase individual productivity. Consequently, employees receive higher wage as the reward of such investment to their own education. Therefore, the human capital model suggests rational behaviors that individual can allocate their limited resources to improve education until the return to education is equal or higher than the marginal cost for pursuing education attainment (Olaniyan and Okemakinde, 2008).

Return to education has been examined in many countries, both developed and developing ones, at diversified aspects and levels. In China, return to education is estimated for returned migrant entrepreneurs in order to understand how education

is useful for business men, who returned from an urban area, in running their firms in the rural area (Hu, 2015). In Bangladesh, return to education is explored to investigate how people in rural – urban areas, public – private sectors, males, and females utilize their education in order to get earning from labor market (Asadullah, 2006). The role of education in economic perspective is figured out at both micro and macro levels. There are more evidence of private and social return to education in which education helps to increase individual wages and, at the same time, to provide a social effect to labor force participation and economic development (Cebeci et al., 2015).

In terms of methodology, there are multiple ways to estimate the return to education. Besides the typical OLS estimation, because of endogeneity of education, the instrumental variable methods are utilized very popular. In addition, alternative methods such as Heckman selection method, control function methods, matching methods are applied depending on various problems of data, objects, and aims of research (Blundell, 2001).

3. Methodology

3.1 Data

The datasets of this research are from VHLSS in 2010 and 2012, which are conducted by the Viet Nam General Statistics Office. These surveys focus on living standard evaluation for making policies and planning socio-economic development. VHLSS is taken every two years at nation level for all groups of people including ethnicity, regions, religions, occupations, and others. Hence, VHLSS data are usually utilized for monitoring living standard of Vietnamese people, evaluating the implementation of the Comprehensive Poverty Reduction and Growth Strategy, and supervising the achievement of the Millennium Developmental Goals in Viet Nam as well as Viet Nam's socio-economic development (General Statistics Office, 2010: 6).

In terms of sample size, VHLSS 2010 and VHLSS 2012 contain data of 37012 individuals and 36655 individuals, respectively. After filtering those ones participating in labor force, who are 15-to-60-years-old males and 15-to-55-years-old females, subsamples VHLSS 2010 and 2012 has data of 23645 observations and 23215 observations, correspondingly. According to Mincer model, return to education is calculated in the relation between actual schooling experience and actual earning gained by labor which were grounded on such education (Mincer, 1974). Therefore, individuals having retirement compensation as the only wage are also excluded from the sub-samples.

In the measurement, labored earning has a unit of a thousand Vietnam Dong, and is regressed in the form of logarithm. Meanwhile, schooling is measured in years that individuals studied in school. In which, the primary degree is equivalent to five schooling years. The secondary degree requires nine schooling years. High school level needs 12 schooling years. Short-term vocational training is a half of schooling year while long-term vocation demands two years for those ones passed high school level, and three years for students owned secondary degree. Students at college and university spend three and four years respectively. In higher education, learners need two additional years for earning their master degree, and four schooling years to complete their doctorate level.

3.2 Model specification

Based on human capital approach, Jacob Mincer developed the standard model of private return to education as following (Mincer, 1974):

$$\ln wage = \beta_0 + \beta_1 Edu_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \varepsilon_i$$

In which, *lnwage* is the natural logarithm of annual labored earning, *Edu_i* is individual's schooling years, *Exp_i* represents working years of individual experience, *Exp_i²* is square of individual working years, and ε_i is the error term. Especially, *Exp_i²* captures the declining effect of working experience on labored earning.

This model has been modified in various ways to adjust with different research problems that economists dealt at different scopes. Briefly, the general specification can be summarized as follows:

$$\ln wage = \beta_0 + \beta_1 Edu_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \beta_4 X_i + \varepsilon_i$$

Where X_i includes many pre-determined individual characteristics such as age, marital status, types of occupation, locations, and so on. For example, religion status, mother's schooling, spouse education are used to estimate the return to education in Bangladesh (Asadullah, 2006). Meanwhile, gender, job tenure for the individual are put into the model of return to education in Indonesia (Purnastuti et al., 2013). In the context of developing countries, such exogenous factors have strong effects on private return to education (Doan and Gibson, 2012).

One of a key potential problem with specifications following Mincer's style is that education (number of schooling years) may be correlated with omitted variables or with the error term. In other words, Edu_i is an endogenous variable. This endogeneity can be overcome when Edu_i is substituted by an instrumental variable which is correlated strongly with Edu_i but is unrelated with the regression error term. In addition, that instrumental variable should have no direct effect on annual labored earning so that it is not an explanatory variable on the right-hand side of Mincerian models. In the case of return to education in Viet Nam, the instrumental variable is ***Maxedu_i*** – the highest schooling years that other household members (except the very individual i) achieved. This is a reasonable instrumental variable from human capital approach because individual's education attainment is not random but a result of family investment strategy. When a family realizes that better education brings better living standards, that family has trended to enable all members to attend school longer. This fact is even stronger in Viet Nam because its culture considers education as a noble achievement of individual and family. Therefore, family education pattern

affects strongly to schooling year of all its members so that members' schooling correlates with the maximum achieved an education of other members.

The model using instrumental variable is following (*Model 1*):

$$\begin{aligned} Lnwage = & \beta_0 + \beta_1 Edu_i + \beta_2 Exp_i + \beta_3 Exp^2_i + \beta_4 Gend_i + \beta_5 Sect_i + \beta_6 Indu_i + \beta_7 Serv_i \\ & + \beta_8 Urban_i + \beta_9 Ethn_i + \varepsilon_i \end{aligned} \quad (1)$$

$$\begin{aligned} \text{And } Edu_i = & \alpha_0 + \alpha_1 Maxedu_i + \alpha_2 Gend_i + \alpha_3 Sect_i + \alpha_4 Indu_i + \alpha_5 Serv_i + \alpha_6 Urban_i \\ & + \alpha_7 Ethn_i + v_i \end{aligned}$$

(2)

where $Gend_i$, a dummy variable, denotes individual's gender, $Sect_i$, a dummy variable, represents the sector (public or private) that individual i is working, $Indu_i$ and $Serv_i$ are dummy variables of industries that individual i is working, $Urban_i$, a dummy variable, shows that whether individual i is living in urban or not. $Ethn_i$, a dummy variable, describes that whether individual i belong to minor ethnic groups or not. Those explanatory variables are added to the specification because gender, working sector, working industries, working locations, and ethnicity are strong factors to annual earning in Viet Nam (Quoc, 2014, Oostendorp and Doan, 2013). Specifically, gender earning gap exists universally crossing countries, race, occupations, and education levels (The American Association of University Women, 2015, Ñopo, 2012, Yeung et al., 2007, García-Aracil, 2007). In Viet Nam, earning gap also exists between public and private sector although this earning inequality is decreasing in recent years. This trend is as similar as in other European transitioning countries (Imbert, 2013, Lausev, 2014). At the same time, in Viet Nam, differentiation in earning with respect to ethnicity is very obvious because of the underdevelopment in groups of minor ethnicity (Pham and Reilly, 2009, Dang, 2012). In term of industries as agriculture, industry, and construction, and tertiary, Vietnamese workers receive different earning that is relatively higher in industry and tertiary, especially those ones oriented to export (Thangavelu, 2013, Oostendorp and

Doan, 2013). A reference group of industries is agriculture, therefore, $Indu_i$ and $Serv_i$ are added into the model to represent industry and construction, and services. Under rapid urbanization, Viet Nam also witnesses significant rural – urban disparities in various aspects including labored earning. Therefore, it is reasonable to believe that individual earnings in rural and urban areas are different given other similar conditions (Nguyen, 2011).

Another serious problem, in terms of data, is selection bias creating censored sample, in which information of earning is collected only from those employed individuals, hence earnings of those self-employed ones are excluded. Censored observations are 59.4% in sub-sample of VHLSS 2010 and 58.3% in those of VHLSS 2012. The observed samples in 2010 and 2012 are non-random. Consequently, the dependent variable becomes limited so that the estimation using OLS method cannot be a best linear unbiased estimator. The OLS is unable to capture the true relation between the latent dependent variable – individual labored earning, and explanatory variables.

There are two solutions to deal with this problem of censored sample. First, it is possible to use the method of limited information maximum likelihood (LIML) estimation using an instrumental variable. This solution deals with both endogeneity of schooling years and censored data on earning. The maximum likelihood estimation is superior to both OLS and the two stages least squares (TSLS) because it performs better in the case of weak instruments, and it also takes into account the covariance of errors. The LIML estimator is proved to converge to normality faster than TSLS estimator and is generally more symmetric (Anderson, 2005, Hill et al., 2012). Applying LIML requires to drop missing values of earning (logarithm of labored wage) so sub-samples VLHSS 2010 and VHLSS 2012 shrink to 9589 observations and 9690 observations, respectively.

Another solution is the maximum likelihood estimation of Heckman's sample selection model. Heckman suggests a two-steps model using selection equation to estimate within censored sample by taking into account the probability that dependent variable is observed. Because of sample selection, there is a correlation between independent variable and error term. Hence, Heckman aims to find the expected value of the error term to replace the non-random part of the error term. This expected value of the error term is treated as a regressor in the model. Generally, Heckman two-step estimation suggests the first stage is to estimate the probability of obtaining information of dependent variable by using the probit model for the full sample and then estimate the inverse Mills ratio – or the expected value of the error term. In the second step, the regression includes the inverse Mills ratio as an additional explanatory variable, then is estimated with the OLS method (Heckman, 1979). However, the Heckman two-step estimation has some weakness such as inefficiency, incorrect standard errors and incorrect t-statistics. The better alternative is to estimate the Heckman selection model by maximum likelihood method. This maximum likelihood procedure applies different forms of the likelihood function for the part of the sample having obtained observations and the part of the sample having missing observations. Therefore, this method is applied for the full sample and results in good estimates which are consistent and asymptotically efficient under the assumption that the uncensored error term is homoscedastic and have a normal distribution.

The regression equation of return to education (**Model 2**) is

$$\begin{aligned} \ln wage_i = & \beta_0 + \beta_1 Edu_i + \beta_2 Edugend_i + \beta_3 Edurban_i + \beta_4 Eduethn_i + \beta_5 Exp_i + \beta_6 Exp^2_i \\ & + \beta_7 Gend_i + \beta_8 Sect_i + \beta_9 Indu_i + \beta_{10} Serv_i + \beta_{11} Urban_i + \beta_{12} Ethn_i + \varepsilon_i \quad (3) \end{aligned}$$

Explanatory variables are similar to the equation (1) except $Edugend_i$, $Edurban_i$, $Eduethn_i$ which are interaction variables of schooling years and gender, urban, ethnicity, respectively. This specification bases on the assumption that different

Vietnamese groups of genders, living locations (urban or rural), and ethnicity exploit different benefit from schooling because education attainment and economic opportunities converting education to earning are heterogeneous among those groups. This is a practical assumption in the Vietnam developing and transitioning economy. Such interaction variables help to differentiate education effect on earning with respect to gender, living locations (urban or rural), and ethnicity. A general return to education is:

$$\frac{\partial \ln wage}{\partial Edu} = \beta_1 + \beta_2 gend + \beta_3 urban + \beta_4 ethn \quad (4)$$

Hence, this specification allows to see how different specific Vietnamese groups of genders, living locations, and ethnicity utilize their return to education.

While the selection equation is:

$$haswage_i = \alpha_0 + \alpha_1 Edu_i + \alpha_2 Gend_i + \alpha_3 Indu_i + \alpha_4 Serv_i + \alpha_5 Age1518_i + \alpha_6 Live_i + \alpha_7 Spouse_i + u_i \quad (5)$$

Where the dependent variable – *haswage* – is 1 if having earning, 0 if not. The dependent variable in the regression equation, $\ln wage_i$, is observed if *haswage* = 1, while it is not observed if *haswage* = 0. The right hand side of this equation includes independent variables that explain the probability of Vietnamese in labor force having earning. In which, schooling years (Edu_i), gender ($Gend_i$), working industries as an industry ($Indu_i$) and services ($Serv_i$) appear in both the regression equation and the selection one. It is obviously that those factors determining the magnitude of labored earning also affect to the probability of having a wage. However, in order to avoid high collinearity, the regression and selection equations should be different because the use of same variables in both equations will imply that the specification of the regression equation now depends mainly on the inverse Mills ratio as an additional regressor (Kennedy, 2008: 271). Hence, the selection equation includes other different variables. Specifically, young age from 15 to 18 years old ($Age1518_i$)

is expected to have a negative correlation with the probability of having wage because Vietnamese teenagers usually choose to go to school, not to work at that age. Meanwhile, a number of livelihoods ($Live_i$) is expected to be positive with the probability of having wage because diversified ways of working increase chances of receiving a wage. In addition, marriage status ($Spouse_i$) imposes more pressure on having wage in order to cover family need, so this variable may have a positive effect on the probability of having earning.

In this *Model 1* and *Model 2*, it is implicitly assumed that any extra year of schooling brings equal additional earning for employees. This seems not be practical because schooling years at different education level contribute unequally to earning. Therefore, it is necessary to express education by dummy variables of different education levels in order to differentiate return to education in each level. The below *Model 3* transforms continuous years of schooling to five education levels:

Model 3:

$$\begin{aligned} Lnwage_i = & \gamma_0 + \gamma_1 Prim_i + \gamma_2 Seco_i + \gamma_3 High_i + \gamma_4 Voca_i + \gamma_5 Univ_i + \gamma_6 Exp_i + \gamma_7 Exp^2_i \\ & + \gamma_8 Gend_i + \gamma_9 Sect_i + \gamma_{10} Indu_i + \gamma_{11} Serv_i + \gamma_{12} Urban_i + \gamma_{13} Ethn_i + v_i \end{aligned} \quad (6)$$

This specification replaces the variables Edu_i , $Edugend_i$, $Edurban_i$, $Eduethn_i$ in *Model 2* by five dummy variables representing five levels of education that individuals obtained as their highest schooling: primary ($Prim_i$), secondary ($Seco_i$), high school ($High_i$), vocational training ($Voca_i$), and university ($Univ_i$). The reference dummy which is excluded from *Model 3* includes those ones have no education. The coefficients of five above variables imply effect of each education level on earning. From human capital approach, it is expected that those coefficients increase at higher education levels because, generally, those people having more schooling years will have better human capital in order to earn higher wage after graduation. However, the difference between such coefficients does not reflex the

rate of return to education because earnings are different with respect to different educational levels. Instead, the rate of return to education is calculated by comparing differential in earning and differential in schooling. Some researchers used this equation for the rate of return to education:

$$r_k = \frac{\gamma_i - \gamma_{i-1}}{S_{Edu_level\ i} - S_{Edu_level\ i-1}}$$

In which γ_i and γ_{i-1} are coefficients of education degree i and $i-1$ in equation (6). $S_{Edu_level\ i}$ and $S_{Edu_level\ i-1}$ are nominal schooling years requiring to complete educational level i and $i-1$ (Purnastuti et al., 2013, Quoc, 2014). For example, in Viet Nam, $S_{Edu_level\ i}$ is 5 years for Primary, 9 years for Secondary, 12 years for High school. However, this equation of rate of returns to schooling is incorrect because actual schooling years are much different from nominal schooling years requiring to achieve degrees. For instance, if a 12th grade student dropped their study before completion of High school degree, they could not be counted as finishing only 9 schooling years at secondary level. Instead, their actual education covered 12 years of schooling. This problem can be solved by replacing average actual schooling years to the nominal ones:

$$r_k = \frac{\gamma_i - \gamma_{i-1}}{\overline{Edu}_i - \overline{Edu}_{i-1}} \quad (7)$$

In which \overline{Edu}_i and \overline{Edu}_{i-1} are average schooling years to complete educational levels i and $i-1$. With the rate of return to education at Primary, γ_0 is zero which represent for no effect from no education to labored earning. Similarly, \overline{Edu}_0 is zero for no education. In terms of university level, the rate of return to education is compared with the high school level, not the vocational education, because Vietnamese student usually choose to study either vocational school or university. In other words, the former level is not an intermediate step to achieve the later level. The selection equation is similar as the equation (5):

$$haswage_i = \pi_0 + \pi_1 Edu_i + \pi_2 Gend_i + \pi_3 Indu_i + \pi_4 Serv_i + \pi_5 Age1518_i + \pi_6 Live_i + \pi_7 Spouse_i + \omega_i \quad (8)$$

The dependent variable in regression equation, $Lnwage$, is observed if $haswage = 1$, while it is not observed if $haswage = 0$.

Table 1: Explanation of variables in above models

Variable	Definition	2010		2012	
		Mean	Std. Dev.	Mean	Std. Dev.
<i>lnwage</i>	Dependent variable = log of labored earning in 12 months	9.603	1.096	10.040	1.034
<i>edu</i>	Number of schooling years that individual studied	8.640	4.213	8.824	4.223
<i>prim</i>	Dummy (= 1 if highest education is Primary)	0.186	0.389	0.181	0.385
<i>seco</i>	Dummy (= 1 if highest education is Secondary)	0.359	0.480	0.351	0.477
<i>high</i>	Dummy (= 1 if highest education is High school)	0.184	0.388	0.192	0.394
<i>voca</i>	Dummy (= 1 if highest education is Vocational education)	0.105	0.306	0.100	0.300
<i>univ</i>	Dummy (= 1 if highest education is University)	0.109	0.312	0.125	0.330
<i>expe</i>	years of experience after graduation	17.358	12.856	17.816	12.974
<i>expe2</i>	Square of experienced year	466.560	500.080	485.730	509.160
<i>gend</i>	Dummy (= 1 if Male)	0.508	0.500	0.516	0.500
<i>sect</i>	Dummy (= 1 if working in Public sector)	0.090	0.286	0.095	0.293
<i>indu</i>	Dummy (= 1 if working in Industry and Construction)	0.202	0.402	0.200	0.400
<i>serv</i>	Dummy (= 1 if working in Services)	0.245	0.430	0.249	0.433

<i>urban</i>	Dummy (= 1 if living in Urban)	0.279	0.448	0.289	0.453
<i>ethn</i>	Dummy (= 1 if belong to ethnic minority)	0.187	0.390	0.190	0.392
<i>age1518</i>	Dummy (=1 if age is between 15 and 18 years old)	0.128	0.334	0.117	0.321
<i>live</i>	Number of livelihoods that an individual is earning wage currently	1.249	0.773	1.254	0.765
<i>spouse</i>	Dummy (= 1 if having a spouse)	0.666	0.472	0.677	0.467
<i>haswage</i>	Dummy variable (= 1 if having wage)	0.406	0.491	0.417	0.493
<i>maxedu</i>	Highest schooling years of other members in household except for the individual i	10.280	3.798	10.475	3.815

Source: VHLSS 2010 and VHLSS 2012, and author's calculation

4. Results and discussion

4.1 Instrumental Estimation of return to education in Viet Nam

As mentioned above, the instrumental estimation using limited information maximum likelihood is a reliable method dealing with both endogeneity of schooling years and censored sample. The instrument of Edu_i is $Maxedu_i$ which is the maximum schooling years of other members in the individual i 's household. The test for weak instrument confirms that $Maxedu_i$ is not a weak instrument for Edu_i when First-stage F-statistic (1, 9579) and F-statistic (1, 9690) are much larger than the critical value (16.38) for desired LIML maximal size at 10% when running tests at a nominal 5% significance level. Hence, the instrumental estimate in *Model 1* is reliable.

Table 2: Limited information maximum likelihood for instrumental estimation

Dependent variable: <i>lnwage</i>
Instrumented: <i>edu</i>

Instruments: <i>const expe expe2 gend sect indu serv urban ethn maxedu</i>					
	2010			2012	
Observations	9589			9690	
	<i>Coefficient</i>	<i>Std. Error</i>		<i>Coefficient</i>	<i>Std. Error</i>
Const	7.81147	0.051925 ***		8.18487	0.0520149 ***
Edu	0.063589	0.00492848***		0.0736138	0.00478958***
Expe	0.047129	0.00288837***		0.0492976	0.00275006***
expe2	-0.00109188	6.91E-05 ***		-0.00108168	6.44993e-05***
Gend	0.280112	0.0171797 ***		0.278468	0.0163493***
Sect	0.277859	0.03213 ***		0.0929039	0.0293041***
Indu	0.842054	0.0232713 ***		0.822012	0.0226435***
Serv	0.727497	0.0294079 ***		0.680071	0.0279338***
Urban	0.366771	0.0204937 ***		0.281316	0.0190423***
Ethn	-0.387259	0.0253094 ***		-0.422479	0.0247645***
Log-likelihood	-104824.8			-105726.8	
Schwarz criterion	209741.3			211545.4	
Weak instrument test	First-stage F-statistic (1, 9579) 3227.8		First-stage F-statistic (1, 9680) 3029.09		
Critical values for desired LIML maximal size, when running tests at a nominal 5% significance level:					
	size	10%	15%	20%	25%
	value	16.38	8.96	6.66	5.53
Maximal size is probably less than 10%					

*, **, *** denote significance at the level of 1, 5, and 10 percent, respectively

Source: VHLSS 2010, VLHSS 2012 and author's calculation

In terms of return to education, at 5% significance, coefficients of schooling years is 0.063589 (2010) and 0.0736032 (2012). Statistically, this implies that, given other variables constant, with 95% confidence, we can conclude that in 2010, an additional schooling year helps Vietnamese employees to increase annual labored earning by 6.3589 percentage point. Meanwhile, the return to education in 2012 is statistically 7.36032 percentage point. In addition, comparing results in 2010 and 2012, there is a trend of increase in return to education by 1 percentage point of annual earning of Vietnamese employees. From 2010 to 2012, change in education attainment of employees is about 2% (8.640 averagely schooling years in 2010, and 8.824 averagely schooling years in 2012). That change cannot be huge enough to

gain such earning increase. Instead, the actual critical reason is that minimum wage in both public and private sector was increased significantly from 13% to around 40% by new law enforcement in Viet Nam (Cuong, 2014). This statutory change forced private and state employers in Viet Nam to raise the labored wage of employees if their levels were below the new minimum wage. However, the increasing trend of return to education needs to be explained clearer by further research.

The result from *Model 1* also suggests that impact of education on annual earning is stronger than the effect of experience because the coefficients of experience (0.047129 in 2010, 0.0492915 in 2012) are always lower than ones of schooling years. We also see the decreasing return from experience when the coefficient of experience square is negative. This is fit with the rationality of Mincerian specification that experience contributes to earning at the diminishing rate along with experience length.

Other findings from *Model 1* are similar to conventional belief. Specifically, given other variables constant, employees in public sector earn more than those in private sector, but the gap reduces significantly from 27.7 percentage point (2010) to 9.29 percentage point (2012). Employees in industry and construction have higher earning about 84.2 percentage point (2010), while those in services earned 72.7 percentage point (2010) than those working in agriculture. However, the relative difference between those industries reduces slightly in 2012 when industry and construction, and services earn 82.2 percentage point and 68 percentage point than agriculture. The reason can be economic crisis during 2010 – 2012 which hit those industries stronger than agriculture. Regarding living location, people in urban earn more than those in rural 36.6 percentage point (2010) and 28.1 percentage point (2012). People in ethnic minority get lower earnings about 38.7 percentage point than people in majority groups.

4.2 Heckman selection estimation of return to education in Viet Nam

- *Result from Model 2*

Because of censored sample, Heckman selection procedure is combined with the maximum likelihood method in order to avoid biased estimate of the return to education. Thus, Table 3 reveals the results of the return to education in Viet Nam in 2010 and 2012.

In comparison with *Model 1*, the *Model 2* is better in terms of specification and methodology because it produces much higher log-likelihood (−22621.28 with sub-sample VHLSS 2010) than such criteria in *Model 1* (−104824.8 with sub-sample VHLSS 2010). In addition, Schwarz criterion in *Model 2* (44716.15 with sub-sample VHLSS 2012) is much lower than in *Model 1* (209741.3 with sub-sample VHLSS 2012). One of the key differences is that *Model 2* is estimated with full sample instead of the censored sample (59.4% censored in VHLSS 2010, 58.3% censored in VHLSS 2012) applied by *Model 1*, which is not random after excluding missing observations.

The Wald test for specification rejects the null hypothesis that all coefficients are zero. Coefficients in *Model 2*, except $Eduethn_i$ and $Urban_i$, are significant at 1% level. These factors imply that results of *Model 2* are reliable.

Table 3: Maximum likelihood estimation for Model 2

	2010		2012	
	lnwage	selection	lnwage	selection
const	7.14447 (0.0536977)***	−2.41517 (0.0413483)***	7.51962 (0.0556859)***	−2.24872 (0.0416478)***
edu	0.0642454 (0.00411273)***	0.0499599 (0.00254782)***	0.0780276 (0.00404506)***	0.0429005 (0.00255058)***
edugend	−0.0207655 (0.00357092)***		−0.0294172 (0.00355893)***	
edurban	0.0252529 (0.00396005)***		0.0128943 (0.00388466)***	
eduethn	0.0013881 (0.00483475)		−0.000666461 (0.00509688)	

expe	0.0469174 (0.00292408)***		0.0494169 (0.00276663)***	
expe2	-0.00109219 (0.0000710421)***		-0.00110592 (6.70015e-05)***	
gend	0.607881 (0.0399096)***	0.367929 (0.0192329)***	0.675833 (0.0408580)***	0.356718 (0.0192705)***
sect	0.316288 (0.0272413)***		0.154064 (0.0245358)***	
indu	1.21282 (0.0250215)***	1.38987 (0.0258636)***	1.20507 (0.0257414)***	1.52466 (0.0267239)***
serv	0.959843 (0.0304475)***	0.898227 (0.0235181)***	0.934234 (0.0287073)***	0.963725 (0.0234240)***
urban	0.0466144 (0.045718)		0.112607 (0.0449126)**	
ethn	-0.368422 (0.045245)***		-0.393510 (0.0476664)***	
age1518		-0.296432 (0.0366357)***		-0.350666 (0.0381702)***
live		0.927299 (0.014606)***		0.821261 (0.0154054)***
spouse		-0.333365 (0.0230816)***		-0.287714 (0.0234125)***
lambda	0.544513 (0.0160884)***		0.482933 (0.0154567)***	
Rho	0.613501		0.576121	
Wald test of independent equations ($\rho = 0$)		$\chi^2(1) = 1029.21$ ***	$\chi^2(1) = 962.90$ ***	
Wald $\chi^2(12)$		8954.2	7952.89	
Prob > χ^2 (all coeffs = 0)		0.0000	0.0000	
Log-likelihood		-22621.28	-22293.86	
Schwarz criterion		45370.92	44716.22	
Total observations	23645		23215	
Censored observations	14056 (59.4%)		13525 (58.3%)	

*, **, *** denote significance at the level of 1, 5, and 10 percent, respectively

Source: VHLSS 2010, VLHSS 2012 and author's calculation

In *Model 2*, the return to education is not unique as in *Model 1* but be diversified across groups of genders, living locations, and ethnicity. Table 4 presents results of the return to education calculating based on equation (4). It should be noted that

general return to education is generated from weighing all specific returns to education of groups with regard to their proportion in the full sample. A general return to education in *Model 2* is lower than the unique return to education in *Model 1*, for example, with sample VHLSS 2010, the general return to education in *Model 2* is 0.060989054, while the unique return to education in *Model 1* is 0.063589. From higher reliability of *Model 2*, it can be said that estimate of *Model 1* is upward biased. However, both models show a similar trend of increasing the return to education when the estimate of the general return to education in 2012 is higher about 0.6 percentage point (increasing by 10%) than that number in 2010.

Among specific returns to education, groups having highest economic benefit from their education are females living in urban areas with the returns varying around 9% in both 2010 and 2012. At the opposite position, males living in rural areas are those ones having a lowest return to education which is around 4.3 – 4.8 percentage point in 2010 and 2012. Because the coefficient of interaction terms of schooling years and gender are negative in both 2010 and 2012, statistically, we can conclude that Vietnamese female employees gain earning relatively higher than Vietnamese male employees. This finding is fit with results of previous research that return to education of females is usually higher than those of males (Quoc, 2014, Doan and Stevens, 2011, Doan and Gibson, 2012). From Table 5, we see that female employees benefit from their education better than males about 30%-47% in 2010, and 48%-61% in 2012. This phenomena should not be confused with the conventional fact that male employees earn more than female ones. In *Model 1*, given other variables constant, Vietnamese males earn statistically 28 percentage point more than Vietnamese females in 2010, and about 27.8 percentage point in 2012.

Table 4: Specific return to education of different groups

	2010	2012
--	------	------

	coefficient	% in sample	coefficient	% in sample
female-rural-major_ethnic	0.0642454	26.85%	0.0780229	25.99%
female-urban-major_ethnic	0.0894983	13.14%	0.0909315	13.28%
female-rural-minor_ethnic	0.0656335	8.35%	0.0773619	8.29%
female-urban- minor_ethnic	0.0908864	0.85%	0.0902705	0.87%
male-rural- major_ethnic	0.0434799	28.31%	0.0485986	28.02%
male-urban- major_ethnic	0.0687328	12.99%	0.0615072	13.74%
male-rural- minor_ethnic	0.044868	8.62%	0.0479376	8.84%
male-urban- minor_ethnic	0.0701209	0.88%	0.0608462	0.96%
General	0.060989054		0.0664491	

Source: Author's calculation from Model 2 results

Table 5: Female - male difference in return to education in Viet Nam

Groups	2010	2012
rural-major_ethnic	47.76%	60.55%
urban-major_ethnic	30.21%	47.84%
rural-minor_ethnic	46.28%	61.38%
urban-minor_ethnic	29.61%	48.36%

Source: Author's calculation from Model 2 results

Table 6: Urban - rural difference in return to education in Viet Nam

Groups	2010	2012
female-major_ethnic	39.31%	16.54%
female-minor_ethnic	38.48%	16.69%
male-Major_ethnic	58.08%	26.56%
male-minor_ethni	56.28%	26.93%

Source: Author's calculation from Model 2 results

Regard to living location, the positive and substantially high coefficient of interaction terms of education and living location in 2010 and 2012 suggest that employees in urban utilize their education for earning wage better than their counterparts in a rural area in Viet Nam. This phenomenon does not conflict with another well-recognized fact that people in urban are paid a higher wage than those in rural areas. In *Model 1*, given other variables constant, wage difference between urban – rural areas is statistically about 36 percentage point in 2010 and 28 percentage point in 2012.

In Table 6, those parameters are approximately 38% - 58% in 2010, and 16%-26% in 2012. Again, this finding reinforces previous conclusion that return to education in an urban area is usually higher than in rural area. There is possibility that urban area develops better education or creates more economic opportunity than rural area does so that employees in urban with their education attainment are able to take economic advantage from that.

The coefficient of interaction term of education and ethnicity is very tiny so that the return to education among ethnic groups are somewhat different. Additionally, the 2010 coefficient is not statistically significant as the 2012 one is.

In term of selection equation, it is tricky to interpret its coefficients because they are estimated only for calculating, in probit model, the probability that dependent variable being observed. In other words, one cannot draw direct meaning from these coefficients which play the only role in maximizing the likelihood function. Hence, one should not interpret its meaning as he does with coefficients in OLS estimation. However, such coefficients can be used to examine the marginal effect of a one-unit change in a specific variable on the probability that $\ln wage_i$ is observed. Also, the sign of those coefficients implies direction of change in the probability (Hill et al., 2012: 590). For example, the negative coefficient of $Age1518_i$ indicates that, in databases of 2010 and 2012, those ones are between 15 years old to 18 years old have a smaller probability of having labored earning. Surprisingly, the coefficient of marriage status ($Spouse_i$) is negative too so that probability of having wage is reduced with employees having a spouse. This is affected by large observations missing information on wage are from those are self-employed, who are usually married before that.

The Rho in *Model 2* is significant and positive in both 2010 and 2012 because the Wald test of independent equations rejects the null hypothesis rho is zero (Prob > chi2 = 0.0000 in both 2010 and 2012). This denotes not only that selection bias

exists, but also error terms in both regression and selection equations are positively correlated. The error term in the regression equation of $\ln wage_i$ can be explained partly by using the result from the probit model of the probability of having a wage.

The lambda term ($= \rho\sigma$) in *Model 2* is significant and positive signed. Therefore, lambda as an additional explanatory variable of the regression equation crowding out impacts of other variables, including variables of education, on the dependent variable ($\ln wage_i$). In other words, the selection caused by sample censoring reduces the estimate of the return to education lower than the latent effect. If the sample is not censored, return to education will be higher. Comparing with *Model 1*, the general weighted return to education (in *Model 2*) is higher than the unique return to education (in *Model 1*) in both 2010 and 2012.

- *Result from Model 3*

According to result from *Model 3*, return to education increases at higher education levels. At primary level, the return is 7.794 percentage point in 2010, 14.15 percentage point in 2012. From secondary to high school, the return raises from 19.953 percentage point to 34.544 percentage point in 2010, and higher change in 2012. It is noted that this is an accumulative return to education, not the return to education from single separated level. Hence, those one studied vocational education or university level are those ones have longest schooling years, then they gain highest accumulative return to education. Statistically, in 2010, an employees with a university education can earn 101.715 percentage point than the wage of those ones having no education. Estimate of *Model 3* is fit with findings of previous research in Viet Nam. For example, Doan and Stevens argued that, in 2008, income premium for university education in Vietnam is about 97 percent above wage of those just finishing the high school education (Doan and Stevens, 2011). The empirical evidence in *Model 3* confirms again conventional belief that higher education level brings larger labored earning. In Table 7, coefficients of education in 2012 is higher

than corresponding coefficients in 2010. This indicates an increase of return to education in Viet Nam from 2010 to 2012. However, as mentioned above, this positive change can be explained partly by an exogenous increase of earning from new law enforcement of minimum wage in 2011.

Table 7: Maximum likelihood estimation for Model 3

Dependent variable: Lnwage_i

	2010		2012	
	<i>Coefficient</i>	<i>Std. Error</i>	<i>Coefficient</i>	<i>Std. Error</i>
const	7.43979	0.05442***	7.873	0.0577***
prim	0.07794	0.04375*	0.1415	0.04708***
seco	0.19953	0.04303***	0.29078	0.04594***
high	0.34544	0.0479***	0.4457	0.0503***
voca	0.6637	0.0487***	0.73517	0.05075***
univ	1.01715	0.05349***	1.0592	0.05359***
expe	0.04595	0.00289***	0.04737	0.00274***
expe2	-0.00105543	7.04E-05***	-0.00104738	6.65E-05***
gend	0.40837	0.01845***	0.39171	0.01748***
sect	0.24978	0.02834***	0.12773	0.02482***
indu	1.21808	0.02474***	1.19923	0.02526***
serv	0.91561	0.03017***	0.88319	0.02844***
urban	0.27679	0.01829***	0.22291	0.01705***
ethn	-0.381859	0.02542***	-0.41495	0.02578***
Selection equation				
const	-2.36332	0.04051***	-2.19016	0.04085***
edu	0.04664	0.00249***	0.0393	0.00251***
gend	0.36726	0.01921***	0.35588	0.01925***
indu	1.39611	0.02587***	1.53358	0.02668***
serv	0.90172	0.02351***	0.96828	0.02339***
age1518	-0.319522	0.03657***	-0.370495	0.03817***
live	0.91529	0.01462***	0.80476	0.01538***
spouse	-0.339665	0.0232***	-0.291207	0.02357***
lambda	0.50951	0.01611***	0.44429	0.01541***
rho	0.58633		0.53992	
Wald test of independent equations (rho = 0)		924.78***		836.92***
Wald $\chi^2(13)$		9708.47		8539.17
Prob > χ^2 (all coeffs = 0)		0.0000		0.0000

Log-likelihood	-22553.55	-22275.78
Schwarz criterion	45244.6	44689.2
Total observations:	23645	23215
Censored observations:	14056 (59.4%)	13525 (58.3%)

*, **, *** denote significance at the level of 1, 5, and 10 percent, respectively

Source: *VHLSS 2010, VLHSS 2012 and author's calculation*

Estimate of *Model 3* is reliable because its specification is significant when the Wald test rejects the null hypothesis that all coefficients are zero. As *Model 2*, ρ and λ in *Model 3* are positive and significant. The Wald test of independent equations rejects the null that ρ equals to 0. This means error terms in the regression equation and the selection equation are correlated positively. This indicates the estimate of the return to education in *Model 3* is lower than the latent estimator if the sample would not be censored.

4.3 Rate of return to education in Viet Nam

Shown in Table 8, the rate of return to education in Viet Nam which is calculated by equation (8), is higher at higher education level. In which, the highest rate is at vocational education, which is considered as “the second best” after university level. In 2010, a year at vocational education had 21.5% stronger positive effect on labored earning than a year in high school could bring. In 2012, the difference was 20.43%. Meanwhile, although the highest return to education is at the university level, the rate of return to education at this level is lower than the rate at vocational education. A year at university increase Vietnamese employees wage stronger 16.32% in 2010 and 15.16% in 2012 than a year at high school. This fact leads to a policy implication that Vietnamese government needs to concentrate higher public investment to vocational education. Also, at individual perspective, after high school graduation, Vietnamese students should consider equipping working skills at vocational school rather than competing harshly to enter a university which has a lower rate of return to education. This implication is useful because in Viet Nam, with the pride of “being educated”, parents usually urge their

children to study at university level. Hence, only those students failing to do so attend vocational education as “the second best”.

Those implications are matched with some recommendations from World Bank for Viet Nam. For instance, Bodewig and Badiani-Magnusson suggested that Viet Nam “needs to renew its focus on education: not just expanding attainment, but equipping its workforce with the right skills will be needed to foster to Vietnam's continued economic modernization in the coming decade and more” (Bodewig and Badiani-Magnusson, 2014).

Table 8: Rate of return to education

	2010			2012		
	Coefficient	mean of schooling years	RORE	Coefficient	mean of schooling years	RORE
Primary	0.07794	3.832384	2.03%	0.1415	3.851931	3.67%
Secondary	0.19953	8.132677	2.83%	0.29078	8.116225	3.50%
High school	0.34544	11.08226	4.95%	0.4457	11.13565	5.13%
Vocational education	0.6637	12.56253	21.50%	0.73517	12.55272	20.43%
University	1.01715	15.19721	16.32%	1.0592	15.18336	15.16%

Source: Author's calculation from Model 3 results

Empirical evidence in Table 8 shows that rate at primary and secondary are not different considerably. This implies that a year in either primary school or secondary school affects similarly to Vietnamese employees wage. However, a huge change in the rate of return to education happens from High school to post-high school levels. If high school students choose to go vocational school, their rate of return to education are four times that the rate of those ones stopped after high school. Meanwhile, the rate of return to education at university level is tripled than the rate at high school. The big gap in the rate of return reflects that, in Viet Nam, profession skills, which are attained at vocational training or university, play an important role in getting a wage, while universal knowledge which is taught from primary to high

school are weak in searching high-paid job. In addition, firms in Viet Nam have a preference in recruiting applicants with working skills rather than those ones obtained only high school diploma. A technical reason for the gap is that sample is censored as there is no data of wage from self-employed individuals. This group contains about 87%-90% people who studied high school education and beyond, so their wage information are not taken into estimating the *Model 3*.

5. Conclusion

Using the instrumental variable method and Heckman selection method with maximum likelihood estimation, return to education is estimated for Vietnamese employees who were in the labor force in 2010 and 2012. Generally, main findings are found that return to education is 6.36 percentage point in 2010 and 7.36 percentage point in 2012 (by instrumental variable method), or 6.06 percentage point in 2010 and 6.65 percentage point (by Heckman selection method). There is an increase of return to education from 2010 to 2012 but the trend might be affected exogenously from the law enforcement in 2011 which raised the minimum wage in both public and the private sector. Interestingly, return to education among Vietnamese groups with respect to gender and living location are heterogeneous. Empirical evidence also supports the belief that employees are having higher education are likely to earn better return to education. In which, the highest return to education is observed at those people who studied university level. In terms of the rate of return to education, surprisingly, estimate in *Model 3* supports that vocational education, not university level, brings the highest rate. It means that a year at this level helps to increase wage stronger than one year at any other education level. Therefore, this implies that both state investment may be allocated to vocational education in order to benefit more from education while individuals also may consider vocational school not as the “*second best*” after university when they orient their career.

6. Reference

- Anderson T W (2005) Origins of the limited information maximum likelihood and two-stage least squares estimators. *Journal of Econometrics*, **127**: 1-16.
- Asadullah M N (2006) Returns to Education in Bangladesh. *Education Economics*, **14**: 453-468.
- Blundell R, Dearden, Lorraine and Sianesi, Barbara (2001) *Estimating the returns to education: models, methods and results*, London, UK: Centre for the Economics of Education, London School of Economics and Political Science.
- Bodewig C, Badiani-Magnusson R (2014) *Skilling up Vietnam : Preparing the Workforce for a Modern Market Economy*. Herndon: World Bank Publications.
- Can N B, Long V V, Tam P T, Sinh N T (2001) Educational financing and budgeting in Viet Nam. *Financial Management of education systems*. Paris: International Institute for Educational Planning/UNESCO.
- Cebeci E, Algan N, Cankaya S (2015) The Returns of the Education in the Context of Micro-macro Analysis. *Procedia - Social and Behavioral Sciences*, **174**: 916-925.
- Cuong N V (2014) Do Minimum Wages Affect Firms' Labor and Capital? Evidence from Vietnam. *IPAG Business School - Working paper series*, **Working Paper 2014-179**.
- Dang H-A (2012) A Widening Poverty Gap for Ethnic Minorities. In: Hall G H (ed.) *Indigenous Peoples, Poverty, and Development*. Cambridge University Press.
- Doan T, Gibson J (2012) Return to education in Vietnam during the recent transformation. *International Journal of Education Economics and Development*, **3**: 314-329.
- Doan T T, Stevens P A (2011) Labour market returns to higher education in Vietnam. *Economics - The Open-Access, Open-Assessment E-Journal*, **5**: 1-21.
- Freeman K J, Rendall M J (1922) *Schools of Hellas : an essay on the practice and theory of ancient Greek education from 600 to 300 B.C*, London: Macmillan.
- García-Aracil A (2007) Gender Earnings Gap among Young European Higher Education Graduates. *Higher Education*, **53**: 431-455.
- General Statistics Office (2010) *Result of the Viet Nam household living standards survey 2010*, Ha Noi: Statistical Publishing House.
- Heckman J J (1979) Sample Selection Bias as a Specification Error. *Econometrica*, **47**: 153-161.
- Hill R C, Griffiths W E, Lim G C (2012) *Principles of Econometrics, 4th Edition*: Wiley.
- Hu F (2015) Return to Education for China's Return Migrant Entrepreneurs. *World Development*, **72**: 296.

- Imbert C (2013) Decomposing the Labor Market Earnings Inequality: The Public and Private Sectors in Vietnam, 1993–2006. *The World Bank Economic Review*, **27**: 55-79.
- Kennedy P (2008) *A Guide to Econometrics 6th edition*: Wiley-Blackwell.
- Lausev J (2014) What has 20 years of public-private pay gap literatur told us? Eastern European transitioning vs. developed economies. *Journal of Economic Surveys*, **28**: 516-550.
- Mccreadie K, Smith A, Books24x I (2009) *Adam Smith's The wealth of nations: a modern-day interpretation of an economic classic*, Oxford: Infinite Ideas.
- Mincer J (1974) *Schooling, experience, and earnings*, New York: National Bureau of Economic Research; distributed by Columbia University Press.
- Nguyen T B (2011) Household income in present day Vietnam. *2nd International Conference on Humanities, Historical and Social Sciences*. Singapore: IPEDR vol.17 (2011) IACSIT Press.
- Ñopo H, Daza, N. & Ramos, J. (2012) Gender earning gaps around the world: a study of 64 countries. *International Journal of Manpower*, **33(5)**: pp. 464-513.
- Olaniyan D A, Okemakinde T (2008) Human capital theory: Implications for educational development. *European Journal of Scientific Research*, **24**: 157-162.
- Oostendorp R H, Doan Q H (2013) Have the returns to education really increased in Vietnam? Wage versus employment effect. *Journal of Comparative Economics*, **41**: 923-938.
- Pham H T, Reilly B (2009) Ethnic wage inequality in Vietnam. *International Journal of Manpower*, **30**: 192-219.
- Purnastuti L, Miller P W, Salim R (2013) Declining rates of return to education: evidence for Indonesia. *Bulletin of Indonesian Economic Studies*, **49**: 213-236.
- Pyatt G (1966) Review of Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education.; the Residual Factor and Economic Growth.; Econometric Models of Education. *The Economic Journal*, **76**: 635-638.
- Quoc T N (2014) Returns to education: A case study in the Mekong Delta - Vietnam. *Economic Conference: The Seventh Vietnam Economist Annual Meeting 2014*. Ho Chi Minh City.
- Thangavelu S (2013) Trade, Technology, Foreign Firms and Wage Gap: Case of Vietnam Manufacturing Firms. In: Hahn C H a D a N (ed.) *Impact of Globalization on Labor Market*. ERIA Research Project Report 2012, no.4, pp.107-133.

- The American Association of University Women (2015) *The simple truth about the gender pay gap*. Washington, DC: The American Association of University Women.
- Tucker M S, Marshall F R (1992) *Thinking for a living: education and the wealth of nations*, New York: Basic Books.
- Undp (1990) *Human development report, 1990: United Nations Development Programme*, Oxford: Oxford University Press.
- Yeung K, Kwack Sung Y, Young Sun L, Heeseon C (2007) Gender Earning Gaps and Return to Schooling in Korea. *Journal of economic research*, **12**: 79-101.